

# Computer algebra independent integration tests

## 8-Special-functions/8.4-Trig-integral-functions

Nasser M. Abbasi

May 24, 2020

Compiled on May 24, 2020 at 10:29pm

# Contents

|          |   |           |
|----------|---|-----------|
| <b>1</b> | <b>Introduction</b>   | <b>7</b>  |
| 1.1      | Listing of CAS systems tested . . . . .                                   | 7         |
| 1.2      | Results . . . . .   | 8         |
| 1.3      | Performance . . . . .   | 11        |
| 1.4      | list of integrals that has no closed form antiderivative . . . . .        | 12        |
| 1.5      | list of integrals solved by CAS but has no known antiderivative . . . . . | 12        |
| 1.6      | list of integrals solved by CAS but failed verification . . . . .         | 12        |
| 1.7      | Timing . . . . .  | 13        |
| 1.8      | Verification . . . . .  | 13        |
| 1.9      | Important notes about some of the results . . . . .                       | 13        |
| 1.10     | Design of the test system . . . . .                                       | 15        |
| <b>2</b> | <b>detailed summary tables of results</b>                                 | <b>17</b> |
| 2.1      | List of integrals sorted by grade for each CAS . . . . .                  | 17        |
| 2.2      | Detailed conclusion table per each integral for all CAS systems . . . . . | 19        |
| 2.3      | Detailed conclusion table specific for Rubi results . . . . .             | 47        |
| <b>3</b> | <b>Listing of integrals</b>   | <b>53</b> |
| 3.1      | $\int x^m \text{Si}(bx) dx$ . . . . .                                     | 53        |
| 3.2      | $\int x^3 \text{Si}(bx) dx$ . . . . .                                     | 57        |
| 3.3      | $\int x^2 \text{Si}(bx) dx$ . . . . .                                     | 61        |
| 3.4      | $\int x \text{Si}(bx) dx$ . . . . .                                       | 65        |

|      |  |     |
|------|--|-----|
| 3.5  | $\int \text{Si}(bx) dx$                            | 69  |
| 3.6  | $\int \frac{\text{Si}(bx)}{x} dx$                  | 72  |
| 3.7  | $\int \frac{\text{Si}(bx)}{x^2} dx$                | 75  |
| 3.8  | $\int \frac{\text{Si}(bx)}{x^3} dx$                | 79  |
| 3.9  | $\int x^m \text{Si}(bx)^2 dx$                      | 83  |
| 3.10 | $\int x^3 \text{Si}(bx)^2 dx$                      | 86  |
| 3.11 | $\int x^2 \text{Si}(bx)^2 dx$                      | 91  |
| 3.12 | $\int x \text{Si}(bx)^2 dx$                        | 96  |
| 3.13 | $\int \text{Si}(bx)^2 dx$                          | 101 |
| 3.14 | $\int \frac{\text{Si}(bx)^2}{x} dx$                | 105 |
| 3.15 | $\int \frac{\text{Si}(bx)^2}{x^2} dx$              | 108 |
| 3.16 | $\int \frac{\text{Si}(bx)^2}{x^3} dx$              | 111 |
| 3.17 | $\int x^m \text{Si}(a + bx) dx$                    | 114 |
| 3.18 | $\int x^3 \text{Si}(a + bx) dx$                    | 117 |
| 3.19 | $\int x^2 \text{Si}(a + bx) dx$                    | 121 |
| 3.20 | $\int x \text{Si}(a + bx) dx$                      | 125 |
| 3.21 | $\int \text{Si}(a + bx) dx$                        | 129 |
| 3.22 | $\int \frac{\text{Si}(a+bx)}{x} dx$                | 132 |
| 3.23 | $\int \frac{\text{Si}(a+bx)}{x^2} dx$              | 135 |
| 3.24 | $\int \frac{\text{Si}(a+bx)}{x^3} dx$              | 139 |
| 3.25 | $\int x^m \text{Si}(a + bx)^2 dx$                  | 144 |
| 3.26 | $\int x^2 \text{Si}(a + bx)^2 dx$                  | 147 |
| 3.27 | $\int x \text{Si}(a + bx)^2 dx$                    | 154 |
| 3.28 | $\int \text{Si}(a + bx)^2 dx$                      | 160 |
| 3.29 | $\int \frac{\text{Si}(a+bx)^2}{x} dx$              | 164 |
| 3.30 | $\int \frac{\text{Si}(a+bx)^2}{x^2} dx$            | 167 |
| 3.31 | $\int \frac{\text{Si}(a+bx)^2}{x^3} dx$            | 170 |
| 3.32 | $\int x^2 \text{Si}(d(a + b \log(cx^n))) dx$       | 173 |
| 3.33 | $\int x \text{Si}(d(a + b \log(cx^n))) dx$         | 177 |
| 3.34 | $\int \text{Si}(d(a + b \log(cx^n))) dx$           | 181 |
| 3.35 | $\int \frac{\text{Si}(d(a+b \log(cx^n)))}{x} dx$   | 185 |
| 3.36 | $\int \frac{\text{Si}(d(a+b \log(cx^n)))}{x^2} dx$ | 188 |
| 3.37 | $\int \frac{\text{Si}(d(a+b \log(cx^n)))}{x^3} dx$ | 192 |
| 3.38 | $\int (ex)^m \text{Si}(d(a + b \log(cx^n))) dx$    | 196 |
| 3.39 | $\int \frac{\sin(bx)\text{Si}(bx)}{x^3} dx$        | 200 |
| 3.40 | $\int \frac{\sin(bx)\text{Si}(bx)}{x^2} dx$        | 205 |

|      |   |     |
|------|---|-----|
| 3.41 | $\int \frac{\sin(bx)\text{Si}(bx)}{x} dx$     | 208 |
| 3.42 | $\int \sin(bx)\text{Si}(bx) dx$               | 211 |
| 3.43 | $\int x \sin(bx)\text{Si}(bx) dx$             | 215 |
| 3.44 | $\int x^2 \sin(bx)\text{Si}(bx) dx$           | 219 |
| 3.45 | $\int x^3 \sin(bx)\text{Si}(bx) dx$           | 224 |
| 3.46 | $\int \frac{\cos(bx)\text{Si}(bx)}{x^3} dx$   | 229 |
| 3.47 | $\int \frac{\cos(bx)\text{Si}(bx)}{x^2} dx$   | 233 |
| 3.48 | $\int \frac{\cos(bx)\text{Si}(bx)}{x} dx$     | 237 |
| 3.49 | $\int \cos(bx)\text{Si}(bx) dx$               | 240 |
| 3.50 | $\int x \cos(bx)\text{Si}(bx) dx$             | 244 |
| 3.51 | $\int x^2 \cos(bx)\text{Si}(bx) dx$           | 248 |
| 3.52 | $\int x^3 \cos(bx)\text{Si}(bx) dx$           | 253 |
| 3.53 | $\int \sin(5x)\text{Si}(2x) dx$               | 258 |
| 3.54 | $\int \cos(5x)\text{Si}(2x) dx$               | 262 |
| 3.55 | $\int x^2 \sin(a + bx)\text{Si}(a + bx) dx$   | 266 |
| 3.56 | $\int x \sin(a + bx)\text{Si}(a + bx) dx$     | 272 |
| 3.57 | $\int \sin(a + bx)\text{Si}(a + bx) dx$       | 277 |
| 3.58 | $\int \frac{\sin(a+bx)\text{Si}(a+bx)}{x} dx$ | 281 |
| 3.59 | $\int x^2 \cos(a + bx)\text{Si}(a + bx) dx$   | 284 |
| 3.60 | $\int x \cos(a + bx)\text{Si}(a + bx) dx$     | 290 |
| 3.61 | $\int \cos(a + bx)\text{Si}(a + bx) dx$       | 295 |
| 3.62 | $\int \frac{\cos(a+bx)\text{Si}(a+bx)}{x} dx$ | 299 |
| 3.63 | $\int x \sin(a + bx)\text{Si}(c + dx) dx$     | 302 |
| 3.64 | $\int \sin(a + bx)\text{Si}(c + dx) dx$       | 308 |
| 3.65 | $\int \frac{\sin(a+bx)\text{Si}(c+dx)}{x} dx$ | 318 |
| 3.66 | $\int x \cos(a + bx)\text{Si}(c + dx) dx$     | 321 |
| 3.67 | $\int \cos(a + bx)\text{Si}(c + dx) dx$       | 327 |
| 3.68 | $\int \frac{\cos(a+bx)\text{Si}(c+dx)}{x} dx$ | 337 |
| 3.69 | $\int x^m \text{CosIntegral}(bx) dx$          | 340 |
| 3.70 | $\int x^3 \text{CosIntegral}(bx) dx$          | 344 |
| 3.71 | $\int x^2 \text{CosIntegral}(bx) dx$          | 348 |
| 3.72 | $\int x \text{CosIntegral}(bx) dx$            | 352 |
| 3.73 | $\int \text{CosIntegral}(bx) dx$              | 356 |
| 3.74 | $\int \frac{\text{CosIntegral}(bx)}{x} dx$    | 359 |
| 3.75 | $\int \frac{\text{CosIntegral}(bx)}{x^2} dx$  | 362 |
| 3.76 | $\int \frac{\text{CosIntegral}(bx)}{x^3} dx$  | 366 |
| 3.77 | $\int x^m \text{CosIntegral}(bx)^2 dx$        | 370 |
| 3.78 | $\int x^3 \text{CosIntegral}(bx)^2 dx$        | 373 |

|       |   |     |
|-------|---|-----|
| 3.79  | $\int x^2 \text{CosIntegral}(bx)^2 dx$                      | 378 |
| 3.80  | $\int x \text{CosIntegral}(bx)^2 dx$                        | 383 |
| 3.81  | $\int \text{CosIntegral}(bx)^2 dx$                          | 388 |
| 3.82  | $\int \frac{\text{CosIntegral}(bx)^2}{x} dx$                | 392 |
| 3.83  | $\int \frac{\text{CosIntegral}(bx)^2}{x^2} dx$              | 395 |
| 3.84  | $\int \frac{\text{CosIntegral}(bx)^2}{x^3} dx$              | 398 |
| 3.85  | $\int x^m \text{CosIntegral}(a + bx) dx$                    | 401 |
| 3.86  | $\int x^3 \text{CosIntegral}(a + bx) dx$                    | 404 |
| 3.87  | $\int x^2 \text{CosIntegral}(a + bx) dx$                    | 408 |
| 3.88  | $\int x \text{CosIntegral}(a + bx) dx$                      | 412 |
| 3.89  | $\int \text{CosIntegral}(a + bx) dx$                        | 416 |
| 3.90  | $\int \frac{\text{CosIntegral}(a+bx)}{x} dx$                | 419 |
| 3.91  | $\int \frac{\text{CosIntegral}(a+bx)}{x^2} dx$              | 422 |
| 3.92  | $\int \frac{\text{CosIntegral}(a+bx)}{x^3} dx$              | 426 |
| 3.93  | $\int x^m \text{CosIntegral}(a + bx)^2 dx$                  | 431 |
| 3.94  | $\int x^2 \text{CosIntegral}(a + bx)^2 dx$                  | 434 |
| 3.95  | $\int x \text{CosIntegral}(a + bx)^2 dx$                    | 441 |
| 3.96  | $\int \text{CosIntegral}(a + bx)^2 dx$                      | 447 |
| 3.97  | $\int \frac{\text{CosIntegral}(a+bx)^2}{x} dx$              | 451 |
| 3.98  | $\int \frac{\text{CosIntegral}(a+bx)^2}{x^2} dx$            | 454 |
| 3.99  | $\int \frac{\text{CosIntegral}(a+bx)^2}{x^3} dx$            | 457 |
| 3.100 | $\int x^2 \text{CosIntegral}(d(a + b \log(cx^n))) dx$       | 460 |
| 3.101 | $\int x \text{CosIntegral}(d(a + b \log(cx^n))) dx$         | 464 |
| 3.102 | $\int \text{CosIntegral}(d(a + b \log(cx^n))) dx$           | 468 |
| 3.103 | $\int \frac{\text{CosIntegral}(d(a+b \log(cx^n)))}{x} dx$   | 472 |
| 3.104 | $\int \frac{\text{CosIntegral}(d(a+b \log(cx^n)))}{x^2} dx$ | 475 |
| 3.105 | $\int \frac{\text{CosIntegral}(d(a+b \log(cx^n)))}{x^3} dx$ | 479 |
| 3.106 | $\int (ex)^m \text{CosIntegral}(d(a + b \log(cx^n))) dx$    | 483 |
| 3.107 | $\int \frac{\text{CosIntegral}(bx) \sin(bx)}{x^3} dx$       | 487 |
| 3.108 | $\int \frac{\text{CosIntegral}(bx) \sin(bx)}{x^2} dx$       | 491 |
| 3.109 | $\int \frac{\text{CosIntegral}(bx) \sin(bx)}{x} dx$         | 495 |
| 3.110 | $\int \text{CosIntegral}(bx) \sin(bx) dx$                   | 498 |
| 3.111 | $\int x \text{CosIntegral}(bx) \sin(bx) dx$                 | 502 |
| 3.112 | $\int x^2 \text{CosIntegral}(bx) \sin(bx) dx$               | 506 |
| 3.113 | $\int x^3 \text{CosIntegral}(bx) \sin(bx) dx$               | 511 |
| 3.114 | $\int \frac{\cos(bx) \text{CosIntegral}(bx)}{x^3} dx$       | 516 |

|          |   |            |
|----------|---|------------|
| 3.115    | $\int \frac{\cos(bx)\text{CosIntegral}(bx)}{x^2} dx$    | 521        |
| 3.116    | $\int \frac{\cos(bx)\text{CosIntegral}(bx)}{x} dx$      | 524        |
| 3.117    | $\int \cos(bx)\text{CosIntegral}(bx) dx$                | 527        |
| 3.118    | $\int x \cos(bx)\text{CosIntegral}(bx) dx$              | 531        |
| 3.119    | $\int x^2 \cos(bx)\text{CosIntegral}(bx) dx$            | 535        |
| 3.120    | $\int x^3 \cos(bx)\text{CosIntegral}(bx) dx$            | 540        |
| 3.121    | $\int \text{CosIntegral}(2x) \sin(5x) dx$               | 545        |
| 3.122    | $\int \cos(5x)\text{CosIntegral}(2x) dx$                | 549        |
| 3.123    | $\int x^2 \text{CosIntegral}(a + bx) \sin(a + bx) dx$   | 553        |
| 3.124    | $\int x \text{CosIntegral}(a + bx) \sin(a + bx) dx$     | 559        |
| 3.125    | $\int \text{CosIntegral}(a + bx) \sin(a + bx) dx$       | 564        |
| 3.126    | $\int \frac{\text{CosIntegral}(a+bx) \sin(a+bx)}{x} dx$ | 568        |
| 3.127    | $\int x^2 \cos(a + bx)\text{CosIntegral}(a + bx) dx$    | 571        |
| 3.128    | $\int x \cos(a + bx)\text{CosIntegral}(a + bx) dx$      | 577        |
| 3.129    | $\int \cos(a + bx)\text{CosIntegral}(a + bx) dx$        | 582        |
| 3.130    | $\int \frac{\cos(a+bx)\text{CosIntegral}(a+bx)}{x} dx$  | 586        |
| 3.131    | $\int x \text{CosIntegral}(c + dx) \sin(a + bx) dx$     | 589        |
| 3.132    | $\int \text{CosIntegral}(c + dx) \sin(a + bx) dx$       | 595        |
| 3.133    | $\int \frac{\text{CosIntegral}(c+dx) \sin(a+bx)}{x} dx$ | 605        |
| 3.134    | $\int x \cos(a + bx)\text{CosIntegral}(c + dx) dx$      | 608        |
| 3.135    | $\int \cos(a + bx)\text{CosIntegral}(c + dx) dx$        | 614        |
| 3.136    | $\int \frac{\cos(a+bx)\text{CosIntegral}(c+dx)}{x} dx$  | 624        |
| <b>4</b> | <b>Listing of Grading functions</b>                     | <b>627</b> |



# Chapter 1

## Introduction

This report gives the result of running the computer algebra independent integration problems. The listing of the problems are maintained by and can be downloaded from <https://rulebasedintegration.org>

The number of integrals in this report is [ 136 ]. This is test number [ 206 ].

### 1.1 Listing of CAS systems tested

The following systems were tested at this time.

1. Mathematica 12.1 (64 bit) on windows 10.
2. Rubi 4.16.1 in Mathematica 12 on windows 10.
3. Maple 2020 (64 bit) on windows 10.
4. Maxima 5.43 on Linux. (via sagemath 8.9)
5. Fricas 1.3.6 on Linux (via sagemath 9.0)
6. Sympy 1.5 under Python 3.7.3 using Anaconda distribution.
7. Giac/Xcas 1.5 on Linux. (via sagemath 8.9)

Maxima, Fricas and Giac/Xcas were called from inside SageMath. This was done using SageMath integrate command by changing the name of the algorithm to use the different CAS systems.

Sympy was called directly using Python.

## 1.2 Results

Important note: A number of problems in this test suite have no antiderivative in closed form. This means the antiderivative of these integrals can not be expressed in terms of elementary, special functions or Hypergeometric2F1 functions. RootSum and RootOf are not allowed.

If a CAS returns the above integral unevaluated within the time limit, then the result is counted as passed and assigned an A grade.

However, if CAS times out, then it is assigned an F grade even if the integral is not integrable, as this implies CAS could not determine that the integral is not integrable in the time limit.

If a CAS returns an antiderivative to such an integral, it is assigned an A grade automatically and this special result is listed in the introduction section of each individual test report to make it easy to identify as this can be important result to investigate.

The results given in in the table below reflects the above.

| System      | solved          | Failed         |
|-------------|-----------------|----------------|
| Rubi        | % 100. ( 136 )  | % 0. ( 0 )     |
| Mathematica | % 98.53 ( 134 ) | % 1.47 ( 2 )   |
| Maple       | % 86.76 ( 118 ) | % 13.24 ( 18 ) |
| Maxima      | % 25. ( 34 )    | % 75. ( 102 )  |
| Fricas      | % 25. ( 34 )    | % 75. ( 102 )  |
| Sympy       | % 36.76 ( 50 )  | % 63.24 ( 86 ) |
| Giac        | % 77.94 ( 106 ) | % 22.06 ( 30 ) |

The table below gives additional break down of the grading of quality of the antiderivatives generated by each CAS. The grading is given using the letters A,B,C and F with A being the best quality. The grading is accomplished by comparing the antiderivative generated with the optimal antiderivatives included in the test suite. The following table describes the meaning of these grades.

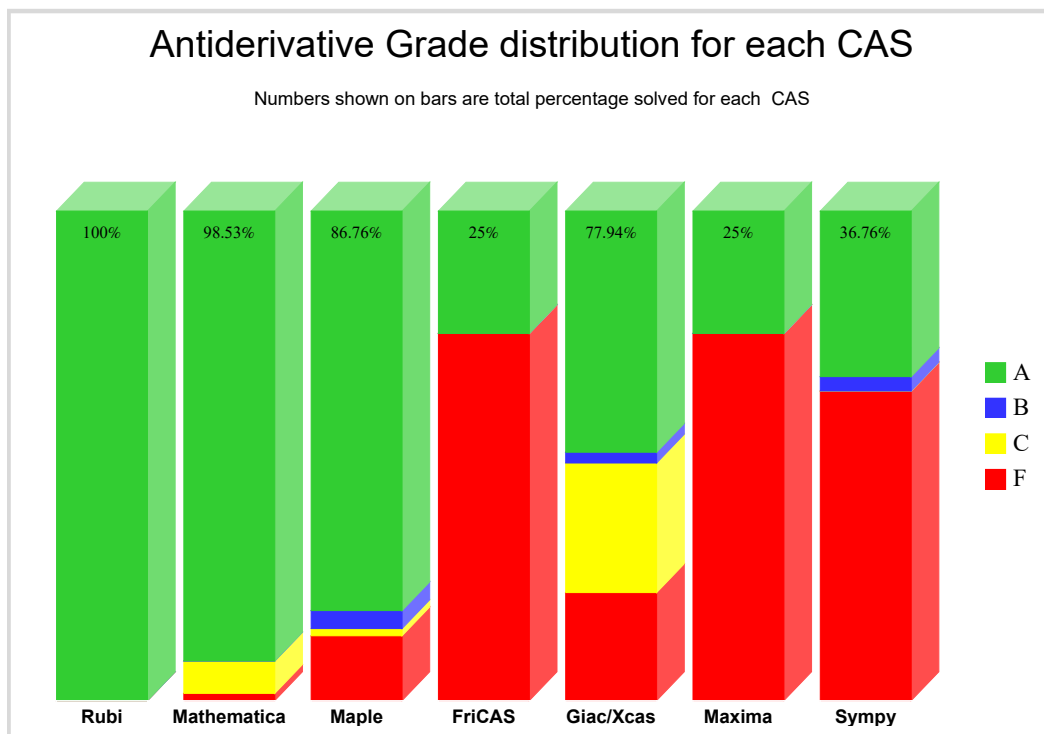


| grade | description   |
|-------|---|
| A     | Integral was solved and antiderivative is optimal in quality and leaf size.   |
| B     | Integral was solved and antiderivative is optimal in quality but leaf size is larger than twice the optimal antiderivatives leaf size.  |
| C     | Integral was solved and antiderivative is non-optimal in quality. This can be due to one or more of the following reasons <ol style="list-style-type: none"> <li>1. antiderivative contains a hypergeometric function and the optimal antiderivative does not.</li> <li>2. antiderivative contains a special function and the optimal antiderivative does not.</li> <li>3. antiderivative contains the imaginary unit and the optimal antiderivative does not.</li> </ol> |
| F     | Integral was not solved. Either the integral was returned unevaluated within the time limit, or it timed out, or CAS hanged or crashed or an exception was raised.  |

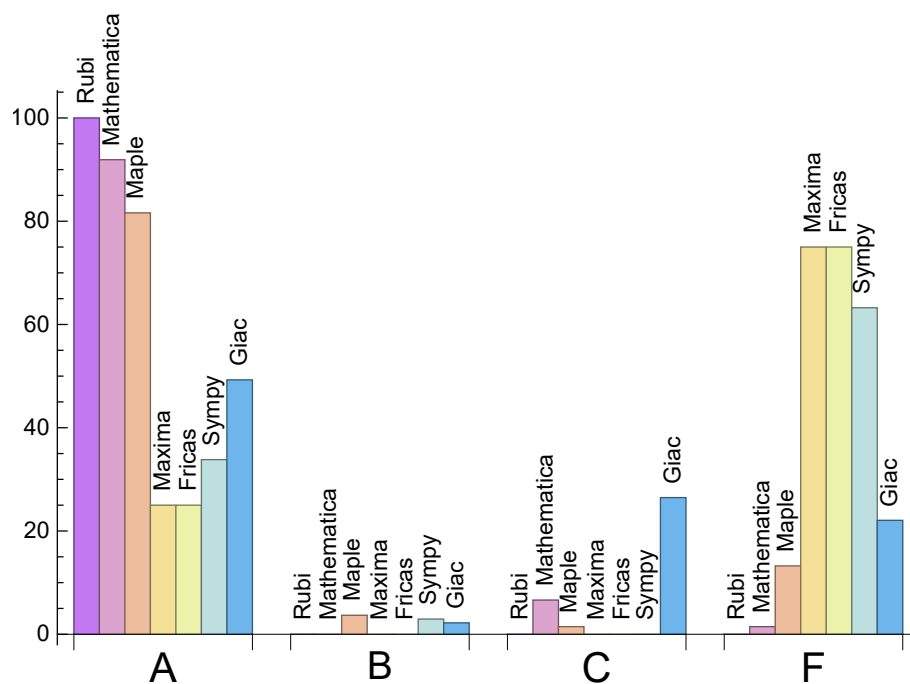
Grading is implemented for all CAS systems. Based on the above, the following table summarizes the grading for this test suite.

| System      | % A grade | % B grade | % C grade | % F grade |
|-------------|-----------|-----------|-----------|-----------|
| Rubi        | 100.      | 0.        | 0.        | 0.        |
| Mathematica | 91.91     | 0.        | 6.62      | 1.47      |
| Maple       | 81.62     | 3.68      | 1.47      | 13.24     |
| Maxima      | 25.       | 0.        | 0.        | 75.       |
| Fricas      | 25.       | 0.        | 0.        | 75.       |
| Sympy       | 33.82     | 2.94      | 0.        | 63.24     |
| Giac        | 49.26     | 2.21      | 26.47     | 22.06     |

The following is a Bar chart illustration of the data in the above table.



The figure below compares the CAS systems for each grade level.



### 1.3 Performance

The table below summarizes the performance of each CAS system in terms of CPU time and leaf size of results.

| System      | Mean time (sec) | Mean size | Normalized mean | Median size | Normalized median |
|-------------|-----------------|-----------|-----------------|-------------|-------------------|
| Rubi        | 0.19            | 78.26     | 0.75            | 49.         | 1.                |
| Mathematica | 1.65            | 62.69     | 0.65            | 44.         | 0.72              |
| Maple       | 0.07            | 97.07     | 0.78            | 43.         | 0.88              |
| Maxima      | 0.              | 0.        | 0.              | 0.          | 0.                |
| Fricas      | 0.              | 0.        | 0.              | 0.          | 0.                |
| Sympy       | 0.5             | 26.14     | 0.5             | 0.          | 0.                |
| Giac        | 0.86            | 555.75    | 4.24            | 62.         | 1.02              |

## 1.4 list of integrals that has no closed form antiderivative

{9, 14, 15, 16, 17, 22, 25, 29, 30, 31, 40, 46, 48, 58, 62, 65, 68, 77, 82, 83, 84, 85, 90, 93, 97, 98, 99, 107, 109, 115, 126, 130, 133, 136}

## 1.5 list of integrals solved by CAS but has no known antiderivative

**Rubi** {}

**Mathematica** {}

**Maple** {}

**Maxima** {}

**Fricas** {}

**Sympy** {}

**Giac** {}

## 1.6 list of integrals solved by CAS but failed verification

The following are integrals solved by CAS but the verification phase failed to verify the anti-derivative produced is correct. This does not mean necessarily that the anti-derivative is wrong, as additional methods of verification might be needed, or more time is needed (3 minutes time limit was used). These integrals are listed here to make it easier to do further investigation to determine why it was not possible to verify the result produced.

**Rubi** {}

**Mathematica** {41, 49, 63, 64, 66, 67}

**Maple** Verification phase not implemented yet.

**Maxima** Verification phase not implemented yet.

**Fricas** Verification phase not implemented yet.

**Sympy** Verification phase not implemented yet.

**Giac** Verification phase not implemented yet.

## 1.7 Timing

The command `AboluteTiming[]` was used in Mathematica to obtain the elapsed time for each integrate call. In Maple, the command `Usage` was used as in the following example

```
cpu_time := Usage(assign ('result_of _int',int(expr,x)),output='realtime')
```

For all other CAS systems, the elapsed time to complete each integral was found by taking the difference between the time after the call has completed from the time before the call was made. This was done using Python's `time.time()` call.

All elapsed times shown are in seconds. A time limit of 3 minutes was used for each integral. If the integrate command did not complete within this time limit, the integral was aborted and considered to have failed and assigned an F grade. The time used by failed integrals due to time out is not counted in the final statistics.

## 1.8 Verification

A verification phase was applied on the result of integration for Rubi and Mathematica. Future version of this report will implement verification for the other CAS systems. For the integrals whose result was not run through a verification phase, it is assumed that the antiderivative produced was correct.

Verification phase has 3 minutes time out. An integral whose result was not verified could still be correct. Further investigation is needed on those integrals which failed verifications. Such integrals are marked in the summary table below and also in each integral separate section so they are easy to identify and locate.

## 1.9 Important notes about some of the results

### 1.9.1 Important note about Maxima results

Since these integrals are run in a batch mode, using an automated script, and by using `sagemath` (SageMath uses Maxima), then any integral where Maxima needs an interactive response from the user to answer a question during evaluation of the integral in order to complete the integration, will fail and is counted as failed.

The exception raised is `ValueError`. Therefore Maxima result below is lower than what could result if Maxima was run directly and each question Maxima asks was answered correctly.

The percentage of such failures were not counted for each test file, but for an example, for the Timofeev test file, there were about 30 such integrals out of total 705, or about 4 percent. This percentage can be higher or lower depending on the specific input test file.

Such integrals can be identified by looking at the output of the integration in each section for Maxima. If the output was an exception `ValueError` then this is most likely due to this reason.

Maxima integrate was run using SageMath with the following settings set by default

```
'besselexpand : true'
'display2d : false'
'domain : complex'
'keepfloat : true'
'load(to_poly_solve)'
'load(simplify_sum)'
'load(abs_integrate)' 'load(diag)'
```

SageMath loading of Maxima `abs_integrate` was found to cause some problem. So the following code was added to disable this effect.

```
from sage.interfaces.maxima_lib import maxima_lib
maxima_lib.set('extra_definite_integration_methods', '[]')
maxima_lib.set('extra_integration_methods', '[]')
```

See <https://ask.sagemath.org/question/43088/integrate-results-that-are-different-from-using-maxima/> for reference.

## 1.9.2 Important note about FriCAS and Giac/X-CAS results

There are Few integrals which failed due to SageMath not able to translate the result back to SageMath syntax and not because these CAS system were not able to do the integrations.

These will fail With error `Exception raised: NotImplementedError`

The number of such cases seems to be very small. About 1 or 2 percent of all integrals.

Hopefully the next version of SageMath will have complete translation of FriCAS and XCAS syntax and I will re-run all the tests again when this happens.

## 1.9.3 Important note about finding leaf size of antiderivative

For Mathematica, Rubi and Maple, the builtin system function `LeafSize` is used to find the leaf size of each antiderivative.

The other CAS systems (SageMath and Sympy) do not have special builtin function for this purpose at this time. Therefore the leaf size is determined as follows.

For Fricas, Giac and Maxima (all called via `sagemath`) the following code is used

#see <https://stackoverflow.com/questions/25202346/how-to-obtain-leaf-count-expression-size-in>

```
def tree(expr):
    if expr.operator() is None:
        return expr
    else:
        return [expr.operator()+map(tree, expr.operands())

try:
    # 1.35 is a fudge factor since this estimate of leaf count is bit lower than
    #what it should be compared to Mathematica's
    leafCount = round(1.35*len(flatten(tree(anti))))
except Exception as ee:
    leafCount =1
```

For Sympy, called directly from Python, the following code is used

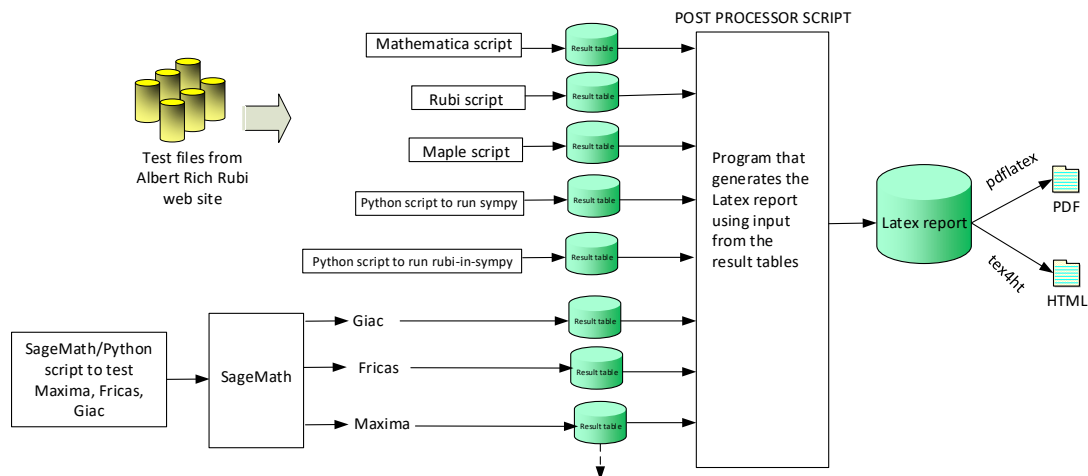
```
try:
    # 1.7 is a fudge factor since it is low side from actual leaf count
    leafCount = round(1.7*count_ops(anti))

except Exception as ee:
    leafCount =1
```

When these cas systems have a builtin function to find the leaf size of expressions, it will be used instead, and these tests run again.

## 1.10 Design of the test system

The following diagram gives a high level view of the current test build system.



One record (line) per one integral result. The line is CSV comma separated. It contains 13 fields. This is description of each record (line)

1. integer, the problem number.
2. integer. 0 or 1 for failed or passed. (this is not the grade field)
3. integer. Leaf size of result.
4. integer. Leaf size of the optimal antiderivative.
5. number. CPU time used to solve this integral. 0 if failed.
6. string. The integral in Latex format
7. string. The input used in CAS own syntax.
8. string. The result (antiderivative) produced by CAS in Latex format
9. string. The optimal antiderivative in Latex format.
10. integer. 0 or 1. Indicates if problem has known antiderivative or not
11. String. The result (antiderivative) in CAS own syntax.
12. String. The grade of the antiderivative. Can be "A", "B", "C", or "F"
13. String. The optimal antiderivative in CAS own syntax.

### High level overview of the CAS independent integration test build system



# Chapter 2

## detailed summary tables of results

### 2.1 List of integrals sorted by grade for each CAS

#### 2.1.1 Rubi

A grade: { 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136 }

B grade: { }

C grade: { }

F grade: { }

#### 2.1.2 Mathematica

A grade: { 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 40, 42, 43, 44, 45, 46, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 65, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 133, 136 }

B grade: { }

C grade: { 41, 63, 64, 66, 67, 131, 132, 134, 135 }

F grade: { 39, 47 }

## 2.1.3 Maple

A grade: { 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 27, 28, 29, 30, 31, 35, 40, 41, 42, 43, 44, 45, 46, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 64, 65, 67, 68, 70, 71, 72, 73, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 95, 96, 97, 98, 99, 103, 107, 109, 110, 111, 112, 113, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 132, 133, 135, 136 }

B grade: { 63, 66, 74, 131, 134 }

C grade: { 1, 69 }

F grade: { 26, 32, 33, 34, 36, 37, 38, 39, 47, 94, 100, 101, 102, 104, 105, 106, 108, 114 }

## 2.1.4 Maxima

A grade: { 9, 14, 15, 16, 17, 22, 25, 29, 30, 31, 40, 46, 48, 58, 62, 65, 68, 77, 82, 83, 84, 85, 90, 93, 97, 98, 99, 107, 109, 115, 126, 130, 133, 136 }

B grade: { }

C grade: { }

F grade: { 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 18, 19, 20, 21, 23, 24, 26, 27, 28, 32, 33, 34, 35, 36, 37, 38, 39, 41, 42, 43, 44, 45, 47, 49, 50, 51, 52, 53, 54, 55, 56, 57, 59, 60, 61, 63, 64, 66, 67, 69, 70, 71, 72, 73, 74, 75, 76, 78, 79, 80, 81, 86, 87, 88, 89, 91, 92, 94, 95, 96, 100, 101, 102, 103, 104, 105, 106, 108, 110, 111, 112, 113, 114, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 127, 128, 129, 131, 132, 134, 135 }

## 2.1.5 FriCAS

A grade: { 9, 14, 15, 16, 17, 22, 25, 29, 30, 31, 40, 46, 48, 58, 62, 65, 68, 77, 82, 83, 84, 85, 90, 93, 97, 98, 99, 107, 109, 115, 126, 130, 133, 136 }

B grade: { }

C grade: { }

F grade: { 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 18, 19, 20, 21, 23, 24, 26, 27, 28, 32, 33, 34, 35, 36, 37, 38, 39, 41, 42, 43, 44, 45, 47, 49, 50, 51, 52, 53, 54, 55, 56, 57, 59, 60, 61, 63, 64, 66, 67, 69, 70, 71, 72, 73, 74, 75, 76, 78, 79, 80, 81, 86, 87, 88, 89, 91, 92, 94, 95, 96, 100, 101, 102, 103, 104, 105, 106, 108, 110, 111, 112, 113, 114, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 127, 128, 129, 131, 132, 134, 135 }

## 2.1.6 Sympy

A grade: { 1, 2, 3, 4, 5, 7, 8, 9, 14, 15, 16, 17, 22, 25, 29, 30, 31, 40, 41, 46, 48, 58, 62, 65, 68, 70, 71, 72, 77, 82, 83, 84, 85, 90, 93, 97, 98, 99, 107, 109, 115, 116, 126, 130, 133, 136 }

B grade: { 69, 73, 75, 76 }

C grade: { }

F grade: { 6, 10, 11, 12, 13, 18, 19, 20, 21, 23, 24, 26, 27, 28, 32, 33, 34, 35, 36, 37, 38, 39, 42, 43, 44, 45, 47, 49, 50, 51, 52, 53, 54, 55, 56, 57, 59, 60, 61, 63, 64, 66, 67, 74, 78, 79, 80, 81, 86, 87, 88, 89, 91, 92, 94, 95, 96, 100, 101, 102, 103, 104, 105, 106, 108, 110, 111, 112, 113, 114, 117, 118, 119, 120, 121, 122, 123, 124, 125, 127, 128, 129, 131, 132, 134, 135 }

## 2.1.7 Giac

A grade: { 2, 3, 4, 5, 7, 9, 10, 12, 14, 15, 16, 17, 22, 25, 29, 30, 31, 35, 40, 41, 43, 45, 46, 48, 49, 51, 53, 54, 58, 62, 65, 68, 70, 71, 72, 73, 76, 77, 78, 80, 82, 83, 84, 85, 86, 87, 88, 90, 93, 97, 98, 99, 103, 107, 109, 110, 112, 115, 116, 118, 120, 121, 122, 126, 130, 133, 136 }

B grade: { 61, 89, 125 }

C grade: { 8, 11, 13, 18, 19, 20, 21, 23, 24, 42, 44, 50, 52, 55, 56, 57, 59, 60, 64, 67, 75, 79, 81, 91, 92, 111, 113, 117, 119, 123, 124, 127, 128, 129, 132, 135 }

F grade: { 1, 6, 26, 27, 28, 32, 33, 34, 36, 37, 38, 39, 47, 63, 66, 69, 74, 94, 95, 96, 100, 101, 102, 104, 105, 106, 108, 114, 131, 134 }

## 2.2 Detailed conclusion table per each integral for all CAS systems

Detailed conclusion table per each integral is given by table below. The elapsed time is in seconds. For failed result it is given as F(-1) if the failure was due to timeout. It is given as F(-2) if the failure was due to an exception being raised, which could indicate a bug in the system. If the failure was due to integral not being evaluated within the time limit, then it is given just an F.

In this table, the column **normalized size** is defined as  $\frac{\text{antiderivative leaf size}}{\text{optimal antiderivative leaf size}}$

| Problem 1       | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | A       | A     | A           | C     | F      | F      | A     | F    |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 86      | 86    | 82          | 37    | 0      | 0      | 46    | 0    |
| normalized size | 1       | 1.    | 0.95        | 0.43  | 0.     | 0.     | 0.53  | 0.   |
| time (sec)      | N/A     | 0.074 | 0.054       | 0.171 | 0.     | 0.     | 0.958 | 0.   |

| Problem 2       | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | A     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 63      | 63    | 50          | 56    | 0      | 0      | 61    | 66    |
| normalized size | 1       | 1.    | 0.79        | 0.89  | 0.     | 0.     | 0.97  | 1.05  |
| time (sec)      | N/A     | 0.068 | 0.036       | 0.056 | 0.     | 0.     | 1.272 | 1.295 |

| Problem 3       | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | A     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 49      | 49    | 41          | 44    | 0      | 0      | 46    | 51    |
| normalized size | 1       | 1.    | 0.84        | 0.9   | 0.     | 0.     | 0.94  | 1.04  |
| time (sec)      | N/A     | 0.046 | 0.027       | 0.054 | 0.     | 0.     | 1.474 | 1.287 |

| Problem 4       | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | A     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 35      | 35    | 35          | 32    | 0      | 0      | 29    | 39    |
| normalized size | 1       | 1.    | 1.          | 0.91  | 0.     | 0.     | 0.83  | 1.11  |
| time (sec)      | N/A     | 0.023 | 0.006       | 0.05  | 0.     | 0.     | 0.743 | 1.305 |

| Problem 5       | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | A     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 15      | 15    | 15          | 17    | 0      | 0      | 12    | 20    |
| normalized size | 1       | 1.    | 1.          | 1.13  | 0.     | 0.     | 0.8   | 1.33  |
| time (sec)      | N/A     | 0.004 | 0.001       | 0.05  | 0.     | 0.     | 0.802 | 1.251 |

| Problem 6       | Optimal | Rubi | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|------|-------------|-------|--------|--------|-------|------|
| grade           | A       | A    | A           | A     | F      | F      | F(-2) | F    |
| verified        | N/A     | Yes  | Yes         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 43      | 43   | 43          | 20    | 0      | 0      | 0     | 0    |
| normalized size | 1       | 1.   | 1.          | 0.47  | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.02 | 0.004       | 0.069 | 0.     | 0.     | 0.    | 0.   |

| Problem 7       | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | A     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 25      | 25    | 25          | 32    | 0      | 0      | 36    | 50    |
| normalized size | 1       | 1.    | 1.          | 1.28  | 0.     | 0.     | 1.44  | 2.    |
| time (sec)      | N/A     | 0.045 | 0.01        | 0.054 | 0.     | 0.     | 1.169 | 1.203 |

| Problem 8       | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | A     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 46      | 46    | 46          | 48    | 0      | 0      | 41    | 201   |
| normalized size | 1       | 1.    | 1.          | 1.04  | 0.     | 0.     | 0.89  | 4.37  |
| time (sec)      | N/A     | 0.065 | 0.013       | 0.052 | 0.     | 0.     | 0.891 | 1.353 |

| Problem 9       | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 12      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.031 | 2.513       | 0.059 | 0.     | 0.     | 0.    | 0.   |

| Problem 10      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 149     | 149   | 107         | 149   | 0      | 0      | 0     | 119   |
| normalized size | 1       | 1.    | 0.72        | 1.    | 0.     | 0.     | 0.    | 0.8   |
| time (sec)      | N/A     | 0.216 | 0.13        | 0.069 | 0.     | 0.     | 0.    | 1.287 |

| Problem 11      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 112     | 112   | 78          | 84    | 0      | 0      | 0     | 105   |
| normalized size | 1       | 1.    | 0.7         | 0.75  | 0.     | 0.     | 0.    | 0.94  |
| time (sec)      | N/A     | 0.135 | 0.073       | 0.149 | 0.     | 0.     | 0.    | 1.281 |

| Problem 12      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 74      | 74    | 58          | 69    | 0      | 0      | 0     | 76    |
| normalized size | 1       | 1.    | 0.78        | 0.93  | 0.     | 0.     | 0.    | 1.03  |
| time (sec)      | N/A     | 0.095 | 0.053       | 0.058 | 0.     | 0.     | 0.    | 1.325 |

| Problem 13      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C    |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 32      | 32    | 32          | 32    | 0      | 0      | 0     | 66   |
| normalized size | 1       | 1.    | 1.          | 1.    | 0.     | 0.     | 0.    | 2.06 |
| time (sec)      | N/A     | 0.051 | 0.008       | 0.05  | 0.     | 0.     | 0.    | 1.34 |

| Problem 14      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 12      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.023 | 0.424       | 0.053 | 0.     | 0.     | 0.    | 0.   |

| Problem 15      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 12      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.024 | 0.469       | 0.056 | 0.     | 0.     | 0.    | 0.   |

| Problem 16      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 12      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.025 | 0.501       | 0.054 | 0.     | 0.     | 0.    | 0.   |

| Problem 17      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 47      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.295 | 4.095       | 0.185 | 0.     | 0.     | 0.    | 0.   |

| Problem 18      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 184     | 184   | 96          | 157   | 0      | 0      | 0     | 74    |
| normalized size | 1       | 1.    | 0.52        | 0.85  | 0.     | 0.     | 0.    | 0.4   |
| time (sec)      | N/A     | 0.368 | 0.197       | 0.049 | 0.     | 0.     | 0.    | 1.286 |

| Problem 19      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 118     | 118   | 63          | 99    | 0      | 0      | 0     | 74    |
| normalized size | 1       | 1.    | 0.53        | 0.84  | 0.     | 0.     | 0.    | 0.63  |
| time (sec)      | N/A     | 0.277 | 0.141       | 0.053 | 0.     | 0.     | 0.    | 1.218 |

| Problem 20      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 71      | 71    | 50          | 61    | 0      | 0      | 0     | 74    |
| normalized size | 1       | 1.    | 0.7         | 0.86  | 0.     | 0.     | 0.    | 1.04  |
| time (sec)      | N/A     | 0.206 | 0.1         | 0.051 | 0.     | 0.     | 0.    | 1.264 |

| Problem 21      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 26      | 26    | 41          | 24    | 0      | 0      | 0     | 62    |
| normalized size | 1       | 1.    | 1.58        | 0.92  | 0.     | 0.     | 0.    | 2.38  |
| time (sec)      | N/A     | 0.005 | 0.036       | 0.049 | 0.     | 0.     | 0.    | 1.345 |

| Problem 22      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 12      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.024 | 0.655       | 0.061 | 0.     | 0.     | 0.    | 0.   |

| Problem 23      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 46      | 46    | 39          | 48    | 0      | 0      | 0     | 244   |
| normalized size | 1       | 1.    | 0.85        | 1.04  | 0.     | 0.     | 0.    | 5.3   |
| time (sec)      | N/A     | 0.232 | 0.073       | 0.057 | 0.     | 0.     | 0.    | 1.318 |

| Problem 24      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 111     | 111   | 84          | 86    | 0      | 0      | 0     | 1092  |
| normalized size | 1       | 1.    | 0.76        | 0.77  | 0.     | 0.     | 0.    | 9.84  |
| time (sec)      | N/A     | 0.325 | 0.331       | 0.06  | 0.     | 0.     | 0.    | 1.337 |

| Problem 25      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 14      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.044 | 5.25        | 0.148 | 0.     | 0.     | 0.    | 0.   |



| Problem 26      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | A       | A     | A           | F     | F      | F      | F     | F    |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 329     | 329   | 158         | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 1.    | 0.48        | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 1.495 | 1.711       | 0.056 | 0.     | 0.     | 0.    | 0.   |

| Problem 27      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | A       | A     | A           | A     | F      | F      | F     | F    |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 154     | 154   | 95          | 135   | 0      | 0      | 0     | 0    |
| normalized size | 1       | 1.    | 0.62        | 0.88  | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.333 | 0.28        | 0.066 | 0.     | 0.     | 0.    | 0.   |

| Problem 28      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | A       | A     | A           | A     | F      | F      | F     | F    |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 49      | 49    | 43          | 45    | 0      | 0      | 0     | 0    |
| normalized size | 1       | 1.    | 0.88        | 0.92  | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.065 | 0.009       | 0.049 | 0.     | 0.     | 0.    | 0.   |

| Problem 29      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 14      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.034 | 3.302       | 0.051 | 0.     | 0.     | 0.    | 0.   |

| Problem 30      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 14      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.034 | 5.059       | 0.056 | 0.     | 0.     | 0.    | 0.   |

| Problem 31      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 14      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.034 | 2.753       | 0.059 | 0.     | 0.     | 0.    | 0.   |

| Problem 32      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | F     | F      | F      | F     | F(-1) |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 137     | 137   | 106         | 0     | 0      | 0      | 0     | 0     |
| normalized size | 1       | 1.    | 0.77        | 0.    | 0.     | 0.     | 0.    | 0.    |
| time (sec)      | N/A     | 0.276 | 1.726       | 0.097 | 0.     | 0.     | 0.    | 0.    |

| Problem 33      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | F     | F      | F      | F     | F(-1) |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 137     | 137   | 106         | 0     | 0      | 0      | 0     | 0     |
| normalized size | 1       | 1.    | 0.77        | 0.    | 0.     | 0.     | 0.    | 0.    |
| time (sec)      | N/A     | 0.263 | 1.694       | 0.095 | 0.     | 0.     | 0.    | 0.    |

| Problem 34      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | F     | F      | F      | F     | F(-1) |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 128     | 128   | 102         | 0     | 0      | 0      | 0     | 0     |
| normalized size | 1       | 1.    | 0.8         | 0.    | 0.     | 0.     | 0.    | 0.    |
| time (sec)      | N/A     | 0.238 | 1.642       | 0.069 | 0.     | 0.     | 0.    | 0.    |

| Problem 35      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 54      | 54    | 95          | 72    | 0      | 0      | 0     | 80    |
| normalized size | 1       | 1.    | 1.76        | 1.33  | 0.     | 0.     | 0.    | 1.48  |
| time (sec)      | N/A     | 0.031 | 0.064       | 0.075 | 0.     | 0.     | 0.    | 1.571 |

| Problem 36      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | F     | F      | F      | F     | F(-1) |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 131     | 131   | 107         | 0     | 0      | 0      | 0     | 0     |
| normalized size | 1       | 1.    | 0.82        | 0.    | 0.     | 0.     | 0.    | 0.    |
| time (sec)      | N/A     | 0.254 | 1.684       | 0.092 | 0.     | 0.     | 0.    | 0.    |

| Problem 37      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | F     | F      | F      | F     | F(-1) |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 139     | 139   | 111         | 0     | 0      | 0      | 0     | 0     |
| normalized size | 1       | 1.    | 0.8         | 0.    | 0.     | 0.     | 0.    | 0.    |
| time (sec)      | N/A     | 0.251 | 1.698       | 0.092 | 0.     | 0.     | 0.    | 0.    |

| Problem 38      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | F     | F      | F      | F     | F(-1) |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 176     | 176   | 128         | 0     | 0      | 0      | 0     | 0     |
| normalized size | 1       | 1.    | 0.73        | 0.    | 0.     | 0.     | 0.    | 0.    |
| time (sec)      | N/A     | 0.315 | 3.02        | 0.093 | 0.     | 0.     | 0.    | 0.    |

| Problem 39      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | A       | A     | F           | F     | F      | F      | F     | F    |
| verified        | N/A     | Yes   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 96      | 96    | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 1.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.203 | 1.004       | 0.056 | 0.     | 0.     | 0.    | 0.   |

| Problem 40      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 48      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.152 | 0.821       | 0.057 | 0.     | 0.     | 0.    | 0.   |

| Problem 41      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | C           | A     | F      | F      | A     | A     |
| verified        | N/A     | Yes   | NO          | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 10      | 10    | 26          | 9     | 0      | 0      | 7     | 11    |
| normalized size | 1       | 1.    | 2.6         | 0.9   | 0.     | 0.     | 0.7   | 1.1   |
| time (sec)      | N/A     | 0.021 | 0.014       | 0.041 | 0.     | 0.     | 1.06  | 1.146 |

| Problem 42      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 26      | 26    | 26          | 23    | 0      | 0      | 0     | 55    |
| normalized size | 1       | 1.    | 1.          | 0.88  | 0.     | 0.     | 0.    | 2.12  |
| time (sec)      | N/A     | 0.046 | 0.011       | 0.05  | 0.     | 0.     | 0.    | 1.224 |

| Problem 43      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 61      | 61    | 44          | 58    | 0      | 0      | 0     | 62    |
| normalized size | 1       | 1.    | 0.72        | 0.95  | 0.     | 0.     | 0.    | 1.02  |
| time (sec)      | N/A     | 0.081 | 0.079       | 0.062 | 0.     | 0.     | 0.    | 1.164 |

| Problem 44      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 91      | 91    | 64          | 69    | 0      | 0      | 0     | 89    |
| normalized size | 1       | 1.    | 0.7         | 0.76  | 0.     | 0.     | 0.    | 0.98  |
| time (sec)      | N/A     | 0.111 | 0.104       | 0.059 | 0.     | 0.     | 0.    | 1.161 |

| Problem 45      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 126     | 126   | 93          | 138   | 0      | 0      | 0     | 104   |
| normalized size | 1       | 1.    | 0.74        | 1.1   | 0.     | 0.     | 0.    | 0.83  |
| time (sec)      | N/A     | 0.194 | 0.177       | 0.059 | 0.     | 0.     | 0.    | 1.177 |

| Problem 46      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 102     | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.188 | 0.829       | 0.084 | 0.     | 0.     | 0.    | 0.   |

| Problem 47      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | A       | A     | F           | F     | F      | F      | F     | F    |
| verified        | N/A     | Yes   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 44      | 44    | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 1.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.095 | 0.617       | 0.062 | 0.     | 0.     | 0.    | 0.   |

| Problem 48      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 14      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.026 | 0.954       | 0.056 | 0.     | 0.     | 0.    | 0.   |

| Problem 49      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | A     |
| verified        | N/A     | Yes   | NO          | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 34      | 34    | 36          | 33    | 0      | 0      | 0     | 45    |
| normalized size | 1       | 1.    | 1.06        | 0.97  | 0.     | 0.     | 0.    | 1.32  |
| time (sec)      | N/A     | 0.058 | 0.013       | 0.053 | 0.     | 0.     | 0.    | 1.182 |

| Problem 50      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 61      | 61    | 42          | 44    | 0      | 0      | 0     | 74    |
| normalized size | 1       | 1.    | 0.69        | 0.72  | 0.     | 0.     | 0.    | 1.21  |
| time (sec)      | N/A     | 0.066 | 0.049       | 0.056 | 0.     | 0.     | 0.    | 1.177 |

| Problem 51      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 98      | 98    | 72          | 105   | 0      | 0      | 0     | 88    |
| normalized size | 1       | 1.    | 0.73        | 1.07  | 0.     | 0.     | 0.    | 0.9   |
| time (sec)      | N/A     | 0.123 | 0.097       | 0.065 | 0.     | 0.     | 0.    | 1.172 |

| Problem 52      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C    |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 128     | 128   | 94          | 111   | 0      | 0      | 0     | 115  |
| normalized size | 1       | 1.    | 0.73        | 0.87  | 0.     | 0.     | 0.    | 0.9  |
| time (sec)      | N/A     | 0.179 | 0.105       | 0.078 | 0.     | 0.     | 0.    | 1.19 |

| Problem 53      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F(-2)  | F     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 29      | 29    | 25          | 24    | 0      | 0      | 0     | 31    |
| normalized size | 1       | 1.    | 0.86        | 0.83  | 0.     | 0.     | 0.    | 1.07  |
| time (sec)      | N/A     | 0.055 | 0.026       | 0.124 | 0.     | 0.     | 0.    | 1.201 |

| Problem 54      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F(-2)  | F     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 29      | 29    | 25          | 24    | 0      | 0      | 0     | 31    |
| normalized size | 1       | 1.    | 0.86        | 0.83  | 0.     | 0.     | 0.    | 1.07  |
| time (sec)      | N/A     | 0.056 | 0.026       | 0.131 | 0.     | 0.     | 0.    | 1.182 |

| Problem 55      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F(-1) | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 187     | 187   | 123         | 171   | 0      | 0      | 0     | 223   |
| normalized size | 1       | 1.    | 0.66        | 0.91  | 0.     | 0.     | 0.    | 1.19  |
| time (sec)      | N/A     | 0.708 | 0.326       | 0.063 | 0.     | 0.     | 0.    | 1.229 |

| Problem 56      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C    |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 97      | 97    | 71          | 89    | 0      | 0      | 0     | 146  |
| normalized size | 1       | 1.    | 0.73        | 0.92  | 0.     | 0.     | 0.    | 1.51 |
| time (sec)      | N/A     | 0.275 | 0.238       | 0.057 | 0.     | 0.     | 0.    | 1.19 |

| Problem 57      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 34      | 34    | 33          | 31    | 0      | 0      | 0     | 77    |
| normalized size | 1       | 1.    | 0.97        | 0.91  | 0.     | 0.     | 0.    | 2.26  |
| time (sec)      | N/A     | 0.054 | 0.017       | 0.049 | 0.     | 0.     | 0.    | 1.199 |

| Problem 58      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 18      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.123 | 4.921       | 0.081 | 0.     | 0.     | 0.    | 0.   |

| Problem 59      | Optimal | Rubi | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A    | A           | A     | F      | F      | F(-1) | C     |
| verified        | N/A     | Yes  | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 218     | 218  | 134         | 209   | 0      | 0      | 0     | 231   |
| normalized size | 1       | 1.   | 0.61        | 0.96  | 0.     | 0.     | 0.    | 1.06  |
| time (sec)      | N/A     | 0.66 | 0.343       | 0.068 | 0.     | 0.     | 0.    | 1.218 |

| Problem 60      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 108     | 108   | 74          | 105   | 0      | 0      | 0     | 144   |
| normalized size | 1       | 1.    | 0.69        | 0.97  | 0.     | 0.     | 0.    | 1.33  |
| time (sec)      | N/A     | 0.232 | 0.198       | 0.061 | 0.     | 0.     | 0.    | 1.202 |

| Problem 61      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | B     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 46      | 46    | 45          | 43    | 0      | 0      | 0     | 128   |
| normalized size | 1       | 1.    | 0.98        | 0.93  | 0.     | 0.     | 0.    | 2.78  |
| time (sec)      | N/A     | 0.075 | 0.021       | 0.055 | 0.     | 0.     | 0.    | 1.173 |

| Problem 62      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 18      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.125 | 2.614       | 0.086 | 0.     | 0.     | 0.    | 0.   |

| Problem 63      | Optimal | Rubi | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A    | C           | B     | F      | F      | F     | F(-1) |
| verified        | N/A     | Yes  | NO          | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 371     | 371  | 345         | 1212  | 0      | 0      | 0     | 0     |
| normalized size | 1       | 1.   | 0.93        | 3.27  | 0.     | 0.     | 0.    | 0.    |
| time (sec)      | N/A     | 0.92 | 5.313       | 0.108 | 0.     | 0.     | 0.    | 0.    |

| Problem 64      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | C           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | NO          | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 154     | 154   | 168         | 282   | 0      | 0      | 0     | 12880 |
| normalized size | 1       | 1.    | 1.09        | 1.83  | 0.     | 0.     | 0.    | 83.64 |
| time (sec)      | N/A     | 0.228 | 1.971       | 0.072 | 0.     | 0.     | 0.    | 2.034 |

| Problem 65      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 18      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.142 | 28.787      | 0.088 | 0.     | 0.     | 0.    | 0.   |



| Problem 66      | Optimal | Rubi | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A    | C           | B     | F      | F      | F     | F(-1) |
| verified        | N/A     | Yes  | NO          | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 370     | 370  | 393         | 1208  | 0      | 0      | 0     | 0     |
| normalized size | 1       | 1.   | 1.06        | 3.26  | 0.     | 0.     | 0.    | 0.    |
| time (sec)      | N/A     | 1.24 | 4.214       | 0.107 | 0.     | 0.     | 0.    | 0.    |

| Problem 67      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | C           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | NO          | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 153     | 153   | 164         | 280   | 0      | 0      | 0     | 12439 |
| normalized size | 1       | 1.    | 1.07        | 1.83  | 0.     | 0.     | 0.    | 81.3  |
| time (sec)      | N/A     | 0.223 | 1.745       | 0.079 | 0.     | 0.     | 0.    | 1.97  |

| Problem 68      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 18      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.107 | 13.115      | 0.093 | 0.     | 0.     | 0.    | 0.   |

| Problem 69      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | A       | A     | A           | C     | F      | F      | B     | F    |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 90      | 90    | 78          | 124   | 0      | 0      | 654   | 0    |
| normalized size | 1       | 1.    | 0.87        | 1.38  | 0.     | 0.     | 7.27  | 0.   |
| time (sec)      | N/A     | 0.082 | 0.076       | 0.099 | 0.     | 0.     | 2.174 | 0.   |

| Problem 70      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | A     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 63      | 63    | 53          | 56    | 0      | 0      | 85    | 66    |
| normalized size | 1       | 1.    | 0.84        | 0.89  | 0.     | 0.     | 1.35  | 1.05  |
| time (sec)      | N/A     | 0.071 | 0.04        | 0.048 | 0.     | 0.     | 2.905 | 1.195 |

| Problem 71      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | A     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 49      | 49    | 44          | 44    | 0      | 0      | 70    | 51    |
| normalized size | 1       | 1.    | 0.9         | 0.9   | 0.     | 0.     | 1.43  | 1.04  |
| time (sec)      | N/A     | 0.048 | 0.029       | 0.05  | 0.     | 0.     | 2.435 | 1.171 |

| Problem 72      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | A     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 35      | 35    | 35          | 32    | 0      | 0      | 53    | 39    |
| normalized size | 1       | 1.    | 1.          | 0.91  | 0.     | 0.     | 1.51  | 1.11  |
| time (sec)      | N/A     | 0.024 | 0.008       | 0.05  | 0.     | 0.     | 1.749 | 1.165 |

| Problem 73      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | B     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 16      | 16    | 16          | 19    | 0      | 0      | 31    | 22    |
| normalized size | 1       | 1.    | 1.          | 1.19  | 0.     | 0.     | 1.94  | 1.38  |
| time (sec)      | N/A     | 0.004 | 0.001       | 0.045 | 0.     | 0.     | 1.684 | 1.191 |

| Problem 74      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | A       | A     | A           | B     | F      | F      | F(-2) | F    |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 61      | 61    | 94          | 158   | 0      | 0      | 0     | 0    |
| normalized size | 1       | 1.    | 1.54        | 2.59  | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.023 | 0.039       | 0.091 | 0.     | 0.     | 0.    | 0.   |

| Problem 75      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | B     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 26      | 26    | 26          | 34    | 0      | 0      | 42    | 147   |
| normalized size | 1       | 1.    | 1.          | 1.31  | 0.     | 0.     | 1.62  | 5.65  |
| time (sec)      | N/A     | 0.048 | 0.011       | 0.047 | 0.     | 0.     | 1.384 | 1.205 |

| Problem 76      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | B     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 46      | 46    | 46          | 48    | 0      | 0      | 87    | 72    |
| normalized size | 1       | 1.    | 1.          | 1.04  | 0.     | 0.     | 1.89  | 1.57  |
| time (sec)      | N/A     | 0.068 | 0.014       | 0.053 | 0.     | 0.     | 3.134 | 1.161 |

| Problem 77      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 12      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.033 | 2.707       | 0.056 | 0.     | 0.     | 0.    | 0.   |

| Problem 78      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 163     | 163   | 108         | 148   | 0      | 0      | 0     | 119   |
| normalized size | 1       | 1.    | 0.66        | 0.91  | 0.     | 0.     | 0.    | 0.73  |
| time (sec)      | N/A     | 0.229 | 0.116       | 0.069 | 0.     | 0.     | 0.    | 1.183 |

| Problem 79      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 112     | 112   | 78          | 84    | 0      | 0      | 0     | 104   |
| normalized size | 1       | 1.    | 0.7         | 0.75  | 0.     | 0.     | 0.    | 0.93  |
| time (sec)      | N/A     | 0.138 | 0.081       | 0.073 | 0.     | 0.     | 0.    | 1.221 |

| Problem 80      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 75      | 75    | 58          | 70    | 0      | 0      | 0     | 76    |
| normalized size | 1       | 1.    | 0.77        | 0.93  | 0.     | 0.     | 0.    | 1.01  |
| time (sec)      | N/A     | 0.091 | 0.049       | 0.059 | 0.     | 0.     | 0.    | 1.298 |

| Problem 81      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 31      | 31    | 31          | 30    | 0      | 0      | 0     | 66    |
| normalized size | 1       | 1.    | 1.          | 0.97  | 0.     | 0.     | 0.    | 2.13  |
| time (sec)      | N/A     | 0.054 | 0.008       | 0.047 | 0.     | 0.     | 0.    | 1.283 |

| Problem 82      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 12      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.022 | 0.401       | 0.047 | 0.     | 0.     | 0.    | 0.   |

| Problem 83      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 12      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.025 | 0.485       | 0.055 | 0.     | 0.     | 0.    | 0.   |

| Problem 84      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 12      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.026 | 0.5         | 0.052 | 0.     | 0.     | 0.    | 0.   |

| Problem 85      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 47      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.316 | 3.607       | 0.155 | 0.     | 0.     | 0.    | 0.   |

| Problem 86      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 184     | 184   | 95          | 154   | 0      | 0      | 0     | 108   |
| normalized size | 1       | 1.    | 0.52        | 0.84  | 0.     | 0.     | 0.    | 0.59  |
| time (sec)      | N/A     | 0.374 | 0.218       | 0.052 | 0.     | 0.     | 0.    | 1.209 |

| Problem 87      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 118     | 118   | 64          | 99    | 0      | 0      | 0     | 108   |
| normalized size | 1       | 1.    | 0.54        | 0.84  | 0.     | 0.     | 0.    | 0.92  |
| time (sec)      | N/A     | 0.272 | 0.15        | 0.049 | 0.     | 0.     | 0.    | 1.177 |

| Problem 88      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 71      | 71    | 49          | 60    | 0      | 0      | 0     | 108   |
| normalized size | 1       | 1.    | 0.69        | 0.85  | 0.     | 0.     | 0.    | 1.52  |
| time (sec)      | N/A     | 0.207 | 0.105       | 0.049 | 0.     | 0.     | 0.    | 1.147 |

| Problem 89      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | B     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 27      | 27    | 42          | 26    | 0      | 0      | 0     | 93    |
| normalized size | 1       | 1.    | 1.56        | 0.96  | 0.     | 0.     | 0.    | 3.44  |
| time (sec)      | N/A     | 0.006 | 0.036       | 0.043 | 0.     | 0.     | 0.    | 1.134 |

| Problem 90      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 12      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.021 | 0.612       | 0.056 | 0.     | 0.     | 0.    | 0.   |

| Problem 91      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 47      | 47    | 40          | 49    | 0      | 0      | 0     | 201   |
| normalized size | 1       | 1.    | 0.85        | 1.04  | 0.     | 0.     | 0.    | 4.28  |
| time (sec)      | N/A     | 0.222 | 0.08        | 0.057 | 0.     | 0.     | 0.    | 1.227 |

| Problem 92      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 111     | 111   | 76          | 88    | 0      | 0      | 0     | 1010  |
| normalized size | 1       | 1.    | 0.68        | 0.79  | 0.     | 0.     | 0.    | 9.1   |
| time (sec)      | N/A     | 0.327 | 0.399       | 0.056 | 0.     | 0.     | 0.    | 1.232 |

| Problem 93      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 14      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.042 | 5.273       | 0.142 | 0.     | 0.     | 0.    | 0.   |

| Problem 94      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | A       | A     | A           | F     | F      | F      | F     | F    |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 329     | 329   | 159         | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 1.    | 0.48        | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 1.322 | 1.216       | 0.053 | 0.     | 0.     | 0.    | 0.   |

| Problem 95      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | A       | A     | A           | A     | F      | F      | F     | F    |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 155     | 155   | 96          | 136   | 0      | 0      | 0     | 0    |
| normalized size | 1       | 1.    | 0.62        | 0.88  | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.338 | 0.327       | 0.061 | 0.     | 0.     | 0.    | 0.   |

| Problem 96      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | A       | A     | A           | A     | F      | F      | F     | F    |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 48      | 48    | 41          | 43    | 0      | 0      | 0     | 0    |
| normalized size | 1       | 1.    | 0.85        | 0.9   | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.065 | 0.011       | 0.046 | 0.     | 0.     | 0.    | 0.   |

| Problem 97      | Optimal | Rubi | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A    | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A  | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 14      | 0    | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.   | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.03 | 1.315       | 0.049 | 0.     | 0.     | 0.    | 0.   |

| Problem 98      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 14      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.036 | 2.179       | 0.059 | 0.     | 0.     | 0.    | 0.   |

| Problem 99      | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 14      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.035 | 2.52        | 0.066 | 0.     | 0.     | 0.    | 0.   |

| Problem 100     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | F     | F      | F      | F     | F(-1) |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 133     | 133   | 102         | 0     | 0      | 0      | 0     | 0     |
| normalized size | 1       | 1.    | 0.77        | 0.    | 0.     | 0.     | 0.    | 0.    |
| time (sec)      | N/A     | 0.251 | 1.743       | 0.096 | 0.     | 0.     | 0.    | 0.    |

| Problem 101     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | F     | F      | F      | F     | F(-1) |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 133     | 133   | 102         | 0     | 0      | 0      | 0     | 0     |
| normalized size | 1       | 1.    | 0.77        | 0.    | 0.     | 0.     | 0.    | 0.    |
| time (sec)      | N/A     | 0.247 | 1.716       | 0.092 | 0.     | 0.     | 0.    | 0.    |

| Problem 102     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | F     | F      | F      | F     | F(-1) |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 124     | 124   | 98          | 0     | 0      | 0      | 0     | 0     |
| normalized size | 1       | 1.    | 0.79        | 0.    | 0.     | 0.     | 0.    | 0.    |
| time (sec)      | N/A     | 0.228 | 1.658       | 0.073 | 0.     | 0.     | 0.    | 0.    |

| Problem 103     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 55      | 55    | 96          | 73    | 0      | 0      | 0     | 82    |
| normalized size | 1       | 1.    | 1.75        | 1.33  | 0.     | 0.     | 0.    | 1.49  |
| time (sec)      | N/A     | 0.035 | 0.079       | 0.07  | 0.     | 0.     | 0.    | 1.336 |

| Problem 104     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | F     | F      | F      | F     | F(-1) |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 127     | 127   | 102         | 0     | 0      | 0      | 0     | 0     |
| normalized size | 1       | 1.    | 0.8         | 0.    | 0.     | 0.     | 0.    | 0.    |
| time (sec)      | N/A     | 0.247 | 1.701       | 0.096 | 0.     | 0.     | 0.    | 0.    |

| Problem 105     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | F     | F      | F      | F     | F(-1) |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 135     | 135   | 105         | 0     | 0      | 0      | 0     | 0     |
| normalized size | 1       | 1.    | 0.78        | 0.    | 0.     | 0.     | 0.    | 0.    |
| time (sec)      | N/A     | 0.239 | 1.713       | 0.097 | 0.     | 0.     | 0.    | 0.    |



| Problem 106     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | F     | F      | F      | F     | F(-1) |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 172     | 172   | 124         | 0     | 0      | 0      | 0     | 0     |
| normalized size | 1       | 1.    | 0.72        | 0.    | 0.     | 0.     | 0.    | 0.    |
| time (sec)      | N/A     | 0.295 | 3.042       | 0.082 | 0.     | 0.     | 0.    | 0.    |

| Problem 107     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 102     | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.251 | 1.466       | 0.056 | 0.     | 0.     | 0.    | 0.   |

| Problem 108     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | A       | A     | A           | F     | F      | F      | F     | F    |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 44      | 44    | 44          | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 1.    | 1.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.103 | 0.01        | 0.059 | 0.     | 0.     | 0.    | 0.   |

| Problem 109     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 14      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.027 | 2.051       | 0.057 | 0.     | 0.     | 0.    | 0.   |

| Problem 110     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 35      | 35    | 37          | 34    | 0      | 0      | 0     | 46    |
| normalized size | 1       | 1.    | 1.06        | 0.97  | 0.     | 0.     | 0.    | 1.31  |
| time (sec)      | N/A     | 0.061 | 0.013       | 0.052 | 0.     | 0.     | 0.    | 1.168 |

| Problem 111     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 62      | 62    | 44          | 45    | 0      | 0      | 0     | 77    |
| normalized size | 1       | 1.    | 0.71        | 0.73  | 0.     | 0.     | 0.    | 1.24  |
| time (sec)      | N/A     | 0.069 | 0.05        | 0.057 | 0.     | 0.     | 0.    | 1.178 |

| Problem 112     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 111     | 111   | 72          | 107   | 0      | 0      | 0     | 89    |
| normalized size | 1       | 1.    | 0.65        | 0.96  | 0.     | 0.     | 0.    | 0.8   |
| time (sec)      | N/A     | 0.128 | 0.086       | 0.062 | 0.     | 0.     | 0.    | 1.153 |

| Problem 113     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 147     | 147   | 94          | 111   | 0      | 0      | 0     | 116   |
| normalized size | 1       | 1.    | 0.64        | 0.76  | 0.     | 0.     | 0.    | 0.79  |
| time (sec)      | N/A     | 0.183 | 0.107       | 0.076 | 0.     | 0.     | 0.    | 1.237 |

| Problem 114     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | A       | A     | A           | F     | F      | F      | F     | F    |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 97      | 97    | 97          | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 1.    | 1.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.199 | 0.014       | 0.082 | 0.     | 0.     | 0.    | 0.   |

| Problem 115     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 50      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.093 | 0.444       | 0.057 | 0.     | 0.     | 0.    | 0.   |

| Problem 116     | Optimal | Rubi | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A    | A           | A     | F      | F      | A     | A     |
| verified        | N/A     | Yes  | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 10      | 10   | 10          | 9     | 0      | 0      | 7     | 11    |
| normalized size | 1       | 1.   | 1.          | 0.9   | 0.     | 0.     | 0.7   | 1.1   |
| time (sec)      | N/A     | 0.02 | 0.003       | 0.046 | 0.     | 0.     | 1.068 | 1.243 |

| Problem 117     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 25      | 25    | 25          | 22    | 0      | 0      | 0     | 54    |
| normalized size | 1       | 1.    | 1.          | 0.88  | 0.     | 0.     | 0.    | 2.16  |
| time (sec)      | N/A     | 0.043 | 0.012       | 0.049 | 0.     | 0.     | 0.    | 1.255 |

| Problem 118     | Optimal | Rubi | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A    | A           | A     | F      | F      | F     | A     |
| verified        | N/A     | Yes  | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 60      | 60   | 42          | 57    | 0      | 0      | 0     | 59    |
| normalized size | 1       | 1.   | 0.7         | 0.95  | 0.     | 0.     | 0.    | 0.98  |
| time (sec)      | N/A     | 0.08 | 0.046       | 0.059 | 0.     | 0.     | 0.    | 1.194 |

| Problem 119     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C    |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 89      | 89    | 64          | 66    | 0      | 0      | 0     | 88   |
| normalized size | 1       | 1.    | 0.72        | 0.74  | 0.     | 0.     | 0.    | 0.99 |
| time (sec)      | N/A     | 0.113 | 0.081       | 0.073 | 0.     | 0.     | 0.    | 1.2  |

| Problem 120     | Optimal | Rubi | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A    | A           | A     | F      | F      | F     | A     |
| verified        | N/A     | Yes  | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 142     | 142  | 93          | 136   | 0      | 0      | 0     | 103   |
| normalized size | 1       | 1.   | 0.65        | 0.96  | 0.     | 0.     | 0.    | 0.73  |
| time (sec)      | N/A     | 0.19 | 0.105       | 0.065 | 0.     | 0.     | 0.    | 1.263 |

| Problem 121     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F(-2)  | F     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 29      | 29    | 23          | 24    | 0      | 0      | 0     | 31    |
| normalized size | 1       | 1.    | 0.79        | 0.83  | 0.     | 0.     | 0.    | 1.07  |
| time (sec)      | N/A     | 0.056 | 0.026       | 0.104 | 0.     | 0.     | 0.    | 1.218 |

| Problem 122     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F(-2)  | F     | A     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 29      | 29    | 27          | 24    | 0      | 0      | 0     | 31    |
| normalized size | 1       | 1.    | 0.93        | 0.83  | 0.     | 0.     | 0.    | 1.07  |
| time (sec)      | N/A     | 0.053 | 0.024       | 0.095 | 0.     | 0.     | 0.    | 1.245 |

| Problem 123     | Optimal | Rubi | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A    | A           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes  | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 220     | 220  | 134         | 211   | 0      | 0      | 0     | 230   |
| normalized size | 1       | 1.   | 0.61        | 0.96  | 0.     | 0.     | 0.    | 1.05  |
| time (sec)      | N/A     | 0.72 | 0.322       | 0.066 | 0.     | 0.     | 0.    | 1.319 |

| Problem 124     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 109     | 109   | 76          | 106   | 0      | 0      | 0     | 150   |
| normalized size | 1       | 1.    | 0.7         | 0.97  | 0.     | 0.     | 0.    | 1.38  |
| time (sec)      | N/A     | 0.229 | 0.182       | 0.062 | 0.     | 0.     | 0.    | 1.214 |

| Problem 125     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | B     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 47      | 47    | 46          | 44    | 0      | 0      | 0     | 130   |
| normalized size | 1       | 1.    | 0.98        | 0.94  | 0.     | 0.     | 0.    | 2.77  |
| time (sec)      | N/A     | 0.076 | 0.024       | 0.052 | 0.     | 0.     | 0.    | 1.191 |

| Problem 126     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 18      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.131 | 6.969       | 0.085 | 0.     | 0.     | 0.    | 0.   |

| Problem 127     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 185     | 185   | 123         | 168   | 0      | 0      | 0     | 221   |
| normalized size | 1       | 1.    | 0.66        | 0.91  | 0.     | 0.     | 0.    | 1.19  |
| time (sec)      | N/A     | 0.586 | 0.301       | 0.083 | 0.     | 0.     | 0.    | 1.208 |

| Problem 128     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 96      | 96    | 69          | 88    | 0      | 0      | 0     | 143   |
| normalized size | 1       | 1.    | 0.72        | 0.92  | 0.     | 0.     | 0.    | 1.49  |
| time (sec)      | N/A     | 0.252 | 0.158       | 0.062 | 0.     | 0.     | 0.    | 1.178 |

| Problem 129     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | A           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 33      | 33    | 32          | 30    | 0      | 0      | 0     | 76    |
| normalized size | 1       | 1.    | 0.97        | 0.91  | 0.     | 0.     | 0.    | 2.3   |
| time (sec)      | N/A     | 0.056 | 0.019       | 0.053 | 0.     | 0.     | 0.    | 1.165 |

| Problem 130     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 18      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.075 | 3.237       | 0.085 | 0.     | 0.     | 0.    | 0.   |

| Problem 131     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | C           | B     | F      | F      | F     | F(-1) |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 371     | 371   | 328         | 1208  | 0      | 0      | 0     | 0     |
| normalized size | 1       | 1.    | 0.88        | 3.26  | 0.     | 0.     | 0.    | 0.    |
| time (sec)      | N/A     | 1.019 | 6.403       | 0.102 | 0.     | 0.     | 0.    | 0.    |

| Problem 132     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | C           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 154     | 154   | 144         | 280   | 0      | 0      | 0     | 12438 |
| normalized size | 1       | 1.    | 0.94        | 1.82  | 0.     | 0.     | 0.    | 80.77 |
| time (sec)      | N/A     | 0.222 | 1.387       | 0.078 | 0.     | 0.     | 0.    | 1.886 |

| Problem 133     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 18      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.138 | 31.069      | 0.088 | 0.     | 0.     | 0.    | 0.   |

| Problem 134     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | C           | B     | F      | F      | F     | F(-1) |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 370     | 370   | 433         | 1212  | 0      | 0      | 0     | 0     |
| normalized size | 1       | 1.    | 1.17        | 3.28  | 0.     | 0.     | 0.    | 0.    |
| time (sec)      | N/A     | 0.801 | 4.406       | 0.105 | 0.     | 0.     | 0.    | 0.    |

| Problem 135     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac  |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|-------|
| grade           | A       | A     | C           | A     | F      | F      | F     | C     |
| verified        | N/A     | Yes   | Yes         | TBD   | TBD    | TBD    | TBD   | TBD   |
| size            | 153     | 153   | 153         | 282   | 0      | 0      | 0     | 12879 |
| normalized size | 1       | 1.    | 1.          | 1.84  | 0.     | 0.     | 0.    | 84.18 |
| time (sec)      | N/A     | 0.217 | 1.577       | 0.074 | 0.     | 0.     | 0.    | 1.94  |

| Problem 136     | Optimal | Rubi  | Mathematica | Maple | Maxima | Fricas | Sympy | Giac |
|-----------------|---------|-------|-------------|-------|--------|--------|-------|------|
| grade           | N/A     | A     | A           | A     | A      | A      | A     | A    |
| verified        | N/A     | N/A   | N/A         | TBD   | TBD    | TBD    | TBD   | TBD  |
| size            | 18      | 0     | 0           | 0     | 0      | 0      | 0     | 0    |
| normalized size | 1       | 0.    | 0.          | 0.    | 0.     | 0.     | 0.    | 0.   |
| time (sec)      | N/A     | 0.092 | 18.706      | 0.089 | 0.     | 0.     | 0.    | 0.   |

## 2.3 Detailed conclusion table specific for Rubi results

The following table is specific to Rubi. It gives additional statistics for each integral. the column **steps** is the number of steps used by Rubi to obtain the antiderivative. The **rules** column is the number of unique rules used. The **integrand size** column is the leaf size of the integrand. Finally the ratio  $\frac{\text{number of rules}}{\text{integrand size}}$  is given. The larger this ratio is, the harder the integral was to solve. In this test, problem number [26] had the largest ratio of [ 1.583 ]

Table 2.1: Rubi specific breakdown of results for each integral

| #  | grade | number of steps used | number of unique rules | normalized antiderivative leaf size | integrand leaf size | $\frac{\text{number of rules}}{\text{integrand leaf size}}$ |
|----|-------|----------------------|------------------------|-------------------------------------|---------------------|---|
| 1  | A     | 5                    | 4                      | 1.                                  | 8                   | 0.5   |
| 2  | A     | 6                    | 4                      | 1.                                  | 8                   | 0.5   |
| 3  | A     | 5                    | 4                      | 1.                                  | 8                   | 0.5   |
| 4  | A     | 4                    | 4                      | 1.                                  | 6                   | 0.667   |
| 5  | A     | 1                    | 1                      | 1.                                  | 4                   | 0.25  |
| 6  | A     | 1                    | 1                      | 1.                                  | 8                   | 0.125   |
| 7  | A     | 4                    | 4                      | 1.                                  | 8                   | 0.5   |
| 8  | A     | 5                    | 4                      | 1.                                  | 8                   | 0.5   |
| 9  | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 10 | A     | 19                   | 11                     | 1.                                  | 10                  | 1.1   |
| 11 | A     | 15                   | 10                     | 1.                                  | 10                  | 1.  |
| 12 | A     | 10                   | 8                      | 1.                                  | 8                   | 1.  |
| 13 | A     | 6                    | 5                      | 1.                                  | 6                   | 0.833   |
| 14 | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 15 | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |

Continued on next page

Table 2.1 – continued from previous page

| #  | grade | number of steps used | number of unique rules | normalized antiderivative leaf size | integrand leaf size | $\frac{\text{number of rules}}{\text{integrand leaf size}}$ |
|----|-------|----------------------|------------------------|-------------------------------------|---------------------|---|
| 16 | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 17 | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 18 | A     | 14                   | 6                      | 1.                                  | 10                  | 0.6   |
| 19 | A     | 10                   | 6                      | 1.                                  | 10                  | 0.6   |
| 20 | A     | 7                    | 6                      | 1.                                  | 8                   | 0.75  |
| 21 | A     | 1                    | 1                      | 1.                                  | 6                   | 0.167   |
| 22 | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 23 | A     | 7                    | 5                      | 1.                                  | 10                  | 0.5   |
| 24 | A     | 11                   | 6                      | 1.                                  | 10                  | 0.6   |
| 25 | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 26 | A     | 39                   | 19                     | 1.                                  | 12                  | 1.583   |
| 27 | A     | 17                   | 14                     | 1.                                  | 10                  | 1.4   |
| 28 | A     | 5                    | 5                      | 1.                                  | 8                   | 0.625   |
| 29 | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 30 | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 31 | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 32 | A     | 7                    | 5                      | 1.                                  | 17                  | 0.294   |
| 33 | A     | 7                    | 5                      | 1.                                  | 15                  | 0.333   |
| 34 | A     | 7                    | 5                      | 1.                                  | 13                  | 0.385   |
| 35 | A     | 3                    | 1                      | 1.                                  | 17                  | 0.059   |
| 36 | A     | 7                    | 5                      | 1.                                  | 17                  | 0.294   |
| 37 | A     | 7                    | 5                      | 1.                                  | 17                  | 0.294   |
| 38 | A     | 7                    | 5                      | 1.                                  | 19                  | 0.263   |
| 39 | A     | 14                   | 10                     | 1.                                  | 12                  | 0.833   |
| 40 | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 41 | A     | 1                    | 1                      | 1.                                  | 12                  | 0.083   |
| 42 | A     | 5                    | 4                      | 1.                                  | 9                   | 0.444   |
| 43 | A     | 9                    | 7                      | 1.                                  | 10                  | 0.7   |
| 44 | A     | 14                   | 9                      | 1.                                  | 12                  | 0.75  |
| 45 | A     | 18                   | 10                     | 1.                                  | 12                  | 0.833   |
| 46 | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 47 | A     | 7                    | 6                      | 1.                                  | 12                  | 0.5   |

Continued on next page



Table 2.1 – continued from previous page

| #  | grade | number of steps used | number of unique rules | normalized antiderivative leaf size | integrand leaf size | $\frac{\text{number of rules}}{\text{integrand leaf size}}$ |
|----|-------|----------------------|------------------------|-------------------------------------|---------------------|---|
| 48 | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 49 | A     | 5                    | 4                      | 1.                                  | 9                   | 0.444   |
| 50 | A     | 9                    | 7                      | 1.                                  | 10                  | 0.7   |
| 51 | A     | 13                   | 9                      | 1.                                  | 12                  | 0.75  |
| 52 | A     | 20                   | 11                     | 1.                                  | 12                  | 0.917   |
| 53 | A     | 6                    | 4                      | 1.                                  | 9                   | 0.444   |
| 54 | A     | 6                    | 4                      | 1.                                  | 9                   | 0.444   |
| 55 | A     | 21                   | 16                     | 1.                                  | 16                  | 1.  |
| 56 | A     | 11                   | 9                      | 1.                                  | 14                  | 0.643   |
| 57 | A     | 4                    | 4                      | 1.                                  | 13                  | 0.308   |
| 58 | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 59 | A     | 21                   | 14                     | 1.                                  | 16                  | 0.875   |
| 60 | A     | 12                   | 10                     | 1.                                  | 14                  | 0.714   |
| 61 | A     | 4                    | 3                      | 1.                                  | 13                  | 0.231   |
| 62 | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 63 | A     | 24                   | 10                     | 1.                                  | 14                  | 0.714   |
| 64 | A     | 9                    | 5                      | 1.                                  | 13                  | 0.385   |
| 65 | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 66 | A     | 24                   | 9                      | 1.                                  | 14                  | 0.643   |
| 67 | A     | 9                    | 5                      | 1.                                  | 13                  | 0.385   |
| 68 | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 69 | A     | 5                    | 4                      | 1.                                  | 8                   | 0.5   |
| 70 | A     | 6                    | 4                      | 1.                                  | 8                   | 0.5   |
| 71 | A     | 5                    | 4                      | 1.                                  | 8                   | 0.5   |
| 72 | A     | 4                    | 4                      | 1.                                  | 6                   | 0.667   |
| 73 | A     | 1                    | 1                      | 1.                                  | 4                   | 0.25  |
| 74 | A     | 1                    | 1                      | 1.                                  | 8                   | 0.125   |
| 75 | A     | 4                    | 4                      | 1.                                  | 8                   | 0.5   |
| 76 | A     | 5                    | 4                      | 1.                                  | 8                   | 0.5   |
| 77 | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 78 | A     | 19                   | 11                     | 1.                                  | 10                  | 1.1   |
| 79 | A     | 15                   | 10                     | 1.                                  | 10                  | 1.  |

Continued on next page

Table 2.1 – continued from previous page

| #   | grade | number of steps used | number of unique rules | normalized antiderivative leaf size | integrand leaf size | $\frac{\text{number of rules}}{\text{integrand leaf size}}$ |
|-----|-------|----------------------|------------------------|-------------------------------------|---------------------|---|
| 80  | A     | 10                   | 8                      | 1.                                  | 8                   | 1.  |
| 81  | A     | 6                    | 5                      | 1.                                  | 6                   | 0.833   |
| 82  | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 83  | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 84  | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 85  | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 86  | A     | 14                   | 6                      | 1.                                  | 10                  | 0.6   |
| 87  | A     | 10                   | 6                      | 1.                                  | 10                  | 0.6   |
| 88  | A     | 7                    | 6                      | 1.                                  | 8                   | 0.75  |
| 89  | A     | 1                    | 1                      | 1.                                  | 6                   | 0.167   |
| 90  | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 91  | A     | 7                    | 5                      | 1.                                  | 10                  | 0.5   |
| 92  | A     | 11                   | 6                      | 1.                                  | 10                  | 0.6   |
| 93  | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 94  | A     | 39                   | 19                     | 1.                                  | 12                  | 1.583   |
| 95  | A     | 17                   | 14                     | 1.                                  | 10                  | 1.4   |
| 96  | A     | 5                    | 5                      | 1.                                  | 8                   | 0.625   |
| 97  | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 98  | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 99  | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 100 | A     | 7                    | 5                      | 1.                                  | 17                  | 0.294   |
| 101 | A     | 7                    | 5                      | 1.                                  | 15                  | 0.333   |
| 102 | A     | 7                    | 5                      | 1.                                  | 13                  | 0.385   |
| 103 | A     | 3                    | 1                      | 1.                                  | 17                  | 0.059   |
| 104 | A     | 7                    | 5                      | 1.                                  | 17                  | 0.294   |
| 105 | A     | 7                    | 5                      | 1.                                  | 17                  | 0.294   |
| 106 | A     | 7                    | 5                      | 1.                                  | 19                  | 0.263   |
| 107 | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 108 | A     | 7                    | 6                      | 1.                                  | 12                  | 0.5   |
| 109 | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 110 | A     | 5                    | 4                      | 1.                                  | 9                   | 0.444   |
| 111 | A     | 9                    | 7                      | 1.                                  | 10                  | 0.7   |

Continued on next page

Table 2.1 – continued from previous page

| #   | grade | number of steps used | number of unique rules | normalized antiderivative leaf size | integrand leaf size | $\frac{\text{number of rules}}{\text{integrand leaf size}}$ |
|-----|-------|----------------------|------------------------|-------------------------------------|---------------------|---|
| 112 | A     | 13                   | 9                      | 1.                                  | 12                  | 0.75  |
| 113 | A     | 20                   | 11                     | 1.                                  | 12                  | 0.917   |
| 114 | A     | 14                   | 10                     | 1.                                  | 12                  | 0.833   |
| 115 | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 116 | A     | 1                    | 1                      | 1.                                  | 12                  | 0.083   |
| 117 | A     | 5                    | 4                      | 1.                                  | 9                   | 0.444   |
| 118 | A     | 9                    | 7                      | 1.                                  | 10                  | 0.7   |
| 119 | A     | 14                   | 9                      | 1.                                  | 12                  | 0.75  |
| 120 | A     | 18                   | 10                     | 1.                                  | 12                  | 0.833   |
| 121 | A     | 6                    | 4                      | 1.                                  | 9                   | 0.444   |
| 122 | A     | 6                    | 4                      | 1.                                  | 9                   | 0.444   |
| 123 | A     | 21                   | 14                     | 1.                                  | 16                  | 0.875   |
| 124 | A     | 12                   | 10                     | 1.                                  | 14                  | 0.714   |
| 125 | A     | 4                    | 3                      | 1.                                  | 13                  | 0.231   |
| 126 | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 127 | A     | 21                   | 16                     | 1.                                  | 16                  | 1.  |
| 128 | A     | 11                   | 9                      | 1.                                  | 14                  | 0.643   |
| 129 | A     | 4                    | 4                      | 1.                                  | 13                  | 0.308   |
| 130 | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 131 | A     | 24                   | 9                      | 1.                                  | 14                  | 0.643   |
| 132 | A     | 9                    | 5                      | 1.                                  | 13                  | 0.385   |
| 133 | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |
| 134 | A     | 24                   | 10                     | 1.                                  | 14                  | 0.714   |
| 135 | A     | 9                    | 5                      | 1.                                  | 13                  | 0.385   |
| 136 | A     | 0                    | 0                      | 0.                                  | 0                   | 0.  |



# Chapter 3

## Listing of integrals

### 3.1 $\int x^m \text{Si}(bx) dx$

**Optimal.** Leaf size=86

$$\frac{x^m(-ibx)^{-m}\Gamma(m+1,-ibx)}{2b(m+1)} + \frac{x^m(ibx)^{-m}\Gamma(m+1,ibx)}{2b(m+1)} + \frac{x^{m+1}\text{Si}(bx)}{m+1}$$

[Out]  $(x^m\Gamma[1+m,(-I)*b*x])/(2*b*(1+m)*((-I)*b*x)^m + (x^m\Gamma[1+m,I*b*x])/(2*b*(1+m)*(I*b*x)^m) + (x^{(1+m)}*\text{SinIntegral}[b*x])/(1+m)$

---

**Rubi [A]** time = 0.073956, antiderivative size = 86, normalized size of antiderivative = 1., number of steps used = 5, number of rules used = 4, integrand size = 8,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.5$ , Rules used = {6503, 12, 3308, 2181}

$$\frac{x^m(-ibx)^{-m}\Gamma(m+1,-ibx)}{2b(m+1)} + \frac{x^m(ibx)^{-m}\Gamma(m+1,ibx)}{2b(m+1)} + \frac{x^{m+1}\text{Si}(bx)}{m+1}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[x^m*\text{SinIntegral}[b*x],x]$

[Out]  $(x^m\Gamma[1+m,(-I)*b*x])/(2*b*(1+m)*((-I)*b*x)^m + (x^m\Gamma[1+m,I*b*x])/(2*b*(1+m)*(I*b*x)^m) + (x^{(1+m)}*\text{SinIntegral}[b*x])/(1+m)$

#### Rule 6503

$\text{Int}[\frac{((c_.) + (d_.)*(x_))^{(m_.)}*\text{SinIntegral}[(a_.) + (b_.)*(x_)]}{(d*(m+1))}, x\_Symbol] :$   
>  $\text{Simp}[\frac{(c + d*x)^{(m+1)}*\text{SinIntegral}[a + b*x]}{(d*(m+1))}, x] - \text{Dist}[b/(d$

$(m + 1)$ ), Int[((c + d\*x)^(m + 1)\*Sin[a + b\*x])/(a + b\*x), x], x] /; FreeQ[{a, b, c, d, m}, x] && NeQ[m, -1]

### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] := Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b\_)\*(v\_)] /; FreeQ[b, x]

### Rule 3308

Int[((c\_.) + (d\_.)\*(x\_))^(m\_.)\*sin[(e\_.) + (f\_.)\*(x\_)], x\_Symbol] := Dist[I/2, Int[(c + d\*x)^m/E^(I\*(e + f\*x)), x], x] - Dist[I/2, Int[(c + d\*x)^m\*E^(I\*(e + f\*x)), x], x] /; FreeQ[{c, d, e, f, m}, x]

### Rule 2181

Int[(F\_)^((g\_.)\*((e\_.) + (f\_.)\*(x\_)))\*((c\_.) + (d\_.)\*(x\_))^(m\_), x\_Symbol] := -Simp[(F^(g\*(e - (c\*f)/d))\*(c + d\*x)^FracPart[m]\*Gamma[m + 1, (-((f\*g\*Log[F])/d))\*(c + d\*x])]/(d\*(-((f\*g\*Log[F])/d))^(IntPart[m] + 1)\*(-((f\*g\*Log[F])\*(c + d\*x))/d))^FracPart[m]), x] /; FreeQ[{F, c, d, e, f, g, m}, x] && !IntegerQ[m]

### Rubi steps

$$\begin{aligned} \int x^m \operatorname{Si}(bx) dx &= \frac{x^{1+m} \operatorname{Si}(bx)}{1+m} - \frac{b \int \frac{x^m \sin(bx)}{b} dx}{1+m} \\ &= \frac{x^{1+m} \operatorname{Si}(bx)}{1+m} - \frac{\int x^m \sin(bx) dx}{1+m} \\ &= \frac{x^{1+m} \operatorname{Si}(bx)}{1+m} - \frac{i \int e^{-ibx} x^m dx}{2(1+m)} + \frac{i \int e^{ibx} x^m dx}{2(1+m)} \\ &= \frac{x^m (-ibx)^{-m} \Gamma(1+m, -ibx)}{2b(1+m)} + \frac{x^m (ibx)^{-m} \Gamma(1+m, ibx)}{2b(1+m)} + \frac{x^{1+m} \operatorname{Si}(bx)}{1+m} \end{aligned}$$

**Mathematica [A]** time = 0.0539509, size = 82, normalized size = 0.95

$$\frac{x^m (b^2 x^2)^{-m} \left( (-ibx)^m \Gamma(m+1, ibx) + (ibx)^m \Gamma(m+1, -ibx) + 2bx (b^2 x^2)^m \operatorname{Si}(bx) \right)}{2b(m+1)}$$

Antiderivative was successfully verified.

[In] Integrate[x^m\*SinIntegral[b\*x],x]

[Out]  $(x^m*((I*b*x)^m*\Gamma[1+m, (-I)*b*x] + ((-I)*b*x)^m*\Gamma[1+m, I*b*x] + 2*b*x*(b^2*x^2)^m*\text{SinIntegral}[b*x]))/(2*b*(1+m)*(b^2*x^2)^m)$

**Maple [C]** time = 0.171, size = 37, normalized size = 0.4

$$\frac{bx^{2+m}}{2+m} {}_2F_3\left(\frac{1}{2}, 1 + \frac{m}{2}; \frac{3}{2}, \frac{3}{2}, 2 + \frac{m}{2}; -\frac{b^2x^2}{4}\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x^m\*Si(b\*x),x)

[Out]  $b/(2+m)*x^{(2+m)}*\text{hypergeom}([1/2, 1+1/2*m], [3/2, 3/2, 2+1/2*m], -1/4*b^2*x^2)$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^m \text{Si}(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^m\*Si(b\*x),x, algorithm="maxima")

[Out] integrate(x^m\*Si(b\*x), x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^m \text{Si}(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^m\*Si(b\*x),x, algorithm="fricas")

[Out] integral(x^m\*sin\_integral(b\*x), x)

---

**Sympy [A]** time = 0.957741, size = 46, normalized size = 0.53

$$\frac{bx^2x^m\Gamma\left(\frac{m}{2}+1\right) {}_2F_3\left(\begin{matrix} \frac{1}{2}, \frac{m}{2}+1 \\ \frac{3}{2}, \frac{3}{2}, \frac{m}{2}+2 \end{matrix} \middle| -\frac{b^2x^2}{4}\right)}{2\Gamma\left(\frac{m}{2}+2\right)}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*\*m\*Si(b\*x),x)

[Out] b\*x\*\*2\*x\*\*m\*gamma(m/2 + 1)\*hyper((1/2, m/2 + 1), (3/2, 3/2, m/2 + 2), -b\*\*2\*x\*\*2/4)/(2\*gamma(m/2 + 2))

---

**Giac [F]** time = 0., size = 0, normalized size = 0.

$$\int x^m \text{Si}(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^m\*Si(b\*x),x, algorithm="giac")

[Out] integrate(x^m\*Si(b\*x), x)



## 3.2 $\int x^3 \text{Si}(bx) dx$

**Optimal.** Leaf size=63

$$-\frac{3x^2 \sin(bx)}{4b^2} + \frac{3 \sin(bx)}{2b^4} - \frac{3x \cos(bx)}{2b^3} + \frac{1}{4}x^4 \text{Si}(bx) + \frac{x^3 \cos(bx)}{4b}$$

[Out]  $(-3*x*\text{Cos}[b*x])/(2*b^3) + (x^3*\text{Cos}[b*x])/(4*b) + (3*\text{Sin}[b*x])/(2*b^4) - (3*x^2*\text{Sin}[b*x])/(4*b^2) + (x^4*\text{SinIntegral}[b*x])/4$

**Rubi [A]** time = 0.0684778, antiderivative size = 63, normalized size of antiderivative = 1., number of steps used = 6, number of rules used = 4, integrand size = 8,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.5$ , Rules used = {6503, 12, 3296, 2637}

$$-\frac{3x^2 \sin(bx)}{4b^2} + \frac{3 \sin(bx)}{2b^4} - \frac{3x \cos(bx)}{2b^3} + \frac{1}{4}x^4 \text{Si}(bx) + \frac{x^3 \cos(bx)}{4b}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[x^3*\text{SinIntegral}[b*x], x]$

[Out]  $(-3*x*\text{Cos}[b*x])/(2*b^3) + (x^3*\text{Cos}[b*x])/(4*b) + (3*\text{Sin}[b*x])/(2*b^4) - (3*x^2*\text{Sin}[b*x])/(4*b^2) + (x^4*\text{SinIntegral}[b*x])/4$

### Rule 6503

$\text{Int}[\left((c_.) + (d_.)*(x_.)\right)^{(m_.)}*\text{SinIntegral}[(a_.) + (b_.)*(x_.)], x\_Symbol] :$   
 $> \text{Simp}[\left((c + d*x)^{(m + 1)}*\text{SinIntegral}[a + b*x]\right)/(d*(m + 1)), x] - \text{Dist}[b/(d*(m + 1)), \text{Int}[\left((c + d*x)^{(m + 1)}*\text{Sin}[a + b*x]\right)/(a + b*x), x], x] /;$   $\text{FreeQ}[\{a, b, c, d, m\}, x] \ \&\& \ \text{NeQ}[m, -1]$

### Rule 12

$\text{Int}[(a_)*(u_), x\_Symbol] :> \text{Dist}[a, \text{Int}[u, x], x] /;$   $\text{FreeQ}[a, x] \ \&\& \ !\text{MatchQ}[u, (b_)*(v_)] /;$   $\text{FreeQ}[b, x]$

### Rule 3296

$\text{Int}[\left((c_.) + (d_.)*(x_.)\right)^{(m_.)}*\sin[(e_.) + (f_.)*(x_.)], x\_Symbol] :> -\text{Simp}[\left((c + d*x)^m*\text{Cos}[e + f*x]\right)/f, x] + \text{Dist}[(d*m)/f, \text{Int}[\left((c + d*x)^{(m - 1)}*\text{Cos}[e + f*x], x\right), x] /;$   $\text{FreeQ}[\{c, d, e, f\}, x] \ \&\& \ \text{GtQ}[m, 0]$

Rule 2637

```
Int[sin[Pi/2 + (c_.) + (d_.)*(x_)], x_Symbol] := Simp[Sin[c + d*x]/d, x] /;
FreeQ[{c, d}, x]
```

Rubi steps

$$\begin{aligned}
\int x^3 \text{Si}(bx) dx &= \frac{1}{4} x^4 \text{Si}(bx) - \frac{1}{4} b \int \frac{x^3 \sin(bx)}{b} dx \\
&= \frac{1}{4} x^4 \text{Si}(bx) - \frac{1}{4} \int x^3 \sin(bx) dx \\
&= \frac{x^3 \cos(bx)}{4b} + \frac{1}{4} x^4 \text{Si}(bx) - \frac{3 \int x^2 \cos(bx) dx}{4b} \\
&= \frac{x^3 \cos(bx)}{4b} - \frac{3x^2 \sin(bx)}{4b^2} + \frac{1}{4} x^4 \text{Si}(bx) + \frac{3 \int x \sin(bx) dx}{2b^2} \\
&= -\frac{3x \cos(bx)}{2b^3} + \frac{x^3 \cos(bx)}{4b} - \frac{3x^2 \sin(bx)}{4b^2} + \frac{1}{4} x^4 \text{Si}(bx) + \frac{3 \int \cos(bx) dx}{2b^3} \\
&= -\frac{3x \cos(bx)}{2b^3} + \frac{x^3 \cos(bx)}{4b} + \frac{3 \sin(bx)}{2b^4} - \frac{3x^2 \sin(bx)}{4b^2} + \frac{1}{4} x^4 \text{Si}(bx)
\end{aligned}$$

**Mathematica [A]** time = 0.0364487, size = 50, normalized size = 0.79

$$\frac{b^4 x^4 \text{Si}(bx) - 3(b^2 x^2 - 2) \sin(bx) + bx(b^2 x^2 - 6) \cos(bx)}{4b^4}$$

Antiderivative was successfully verified.

```
[In] Integrate[x^3*SinIntegral[b*x], x]
```

```
[Out] (b*x*(-6 + b^2*x^2)*Cos[b*x] - 3*(-2 + b^2*x^2)*Sin[b*x] + b^4*x^4*SinIntegral[b*x])/(4*b^4)
```

**Maple [A]** time = 0.056, size = 56, normalized size = 0.9

$$\frac{1}{b^4} \left( \frac{b^4 x^4 \text{Si}(bx)}{4} + \frac{b^3 x^3 \cos(bx)}{4} - \frac{3 b^2 x^2 \sin(bx)}{4} + \frac{3 \sin(bx)}{2} - \frac{3 bx \cos(bx)}{2} \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(x^3*Si(b*x),x)`

[Out]  $1/b^4*(1/4*b^4*x^4*Si(b*x)+1/4*b^3*x^3*\cos(b*x)-3/4*b^2*x^2*\sin(b*x)+3/2*\sin(b*x)-3/2*b*x*\cos(b*x))$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^3 \text{Si}(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^3*Si(b*x),x, algorithm="maxima")`

[Out] `integrate(x^3*Si(b*x), x)`

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^3 \text{Si}(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^3*Si(b*x),x, algorithm="fricas")`

[Out] `integral(x^3*sin_integral(b*x), x)`

**Sympy [A]** time = 1.27236, size = 61, normalized size = 0.97

$$\frac{x^4 \text{Si}(bx)}{4} + \frac{x^3 \cos(bx)}{4b} - \frac{3x^2 \sin(bx)}{4b^2} - \frac{3x \cos(bx)}{2b^3} + \frac{3 \sin(bx)}{2b^4}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x**3*Si(b*x),x)`

[Out]  $x**4*Si(b*x)/4 + x**3*\cos(b*x)/(4*b) - 3*x**2*\sin(b*x)/(4*b**2) - 3*x*\cos(b*x)/(2*b**3) + 3*\sin(b*x)/(2*b**4)$

---

**Giac [A]** time = 1.29534, size = 66, normalized size = 1.05

$$\frac{1}{4} x^4 \operatorname{Si}(bx) + \frac{(b^3 x^3 - 6bx) \cos(bx)}{4b^4} - \frac{3(b^2 x^2 - 2) \sin(bx)}{4b^4}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^3\*Si(b\*x),x, algorithm="giac")

[Out] 1/4\*x^4\*sin\_integral(b\*x) + 1/4\*(b^3\*x^3 - 6\*b\*x)\*cos(b\*x)/b^4 - 3/4\*(b^2\*x^2 - 2)\*sin(b\*x)/b^4

### 3.3 $\int x^2 \text{Si}(bx) dx$

**Optimal.** Leaf size=49

$$-\frac{2x \sin(bx)}{3b^2} - \frac{2 \cos(bx)}{3b^3} + \frac{1}{3}x^3 \text{Si}(bx) + \frac{x^2 \cos(bx)}{3b}$$

[Out]  $(-2*\text{Cos}[b*x])/(3*b^3) + (x^2*\text{Cos}[b*x])/(3*b) - (2*x*\text{Sin}[b*x])/(3*b^2) + (x^3*\text{SinIntegral}[b*x])/3$

**Rubi [A]** time = 0.0461829, antiderivative size = 49, normalized size of antiderivative = 1., number of steps used = 5, number of rules used = 4, integrand size = 8,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.5$ , Rules used = {6503, 12, 3296, 2638}

$$-\frac{2x \sin(bx)}{3b^2} - \frac{2 \cos(bx)}{3b^3} + \frac{1}{3}x^3 \text{Si}(bx) + \frac{x^2 \cos(bx)}{3b}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[x^2*\text{SinIntegral}[b*x], x]$

[Out]  $(-2*\text{Cos}[b*x])/(3*b^3) + (x^2*\text{Cos}[b*x])/(3*b) - (2*x*\text{Sin}[b*x])/(3*b^2) + (x^3*\text{SinIntegral}[b*x])/3$

#### Rule 6503

$\text{Int}[\left((c_.) + (d_.)*(x_.)\right)^{(m_.)}*\text{SinIntegral}[(a_.) + (b_.)*(x_.)], x\_Symbol] :$   
 $> \text{Simp}[\left((c + d*x)^{(m + 1)}*\text{SinIntegral}[a + b*x]\right)/(d*(m + 1)), x] - \text{Dist}[b/(d*(m + 1)), \text{Int}[\left((c + d*x)^{(m + 1)}*\text{Sin}[a + b*x]\right)/(a + b*x), x], x] /;$   $\text{FreeQ}[\{a, b, c, d, m\}, x] \ \&\& \ \text{NeQ}[m, -1]$

#### Rule 12

$\text{Int}[(a_)*(u_), x\_Symbol] :> \text{Dist}[a, \text{Int}[u, x], x] /;$   $\text{FreeQ}[a, x] \ \&\& \ !\text{Match}[Q[u, (b_)*(v_)] /;$   $\text{FreeQ}[b, x]$

#### Rule 3296

$\text{Int}[\left((c_.) + (d_.)*(x_.)\right)^{(m_.)}*\sin[(e_.) + (f_.)*(x_.)], x\_Symbol] :> -\text{Simp}[\left((c + d*x)^m*\text{Cos}[e + f*x]\right)/f, x] + \text{Dist}[(d*m)/f, \text{Int}[(c + d*x)^{(m - 1)}*\text{Cos}[e + f*x], x], x] /;$   $\text{FreeQ}[\{c, d, e, f\}, x] \ \&\& \ \text{GtQ}[m, 0]$

Rule 2638

```
Int[sin[(c_.) + (d_.)*(x_)], x_Symbol] := -Simp[Cos[c + d*x]/d, x] /; FreeQ
[{c, d}, x]
```

Rubi steps

$$\begin{aligned}
 \int x^2 \text{Si}(bx) dx &= \frac{1}{3} x^3 \text{Si}(bx) - \frac{1}{3} b \int \frac{x^2 \sin(bx)}{b} dx \\
 &= \frac{1}{3} x^3 \text{Si}(bx) - \frac{1}{3} \int x^2 \sin(bx) dx \\
 &= \frac{x^2 \cos(bx)}{3b} + \frac{1}{3} x^3 \text{Si}(bx) - \frac{2 \int x \cos(bx) dx}{3b} \\
 &= \frac{x^2 \cos(bx)}{3b} - \frac{2x \sin(bx)}{3b^2} + \frac{1}{3} x^3 \text{Si}(bx) + \frac{2 \int \sin(bx) dx}{3b^2} \\
 &= -\frac{2 \cos(bx)}{3b^3} + \frac{x^2 \cos(bx)}{3b} - \frac{2x \sin(bx)}{3b^2} + \frac{1}{3} x^3 \text{Si}(bx)
 \end{aligned}$$

**Mathematica [A]** time = 0.0271712, size = 41, normalized size = 0.84

$$\frac{b^3 x^3 \text{Si}(bx) + (b^2 x^2 - 2) \cos(bx) - 2bx \sin(bx)}{3b^3}$$

Antiderivative was successfully verified.

```
[In] Integrate[x^2*SinIntegral[b*x],x]
```

```
[Out] ((-2 + b^2*x^2)*Cos[b*x] - 2*b*x*Sin[b*x] + b^3*x^3*SinIntegral[b*x])/(3*b^3)
```

**Maple [A]** time = 0.054, size = 44, normalized size = 0.9

$$\frac{1}{b^3} \left( \frac{b^3 x^3 \text{Si}(bx)}{3} + \frac{b^2 x^2 \cos(bx)}{3} - \frac{2 \cos(bx)}{3} - \frac{2 \sin(bx) bx}{3} \right)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(x^2*Si(b*x),x)
```

[Out]  $1/b^3*(1/3*b^3*x^3*Si(b*x)+1/3*b^2*x^2*cos(b*x)-2/3*cos(b*x)-2/3*sin(b*x)*b*x)$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 Si(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Si(b*x),x, algorithm="maxima")`

[Out] `integrate(x^2*Si(b*x), x)`

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^2 Si(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Si(b*x),x, algorithm="fricas")`

[Out] `integral(x^2*sin_integral(b*x), x)`

**Sympy [A]** time = 1.47372, size = 46, normalized size = 0.94

$$\frac{x^3 Si(bx)}{3} + \frac{x^2 \cos(bx)}{3b} - \frac{2x \sin(bx)}{3b^2} - \frac{2 \cos(bx)}{3b^3}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x**2*Si(b*x),x)`

[Out] `x**3*Si(b*x)/3 + x**2*cos(b*x)/(3*b) - 2*x*sin(b*x)/(3*b**2) - 2*cos(b*x)/(3*b**3)`

**Giac [A]** time = 1.28744, size = 51, normalized size = 1.04

$$\frac{1}{3}x^3 \operatorname{Si}(bx) - \frac{2x \sin(bx)}{3b^2} + \frac{(b^2x^2 - 2) \cos(bx)}{3b^3}$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x^2*Si(b*x),x, algorithm="giac")
```

```
[Out] 1/3*x^3*sin_integral(b*x) - 2/3*x*sin(b*x)/b^2 + 1/3*(b^2*x^2 - 2)*cos(b*x)/b^3
```



### 3.4 $\int x \text{Si}(bx) dx$

**Optimal.** Leaf size=35

$$-\frac{\sin(bx)}{2b^2} + \frac{1}{2}x^2\text{Si}(bx) + \frac{x \cos(bx)}{2b}$$

[Out]  $(x \cos[bx])/(2b) - \sin[bx]/(2b^2) + (x^2 \text{SinIntegral}[bx])/2$

**Rubi [A]** time = 0.0227732, antiderivative size = 35, normalized size of antiderivative = 1., number of steps used = 4, number of rules used = 4, integrand size = 6,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.667$ , Rules used = {6503, 12, 3296, 2637}

$$-\frac{\sin(bx)}{2b^2} + \frac{1}{2}x^2\text{Si}(bx) + \frac{x \cos(bx)}{2b}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[x \text{SinIntegral}[bx], x]$

[Out]  $(x \cos[bx])/(2b) - \sin[bx]/(2b^2) + (x^2 \text{SinIntegral}[bx])/2$

#### Rule 6503

$\text{Int}[(c_. + (d_.)(x_))^{(m_.)} \text{SinIntegral}[(a_.) + (b_.)(x_)], x\_Symbol] :> \text{Simp}[(c + d*x)^{(m + 1)} \text{SinIntegral}[a + b*x]/(d*(m + 1)), x] - \text{Dist}[b/(d*(m + 1)), \text{Int}[(c + d*x)^{(m + 1)} \text{Sin}[a + b*x]/(a + b*x), x], x] /; \text{FreeQ}[\{a, b, c, d, m\}, x] \&\& \text{NeQ}[m, -1]$

#### Rule 12

$\text{Int}[(a_)(u_), x\_Symbol] :> \text{Dist}[a, \text{Int}[u, x], x] /; \text{FreeQ}[a, x] \&\& \text{!MatchQ}[u, (b_)(v_)] /; \text{FreeQ}[b, x]$

#### Rule 3296

$\text{Int}[(c_. + (d_.)(x_))^{(m_.)} \sin[(e_.) + (f_.)(x_)], x\_Symbol] :> -\text{Simp}[(c + d*x)^m \cos[e + f*x]/f, x] + \text{Dist}[(d*m)/f, \text{Int}[(c + d*x)^{(m - 1)} \cos[e + f*x], x], x] /; \text{FreeQ}[\{c, d, e, f\}, x] \&\& \text{GtQ}[m, 0]$

#### Rule 2637

```
Int[sin[Pi/2 + (c_.) + (d_.)*(x_)], x_Symbol] := Simp[Sin[c + d*x]/d, x] /;
FreeQ[{c, d}, x]
```

### Rubi steps

$$\begin{aligned}
 \int x \operatorname{Si}(bx) dx &= \frac{1}{2} x^2 \operatorname{Si}(bx) - \frac{1}{2} b \int \frac{x \sin(bx)}{b} dx \\
 &= \frac{1}{2} x^2 \operatorname{Si}(bx) - \frac{1}{2} \int x \sin(bx) dx \\
 &= \frac{x \cos(bx)}{2b} + \frac{1}{2} x^2 \operatorname{Si}(bx) - \frac{\int \cos(bx) dx}{2b} \\
 &= \frac{x \cos(bx)}{2b} - \frac{\sin(bx)}{2b^2} + \frac{1}{2} x^2 \operatorname{Si}(bx)
 \end{aligned}$$

**Mathematica [A]** time = 0.0063835, size = 35, normalized size = 1.

$$-\frac{\sin(bx)}{2b^2} + \frac{1}{2} x^2 \operatorname{Si}(bx) + \frac{x \cos(bx)}{2b}$$

Antiderivative was successfully verified.

```
[In] Integrate[x*SinIntegral[b*x], x]
```

```
[Out] (x*Cos[b*x])/(2*b) - Sin[b*x]/(2*b^2) + (x^2*SinIntegral[b*x])/2
```

**Maple [A]** time = 0.05, size = 32, normalized size = 0.9

$$\frac{1}{b^2} \left( \frac{b^2 x^2 \operatorname{Si}(bx)}{2} + \frac{bx \cos(bx)}{2} - \frac{\sin(bx)}{2} \right)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(x*Si(b*x), x)
```

```
[Out] 1/b^2*(1/2*b^2*x^2*Si(b*x)+1/2*b*x*cos(b*x)-1/2*sin(b*x))
```

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x \operatorname{Si}(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Si(b\*x),x, algorithm="maxima")

[Out] integrate(x\*Si(b\*x), x)

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(x \operatorname{Si}(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Si(b\*x),x, algorithm="fricas")

[Out] integral(x\*sin\_integral(b\*x), x)

---

**Sympy [A]** time = 0.743066, size = 29, normalized size = 0.83

$$\frac{x^2 \operatorname{Si}(bx)}{2} + \frac{x \cos(bx)}{2b} - \frac{\sin(bx)}{2b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Si(b\*x),x)

[Out] x\*\*2\*Si(b\*x)/2 + x\*cos(b\*x)/(2\*b) - sin(b\*x)/(2\*b\*\*2)

---

**Giac [A]** time = 1.30504, size = 39, normalized size = 1.11

$$\frac{1}{2} x^2 \operatorname{Si}(bx) + \frac{x \cos(bx)}{2b} - \frac{\sin(bx)}{2b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x*Si(b*x),x, algorithm="giac")
```

```
[Out] 1/2*x^2*sin_integral(b*x) + 1/2*x*cos(b*x)/b - 1/2*sin(b*x)/b^2
```

### 3.5 $\int \text{Si}(bx) dx$

Optimal. Leaf size=15

$$x\text{Si}(bx) + \frac{\cos(bx)}{b}$$

[Out] Cos[b\*x]/b + x\*SinIntegral[b\*x]

**Rubi [A]** time = 0.0038514, antiderivative size = 15, normalized size of antiderivative = 1., number of steps used = 1, number of rules used = 1, integrand size = 4,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.25$ , Rules used = {6499}

$$x\text{Si}(bx) + \frac{\cos(bx)}{b}$$

Antiderivative was successfully verified.

[In] Int[SinIntegral[b\*x],x]

[Out] Cos[b\*x]/b + x\*SinIntegral[b\*x]

#### Rule 6499

Int[SinIntegral[(a\_.) + (b\_.)\*(x\_.)], x\_Symbol] :> Simp[((a + b\*x)\*SinIntegral[a + b\*x])/b, x] + Simp[Cos[a + b\*x]/b, x] /; FreeQ[{a, b}, x]

#### Rubi steps

$$\int \text{Si}(bx) dx = \frac{\cos(bx)}{b} + x\text{Si}(bx)$$

**Mathematica [A]** time = 0.0014557, size = 15, normalized size = 1.

$$x\text{Si}(bx) + \frac{\cos(bx)}{b}$$

Antiderivative was successfully verified.

[In] Integrate[SinIntegral[b\*x],x]

[Out]  $\text{Cos}[b*x]/b + x*\text{SinIntegral}[b*x]$

---

**Maple [A]** time = 0.05, size = 17, normalized size = 1.1

$$\frac{bx\text{Si}(bx) + \cos(bx)}{b}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(Si(b*x), x)`

[Out]  $1/b*(b*x*\text{Si}(b*x)+\cos(b*x))$

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \text{Si}(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(b*x), x, algorithm="maxima")`

[Out] `integrate(Si(b*x), x)`

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(\text{Si}(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(b*x), x, algorithm="fricas")`

[Out] `integral(sin_integral(b*x), x)`

---

**Sympy [A]** time = 0.802061, size = 12, normalized size = 0.8

$$x \operatorname{Si}(bx) + \frac{\cos(bx)}{b}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x),x)

[Out] x\*Si(b\*x) + cos(b\*x)/b

**Giac [A]** time = 1.25101, size = 20, normalized size = 1.33

$$x \operatorname{Si}(bx) + \frac{\cos(bx)}{b}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x),x, algorithm="giac")

[Out] x\*sin\_integral(b\*x) + cos(b\*x)/b

### 3.6 $\int \frac{\text{Si}(bx)}{x} dx$

**Optimal.** Leaf size=43

$$\frac{1}{2}bx\text{HypergeometricPFQ}(\{1,1,1\},\{2,2,2\},-ibx) + \frac{1}{2}bx\text{HypergeometricPFQ}(\{1,1,1\},\{2,2,2\},ibx)$$

[Out] (b\*x\*HypergeometricPFQ[{1, 1, 1}, {2, 2, 2}, (-I)\*b\*x])/2 + (b\*x\*HypergeometricPFQ[{1, 1, 1}, {2, 2, 2}, I\*b\*x])/2

**Rubi [A]** time = 0.0200348, antiderivative size = 43, normalized size of antiderivative = 1., number of steps used = 1, number of rules used = 1, integrand size = 8,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.125$ , Rules used = {6501}

$$\frac{1}{2}bx {}_3F_3(1,1,1;2,2,2;-ibx) + \frac{1}{2}bx {}_3F_3(1,1,1;2,2,2;ibx)$$

Antiderivative was successfully verified.

[In] Int[SinIntegral[b\*x]/x,x]

[Out] (b\*x\*HypergeometricPFQ[{1, 1, 1}, {2, 2, 2}, (-I)\*b\*x])/2 + (b\*x\*HypergeometricPFQ[{1, 1, 1}, {2, 2, 2}, I\*b\*x])/2

#### Rule 6501

Int[SinIntegral[(b\_.)\*(x\_)]/(x\_), x\_Symbol] := Simp[(1\*b\*x\*HypergeometricPFQ[{1, 1, 1}, {2, 2, 2}, -(I\*b\*x)])/2, x] + Simp[(1\*b\*x\*HypergeometricPFQ[{1, 1, 1}, {2, 2, 2}, I\*b\*x])/2, x] /; FreeQ[b, x]

#### Rubi steps

$$\int \frac{\text{Si}(bx)}{x} dx = \frac{1}{2}bx {}_3F_3(1,1,1;2,2,2;-ibx) + \frac{1}{2}bx {}_3F_3(1,1,1;2,2,2;ibx)$$

**Mathematica [A]** time = 0.0042725, size = 43, normalized size = 1.

$$\frac{1}{2}bx\text{HypergeometricPFQ}(\{1,1,1\},\{2,2,2\},-ibx) + \frac{1}{2}bx\text{HypergeometricPFQ}(\{1,1,1\},\{2,2,2\},ibx)$$



Antiderivative was successfully verified.

```
[In] Integrate[SinIntegral[b*x]/x,x]
```

```
[Out] (b*x*HypergeometricPFQ[{1, 1, 1}, {2, 2, 2}, (-I)*b*x])/2 + (b*x*HypergeometricPFQ[{1, 1, 1}, {2, 2, 2}, I*b*x])/2
```

**Maple [A]** time = 0.069, size = 20, normalized size = 0.5

$$bx {}_2F_3\left(\frac{1}{2}, \frac{1}{2}; \frac{3}{2}, \frac{3}{2}, \frac{3}{2}; -\frac{b^2x^2}{4}\right)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(Si(b*x)/x,x)
```

```
[Out] b*x*hypergeom([1/2,1/2],[3/2,3/2,3/2],-1/4*b^2*x^2)
```

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(b*x)/x,x, algorithm="maxima")
```

```
[Out] integrate(Si(b*x)/x, x)
```

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Si}(bx)}{x}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(b*x)/x,x, algorithm="fricas")
```

```
[Out] integral(sin_integral(b*x)/x, x)
```

---

**Sympy [F(-2)]** time = 0., size = 0, normalized size = 0.

Exception raised: AttributeError

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(b*x)/x,x)
```

```
[Out] Exception raised: AttributeError
```

---

**Giac [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(b*x)/x,x, algorithm="giac")
```

```
[Out] integrate(Si(b*x)/x, x)
```

### 3.7 $\int \frac{\text{Si}(bx)}{x^2} dx$

**Optimal.** Leaf size=25

$$b\text{CosIntegral}(bx) - \frac{\text{Si}(bx)}{x} - \frac{\sin(bx)}{x}$$

[Out] b\*CosIntegral[b\*x] - Sin[b\*x]/x - SinIntegral[b\*x]/x

**Rubi [A]** time = 0.0452787, antiderivative size = 25, normalized size of antiderivative = 1., number of steps used = 4, number of rules used = 4, integrand size = 8,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.5$ , Rules used = {6503, 12, 3297, 3302}

$$b\text{CosIntegral}(bx) - \frac{\text{Si}(bx)}{x} - \frac{\sin(bx)}{x}$$

Antiderivative was successfully verified.

[In] Int[SinIntegral[b\*x]/x^2,x]

[Out] b\*CosIntegral[b\*x] - Sin[b\*x]/x - SinIntegral[b\*x]/x

#### Rule 6503

```
Int[((c_.) + (d_.)*(x_))^(m_.)*SinIntegral[(a_.) + (b_.)*(x_)], x_Symbol] :
> Simp[((c + d*x)^(m + 1)*SinIntegral[a + b*x])/(d*(m + 1)), x] - Dist[b/(d
*(m + 1)), Int[((c + d*x)^(m + 1)*Sin[a + b*x])/(a + b*x), x], x] /; FreeQ[
{a, b, c, d, m}, x] && NeQ[m, -1]
```

#### Rule 12

```
Int[(a_)*(u_), x_Symbol] :> Dist[a, Int[u, x], x] /; FreeQ[a, x] && !Match
Q[u, (b_)*(v_) /; FreeQ[b, x]]
```

#### Rule 3297

```
Int[((c_.) + (d_.)*(x_))^(m_.)*sin[(e_.) + (f_.)*(x_)], x_Symbol] :> Simp[((
c + d*x)^(m + 1)*Sin[e + f*x])/(d*(m + 1)), x] - Dist[f/(d*(m + 1)), Int[(c
+ d*x)^(m + 1)*Cos[e + f*x], x], x] /; FreeQ[{c, d, e, f}, x] && LtQ[m, -1
]
```

#### Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[CosIntegral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) - c*f, 0]
```

### Rubi steps

$$\begin{aligned}\int \frac{\text{Si}(bx)}{x^2} dx &= -\frac{\text{Si}(bx)}{x} + b \int \frac{\sin(bx)}{bx^2} dx \\ &= -\frac{\text{Si}(bx)}{x} + \int \frac{\sin(bx)}{x^2} dx \\ &= -\frac{\sin(bx)}{x} - \frac{\text{Si}(bx)}{x} + b \int \frac{\cos(bx)}{x} dx \\ &= b\text{Ci}(bx) - \frac{\sin(bx)}{x} - \frac{\text{Si}(bx)}{x}\end{aligned}$$

**Mathematica [A]** time = 0.009746, size = 25, normalized size = 1.

$$b\text{CosIntegral}(bx) - \frac{\text{Si}(bx)}{x} - \frac{\sin(bx)}{x}$$

Antiderivative was successfully verified.

```
[In] Integrate[SinIntegral[b*x]/x^2,x]
```

```
[Out] b*CosIntegral[b*x] - Sin[b*x]/x - SinIntegral[b*x]/x
```

**Maple [A]** time = 0.054, size = 32, normalized size = 1.3

$$b \left( -\frac{\text{Si}(bx)}{bx} - \frac{\sin(bx)}{bx} + \text{Ci}(bx) \right)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(Si(b*x)/x^2,x)
```

```
[Out] b*(-Si(b*x)/b/x-sin(b*x)/b/x+Ci(b*x))
```

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x)/x^2,x, algorithm="maxima")

[Out] integrate(Si(b\*x)/x^2, x)

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Si}(bx)}{x^2}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x)/x^2,x, algorithm="fricas")

[Out] integral(sin\_integral(b\*x)/x^2, x)

---

**Sympy [A]** time = 1.16882, size = 36, normalized size = 1.44

$$-\frac{b^3 x^2 {}_3F_4\left(1, 1, \frac{3}{2} \middle| -\frac{b^2 x^2}{4}\right)}{36} + \frac{b \log(b^2 x^2)}{2}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x)/x\*\*2,x)

[Out] -b\*\*3\*x\*\*2\*hyper((1, 1, 3/2), (2, 2, 5/2, 5/2), -b\*\*2\*x\*\*2/4)/36 + b\*log(b\*  
\*2\*x\*\*2)/2

---

**Giac [A]** time = 1.20313, size = 50, normalized size = 2.

$$\frac{bx \text{Ci}(bx) + bx \text{Ci}(-bx) - 2 \sin(bx)}{2x} - \frac{\text{Si}(bx)}{x}$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(b*x)/x^2,x, algorithm="giac")
```

```
[Out] 1/2*(b*x*cos_integral(b*x) + b*x*cos_integral(-b*x) - 2*sin(b*x))/x - sin_i  
ntegral(b*x)/x
```

### 3.8 $\int \frac{\text{Si}(bx)}{x^3} dx$

**Optimal.** Leaf size=46

$$-\frac{1}{4}b^2\text{Si}(bx) - \frac{\text{Si}(bx)}{2x^2} - \frac{\sin(bx)}{4x^2} - \frac{b \cos(bx)}{4x}$$

[Out]  $-(b*\text{Cos}[b*x])/(4*x) - \text{Sin}[b*x]/(4*x^2) - (b^2*\text{SinIntegral}[b*x])/4 - \text{SinIntegral}[b*x]/(2*x^2)$

**Rubi [A]** time = 0.0646036, antiderivative size = 46, normalized size of antiderivative = 1., number of steps used = 5, number of rules used = 4, integrand size = 8,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.5$ , Rules used = {6503, 12, 3297, 3299}

$$-\frac{1}{4}b^2\text{Si}(bx) - \frac{\text{Si}(bx)}{2x^2} - \frac{\sin(bx)}{4x^2} - \frac{b \cos(bx)}{4x}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[\text{SinIntegral}[b*x]/x^3, x]$

[Out]  $-(b*\text{Cos}[b*x])/(4*x) - \text{Sin}[b*x]/(4*x^2) - (b^2*\text{SinIntegral}[b*x])/4 - \text{SinIntegral}[b*x]/(2*x^2)$

#### Rule 6503

$\text{Int}[(c + d*x)^m * \text{SinIntegral}[a + b*x], x\_Symbol] :> \text{Simp}[(c + d*x)^{m+1} * \text{SinIntegral}[a + b*x] / (d*(m+1)), x] - \text{Dist}[b / (d*(m+1)), \text{Int}[(c + d*x)^{m+1} * \text{Sin}[a + b*x] / (a + b*x), x], x] /;$   $\text{FreeQ}\{a, b, c, d, m\}, x \ \&\& \ \text{NeQ}[m, -1]$

#### Rule 12

$\text{Int}[(a)*(u), x\_Symbol] :> \text{Dist}[a, \text{Int}[u, x], x] /;$   $\text{FreeQ}[a, x] \ \&\& \ \text{!MatchQ}[u, (b)*(v)] /;$   $\text{FreeQ}[b, x]$

#### Rule 3297

$\text{Int}[(c + d*x)^m * \sin[e + f*x], x\_Symbol] :> \text{Simp}[(c + d*x)^{m+1} * \text{Sin}[e + f*x] / (d*(m+1)), x] - \text{Dist}[f / (d*(m+1)), \text{Int}[(c + d*x)^{m+1} * \text{Cos}[e + f*x], x], x] /;$   $\text{FreeQ}\{c, d, e, f\}, x \ \&\& \ \text{LtQ}[m, -1]$

]

**Rule 3299**

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] :> Simp[SinIntegral[e + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*e - c\*f, 0]

**Rubi steps**

$$\begin{aligned}
 \int \frac{\text{Si}(bx)}{x^3} dx &= -\frac{\text{Si}(bx)}{2x^2} + \frac{1}{2}b \int \frac{\sin(bx)}{bx^3} dx \\
 &= -\frac{\text{Si}(bx)}{2x^2} + \frac{1}{2} \int \frac{\sin(bx)}{x^3} dx \\
 &= -\frac{\sin(bx)}{4x^2} - \frac{\text{Si}(bx)}{2x^2} + \frac{1}{4}b \int \frac{\cos(bx)}{x^2} dx \\
 &= -\frac{b \cos(bx)}{4x} - \frac{\sin(bx)}{4x^2} - \frac{\text{Si}(bx)}{2x^2} - \frac{1}{4}b^2 \int \frac{\sin(bx)}{x} dx \\
 &= -\frac{b \cos(bx)}{4x} - \frac{\sin(bx)}{4x^2} - \frac{1}{4}b^2 \text{Si}(bx) - \frac{\text{Si}(bx)}{2x^2}
 \end{aligned}$$

**Mathematica [A]** time = 0.0130357, size = 46, normalized size = 1.

$$-\frac{1}{4}b^2 \text{Si}(bx) - \frac{\text{Si}(bx)}{2x^2} - \frac{\sin(bx)}{4x^2} - \frac{b \cos(bx)}{4x}$$

Antiderivative was successfully verified.

[In] Integrate[SinIntegral[b\*x]/x^3,x]

[Out] -(b\*Cos[b\*x])/(4\*x) - Sin[b\*x]/(4\*x^2) - (b^2\*SinIntegral[b\*x])/4 - SinIntegral[b\*x]/(2\*x^2)

**Maple [A]** time = 0.052, size = 48, normalized size = 1.

$$b^2 \left( -\frac{\text{Si}(bx)}{2b^2x^2} - \frac{\sin(bx)}{4b^2x^2} - \frac{\cos(bx)}{4bx} - \frac{\text{Si}(bx)}{4} \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Si(b\*x)/x^3,x)



[Out]  $b^2*(-1/2*Si(b*x)/b^2/x^2-1/4*\sin(b*x)/b^2/x^2-1/4*\cos(b*x)/b/x-1/4*Si(b*x))$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{Si(bx)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(b*x)/x^3,x, algorithm="maxima")`

[Out] `integrate(Si(b*x)/x^3, x)`

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{Si(bx)}{x^3}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(b*x)/x^3,x, algorithm="fricas")`

[Out] `integral(sin_integral(b*x)/x^3, x)`

**Sympy [A]** time = 0.891122, size = 41, normalized size = 0.89

$$-\frac{b^2 Si(bx)}{4} - \frac{b \cos(bx)}{4x} - \frac{\sin(bx)}{4x^2} - \frac{Si(bx)}{2x^2}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(b*x)/x**3,x)`

[Out] `-b**2*Si(b*x)/4 - b*cos(b*x)/(4*x) - sin(b*x)/(4*x**2) - Si(b*x)/(2*x**2)`

**Giac [C]** time = 1.35264, size = 201, normalized size = 4.37

$$\frac{b^2 x^2 \Im(\text{Ci}(bx)) \tan\left(\frac{1}{2} bx\right)^2 - b^2 x^2 \Im(\text{Ci}(-bx)) \tan\left(\frac{1}{2} bx\right)^2 + 2 b^2 x^2 \text{Si}(bx) \tan\left(\frac{1}{2} bx\right)^2 + b^2 x^2 \Im(\text{Ci}(bx)) - b^2 x^2 \Im(\text{Ci}(-bx))}{8 \left( x^2 \tan\left(\frac{1}{2} bx\right)^2 + x^2 \right)}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x)/x^3,x, algorithm="giac")

[Out] 
$$\frac{-1/8*(b^2*x^2*\text{imag\_part}(\text{cos\_integral}(b*x))*\tan(1/2*b*x)^2 - b^2*x^2*\text{imag\_part}(\text{cos\_integral}(-b*x))*\tan(1/2*b*x)^2 + 2*b^2*x^2*\text{sin\_integral}(b*x)*\tan(1/2*b*x)^2 + b^2*x^2*\text{imag\_part}(\text{cos\_integral}(b*x)) - b^2*x^2*\text{imag\_part}(\text{cos\_integral}(-b*x)) + 2*b^2*x^2*\text{sin\_integral}(b*x) - 2*b*x*\tan(1/2*b*x)^2 + 2*b*x + 4*\tan(1/2*b*x))/(x^2*\tan(1/2*b*x)^2 + x^2) - 1/2*\text{sin\_integral}(b*x)/x^2}$$

### 3.9 $\int x^m \mathbf{Si}(bx)^2 dx$

Optimal. Leaf size=12

CannotIntegrate( $x^m \mathbf{Si}(bx)^2, x$ )

[Out] CannotIntegrate[x<sup>m</sup>\*SinIntegral[b\*x]<sup>2</sup>, x]

**Rubi [A]** time = 0.0310492, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int x^m \mathbf{Si}(bx)^2 dx$$

Verification is Not applicable to the result.

[In] Int[x<sup>m</sup>\*SinIntegral[b\*x]<sup>2</sup>,x]

[Out] Defer[Int][x<sup>m</sup>\*SinIntegral[b\*x]<sup>2</sup>, x]

Rubi steps

$$\int x^m \mathbf{Si}(bx)^2 dx = \int x^m \mathbf{Si}(bx)^2 dx$$

**Mathematica [A]** time = 2.51324, size = 0, normalized size = 0.

$$\int x^m \mathbf{Si}(bx)^2 dx$$

Verification is Not applicable to the result.

[In] Integrate[x<sup>m</sup>\*SinIntegral[b\*x]<sup>2</sup>,x]

[Out] Integrate[x<sup>m</sup>\*SinIntegral[b\*x]<sup>2</sup>, x]

**Maple [A]** time = 0.059, size = 0, normalized size = 0.

$$\int x^m (\operatorname{Si}(bx))^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(x^m*Si(b*x)^2,x)`

[Out] `int(x^m*Si(b*x)^2,x)`

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int x^m \operatorname{Si}(bx)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^m*Si(b*x)^2,x, algorithm="maxima")`

[Out] `integrate(x^m*Si(b*x)^2, x)`

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(x^m \operatorname{Si}(bx)^2, x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^m*Si(b*x)^2,x, algorithm="fricas")`

[Out] `integral(x^m*sin_integral(b*x)^2, x)`

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int x^m \operatorname{Si}^2(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x**m*Si(b*x)**2,x)
```

```
[Out] Integral(x**m*Si(b*x)**2, x)
```

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int x^m \text{Si}(bx)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x^m*Si(b*x)^2,x, algorithm="giac")
```

```
[Out] integrate(x^m*Si(b*x)^2, x)
```

### 3.10 $\int x^3 \text{Si}(bx)^2 dx$

**Optimal.** Leaf size=149

$$\frac{3\text{CosIntegral}(2bx)}{2b^4} - \frac{3x^2\text{Si}(bx)\sin(bx)}{2b^2} + \frac{3\text{Si}(bx)\sin(bx)}{b^4} - \frac{3x\text{Si}(bx)\cos(bx)}{b^3} + \frac{x^2}{2b^2} - \frac{x^2\sin^2(bx)}{4b^2} - \frac{3\log(x)}{2b^4} + \frac{2\sin^2(bx)}{b^4}$$

```
[Out] x^2/(2*b^2) + (3*CosIntegral[2*b*x])/(2*b^4) - (3*Log[x])/(2*b^4) - (x*Cos[
b*x]*Sin[b*x])/b^3 + (2*Sin[b*x]^2)/b^4 - (x^2*Sin[b*x]^2)/(4*b^2) - (3*x*Cos
os[b*x]*SinIntegral[b*x])/b^3 + (x^3*Cos[b*x]*SinIntegral[b*x])/(2*b) + (3*
Sin[b*x]*SinIntegral[b*x])/b^4 - (3*x^2*Sin[b*x]*SinIntegral[b*x])/(2*b^2)
+ (x^4*SinIntegral[b*x]^2)/4
```

**Rubi [A]** time = 0.215849, antiderivative size = 149, normalized size of antiderivative = 1., number of steps used = 19, number of rules used = 11, integrand size = 10,  $\frac{\text{number of rules}}{\text{integrand size}} = 1.1$ , Rules used = {6507, 6513, 12, 3443, 3310, 30, 6519, 2564, 6517, 3312, 3302}

$$\frac{3\text{CosIntegral}(2bx)}{2b^4} - \frac{3x^2\text{Si}(bx)\sin(bx)}{2b^2} + \frac{3\text{Si}(bx)\sin(bx)}{b^4} - \frac{3x\text{Si}(bx)\cos(bx)}{b^3} + \frac{x^2}{2b^2} - \frac{x^2\sin^2(bx)}{4b^2} - \frac{3\log(x)}{2b^4} + \frac{2\sin^2(bx)}{b^4}$$

Antiderivative was successfully verified.

```
[In] Int[x^3*SinIntegral[b*x]^2,x]
```

```
[Out] x^2/(2*b^2) + (3*CosIntegral[2*b*x])/(2*b^4) - (3*Log[x])/(2*b^4) - (x*Cos[
b*x]*Sin[b*x])/b^3 + (2*Sin[b*x]^2)/b^4 - (x^2*Sin[b*x]^2)/(4*b^2) - (3*x*Cos
os[b*x]*SinIntegral[b*x])/b^3 + (x^3*Cos[b*x]*SinIntegral[b*x])/(2*b) + (3*
Sin[b*x]*SinIntegral[b*x])/b^4 - (3*x^2*Sin[b*x]*SinIntegral[b*x])/(2*b^2)
+ (x^4*SinIntegral[b*x]^2)/4
```

#### Rule 6507

```
Int[(x_)^(m_)*SinIntegral[(b_)*(x_)^2, x_Symbol] :> Simp[(x^(m + 1)*SinI
ntegral[b*x]^2)/(m + 1), x] - Dist[2/(m + 1), Int[x^m*Sin[b*x]*SinIntegral[
b*x], x], x] /; FreeQ[b, x] && IGtQ[m, 0]
```

#### Rule 6513

```
Int[((e_) + (f_)*(x_))^(m_)*Sin[(a_) + (b_)*(x_)]*SinIntegral[(c_) +
(d_)*(x_)], x_Symbol] :> -Simp[((e + f*x)^m*Cos[a + b*x]*SinIntegral[c + d
*x])/b, x] + (Dist[d/b, Int[((e + f*x)^m*Cos[a + b*x]*Sin[c + d*x])/(c + d*
x), x], x] + Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*Cos[a + b*x]*SinIntegral[c
```

+ d\*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]

### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] := Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b\_)\*(v\_)] /; FreeQ[b, x]

### Rule 3443

Int[Cos[(a\_.) + (b\_.)\*(x\_)^(n\_.)]\*(x\_)^(m\_.)\*Sin[(a\_.) + (b\_.)\*(x\_)^(n\_.)]^(p\_.), x\_Symbol] := Simp[(x^(m - n + 1)\*Sin[a + b\*x^n]^(p + 1))/(b\*n\*(p + 1)), x] - Dist[(m - n + 1)/(b\*n\*(p + 1)), Int[x^(m - n)\*Sin[a + b\*x^n]^(p + 1), x], x] /; FreeQ[{a, b, p}, x] && LtQ[0, n, m + 1] && NeQ[p, -1]

### Rule 3310

Int[((c\_.) + (d\_.)\*(x\_))\*((b\_.)\*sin[(e\_.) + (f\_.)\*(x\_)])^(n\_), x\_Symbol] := Simp[(d\*(b\*Sine[e + f\*x])^n)/(f^2\*n^2), x] + (Dist[(b^2\*(n - 1))/n, Int[(c + d\*x)\*(b\*Sine[e + f\*x])^(n - 2), x], x] - Simp[(b\*(c + d\*x)\*Cos[e + f\*x]\*(b\*Sine[e + f\*x])^(n - 1))/(f\*n), x]) /; FreeQ[{b, c, d, e, f}, x] && GtQ[n, 1]

### Rule 30

Int[(x\_)^(m\_.), x\_Symbol] := Simp[x^(m + 1)/(m + 1), x] /; FreeQ[m, x] && NeQ[m, -1]

### Rule 6519

Int[Cos[(a\_.) + (b\_.)\*(x\_)]\*((e\_.) + (f\_.)\*(x\_))^(m\_.)\*SinIntegral[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] := Simp[((e + f\*x)^m\*Sine[a + b\*x]\*SinIntegral[c + d\*x])/b, x] + (-Dist[d/b, Int[((e + f\*x)^m\*Sine[a + b\*x]\*Sine[c + d\*x])/(c + d\*x), x], x] - Dist[(f\*m)/b, Int[(e + f\*x)^(m - 1)\*Sine[a + b\*x]\*SinIntegral[c + d\*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]

### Rule 2564

Int[cos[(e\_.) + (f\_.)\*(x\_)]^(n\_.)\*((a\_.)\*sin[(e\_.) + (f\_.)\*(x\_)])^(m\_.), x\_Symbol] := Dist[1/(a\*f), Subst[Int[x^m\*(1 - x^2/a^2)^((n - 1)/2), x], x, a\*Sine[e + f\*x]], x] /; FreeQ[{a, e, f, m}, x] && IntegerQ[(n - 1)/2] && !(IntegerQ[(m - 1)/2] && LtQ[0, m, n])

### Rule 6517

```
Int[Cos[(a_.) + (b_.)*(x_)]*SinIntegral[(c_.) + (d_.)*(x_)], x_Symbol] := S
imp[(Sin[a + b*x]*SinIntegral[c + d*x])/b, x] - Dist[d/b, Int[(Sin[a + b*x]
*Sin[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

### Rule 3312

```
Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)]^(n_), x_Symbol] := In
t[ExpandTrigReduce[(c + d*x)^m, Sin[e + f*x]^n, x], x] /; FreeQ[{c, d, e, f
, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))
```

### Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[CosInte
gral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) -
c*f, 0]
```

### Rubi steps

$$\begin{aligned}
\int x^3 \text{Si}(bx)^2 dx &= \frac{1}{4}x^4 \text{Si}(bx)^2 - \frac{1}{2} \int x^3 \sin(bx) \text{Si}(bx) dx \\
&= \frac{x^3 \cos(bx) \text{Si}(bx)}{2b} + \frac{1}{4}x^4 \text{Si}(bx)^2 - \frac{1}{2} \int \frac{x^2 \cos(bx) \sin(bx)}{b} dx - \frac{3 \int x^2 \cos(bx) \text{Si}(bx) dx}{2b} \\
&= \frac{x^3 \cos(bx) \text{Si}(bx)}{2b} - \frac{3x^2 \sin(bx) \text{Si}(bx)}{2b^2} + \frac{1}{4}x^4 \text{Si}(bx)^2 + \frac{3 \int x \sin(bx) \text{Si}(bx) dx}{b^2} - \frac{\int x^2 \cos(bx) \sin(bx) dx}{2b} \\
&= -\frac{x^2 \sin^2(bx)}{4b^2} - \frac{3x \cos(bx) \text{Si}(bx)}{b^3} + \frac{x^3 \cos(bx) \text{Si}(bx)}{2b} - \frac{3x^2 \sin(bx) \text{Si}(bx)}{2b^2} + \frac{1}{4}x^4 \text{Si}(bx)^2 + \frac{3 \int \cos(bx) \text{Si}(bx) dx}{b^3} \\
&= -\frac{x \cos(bx) \sin(bx)}{b^3} + \frac{\sin^2(bx)}{2b^4} - \frac{x^2 \sin^2(bx)}{4b^2} - \frac{3x \cos(bx) \text{Si}(bx)}{b^3} + \frac{x^3 \cos(bx) \text{Si}(bx)}{2b} + \frac{3 \sin(bx) \text{Si}(bx)}{b^4} \\
&= \frac{x^2}{2b^2} - \frac{x \cos(bx) \sin(bx)}{b^3} + \frac{\sin^2(bx)}{2b^4} - \frac{x^2 \sin^2(bx)}{4b^2} - \frac{3x \cos(bx) \text{Si}(bx)}{b^3} + \frac{x^3 \cos(bx) \text{Si}(bx)}{2b} + \frac{3 \sin(bx) \text{Si}(bx)}{b^4} \\
&= \frac{x^2}{2b^2} - \frac{x \cos(bx) \sin(bx)}{b^3} + \frac{2 \sin^2(bx)}{b^4} - \frac{x^2 \sin^2(bx)}{4b^2} - \frac{3x \cos(bx) \text{Si}(bx)}{b^3} + \frac{x^3 \cos(bx) \text{Si}(bx)}{2b} + \frac{3 \sin(bx) \text{Si}(bx)}{b^4} \\
&= \frac{x^2}{2b^2} - \frac{3 \log(x)}{2b^4} - \frac{x \cos(bx) \sin(bx)}{b^3} + \frac{2 \sin^2(bx)}{b^4} - \frac{x^2 \sin^2(bx)}{4b^2} - \frac{3x \cos(bx) \text{Si}(bx)}{b^3} + \frac{x^3 \cos(bx) \text{Si}(bx)}{2b} \\
&= \frac{x^2}{2b^2} + \frac{3 \text{Ci}(2bx)}{2b^4} - \frac{3 \log(x)}{2b^4} - \frac{x \cos(bx) \sin(bx)}{b^3} + \frac{2 \sin^2(bx)}{b^4} - \frac{x^2 \sin^2(bx)}{4b^2} - \frac{3x \cos(bx) \text{Si}(bx)}{b^3} + \frac{x^3 \cos(bx) \text{Si}(bx)}{2b}
\end{aligned}$$



**Mathematica [A]** time = 0.129789, size = 107, normalized size = 0.72

$$\frac{2b^4x^4\text{Si}(bx)^2 + 4\text{Si}(bx)\left(bx(b^2x^2 - 6)\cos(bx) - 3(b^2x^2 - 2)\sin(bx)\right) + 3b^2x^2 + b^2x^2\cos(2bx) + 12\text{CosIntegral}(2bx) - 12\text{Log}[x] - 4b^2x\text{Sin}[2bx] + 4(b^2x(-6 + b^2x^2))\text{Cos}[bx] - 3(-2 + b^2x^2)\text{Sin}[bx])\text{SinIntegral}[bx] + 2b^4x^4\text{SinIntegral}[bx]^2}{8b^4}$$

Antiderivative was successfully verified.

[In] Integrate[x^3\*SinIntegral[b\*x]^2,x]

[Out] (3\*b^2\*x^2 - 8\*Cos[2\*b\*x] + b^2\*x^2\*Cos[2\*b\*x] + 12\*CosIntegral[2\*b\*x] - 12\*Log[x] - 4\*b\*x\*Sin[2\*b\*x] + 4\*(b\*x\*(-6 + b^2\*x^2))\*Cos[b\*x] - 3\*(-2 + b^2\*x^2)\*Sin[b\*x])\*SinIntegral[b\*x] + 2\*b^4\*x^4\*SinIntegral[b\*x]^2)/(8\*b^4)

**Maple [A]** time = 0.069, size = 149, normalized size = 1.

$$\frac{x^4(\text{Si}(bx))^2}{4} + \frac{x^3\cos(bx)\text{Si}(bx)}{2b} - \frac{3x^2\text{Si}(bx)\sin(bx)}{2b^2} + 3\frac{\text{Si}(bx)\sin(bx)}{b^4} - 3\frac{x\cos(bx)\text{Si}(bx)}{b^3} + \frac{x^2(\cos(bx))^2}{4b^2} - \frac{x\cos(bx)\text{Si}(bx)}{b^3}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x^3\*Si(b\*x)^2,x)

[Out] 1/4\*x^4\*Si(b\*x)^2+1/2\*x^3\*cos(b\*x)\*Si(b\*x)/b-3/2\*x^2\*Si(b\*x)\*sin(b\*x)/b^2+3\*Si(b\*x)\*sin(b\*x)/b^4-3\*x\*cos(b\*x)\*Si(b\*x)/b^3+1/4/b^2\*x^2\*cos(b\*x)^2-x\*cos(b\*x)\*sin(b\*x)/b^3+1/4\*x^2/b^2+1/2\*sin(b\*x)^2/b^4-3/2\*cos(b\*x)^2/b^4-3/2/b^4\*ln(b\*x)+3/2\*Ci(2\*b\*x)/b^4

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^3\text{Si}(bx)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^3\*Si(b\*x)^2,x, algorithm="maxima")

[Out] integrate(x^3\*Si(b\*x)^2, x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^3 \text{Si}(bx)^2, x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^3\*Si(b\*x)^2,x, algorithm="fricas")

[Out] integral(x^3\*sin\_integral(b\*x)^2, x)

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x^3 \text{Si}^2(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*\*3\*Si(b\*x)\*\*2,x)

[Out] Integral(x\*\*3\*Si(b\*x)\*\*2, x)

**Giac [A]** time = 1.28656, size = 119, normalized size = 0.8

$$\frac{1}{4} x^4 \text{Si}(bx)^2 + \frac{1}{2} \left( \frac{(b^3 x^3 - 6bx) \cos(bx)}{b^4} - \frac{3(b^2 x^2 - 2) \sin(bx)}{b^4} \right) \text{Si}(bx) + \frac{3(b^2 x^2 + 2 \text{Ci}(2bx) + 2 \text{Ci}(-2bx) - 4 \log(x))}{8b^4}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^3\*Si(b\*x)^2,x, algorithm="giac")

[Out] 1/4\*x^4\*sin\_integral(b\*x)^2 + 1/2\*((b^3\*x^3 - 6\*b\*x)\*cos(b\*x)/b^4 - 3\*(b^2\*x^2 - 2)\*sin(b\*x)/b^4)\*sin\_integral(b\*x) + 3/8\*(b^2\*x^2 + 2\*cos\_integral(2\*b\*x) + 2\*cos\_integral(-2\*b\*x) - 4\*log(x))/b^4

### 3.11 $\int x^2 \text{Si}(bx)^2 dx$

**Optimal.** Leaf size=112

$$\frac{2\text{Si}(2bx)}{3b^3} - \frac{4x\text{Si}(bx)\sin(bx)}{3b^2} - \frac{4\text{Si}(bx)\cos(bx)}{3b^3} + \frac{5x}{6b^2} - \frac{x\sin^2(bx)}{3b^2} - \frac{5\sin(bx)\cos(bx)}{6b^3} + \frac{1}{3}x^3\text{Si}(bx)^2 + \frac{2x^2\text{Si}(bx)\cos(bx)}{3b}$$

[Out] (5\*x)/(6\*b^2) - (5\*Cos[b\*x]\*Sin[b\*x])/(6\*b^3) - (x\*Sin[b\*x]^2)/(3\*b^2) - (4\*Cos[b\*x]\*SinIntegral[b\*x])/(3\*b^3) + (2\*x^2\*Cos[b\*x]\*SinIntegral[b\*x])/(3\*b) - (4\*x\*Sin[b\*x]\*SinIntegral[b\*x])/(3\*b^2) + (x^3\*SinIntegral[b\*x]^2)/3 + (2\*SinIntegral[2\*b\*x])/(3\*b^3)

---

**Rubi [A]** time = 0.134827, antiderivative size = 112, normalized size of antiderivative = 1., number of steps used = 15, number of rules used = 10, integrand size = 10,  $\frac{\text{number of rules}}{\text{integrand size}} = 1.$ , Rules used = {6507, 6513, 12, 3443, 2635, 8, 6519, 6511, 4406, 3299}

$$\frac{2\text{Si}(2bx)}{3b^3} - \frac{4x\text{Si}(bx)\sin(bx)}{3b^2} - \frac{4\text{Si}(bx)\cos(bx)}{3b^3} + \frac{5x}{6b^2} - \frac{x\sin^2(bx)}{3b^2} - \frac{5\sin(bx)\cos(bx)}{6b^3} + \frac{1}{3}x^3\text{Si}(bx)^2 + \frac{2x^2\text{Si}(bx)\cos(bx)}{3b}$$

Antiderivative was successfully verified.

[In] Int[x^2\*SinIntegral[b\*x]^2,x]

[Out] (5\*x)/(6\*b^2) - (5\*Cos[b\*x]\*Sin[b\*x])/(6\*b^3) - (x\*Sin[b\*x]^2)/(3\*b^2) - (4\*Cos[b\*x]\*SinIntegral[b\*x])/(3\*b^3) + (2\*x^2\*Cos[b\*x]\*SinIntegral[b\*x])/(3\*b) - (4\*x\*Sin[b\*x]\*SinIntegral[b\*x])/(3\*b^2) + (x^3\*SinIntegral[b\*x]^2)/3 + (2\*SinIntegral[2\*b\*x])/(3\*b^3)

#### Rule 6507

Int[(x\_)^(m\_)\*SinIntegral[(b\_)\*(x\_)]^2, x\_Symbol] :> Simp[(x^(m + 1)\*SinIntegral[b\*x]^2)/(m + 1), x] - Dist[2/(m + 1), Int[x^m\*Sin[b\*x]\*SinIntegral[b\*x], x], x] /; FreeQ[b, x] && IGtQ[m, 0]

#### Rule 6513

Int[((e\_) + (f\_)\*(x\_))^(m\_)\*Sin[(a\_) + (b\_)\*(x\_)]\*SinIntegral[(c\_) + (d\_)\*(x\_)], x\_Symbol] :> -Simp[((e + f\*x)^m\*Cos[a + b\*x]\*SinIntegral[c + d\*x])/b, x] + (Dist[d/b, Int[((e + f\*x)^m\*Cos[a + b\*x]\*Sin[c + d\*x])/(c + d\*x), x], x] + Dist[(f\*m)/b, Int[(e + f\*x)^(m - 1)\*Cos[a + b\*x]\*SinIntegral[c + d\*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]

Rule 12

$\text{Int}[(a_*)(u_), x\_Symbol] \rightarrow \text{Dist}[a, \text{Int}[u, x], x] /; \text{FreeQ}[a, x] \ \&\& \ !\text{MatchQ}[u, (b_*)(v_)] /; \text{FreeQ}[b, x]$

Rule 3443

$\text{Int}[\text{Cos}[(a_.) + (b_.)*(x_)]^{(n_.)}*(x_)]^{(m_.)}*\text{Sin}[(a_.) + (b_.)*(x_)]^{(p_.)}, x\_Symbol] \rightarrow \text{Simp}[(x^{(m-n+1)}*\text{Sin}[a + b*x^n]^{(p+1)})/(b*n*(p+1)), x] - \text{Dist}[(m-n+1)/(b*n*(p+1)), \text{Int}[x^{(m-n)}*\text{Sin}[a + b*x^n]^{(p+1)}, x], x] /; \text{FreeQ}\{a, b, p\}, x] \ \&\& \ \text{LtQ}[0, n, m+1] \ \&\& \ \text{NeQ}[p, -1]$

Rule 2635

$\text{Int}[(b_*)*\text{sin}[(c_.) + (d_.)*(x_)]^{(n_.)}, x\_Symbol] \rightarrow -\text{Simp}[(b*\text{Cos}[c + d*x] * (b*\text{Sin}[c + d*x])^{(n-1)})/(d*n), x] + \text{Dist}[(b^2*(n-1))/n, \text{Int}[(b*\text{Sin}[c + d*x])^{(n-2)}, x], x] /; \text{FreeQ}\{b, c, d\}, x] \ \&\& \ \text{GtQ}[n, 1] \ \&\& \ \text{IntegerQ}[2*n]$

Rule 8

$\text{Int}[a_, x\_Symbol] \rightarrow \text{Simp}[a*x, x] /; \text{FreeQ}[a, x]$

Rule 6519

$\text{Int}[\text{Cos}[(a_.) + (b_.)*(x_)]*((e_.) + (f_.)*(x_))^{(m_.)}*\text{SinIntegral}[(c_.) + (d_.)*(x_)], x\_Symbol] \rightarrow \text{Simp}[(e + f*x)^m*\text{Sin}[a + b*x]*\text{SinIntegral}[c + d*x]/b, x] + (-\text{Dist}[d/b, \text{Int}[(e + f*x)^m*\text{Sin}[a + b*x]*\text{Sin}[c + d*x]/(c + d*x), x], x] - \text{Dist}[(f*m)/b, \text{Int}[(e + f*x)^{(m-1)}*\text{Sin}[a + b*x]*\text{SinIntegral}[c + d*x], x], x]) /; \text{FreeQ}\{a, b, c, d, e, f\}, x] \ \&\& \ \text{IGtQ}[m, 0]$

Rule 6511

$\text{Int}[\text{Sin}[(a_.) + (b_.)*(x_)]*\text{SinIntegral}[(c_.) + (d_.)*(x_)], x\_Symbol] \rightarrow -\text{Simp}[(\text{Cos}[a + b*x]*\text{SinIntegral}[c + d*x])/b, x] + \text{Dist}[d/b, \text{Int}[(\text{Cos}[a + b*x]*\text{Sin}[c + d*x])/(c + d*x), x], x] /; \text{FreeQ}\{a, b, c, d\}, x]$

Rule 4406

$\text{Int}[\text{Cos}[(a_.) + (b_.)*(x_)]^{(p_.)}*((c_.) + (d_.)*(x_))^{(m_.)}*\text{Sin}[(a_.) + (b_.)*(x_)]^{(n_.)}, x\_Symbol] \rightarrow \text{Int}[\text{ExpandTrigReduce}[(c + d*x)^m, \text{Sin}[a + b*x]^{n*}\text{Cos}[a + b*x]^p, x], x] /; \text{FreeQ}\{a, b, c, d, m\}, x] \ \&\& \ \text{IGtQ}[n, 0] \ \&\& \ \text{IGtQ}[p, 0]$

Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_.)]/((c_.) + (d_.)*(x_.)), x_Symbol] := Simp[SinInte
gral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

### Rubi steps

$$\begin{aligned}
\int x^2 \text{Si}(bx)^2 dx &= \frac{1}{3}x^3 \text{Si}(bx)^2 - \frac{2}{3} \int x^2 \sin(bx) \text{Si}(bx) dx \\
&= \frac{2x^2 \cos(bx) \text{Si}(bx)}{3b} + \frac{1}{3}x^3 \text{Si}(bx)^2 - \frac{2}{3} \int \frac{x \cos(bx) \sin(bx)}{b} dx - \frac{4 \int x \cos(bx) \text{Si}(bx) dx}{3b} \\
&= \frac{2x^2 \cos(bx) \text{Si}(bx)}{3b} - \frac{4x \sin(bx) \text{Si}(bx)}{3b^2} + \frac{1}{3}x^3 \text{Si}(bx)^2 + \frac{4 \int \sin(bx) \text{Si}(bx) dx}{3b^2} - \frac{2 \int x \cos(bx) \sin(bx) dx}{3b} \\
&= -\frac{x \sin^2(bx)}{3b^2} - \frac{4 \cos(bx) \text{Si}(bx)}{3b^3} + \frac{2x^2 \cos(bx) \text{Si}(bx)}{3b} - \frac{4x \sin(bx) \text{Si}(bx)}{3b^2} + \frac{1}{3}x^3 \text{Si}(bx)^2 + \frac{\int \sin^2(bx) dx}{3b^2} \\
&= -\frac{5 \cos(bx) \sin(bx)}{6b^3} - \frac{x \sin^2(bx)}{3b^2} - \frac{4 \cos(bx) \text{Si}(bx)}{3b^3} + \frac{2x^2 \cos(bx) \text{Si}(bx)}{3b} - \frac{4x \sin(bx) \text{Si}(bx)}{3b^2} + \frac{1}{3}x^3 \text{Si}(bx)^2 \\
&= \frac{5x}{6b^2} - \frac{5 \cos(bx) \sin(bx)}{6b^3} - \frac{x \sin^2(bx)}{3b^2} - \frac{4 \cos(bx) \text{Si}(bx)}{3b^3} + \frac{2x^2 \cos(bx) \text{Si}(bx)}{3b} - \frac{4x \sin(bx) \text{Si}(bx)}{3b^2} + \frac{1}{3}x^3 \text{Si}(bx)^2 \\
&= \frac{5x}{6b^2} - \frac{5 \cos(bx) \sin(bx)}{6b^3} - \frac{x \sin^2(bx)}{3b^2} - \frac{4 \cos(bx) \text{Si}(bx)}{3b^3} + \frac{2x^2 \cos(bx) \text{Si}(bx)}{3b} - \frac{4x \sin(bx) \text{Si}(bx)}{3b^2} + \frac{1}{3}x^3 \text{Si}(bx)^2 \\
&= \frac{5x}{6b^2} - \frac{5 \cos(bx) \sin(bx)}{6b^3} - \frac{x \sin^2(bx)}{3b^2} - \frac{4 \cos(bx) \text{Si}(bx)}{3b^3} + \frac{2x^2 \cos(bx) \text{Si}(bx)}{3b} - \frac{4x \sin(bx) \text{Si}(bx)}{3b^2} + \frac{1}{3}x^3 \text{Si}(bx)^2
\end{aligned}$$

**Mathematica [A]** time = 0.0725869, size = 78, normalized size = 0.7

$$\frac{4b^3 x^3 \text{Si}(bx)^2 + 8 \text{Si}(bx) \left( (b^2 x^2 - 2) \cos(bx) - 2bx \sin(bx) \right) + 8 \text{Si}(2bx) + 8bx - 5 \sin(2bx) + 2bx \cos(2bx)}{12b^3}$$

Antiderivative was successfully verified.

```
[In] Integrate[x^2*SinIntegral[b*x]^2,x]
```

```
[Out] (8*b*x + 2*b*x*Cos[2*b*x] - 5*Sin[2*b*x] + 8*((-2 + b^2*x^2)*Cos[b*x] - 2*b*x*Sin[b*x])*SinIntegral[b*x] + 4*b^3*x^3*SinIntegral[b*x]^2 + 8*SinIntegral[2*b*x])/(12*b^3)
```

**Maple [A]** time = 0.149, size = 84, normalized size = 0.8

$$\frac{1}{b^3} \left( \frac{b^3 x^3 (\text{Si}(bx))^2}{3} - 2 \text{Si}(bx) \left( -\frac{1}{3} b^2 x^2 \cos(bx) + \frac{2}{3} \cos(bx) + \frac{2}{3} \sin(bx) bx \right) + \frac{bx (\cos(bx))^2}{3} - \frac{5 \sin(bx) \cos(bx)}{6} \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x^2\*Si(b\*x)^2,x)

[Out] 1/b^3\*(1/3\*b^3\*x^3\*Si(b\*x)^2-2\*Si(b\*x)\*(-1/3\*b^2\*x^2\*cos(b\*x)+2/3\*cos(b\*x)+2/3\*sin(b\*x)\*b\*x)+1/3\*b\*x\*cos(b\*x)^2-5/6\*sin(b\*x)\*cos(b\*x)+1/2\*b\*x+2/3\*Si(2\*b\*x))

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \text{Si}(bx)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^2\*Si(b\*x)^2,x, algorithm="maxima")

[Out] integrate(x^2\*Si(b\*x)^2, x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^2 \text{Si}(bx)^2, x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^2\*Si(b\*x)^2,x, algorithm="fricas")

[Out] integral(x^2\*sin\_integral(b\*x)^2, x)

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \text{Si}^2(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*\*2\*Si(b\*x)\*\*2,x)

[Out] Integral(x\*\*2\*Si(b\*x)\*\*2, x)

**Giac [C]** time = 1.28072, size = 105, normalized size = 0.94

$$\frac{1}{3} x^3 \operatorname{Si}(bx)^2 - \frac{2}{3} \left( \frac{2x \sin(bx)}{b^2} - \frac{(b^2 x^2 - 2) \cos(bx)}{b^3} \right) \operatorname{Si}(bx) + \frac{2bx + \Im(\operatorname{Ci}(2bx)) - \Im(\operatorname{Ci}(-2bx)) + 2 \operatorname{Si}(2bx)}{3b^3}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^2\*Si(b\*x)^2,x, algorithm="giac")

[Out] 1/3\*x^3\*sin\_integral(b\*x)^2 - 2/3\*(2\*x\*sin(b\*x)/b^2 - (b^2\*x^2 - 2)\*cos(b\*x)/b^3)\*sin\_integral(b\*x) + 1/3\*(2\*b\*x + imag\_part(cos\_integral(2\*b\*x)) - imag\_part(cos\_integral(-2\*b\*x)) + 2\*sin\_integral(2\*b\*x))/b^3

### 3.12 $\int x \text{Si}(bx)^2 dx$

**Optimal.** Leaf size=74

$$-\frac{\text{CosIntegral}(2bx)}{2b^2} - \frac{\text{Si}(bx) \sin(bx)}{b^2} + \frac{\log(x)}{2b^2} - \frac{\sin^2(bx)}{2b^2} + \frac{1}{2}x^2 \text{Si}(bx)^2 + \frac{x \text{Si}(bx) \cos(bx)}{b}$$

[Out] -CosIntegral[2\*b\*x]/(2\*b^2) + Log[x]/(2\*b^2) - Sin[b\*x]^2/(2\*b^2) + (x\*Cos[b\*x]\*SinIntegral[b\*x])/b - (Sin[b\*x]\*SinIntegral[b\*x])/b^2 + (x^2\*SinIntegral[b\*x]^2)/2

**Rubi [A]** time = 0.0952158, antiderivative size = 74, normalized size of antiderivative = 1., number of steps used = 10, number of rules used = 8, integrand size = 8,  $\frac{\text{number of rules}}{\text{integrand size}} = 1.$ , Rules used = {6507, 6513, 12, 2564, 30, 6517, 3312, 3302}

$$-\frac{\text{CosIntegral}(2bx)}{2b^2} - \frac{\text{Si}(bx) \sin(bx)}{b^2} + \frac{\log(x)}{2b^2} - \frac{\sin^2(bx)}{2b^2} + \frac{1}{2}x^2 \text{Si}(bx)^2 + \frac{x \text{Si}(bx) \cos(bx)}{b}$$

Antiderivative was successfully verified.

[In] Int[x\*SinIntegral[b\*x]^2,x]

[Out] -CosIntegral[2\*b\*x]/(2\*b^2) + Log[x]/(2\*b^2) - Sin[b\*x]^2/(2\*b^2) + (x\*Cos[b\*x]\*SinIntegral[b\*x])/b - (Sin[b\*x]\*SinIntegral[b\*x])/b^2 + (x^2\*SinIntegral[b\*x]^2)/2

#### Rule 6507

Int[(x\_)^(m\_)\*SinIntegral[(b\_)\*(x\_)]^2, x\_Symbol] :> Simp[(x^(m + 1)\*SinIntegral[b\*x]^2)/(m + 1), x] - Dist[2/(m + 1), Int[x^m\*Sin[b\*x]\*SinIntegral[b\*x], x], x] /; FreeQ[b, x] && IGtQ[m, 0]

#### Rule 6513

Int[((e\_.) + (f\_)\*(x\_))^(m\_)\*Sin[(a\_.) + (b\_)\*(x\_)]\*SinIntegral[(c\_.) + (d\_)\*(x\_)], x\_Symbol] :> -Simp[((e + f\*x)^m\*Cos[a + b\*x]\*SinIntegral[c + d\*x])/b, x] + (Dist[d/b, Int[((e + f\*x)^m\*Cos[a + b\*x]\*Sin[c + d\*x])/(c + d\*x), x], x] + Dist[(f\*m)/b, Int[(e + f\*x)^(m - 1)\*Cos[a + b\*x]\*SinIntegral[c + d\*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]

#### Rule 12



```
Int[(a_)*(u_), x_Symbol] :=> Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b_)*(v_)] /; FreeQ[b, x]
```

### Rule 2564

```
Int[cos[(e_.) + (f_.)*(x_)]^(n_.)*((a_.)*sin[(e_.) + (f_.)*(x_)]^(m_.), x_Symbol] :=> Dist[1/(a*f), Subst[Int[x^m*(1 - x^2/a^2)^((n - 1)/2), x], x, a*Sin[e + f*x]], x] /; FreeQ[{a, e, f, m}, x] && IntegerQ[(n - 1)/2] && !(IntegerQ[(m - 1)/2] && LtQ[0, m, n])
```

### Rule 30

```
Int[(x_)^(m_.), x_Symbol] :=> Simp[x^(m + 1)/(m + 1), x] /; FreeQ[m, x] && NeQ[m, -1]
```

### Rule 6517

```
Int[Cos[(a_.) + (b_.)*(x_)]*SinIntegral[(c_.) + (d_.)*(x_)], x_Symbol] :=> Simp[(Sin[a + b*x]*SinIntegral[c + d*x])/b, x] - Dist[d/b, Int[(Sin[a + b*x]*Sin[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

### Rule 3312

```
Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)]^(n_), x_Symbol] :=> Int[ExpandTrigReduce[(c + d*x)^m, Sin[e + f*x]^n, x], x] /; FreeQ[{c, d, e, f, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))
```

### Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] :=> Simp[CosIntegral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) - c*f, 0]
```

### Rubi steps

$$\begin{aligned}
\int x \operatorname{Si}(bx)^2 dx &= \frac{1}{2} x^2 \operatorname{Si}(bx)^2 - \int x \sin(bx) \operatorname{Si}(bx) dx \\
&= \frac{x \cos(bx) \operatorname{Si}(bx)}{b} + \frac{1}{2} x^2 \operatorname{Si}(bx)^2 - \frac{\int \cos(bx) \operatorname{Si}(bx) dx}{b} - \int \frac{\cos(bx) \sin(bx)}{b} dx \\
&= \frac{x \cos(bx) \operatorname{Si}(bx)}{b} - \frac{\sin(bx) \operatorname{Si}(bx)}{b^2} + \frac{1}{2} x^2 \operatorname{Si}(bx)^2 - \frac{\int \cos(bx) \sin(bx) dx}{b} + \frac{\int \frac{\sin^2(bx)}{bx} dx}{b} \\
&= \frac{x \cos(bx) \operatorname{Si}(bx)}{b} - \frac{\sin(bx) \operatorname{Si}(bx)}{b^2} + \frac{1}{2} x^2 \operatorname{Si}(bx)^2 + \frac{\int \frac{\sin^2(bx)}{x} dx}{b^2} - \frac{\operatorname{Subst}(\int x dx, x, \sin(bx))}{b^2} \\
&= -\frac{\sin^2(bx)}{2b^2} + \frac{x \cos(bx) \operatorname{Si}(bx)}{b} - \frac{\sin(bx) \operatorname{Si}(bx)}{b^2} + \frac{1}{2} x^2 \operatorname{Si}(bx)^2 + \frac{\int \left( \frac{1}{2x} - \frac{\cos(2bx)}{2x} \right) dx}{b^2} \\
&= \frac{\log(x)}{2b^2} - \frac{\sin^2(bx)}{2b^2} + \frac{x \cos(bx) \operatorname{Si}(bx)}{b} - \frac{\sin(bx) \operatorname{Si}(bx)}{b^2} + \frac{1}{2} x^2 \operatorname{Si}(bx)^2 - \frac{\int \frac{\cos(2bx)}{x} dx}{2b^2} \\
&= -\frac{\operatorname{Ci}(2bx)}{2b^2} + \frac{\log(x)}{2b^2} - \frac{\sin^2(bx)}{2b^2} + \frac{x \cos(bx) \operatorname{Si}(bx)}{b} - \frac{\sin(bx) \operatorname{Si}(bx)}{b^2} + \frac{1}{2} x^2 \operatorname{Si}(bx)^2
\end{aligned}$$

**Mathematica [A]** time = 0.0533695, size = 58, normalized size = 0.78

$$\frac{2b^2 x^2 \operatorname{Si}(bx)^2 - 2 \operatorname{CosIntegral}(2bx) + 4 \operatorname{Si}(bx)(bx \cos(bx) - \sin(bx)) + \cos(2bx) + 2 \log(x)}{4b^2}$$

Antiderivative was successfully verified.

[In] Integrate[x\*SinIntegral[b\*x]^2,x]

[Out] (Cos[2\*b\*x] - 2\*CosIntegral[2\*b\*x] + 2\*Log[x] + 4\*(b\*x\*Cos[b\*x] - Sin[b\*x]) \*SinIntegral[b\*x] + 2\*b^2\*x^2\*SinIntegral[b\*x]^2)/(4\*b^2)

**Maple [A]** time = 0.058, size = 69, normalized size = 0.9

$$\frac{x^2 (\operatorname{Si}(bx))^2}{2} + \frac{x \cos(bx) \operatorname{Si}(bx)}{b} - \frac{\operatorname{Si}(bx) \sin(bx)}{b^2} + \frac{(\cos(bx))^2}{2b^2} + \frac{\ln(bx)}{2b^2} - \frac{\operatorname{Ci}(2bx)}{2b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x\*Si(b\*x)^2,x)

[Out]  $\frac{1}{2}x^2\text{Si}(bx)^2 + x\cos(bx)\text{Si}(bx) - \text{Si}(bx)\sin(bx) - \frac{1}{2b^2} + \frac{1}{2b^2}\cos(bx)^2 + \frac{1}{2b^2}\ln(bx) - \frac{1}{2}\text{Ci}(2bx)/b^2$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x\text{Si}(bx)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*Si(b*x)^2,x, algorithm="maxima")`

[Out] `integrate(x*Si(b*x)^2, x)`

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x\text{Si}(bx)^2, x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*Si(b*x)^2,x, algorithm="fricas")`

[Out] `integral(x*sin_integral(b*x)^2, x)`

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x\text{Si}^2(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*Si(b*x)**2,x)`

[Out] `Integral(x*Si(b*x)**2, x)`

**Giac [A]** time = 1.32525, size = 76, normalized size = 1.03

$$\frac{1}{2}x^2 \operatorname{Si}(bx)^2 + \left( \frac{x \cos(bx)}{b} - \frac{\sin(bx)}{b^2} \right) \operatorname{Si}(bx) - \frac{\operatorname{Ci}(2bx) + \operatorname{Ci}(-2bx) - 2 \log(x)}{4b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Si(b\*x)^2,x, algorithm="giac")

[Out] 1/2\*x^2\*sin\_integral(b\*x)^2 + (x\*cos(b\*x)/b - sin(b\*x)/b^2)\*sin\_integral(b\*x) - 1/4\*(cos\_integral(2\*b\*x) + cos\_integral(-2\*b\*x) - 2\*log(x))/b^2

### 3.13 $\int \text{Si}(bx)^2 dx$

**Optimal.** Leaf size=32

$$x\text{Si}(bx)^2 - \frac{\text{Si}(2bx)}{b} + \frac{2\text{Si}(bx)\cos(bx)}{b}$$

[Out] (2\*Cos[b\*x]\*SinIntegral[b\*x])/b + x\*SinIntegral[b\*x]^2 - SinIntegral[2\*b\*x]/b

**Rubi [A]** time = 0.0508099, antiderivative size = 32, normalized size of antiderivative = 1., number of steps used = 6, number of rules used = 5, integrand size = 6,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.833$ , Rules used = {6505, 6511, 12, 4406, 3299}

$$x\text{Si}(bx)^2 - \frac{\text{Si}(2bx)}{b} + \frac{2\text{Si}(bx)\cos(bx)}{b}$$

Antiderivative was successfully verified.

[In] Int[SinIntegral[b\*x]^2,x]

[Out] (2\*Cos[b\*x]\*SinIntegral[b\*x])/b + x\*SinIntegral[b\*x]^2 - SinIntegral[2\*b\*x]/b

#### Rule 6505

Int[SinIntegral[(a\_.) + (b\_.)\*(x\_)]^2, x\_Symbol] :> Simp[((a + b\*x)\*SinIntegral[a + b\*x]^2)/b, x] - Dist[2, Int[Sin[a + b\*x]\*SinIntegral[a + b\*x], x], x] /; FreeQ[{a, b}, x]

#### Rule 6511

Int[Sin[(a\_.) + (b\_.)\*(x\_)]\*SinIntegral[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] :> -Simp[(Cos[a + b\*x]\*SinIntegral[c + d\*x])/b, x] + Dist[d/b, Int[(Cos[a + b\*x]\*Sin[c + d\*x])/(c + d\*x), x], x] /; FreeQ[{a, b, c, d}, x]

#### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] :> Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b\_)\*(v\_)] /; FreeQ[b, x]

#### Rule 4406

```
Int[Cos[(a_.) + (b_.)*(x_)]^(p_.)*((c_.) + (d_.)*(x_))^(m_.)*Sin[(a_.) + (b_.)*(x_)]^(n_.), x_Symbol] := Int[ExpandTrigReduce[(c + d*x)^m, Sin[a + b*x]^(n)*Cos[a + b*x]^p, x], x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IGtQ[p, 0]
```

### Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[SinIntegral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

### Rubi steps

$$\begin{aligned}
 \int \text{Si}(bx)^2 dx &= x\text{Si}(bx)^2 - 2 \int \sin(bx)\text{Si}(bx) dx \\
 &= \frac{2 \cos(bx)\text{Si}(bx)}{b} + x\text{Si}(bx)^2 - 2 \int \frac{\cos(bx) \sin(bx)}{bx} dx \\
 &= \frac{2 \cos(bx)\text{Si}(bx)}{b} + x\text{Si}(bx)^2 - \frac{2 \int \frac{\cos(bx) \sin(bx)}{x} dx}{b} \\
 &= \frac{2 \cos(bx)\text{Si}(bx)}{b} + x\text{Si}(bx)^2 - \frac{2 \int \frac{\sin(2bx)}{2x} dx}{b} \\
 &= \frac{2 \cos(bx)\text{Si}(bx)}{b} + x\text{Si}(bx)^2 - \frac{\int \frac{\sin(2bx)}{x} dx}{b} \\
 &= \frac{2 \cos(bx)\text{Si}(bx)}{b} + x\text{Si}(bx)^2 - \frac{\text{Si}(2bx)}{b}
 \end{aligned}$$

**Mathematica [A]** time = 0.0075411, size = 32, normalized size = 1.

$$x\text{Si}(bx)^2 - \frac{\text{Si}(2bx)}{b} + \frac{2\text{Si}(bx) \cos(bx)}{b}$$

Antiderivative was successfully verified.

```
[In] Integrate[SinIntegral[b*x]^2, x]
```

```
[Out] (2*Cos[b*x]*SinIntegral[b*x])/b + x*SinIntegral[b*x]^2 - SinIntegral[2*b*x]/b
```

**Maple [A]** time = 0.05, size = 32, normalized size = 1.

$$\frac{bx (\text{Si}(bx))^2 + 2 \cos(bx) \text{Si}(bx) - \text{Si}(2bx)}{b}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Si(b\*x)^2,x)

[Out] 1/b\*(b\*x\*Si(b\*x)^2+2\*cos(b\*x)\*Si(b\*x)-Si(2\*b\*x))

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \text{Si}(bx)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x)^2,x, algorithm="maxima")

[Out] integrate(Si(b\*x)^2, x)

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(\text{Si}(bx)^2, x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x)^2,x, algorithm="fricas")

[Out] integral(sin\_integral(b\*x)^2, x)

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \text{Si}^2(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(b*x)**2,x)
```

```
[Out] Integral(Si(b*x)**2, x)
```

**Giac [C]** time = 1.33996, size = 66, normalized size = 2.06

$$x \operatorname{Si}(bx)^2 + \frac{2 \cos(bx) \operatorname{Si}(bx)}{b} - \frac{\Im(\operatorname{Ci}(2bx)) - \Im(\operatorname{Ci}(-2bx)) + 2 \operatorname{Si}(2bx)}{2b}$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(b*x)^2,x, algorithm="giac")
```

```
[Out] x*sin_integral(b*x)^2 + 2*cos(b*x)*sin_integral(b*x)/b - 1/2*(imag_part(cos
_integral(2*b*x)) - imag_part(cos_integral(-2*b*x)) + 2*sin_integral(2*b*x)
)/b
```



$$3.14 \quad \int \frac{\text{Si}(bx)^2}{x} dx$$

**Optimal.** Leaf size=12

$$\text{CannotIntegrate}\left(\frac{\text{Si}(bx)^2}{x}, x\right)$$

[Out] CannotIntegrate[ $\text{SinIntegral}[b*x]^2/x$ , x]

**Rubi [A]** time = 0.022994, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\text{Si}(bx)^2}{x} dx$$

Verification is Not applicable to the result.

[In] Int[ $\text{SinIntegral}[b*x]^2/x$ , x]

[Out] Defer[Int][ $\text{SinIntegral}[b*x]^2/x$ , x]

Rubi steps

$$\int \frac{\text{Si}(bx)^2}{x} dx = \int \frac{\text{Si}(bx)^2}{x} dx$$

**Mathematica [A]** time = 0.423825, size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx)^2}{x} dx$$

Verification is Not applicable to the result.

[In] Integrate[ $\text{SinIntegral}[b*x]^2/x$ , x]

[Out] Integrate[ $\text{SinIntegral}[b*x]^2/x$ , x]

---

**Maple [A]** time = 0.053, size = 0, normalized size = 0.

$$\int \frac{(\text{Si}(bx))^2}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Si(b\*x)^2/x,x)

[Out] int(Si(b\*x)^2/x,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx)^2}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x)^2/x,x, algorithm="maxima")

[Out] integrate(Si(b\*x)^2/x, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Si}(bx)^2}{x}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x)^2/x,x, algorithm="fricas")

[Out] integral(sin\_integral(b\*x)^2/x, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}^2(bx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(b*x)**2/x,x)
```

```
[Out] Integral(Si(b*x)**2/x, x)
```

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx)^2}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(b*x)^2/x,x, algorithm="giac")
```

```
[Out] integrate(Si(b*x)^2/x, x)
```

$$3.15 \quad \int \frac{\text{Si}(bx)^2}{x^2} dx$$

**Optimal.** Leaf size=12

$$\text{CannotIntegrate}\left(\frac{\text{Si}(bx)^2}{x^2}, x\right)$$

[Out] CannotIntegrate[SinIntegral[b\*x]^2/x^2, x]

**Rubi [A]** time = 0.0244746, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\text{Si}(bx)^2}{x^2} dx$$

Verification is Not applicable to the result.

[In] Int[SinIntegral[b\*x]^2/x^2, x]

[Out] Defer[Int][SinIntegral[b\*x]^2/x^2, x]

Rubi steps

$$\int \frac{\text{Si}(bx)^2}{x^2} dx = \int \frac{\text{Si}(bx)^2}{x^2} dx$$

**Mathematica [A]** time = 0.468781, size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx)^2}{x^2} dx$$

Verification is Not applicable to the result.

[In] Integrate[SinIntegral[b\*x]^2/x^2, x]

[Out] Integrate[SinIntegral[b\*x]^2/x^2, x]

---

**Maple [A]** time = 0.056, size = 0, normalized size = 0.

$$\int \frac{(\text{Si}(bx))^2}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Si(b\*x)^2/x^2,x)

[Out] int(Si(b\*x)^2/x^2,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx)^2}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x)^2/x^2,x, algorithm="maxima")

[Out] integrate(Si(b\*x)^2/x^2, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Si}(bx)^2}{x^2}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x)^2/x^2,x, algorithm="fricas")

[Out] integral(sin\_integral(b\*x)^2/x^2, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}^2(bx)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(b*x)**2/x**2,x)
```

```
[Out] Integral(Si(b*x)**2/x**2, x)
```

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx)^2}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(b*x)^2/x^2,x, algorithm="giac")
```

```
[Out] integrate(Si(b*x)^2/x^2, x)
```

$$3.16 \quad \int \frac{\text{Si}(bx)^2}{x^3} dx$$

Optimal. Leaf size=12

$$\text{CannotIntegrate}\left(\frac{\text{Si}(bx)^2}{x^3}, x\right)$$

[Out] CannotIntegrate[ $\text{SinIntegral}[b*x]^2/x^3$ , x]

Rubi [A] time = 0.02474, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\text{Si}(bx)^2}{x^3} dx$$

Verification is Not applicable to the result.

[In] Int[ $\text{SinIntegral}[b*x]^2/x^3$ , x]

[Out] Defer[Int][ $\text{SinIntegral}[b*x]^2/x^3$ , x]

Rubi steps

$$\int \frac{\text{Si}(bx)^2}{x^3} dx = \int \frac{\text{Si}(bx)^2}{x^3} dx$$

Mathematica [A] time = 0.501191, size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx)^2}{x^3} dx$$

Verification is Not applicable to the result.

[In] Integrate[ $\text{SinIntegral}[b*x]^2/x^3$ , x]

[Out] Integrate[ $\text{SinIntegral}[b*x]^2/x^3$ , x]

---

**Maple [A]** time = 0.054, size = 0, normalized size = 0.

$$\int \frac{(\text{Si}(bx))^2}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Si(b\*x)^2/x^3,x)

[Out] int(Si(b\*x)^2/x^3,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx)^2}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x)^2/x^3,x, algorithm="maxima")

[Out] integrate(Si(b\*x)^2/x^3, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Si}(bx)^2}{x^3}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x)^2/x^3,x, algorithm="fricas")

[Out] integral(sin\_integral(b\*x)^2/x^3, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}^2(bx)}{x^3} dx$$



Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(b*x)**2/x**3,x)
```

```
[Out] Integral(Si(b*x)**2/x**3, x)
```

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx)^2}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(b*x)^2/x^3,x, algorithm="giac")
```

```
[Out] integrate(Si(b*x)^2/x^3, x)
```

### 3.17 $\int x^m \mathbf{Si}(a + bx) dx$

Optimal. Leaf size=47

$$\frac{x^{m+1} \mathbf{Si}(a + bx)}{m + 1} - \frac{b \mathbf{CannotIntegrate}\left(\frac{x^{m+1} \sin(a+bx)}{a+bx}, x\right)}{m + 1}$$

[Out]  $-\left(\frac{b \mathbf{CannotIntegrate}[(x^{1+m} \mathbf{Sin}[a + b*x])/(a + b*x), x]}{(1 + m)}\right) + \frac{x^{1+m} \mathbf{SinIntegral}[a + b*x]}{(1 + m)}$

**Rubi [A]** time = 0.294585, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int x^m \mathbf{Si}(a + bx) dx$$

Verification is Not applicable to the result.

[In] `Int[x^m*SinIntegral[a + b*x],x]`

[Out]  $\frac{x^{1+m} \mathbf{SinIntegral}[a + b*x]}{(1 + m)} - \frac{b \mathbf{Defer}[\mathbf{Int}[(x^{1+m} \mathbf{Sin}[a + b*x])/(a + b*x), x]]}{(1 + m)}$

Rubi steps

$$\int x^m \mathbf{Si}(a + bx) dx = \frac{x^{1+m} \mathbf{Si}(a + bx)}{1 + m} - \frac{b \int \frac{x^{1+m} \sin(a+bx)}{a+bx} dx}{1 + m}$$

**Mathematica [A]** time = 4.09459, size = 0, normalized size = 0.

$$\int x^m \mathbf{Si}(a + bx) dx$$

Verification is Not applicable to the result.

[In] `Integrate[x^m*SinIntegral[a + b*x],x]`

[Out] Integrate[x<sup>m</sup>\*SinIntegral[a + b\*x], x]

---

**Maple [A]** time = 0.185, size = 0, normalized size = 0.

$$\int x^m \text{Si}(bx + a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x<sup>m</sup>\*Si(b\*x+a),x)

[Out] int(x<sup>m</sup>\*Si(b\*x+a),x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int x^m \text{Si}(bx + a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x<sup>m</sup>\*Si(b\*x+a),x, algorithm="maxima")

[Out] integrate(x<sup>m</sup>\*Si(b\*x + a), x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^m \text{Si}(bx + a), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x<sup>m</sup>\*Si(b\*x+a),x, algorithm="fricas")

[Out] integral(x<sup>m</sup>\*sin\_integral(b\*x + a), x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int x^m \text{Si}(a + bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x**m*Si(b*x+a),x)
```

```
[Out] Integral(x**m*Si(a + b*x), x)
```

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int x^m \operatorname{Si}(bx + a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x^m*Si(b*x+a),x, algorithm="giac")
```

```
[Out] integrate(x^m*Si(b*x + a), x)
```

### 3.18 $\int x^3 \text{Si}(a + bx) dx$

**Optimal.** Leaf size=184

$$-\frac{a^4 \text{Si}(a + bx)}{4b^4} - \frac{a^2 \sin(a + bx)}{4b^4} - \frac{a^3 \cos(a + bx)}{4b^4} + \frac{a^2 x \cos(a + bx)}{4b^3} - \frac{3x^2 \sin(a + bx)}{4b^2} - \frac{ax^2 \cos(a + bx)}{4b^2} + \frac{ax \sin(a + bx)}{2b^3}$$

```
[Out] (a*Cos[a + b*x])/(2*b^4) - (a^3*Cos[a + b*x])/(4*b^4) - (3*x*Cos[a + b*x])/(2*b^3) + (a^2*x*Cos[a + b*x])/(4*b^3) - (a*x^2*Cos[a + b*x])/(4*b^2) + (x^3*Cos[a + b*x])/(4*b) + (3*Sin[a + b*x])/(2*b^4) - (a^2*Sin[a + b*x])/(4*b^4) + (a*x*Sin[a + b*x])/(2*b^3) - (3*x^2*Sin[a + b*x])/(4*b^2) - (a^4*SinIntegral[a + b*x])/(4*b^4) + (x^4*SinIntegral[a + b*x])/4
```

**Rubi [A]** time = 0.36786, antiderivative size = 184, normalized size of antiderivative = 1., number of steps used = 14, number of rules used = 6, integrand size = 10,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.6$ , Rules used = {6503, 6742, 2638, 3296, 2637, 3299}

$$-\frac{a^4 \text{Si}(a + bx)}{4b^4} - \frac{a^2 \sin(a + bx)}{4b^4} - \frac{a^3 \cos(a + bx)}{4b^4} + \frac{a^2 x \cos(a + bx)}{4b^3} - \frac{3x^2 \sin(a + bx)}{4b^2} - \frac{ax^2 \cos(a + bx)}{4b^2} + \frac{ax \sin(a + bx)}{2b^3}$$

Antiderivative was successfully verified.

```
[In] Int[x^3*SinIntegral[a + b*x],x]
```

```
[Out] (a*Cos[a + b*x])/(2*b^4) - (a^3*Cos[a + b*x])/(4*b^4) - (3*x*Cos[a + b*x])/(2*b^3) + (a^2*x*Cos[a + b*x])/(4*b^3) - (a*x^2*Cos[a + b*x])/(4*b^2) + (x^3*Cos[a + b*x])/(4*b) + (3*Sin[a + b*x])/(2*b^4) - (a^2*Sin[a + b*x])/(4*b^4) + (a*x*Sin[a + b*x])/(2*b^3) - (3*x^2*Sin[a + b*x])/(4*b^2) - (a^4*SinIntegral[a + b*x])/(4*b^4) + (x^4*SinIntegral[a + b*x])/4
```

#### Rule 6503

```
Int[((c_.) + (d_.)*(x_))^(m_.)*SinIntegral[(a_.) + (b_.)*(x_)], x_Symbol] :> Simp[((c + d*x)^(m + 1)*SinIntegral[a + b*x])/(d*(m + 1)), x] - Dist[b/(d*(m + 1)), Int[((c + d*x)^(m + 1)*Sin[a + b*x])/(a + b*x), x], x] /; FreeQ[{a, b, c, d, m}, x] && NeQ[m, -1]
```

#### Rule 6742

```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]]
```

Rule 2638

```
Int[sin[(c_.) + (d_.)*(x_)], x_Symbol] := -Simp[Cos[c + d*x]/d, x] /; FreeQ
[{c, d}, x]
```

Rule 3296

```
Int[((c_.) + (d_.)*(x_))^(m_.)*sin[(e_.) + (f_.)*(x_)], x_Symbol] := -Simp[
((c + d*x)^m*Cos[e + f*x])/f, x] + Dist[(d*m)/f, Int[(c + d*x)^(m - 1)*Cos[
e + f*x], x], x] /; FreeQ[{c, d, e, f}, x] && GtQ[m, 0]
```

Rule 2637

```
Int[sin[Pi/2 + (c_.) + (d_.)*(x_)], x_Symbol] := Simp[Sin[c + d*x]/d, x] /;
FreeQ[{c, d}, x]
```

Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[SinInte
gral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

Rubi steps

$$\begin{aligned}
\int x^3 \text{Si}(a + bx) dx &= \frac{1}{4} x^4 \text{Si}(a + bx) - \frac{1}{4} b \int \frac{x^4 \sin(a + bx)}{a + bx} dx \\
&= \frac{1}{4} x^4 \text{Si}(a + bx) - \frac{1}{4} b \int \left( -\frac{a^3 \sin(a + bx)}{b^4} + \frac{a^2 x \sin(a + bx)}{b^3} - \frac{a x^2 \sin(a + bx)}{b^2} + \frac{x^3 \sin(a + bx)}{b} + \frac{a^4}{b} \right) dx \\
&= \frac{1}{4} x^4 \text{Si}(a + bx) - \frac{1}{4} \int x^3 \sin(a + bx) dx + \frac{a^3 \int \sin(a + bx) dx}{4b^3} - \frac{a^4 \int \frac{\sin(a + bx)}{a + bx} dx}{4b^3} - \frac{a^2 \int x \sin(a + bx) dx}{4b^2} \\
&= -\frac{a^3 \cos(a + bx)}{4b^4} + \frac{a^2 x \cos(a + bx)}{4b^3} - \frac{a x^2 \cos(a + bx)}{4b^2} + \frac{x^3 \cos(a + bx)}{4b} - \frac{a^4 \text{Si}(a + bx)}{4b^4} + \frac{1}{4} x^4 \text{Si}(a + bx) \\
&= -\frac{a^3 \cos(a + bx)}{4b^4} + \frac{a^2 x \cos(a + bx)}{4b^3} - \frac{a x^2 \cos(a + bx)}{4b^2} + \frac{x^3 \cos(a + bx)}{4b} - \frac{a^2 \sin(a + bx)}{4b^4} + \frac{a x \sin(a + bx)}{2b^3} \\
&= \frac{a \cos(a + bx)}{2b^4} - \frac{a^3 \cos(a + bx)}{4b^4} - \frac{3x \cos(a + bx)}{2b^3} + \frac{a^2 x \cos(a + bx)}{4b^3} - \frac{a x^2 \cos(a + bx)}{4b^2} + \frac{x^3 \cos(a + bx)}{4b} \\
&= \frac{a \cos(a + bx)}{2b^4} - \frac{a^3 \cos(a + bx)}{4b^4} - \frac{3x \cos(a + bx)}{2b^3} + \frac{a^2 x \cos(a + bx)}{4b^3} - \frac{a x^2 \cos(a + bx)}{4b^2} + \frac{x^3 \cos(a + bx)}{4b}
\end{aligned}$$

**Mathematica [A]** time = 0.196839, size = 96, normalized size = 0.52

$$\frac{(b^4 x^4 - a^4) \text{Si}(a + bx) - (a^2 - 2abx + 3b^2 x^2 - 6) \sin(a + bx) + (a^2 bx - a^3 - ab^2 x^2 + 2a + b^3 x^3 - 6bx) \cos(a + bx)}{4b^4}$$

Antiderivative was successfully verified.

[In] Integrate[x^3\*SinIntegral[a + b\*x],x]

[Out]  $((2*a - a^3 - 6*b*x + a^2*b*x - a*b^2*x^2 + b^3*x^3)*\text{Cos}[a + b*x] - (-6 + a^2 - 2*a*b*x + 3*b^2*x^2)*\text{Sin}[a + b*x] + (-a^4 + b^4*x^4)*\text{SinIntegral}[a + b*x])/(4*b^4)$

**Maple [A]** time = 0.049, size = 157, normalized size = 0.9

$$\frac{1}{b^4} \left( \frac{\text{Si}(bx+a)b^4x^4}{4} + \frac{(bx+a)^3 \cos(bx+a)}{4} - \frac{3(bx+a)^2 \sin(bx+a)}{4} + \frac{3 \sin(bx+a)}{2} - \frac{(3bx+3a) \cos(bx+a)}{2} + a \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x^3\*Si(b\*x+a),x)

[Out]  $1/b^4*(1/4*\text{Si}(b*x+a)*b^4*x^4+1/4*(b*x+a)^3*\cos(b*x+a)-3/4*(b*x+a)^2*\sin(b*x+a)+3/2*\sin(b*x+a)-3/2*(b*x+a)*\cos(b*x+a)+a*(-(b*x+a)^2*\cos(b*x+a)+2*\cos(b*x+a)+2*\sin(b*x+a)*(b*x+a))-3/2*a^2*(-(b*x+a)*\cos(b*x+a)+\sin(b*x+a))-a^3*\cos(b*x+a)-1/4*a^4*\text{Si}(b*x+a))$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^3 \text{Si}(bx+a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^3\*Si(b\*x+a),x, algorithm="maxima")

[Out] integrate(x^3\*Si(b\*x + a), x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^3 \text{Si}(bx+a), x)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x^3*Si(b*x+a),x, algorithm="fricas")
```

```
[Out] integral(x^3*sin_integral(b*x + a), x)
```

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x^3 \operatorname{Si}(a + bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x**3*Si(b*x+a),x)
```

```
[Out] Integral(x**3*Si(a + b*x), x)
```

**Giac [C]** time = 1.28597, size = 74, normalized size = 0.4

$$\frac{1}{4} x^4 \operatorname{Si}(bx + a) - \frac{a^4 \Im(\operatorname{Ci}(bx + a)) - a^4 \Im(\operatorname{Ci}(-bx - a)) + 2 a^4 \operatorname{Si}(bx + a)}{8 b^4}$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x^3*Si(b*x+a),x, algorithm="giac")
```

```
[Out] 1/4*x^4*sin_integral(b*x + a) - 1/8*(a^4*imag_part(cos_integral(b*x + a)) -
a^4*imag_part(cos_integral(-b*x - a)) + 2*a^4*sin_integral(b*x + a))/b^4
```



### 3.19 $\int x^2 \text{Si}(a + bx) dx$

**Optimal.** Leaf size=118

$$\frac{a^3 \text{Si}(a + bx)}{3b^3} + \frac{a^2 \cos(a + bx)}{3b^3} + \frac{a \sin(a + bx)}{3b^3} - \frac{2x \sin(a + bx)}{3b^2} - \frac{ax \cos(a + bx)}{3b^2} - \frac{2 \cos(a + bx)}{3b^3} + \frac{1}{3} x^3 \text{Si}(a + bx) + \dots$$

[Out]  $(-2*\text{Cos}[a + b*x])/(3*b^3) + (a^2*\text{Cos}[a + b*x])/(3*b^3) - (a*x*\text{Cos}[a + b*x])/(3*b^2) + (x^2*\text{Cos}[a + b*x])/(3*b) + (a*\text{Sin}[a + b*x])/(3*b^3) - (2*x*\text{Sin}[a + b*x])/(3*b^2) + (a^3*\text{SinIntegral}[a + b*x])/(3*b^3) + (x^3*\text{SinIntegral}[a + b*x])/3$

**Rubi [A]** time = 0.276629, antiderivative size = 118, normalized size of antiderivative = 1., number of steps used = 10, number of rules used = 6, integrand size = 10,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.6$ , Rules used = {6503, 6742, 2638, 3296, 2637, 3299}

$$\frac{a^3 \text{Si}(a + bx)}{3b^3} + \frac{a^2 \cos(a + bx)}{3b^3} + \frac{a \sin(a + bx)}{3b^3} - \frac{2x \sin(a + bx)}{3b^2} - \frac{ax \cos(a + bx)}{3b^2} - \frac{2 \cos(a + bx)}{3b^3} + \frac{1}{3} x^3 \text{Si}(a + bx) + \dots$$

Antiderivative was successfully verified.

[In]  $\text{Int}[x^2*\text{SinIntegral}[a + b*x], x]$

[Out]  $(-2*\text{Cos}[a + b*x])/(3*b^3) + (a^2*\text{Cos}[a + b*x])/(3*b^3) - (a*x*\text{Cos}[a + b*x])/(3*b^2) + (x^2*\text{Cos}[a + b*x])/(3*b) + (a*\text{Sin}[a + b*x])/(3*b^3) - (2*x*\text{Sin}[a + b*x])/(3*b^2) + (a^3*\text{SinIntegral}[a + b*x])/(3*b^3) + (x^3*\text{SinIntegral}[a + b*x])/3$

#### Rule 6503

$\text{Int}[(c + d*x)^m * \text{SinIntegral}[a + b*x], x\_Symbol] :> \text{Simp}[(c + d*x)^{m+1} * \text{SinIntegral}[a + b*x] / (d*(m+1)), x] - \text{Dist}[b / (d*(m+1)), \text{Int}[(c + d*x)^{m+1} * \text{Sin}[a + b*x] / (a + b*x), x], x] /;$  FreeQ[{a, b, c, d, m}, x] && NeQ[m, -1]

#### Rule 6742

$\text{Int}[u, x\_Symbol] :> \text{With}[\{v = \text{ExpandIntegrand}[u, x]\}, \text{Int}[v, x] /; \text{SumQ}[v]]$

#### Rule 2638

Int[sin[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] := -Simp[Cos[c + d\*x]/d, x] /; FreeQ[{c, d}, x]

### Rule 3296

Int[((c\_.) + (d\_.)\*(x\_))^(m\_.)\*sin[(e\_.) + (f\_.)\*(x\_)], x\_Symbol] := -Simp[((c + d\*x)^m\*cos[e + f\*x])/f, x] + Dist[(d\*m)/f, Int[(c + d\*x)^(m - 1)\*cos[e + f\*x], x], x] /; FreeQ[{c, d, e, f}, x] && GtQ[m, 0]

### Rule 2637

Int[sin[Pi/2 + (c\_.) + (d\_.)\*(x\_)], x\_Symbol] := Simp[Sin[c + d\*x]/d, x] /; FreeQ[{c, d}, x]

### Rule 3299

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] := Simp[SinIntegral[e + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*e - c\*f, 0]

### Rubi steps

$$\begin{aligned}
 \int x^2 \text{Si}(a + bx) dx &= \frac{1}{3} x^3 \text{Si}(a + bx) - \frac{1}{3} b \int \frac{x^3 \sin(a + bx)}{a + bx} dx \\
 &= \frac{1}{3} x^3 \text{Si}(a + bx) - \frac{1}{3} b \int \left( \frac{a^2 \sin(a + bx)}{b^3} - \frac{ax \sin(a + bx)}{b^2} + \frac{x^2 \sin(a + bx)}{b} - \frac{a^3 \sin(a + bx)}{b^3(a + bx)} \right) dx \\
 &= \frac{1}{3} x^3 \text{Si}(a + bx) - \frac{1}{3} \int x^2 \sin(a + bx) dx - \frac{a^2 \int \sin(a + bx) dx}{3b^2} + \frac{a^3 \int \frac{\sin(a + bx)}{a + bx} dx}{3b^2} + \frac{a \int x \sin(a + bx)}{3b} \\
 &= \frac{a^2 \cos(a + bx)}{3b^3} - \frac{ax \cos(a + bx)}{3b^2} + \frac{x^2 \cos(a + bx)}{3b} + \frac{a^3 \text{Si}(a + bx)}{3b^3} + \frac{1}{3} x^3 \text{Si}(a + bx) + \frac{a \int \cos(a + bx)}{3b^2} \\
 &= \frac{a^2 \cos(a + bx)}{3b^3} - \frac{ax \cos(a + bx)}{3b^2} + \frac{x^2 \cos(a + bx)}{3b} + \frac{a \sin(a + bx)}{3b^3} - \frac{2x \sin(a + bx)}{3b^2} + \frac{a^3 \text{Si}(a + bx)}{3b^3} \\
 &= -\frac{2 \cos(a + bx)}{3b^3} + \frac{a^2 \cos(a + bx)}{3b^3} - \frac{ax \cos(a + bx)}{3b^2} + \frac{x^2 \cos(a + bx)}{3b} + \frac{a \sin(a + bx)}{3b^3} - \frac{2x \sin(a + bx)}{3b^2}
 \end{aligned}$$

**Mathematica [A]** time = 0.141367, size = 63, normalized size = 0.53

$$\frac{(a^3 + b^3 x^3) \text{Si}(a + bx) + (a^2 - abx + b^2 x^2 - 2) \cos(a + bx) + (a - 2bx) \sin(a + bx)}{3b^3}$$

Antiderivative was successfully verified.

[In] Integrate[x^2\*SinIntegral[a + b\*x],x]

[Out]  $((-2 + a^2 - a*b*x + b^2*x^2)*\text{Cos}[a + b*x] + (a - 2*b*x)*\text{Sin}[a + b*x] + (a^3 + b^3*x^3)*\text{SinIntegral}[a + b*x])/(3*b^3)$

**Maple [A]** time = 0.053, size = 99, normalized size = 0.8

$$\frac{1}{b^3} \left( \frac{b^3 x^3 \text{Si}(bx+a)}{3} + \frac{(bx+a)^2 \cos(bx+a)}{3} - \frac{2 \cos(bx+a)}{3} - \frac{2 \sin(bx+a)(bx+a)}{3} + a(-bx+a) \cos(bx+a) + \sin(bx+a) \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x^2\*Si(b\*x+a),x)

[Out]  $1/b^3*(1/3*b^3*x^3*Si(b*x+a)+1/3*(b*x+a)^2*\cos(b*x+a)-2/3*\cos(b*x+a)-2/3*\sin(b*x+a)*(b*x+a)+a*(-(b*x+a)*\cos(b*x+a)+\sin(b*x+a))+a^2*\cos(b*x+a)+1/3*a^3*Si(b*x+a))$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \text{Si}(bx+a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^2\*Si(b\*x+a),x, algorithm="maxima")

[Out] integrate(x^2\*Si(b\*x + a), x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^2 \text{Si}(bx+a), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^2\*Si(b\*x+a),x, algorithm="fricas")

[Out] `integral(x^2*sin_integral(b*x + a), x)`

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \operatorname{Si}(a + bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x**2*Si(b*x+a),x)`

[Out] `Integral(x**2*Si(a + b*x), x)`

**Giac [C]** time = 1.21799, size = 74, normalized size = 0.63

$$\frac{1}{3} x^3 \operatorname{Si}(bx + a) + \frac{a^3 \Im(\operatorname{Ci}(bx + a)) - a^3 \Im(\operatorname{Ci}(-bx - a)) + 2 a^3 \operatorname{Si}(bx + a)}{6 b^3}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Si(b*x+a),x, algorithm="giac")`

[Out] `1/3*x^3*sin_integral(b*x + a) + 1/6*(a^3*imag_part(cos_integral(b*x + a)) - a^3*imag_part(cos_integral(-b*x - a)) + 2*a^3*sin_integral(b*x + a))/b^3`

## 3.20 $\int x \text{Si}(a + bx) dx$

**Optimal.** Leaf size=71

$$-\frac{a^2 \text{Si}(a + bx)}{2b^2} - \frac{\sin(a + bx)}{2b^2} - \frac{a \cos(a + bx)}{2b^2} + \frac{1}{2} x^2 \text{Si}(a + bx) + \frac{x \cos(a + bx)}{2b}$$

[Out]  $-(a \cdot \text{Cos}[a + b \cdot x]) / (2 \cdot b^2) + (x \cdot \text{Cos}[a + b \cdot x]) / (2 \cdot b) - \text{Sin}[a + b \cdot x] / (2 \cdot b^2) - (a^2 \cdot \text{SinIntegral}[a + b \cdot x]) / (2 \cdot b^2) + (x^2 \cdot \text{SinIntegral}[a + b \cdot x]) / 2$

**Rubi [A]** time = 0.206409, antiderivative size = 71, normalized size of antiderivative = 1., number of steps used = 7, number of rules used = 6, integrand size = 8,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.75$ , Rules used = {6503, 6742, 2638, 3296, 2637, 3299}

$$-\frac{a^2 \text{Si}(a + bx)}{2b^2} - \frac{\sin(a + bx)}{2b^2} - \frac{a \cos(a + bx)}{2b^2} + \frac{1}{2} x^2 \text{Si}(a + bx) + \frac{x \cos(a + bx)}{2b}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[x \cdot \text{SinIntegral}[a + b \cdot x], x]$

[Out]  $-(a \cdot \text{Cos}[a + b \cdot x]) / (2 \cdot b^2) + (x \cdot \text{Cos}[a + b \cdot x]) / (2 \cdot b) - \text{Sin}[a + b \cdot x] / (2 \cdot b^2) - (a^2 \cdot \text{SinIntegral}[a + b \cdot x]) / (2 \cdot b^2) + (x^2 \cdot \text{SinIntegral}[a + b \cdot x]) / 2$

### Rule 6503

$\text{Int}[(c + d \cdot x)^m \cdot \text{SinIntegral}[a + b \cdot x], x\_Symbol] :> \text{Simp}[(c + d \cdot x)^{m+1} \cdot \text{SinIntegral}[a + b \cdot x] / (d \cdot (m+1)), x] - \text{Dist}[b / (d \cdot (m+1)), \text{Int}[(c + d \cdot x)^{m+1} \cdot \text{Sin}[a + b \cdot x] / (a + b \cdot x), x], x] /;$   $\text{FreeQ}[\{a, b, c, d, m\}, x] \ \&\& \ \text{NeQ}[m, -1]$

### Rule 6742

$\text{Int}[u, x\_Symbol] :> \text{With}[\{v = \text{ExpandIntegrand}[u, x]\}, \text{Int}[v, x] /; \text{SumQ}[v]]$

### Rule 2638

$\text{Int}[\sin[c + d \cdot x], x\_Symbol] :> -\text{Simp}[\text{Cos}[c + d \cdot x] / d, x] /; \text{FreeQ}[\{c, d\}, x]$

### Rule 3296

```
Int[((c_.) + (d_.)*(x_))^(m_.)*sin[(e_.) + (f_.)*(x_)], x_Symbol] := -Simp[
((c + d*x)^m*Cos[e + f*x])/f, x] + Dist[(d*m)/f, Int[(c + d*x)^(m - 1)*Cos[
e + f*x], x], x] /; FreeQ[{c, d, e, f}, x] && GtQ[m, 0]
```

### Rule 2637

```
Int[sin[Pi/2 + (c_.) + (d_.)*(x_)], x_Symbol] := Simp[Sin[c + d*x]/d, x] /;
FreeQ[{c, d}, x]
```

### Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[SinInte
gral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

### Rubi steps

$$\begin{aligned}
\int x \operatorname{Si}(a + bx) dx &= \frac{1}{2} x^2 \operatorname{Si}(a + bx) - \frac{1}{2} b \int \frac{x^2 \sin(a + bx)}{a + bx} dx \\
&= \frac{1}{2} x^2 \operatorname{Si}(a + bx) - \frac{1}{2} b \int \left( -\frac{a \sin(a + bx)}{b^2} + \frac{x \sin(a + bx)}{b} + \frac{a^2 \sin(a + bx)}{b^2(a + bx)} \right) dx \\
&= \frac{1}{2} x^2 \operatorname{Si}(a + bx) - \frac{1}{2} \int x \sin(a + bx) dx + \frac{a \int \sin(a + bx) dx}{2b} - \frac{a^2 \int \frac{\sin(a + bx)}{a + bx} dx}{2b} \\
&= -\frac{a \cos(a + bx)}{2b^2} + \frac{x \cos(a + bx)}{2b} - \frac{a^2 \operatorname{Si}(a + bx)}{2b^2} + \frac{1}{2} x^2 \operatorname{Si}(a + bx) - \frac{\int \cos(a + bx) dx}{2b} \\
&= -\frac{a \cos(a + bx)}{2b^2} + \frac{x \cos(a + bx)}{2b} - \frac{\sin(a + bx)}{2b^2} - \frac{a^2 \operatorname{Si}(a + bx)}{2b^2} + \frac{1}{2} x^2 \operatorname{Si}(a + bx)
\end{aligned}$$

**Mathematica [A]** time = 0.0998636, size = 50, normalized size = 0.7

$$\frac{(b^2 x^2 - a^2) \operatorname{Si}(a + bx) - \sin(a + bx) + (bx - a) \cos(a + bx)}{2b^2}$$

Antiderivative was successfully verified.

```
[In] Integrate[x*SinIntegral[a + b*x], x]
```

```
[Out] ((-a + b*x)*Cos[a + b*x] - Sin[a + b*x] + (-a^2 + b^2*x^2)*SinIntegral[a +
b*x])/(2*b^2)
```

**Maple [A]** time = 0.051, size = 61, normalized size = 0.9

$$\frac{1}{b^2} \left( \text{Si}(bx + a) \left( \frac{(bx + a)^2}{2} - a(bx + a) \right) + \frac{(bx + a) \cos(bx + a)}{2} - \frac{\sin(bx + a)}{2} - a \cos(bx + a) \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(x*Si(b*x+a),x)`

[Out] `1/b^2*(Si(b*x+a)*(1/2*(b*x+a)^2-a*(b*x+a))+1/2*(b*x+a)*cos(b*x+a)-1/2*sin(b*x+a)-a*cos(b*x+a))`

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x \text{Si}(bx + a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*Si(b*x+a),x, algorithm="maxima")`

[Out] `integrate(x*Si(b*x + a), x)`

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x \text{Si}(bx + a), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*Si(b*x+a),x, algorithm="fricas")`

[Out] `integral(x*sin_integral(b*x + a), x)`

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x \text{Si}(a + bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Si(b\*x+a),x)

[Out] Integral(x\*Si(a + b\*x), x)

**Giac [C]** time = 1.26429, size = 74, normalized size = 1.04

$$\frac{1}{2}x^2 \operatorname{Si}(bx + a) - \frac{a^2 \Im(\operatorname{Ci}(bx + a)) - a^2 \Im(\operatorname{Ci}(-bx - a)) + 2a^2 \operatorname{Si}(bx + a)}{4b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Si(b\*x+a),x, algorithm="giac")

[Out]  $\frac{1}{2}x^2 \sin\_integral(b*x + a) - \frac{1}{4}(a^2 \operatorname{imag\_part}(\cos\_integral(b*x + a)) - a^2 \operatorname{imag\_part}(\cos\_integral(-b*x - a)) + 2a^2 \sin\_integral(b*x + a))/b^2$



### 3.21 $\int \text{Si}(a + bx) dx$

**Optimal.** Leaf size=26

$$\frac{(a + bx)\text{Si}(a + bx)}{b} + \frac{\cos(a + bx)}{b}$$

[Out] Cos[a + b\*x]/b + ((a + b\*x)\*SinIntegral[a + b\*x])/b

**Rubi [A]** time = 0.0054842, antiderivative size = 26, normalized size of antiderivative = 1., number of steps used = 1, number of rules used = 1, integrand size = 6,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.167$ , Rules used = {6499}

$$\frac{(a + bx)\text{Si}(a + bx)}{b} + \frac{\cos(a + bx)}{b}$$

Antiderivative was successfully verified.

[In] Int[SinIntegral[a + b\*x],x]

[Out] Cos[a + b\*x]/b + ((a + b\*x)\*SinIntegral[a + b\*x])/b

#### Rule 6499

Int[SinIntegral[(a\_.) + (b\_.)\*(x\_.)], x\_Symbol] :> Simp[((a + b\*x)\*SinIntegral[a + b\*x])/b, x] + Simp[Cos[a + b\*x]/b, x] /; FreeQ[{a, b}, x]

#### Rubi steps

$$\int \text{Si}(a + bx) dx = \frac{\cos(a + bx)}{b} + \frac{(a + bx)\text{Si}(a + bx)}{b}$$

**Mathematica [A]** time = 0.0359392, size = 41, normalized size = 1.58

$$x\text{Si}(a + bx) + \frac{a\text{Si}(a + bx)}{b} - \frac{\sin(a)\sin(bx)}{b} + \frac{\cos(a)\cos(bx)}{b}$$

Antiderivative was successfully verified.

[In] Integrate[SinIntegral[a + b\*x],x]

[Out]  $(\cos[a]\cos[bx])/b - (\sin[a]\sin[bx])/b + (a\text{SinIntegral}[a + bx])/b + x\text{SinIntegral}[a + bx]$

---

**Maple [A]** time = 0.049, size = 24, normalized size = 0.9

$$\frac{(bx + a)\text{Si}(bx + a) + \cos(bx + a)}{b}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(Si(b*x+a),x)`

[Out] `1/b*((b*x+a)*Si(b*x+a)+cos(b*x+a))`

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \text{Si}(bx + a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(b*x+a),x, algorithm="maxima")`

[Out] `integrate(Si(b*x + a), x)`

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(\text{Si}(bx + a), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(b*x+a),x, algorithm="fricas")`

[Out] `integral(sin_integral(b*x + a), x)`

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \text{Si}(a + bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a), x)

[Out] Integral(Si(a + b\*x), x)

**Giac [C]** time = 1.34509, size = 62, normalized size = 2.38

$$x \text{Si}(bx + a) + \frac{a \Im(\text{Ci}(bx + a)) - a \Im(\text{Ci}(-bx - a)) + 2a \text{Si}(bx + a)}{2b}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a), x, algorithm="giac")

[Out] x\*sin\_integral(b\*x + a) + 1/2\*(a\*imag\_part(cos\_integral(b\*x + a)) - a\*imag\_part(cos\_integral(-b\*x - a)) + 2\*a\*sin\_integral(b\*x + a))/b

$$3.22 \quad \int \frac{\text{Si}(a+bx)}{x} dx$$

**Optimal.** Leaf size=12

$$\text{CannotIntegrate}\left(\frac{\text{Si}(a+bx)}{x}, x\right)$$

[Out] CannotIntegrate[SinIntegral[a + b\*x]/x, x]

**Rubi [A]** time = 0.0235792, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\text{Si}(a+bx)}{x} dx$$

Verification is Not applicable to the result.

[In] Int[SinIntegral[a + b\*x]/x,x]

[Out] Defer[Int][SinIntegral[a + b\*x]/x, x]

Rubi steps

$$\int \frac{\text{Si}(a+bx)}{x} dx = \int \frac{\text{Si}(a+bx)}{x} dx$$

**Mathematica [A]** time = 0.654852, size = 0, normalized size = 0.

$$\int \frac{\text{Si}(a+bx)}{x} dx$$

Verification is Not applicable to the result.

[In] Integrate[SinIntegral[a + b\*x]/x,x]

[Out] Integrate[SinIntegral[a + b\*x]/x, x]

**Maple [A]** time = 0.061, size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Si(b\*x+a)/x,x)

[Out] int(Si(b\*x+a)/x,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a)/x,x, algorithm="maxima")

[Out] integrate(Si(b\*x + a)/x, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Si}(bx + a)}{x}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a)/x,x, algorithm="fricas")

[Out] integral(sin\_integral(b\*x + a)/x, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(a + bx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(b*x+a)/x,x)
```

```
[Out] Integral(Si(a + b*x)/x, x)
```

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(b*x+a)/x,x, algorithm="giac")
```

```
[Out] integrate(Si(b*x + a)/x, x)
```

### 3.23 $\int \frac{\text{Si}(a+bx)}{x^2} dx$

**Optimal.** Leaf size=46

$$\frac{b \sin(a) \text{CosIntegral}(bx)}{a} - \frac{b \text{Si}(a+bx)}{a} - \frac{\text{Si}(a+bx)}{x} + \frac{b \cos(a) \text{Si}(bx)}{a}$$

[Out] (b\*CosIntegral[b\*x]\*Sin[a])/a + (b\*Cos[a]\*SinIntegral[b\*x])/a - (b\*SinIntegral[a + b\*x])/a - SinIntegral[a + b\*x]/x

**Rubi [A]** time = 0.232405, antiderivative size = 46, normalized size of antiderivative = 1., number of steps used = 7, number of rules used = 5, integrand size = 10,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.5$ , Rules used = {6503, 6742, 3303, 3299, 3302}

$$\frac{b \sin(a) \text{CosIntegral}(bx)}{a} - \frac{b \text{Si}(a+bx)}{a} - \frac{\text{Si}(a+bx)}{x} + \frac{b \cos(a) \text{Si}(bx)}{a}$$

Antiderivative was successfully verified.

[In] Int[SinIntegral[a + b\*x]/x^2,x]

[Out] (b\*CosIntegral[b\*x]\*Sin[a])/a + (b\*Cos[a]\*SinIntegral[b\*x])/a - (b\*SinIntegral[a + b\*x])/a - SinIntegral[a + b\*x]/x

#### Rule 6503

```
Int[((c_.) + (d_.)*(x_))^(m_.)*SinIntegral[(a_.) + (b_.)*(x_)], x_Symbol] :
> Simp[((c + d*x)^(m + 1)*SinIntegral[a + b*x])/(d*(m + 1)), x] - Dist[b/(d
*(m + 1)), Int[((c + d*x)^(m + 1)*Sin[a + b*x])/(a + b*x), x], x] /; FreeQ[
{a, b, c, d, m}, x] && NeQ[m, -1]
```

#### Rule 6742

```
Int[u_, x_Symbol] :=> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

#### Rule 3303

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] :=> Dist[Cos[(d*
e - c*f)/d], Int[Sin[(c*f)/d + f*x]/(c + d*x), x], x] + Dist[Sin[(d*e - c*f
)/d], Int[Cos[(c*f)/d + f*x]/(c + d*x), x], x] /; FreeQ[{c, d, e, f}, x] &&
```

NeQ[d\*e - c\*f, 0]

### Rule 3299

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] := Simp[SinIntegral[e + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*e - c\*f, 0]

### Rule 3302

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] := Simp[CosIntegral[e - Pi/2 + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*(e - Pi/2) - c\*f, 0]

### Rubi steps

$$\begin{aligned}
 \int \frac{\text{Si}(a+bx)}{x^2} dx &= -\frac{\text{Si}(a+bx)}{x} + b \int \frac{\sin(a+bx)}{x(a+bx)} dx \\
 &= -\frac{\text{Si}(a+bx)}{x} + b \int \left( \frac{\sin(a+bx)}{ax} - \frac{b \sin(a+bx)}{a(a+bx)} \right) dx \\
 &= -\frac{\text{Si}(a+bx)}{x} + \frac{b}{a} \int \frac{\sin(a+bx)}{x} dx - \frac{b^2}{a} \int \frac{\sin(a+bx)}{a+bx} dx \\
 &= -\frac{b \text{Si}(a+bx)}{a} - \frac{\text{Si}(a+bx)}{x} + \frac{(b \cos(a)) \int \frac{\sin(bx)}{x} dx}{a} + \frac{(b \sin(a)) \int \frac{\cos(bx)}{x} dx}{a} \\
 &= \frac{b \text{Ci}(bx) \sin(a)}{a} + \frac{b \cos(a) \text{Si}(bx)}{a} - \frac{b \text{Si}(a+bx)}{a} - \frac{\text{Si}(a+bx)}{x}
 \end{aligned}$$

**Mathematica [A]** time = 0.0732792, size = 39, normalized size = 0.85

$$\frac{bx \sin(a) \text{CosIntegral}(bx) - (a+bx) \text{Si}(a+bx) + bx \cos(a) \text{Si}(bx)}{ax}$$

Antiderivative was successfully verified.

[In] Integrate[SinIntegral[a + b\*x]/x^2, x]

[Out] (b\*x\*CosIntegral[b\*x]\*Sin[a] + b\*x\*Cos[a]\*SinIntegral[b\*x] - (a + b\*x)\*SinIntegral[a + b\*x])/(a\*x)



**Maple [A]** time = 0.057, size = 48, normalized size = 1.

$$b \left( -\frac{\text{Si}(bx+a)}{bx} - \frac{\text{Si}(bx+a)}{a} + \frac{\text{Si}(bx)\cos(a) + \text{Ci}(bx)\sin(a)}{a} \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Si(b\*x+a)/x^2,x)

[Out] b\*(-Si(b\*x+a)/b/x-1/a\*Si(b\*x+a)+1/a\*(Si(b\*x)\*cos(a)+Ci(b\*x)\*sin(a)))

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx+a)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a)/x^2,x, algorithm="maxima")

[Out] integrate(Si(b\*x + a)/x^2, x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Si}(bx+a)}{x^2}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a)/x^2,x, algorithm="fricas")

[Out] integral(sin\_integral(b\*x + a)/x^2, x)

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(a+bx)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a)/x\*\*2,x)

[Out] Integral(Si(a + b\*x)/x\*\*2, x)

**Giac [C]** time = 1.31766, size = 244, normalized size = 5.3

$$\left( \Im(\operatorname{Ci}(bx+a)) \tan\left(\frac{1}{2}a\right)^2 + \Im(\operatorname{Ci}(bx)) \tan\left(\frac{1}{2}a\right)^2 - \Im(\operatorname{Ci}(-bx-a)) \tan\left(\frac{1}{2}a\right)^2 - \Im(\operatorname{Ci}(-bx)) \tan\left(\frac{1}{2}a\right)^2 + 2 \operatorname{Si}(bx+a) \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a)/x^2,x, algorithm="giac")

[Out]  $-1/2*(\operatorname{imag\_part}(\operatorname{cos\_integral}(b*x + a))*\tan(1/2*a)^2 + \operatorname{imag\_part}(\operatorname{cos\_integral}(b*x))*\tan(1/2*a)^2 - \operatorname{imag\_part}(\operatorname{cos\_integral}(-b*x - a))*\tan(1/2*a)^2 - \operatorname{imag\_part}(\operatorname{cos\_integral}(-b*x))*\tan(1/2*a)^2 + 2*\operatorname{sin\_integral}(b*x + a)*\tan(1/2*a)^2 + 2*\operatorname{sin\_integral}(b*x)*\tan(1/2*a)^2 - 2*\operatorname{real\_part}(\operatorname{cos\_integral}(b*x))*\tan(1/2*a) - 2*\operatorname{real\_part}(\operatorname{cos\_integral}(-b*x))*\tan(1/2*a) + \operatorname{imag\_part}(\operatorname{cos\_integral}(b*x + a)) - \operatorname{imag\_part}(\operatorname{cos\_integral}(b*x)) - \operatorname{imag\_part}(\operatorname{cos\_integral}(-b*x - a)) + \operatorname{imag\_part}(\operatorname{cos\_integral}(-b*x)) + 2*\operatorname{sin\_integral}(b*x + a) - 2*\operatorname{sin\_integral}(b*x))*b/(a*\tan(1/2*a)^2 + a) - \operatorname{sin\_integral}(b*x + a)/x$

### 3.24 $\int \frac{\text{Si}(a+bx)}{x^3} dx$

**Optimal.** Leaf size=111

$$-\frac{b^2 \sin(a) \text{CosIntegral}(bx)}{2a^2} + \frac{b^2 \text{Si}(a+bx)}{2a^2} - \frac{b^2 \cos(a) \text{Si}(bx)}{2a^2} + \frac{b^2 \cos(a) \text{CosIntegral}(bx)}{2a} - \frac{b^2 \sin(a) \text{Si}(bx)}{2a} - \frac{\text{Si}(a+bx)}{2x^2}$$

```
[Out] (b^2*Cos[a]*CosIntegral[b*x])/(2*a) - (b^2*CosIntegral[b*x]*Sin[a])/(2*a^2)
- (b*Sin[a + b*x])/(2*a*x) - (b^2*Cos[a]*SinIntegral[b*x])/(2*a^2) - (b^2*
Sin[a]*SinIntegral[b*x])/(2*a) + (b^2*SinIntegral[a + b*x])/(2*a^2) - SinIn
tegral[a + b*x]/(2*x^2)
```

**Rubi [A]** time = 0.325046, antiderivative size = 111, normalized size of antiderivative = 1., number of steps used = 11, number of rules used = 6, integrand size = 10,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.6$ , Rules used = {6503, 6742, 3297, 3303, 3299, 3302}

$$-\frac{b^2 \sin(a) \text{CosIntegral}(bx)}{2a^2} + \frac{b^2 \text{Si}(a+bx)}{2a^2} - \frac{b^2 \cos(a) \text{Si}(bx)}{2a^2} + \frac{b^2 \cos(a) \text{CosIntegral}(bx)}{2a} - \frac{b^2 \sin(a) \text{Si}(bx)}{2a} - \frac{\text{Si}(a+bx)}{2x^2}$$

Antiderivative was successfully verified.

```
[In] Int[SinIntegral[a + b*x]/x^3, x]
```

```
[Out] (b^2*Cos[a]*CosIntegral[b*x])/(2*a) - (b^2*CosIntegral[b*x]*Sin[a])/(2*a^2)
- (b*Sin[a + b*x])/(2*a*x) - (b^2*Cos[a]*SinIntegral[b*x])/(2*a^2) - (b^2*
Sin[a]*SinIntegral[b*x])/(2*a) + (b^2*SinIntegral[a + b*x])/(2*a^2) - SinIn
tegral[a + b*x]/(2*x^2)
```

#### Rule 6503

```
Int[((c_.) + (d_.)*(x_))^(m_.)*SinIntegral[(a_.) + (b_.)*(x_)], x_Symbol] :
> Simp[((c + d*x)^(m + 1)*SinIntegral[a + b*x])/(d*(m + 1)), x] - Dist[b/(d
*(m + 1)), Int[((c + d*x)^(m + 1)*Sin[a + b*x])/(a + b*x), x], x] /; FreeQ[
{a, b, c, d, m}, x] && NeQ[m, -1]
```

#### Rule 6742

```
Int[u_, x_Symbol] := With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

#### Rule 3297

```
Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)], x_Symbol] := Simp[((c + d*x)^(m + 1)*Sin[e + f*x]/(d*(m + 1)), x] - Dist[f/(d*(m + 1)), Int[(c + d*x)^(m + 1)*Cos[e + f*x], x], x] /; FreeQ[{c, d, e, f}, x] && LtQ[m, -1]
```

### Rule 3303

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Dist[Cos[(d*e - c*f)/d], Int[Sin[(c*f)/d + f*x]/(c + d*x), x], x] + Dist[Sin[(d*e - c*f)/d], Int[Cos[(c*f)/d + f*x]/(c + d*x), x], x] /; FreeQ[{c, d, e, f}, x] && NeQ[d*e - c*f, 0]
```

### Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[SinIntegral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

### Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[CosIntegral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) - c*f, 0]
```

### Rubi steps

$$\begin{aligned}
\int \frac{\text{Si}(a + bx)}{x^3} dx &= -\frac{\text{Si}(a + bx)}{2x^2} + \frac{1}{2}b \int \frac{\sin(a + bx)}{x^2(a + bx)} dx \\
&= -\frac{\text{Si}(a + bx)}{2x^2} + \frac{1}{2}b \int \left( \frac{\sin(a + bx)}{ax^2} - \frac{b \sin(a + bx)}{a^2x} + \frac{b^2 \sin(a + bx)}{a^2(a + bx)} \right) dx \\
&= -\frac{\text{Si}(a + bx)}{2x^2} + \frac{b \int \frac{\sin(a + bx)}{x^2} dx}{2a} - \frac{b^2 \int \frac{\sin(a + bx)}{x} dx}{2a^2} + \frac{b^3 \int \frac{\sin(a + bx)}{a + bx} dx}{2a^2} \\
&= -\frac{b \sin(a + bx)}{2ax} + \frac{b^2 \text{Si}(a + bx)}{2a^2} - \frac{\text{Si}(a + bx)}{2x^2} + \frac{b^2 \int \frac{\cos(a + bx)}{x} dx}{2a} - \frac{(b^2 \cos(a)) \int \frac{\sin(bx)}{x} dx}{2a^2} - \frac{(b^2 \sin(a)) \int \frac{\cos(bx)}{x} dx}{2a^2} \\
&= -\frac{b^2 \text{Ci}(bx) \sin(a)}{2a^2} - \frac{b \sin(a + bx)}{2ax} - \frac{b^2 \cos(a) \text{Si}(bx)}{2a^2} + \frac{b^2 \text{Si}(a + bx)}{2a^2} - \frac{\text{Si}(a + bx)}{2x^2} + \frac{(b^2 \cos(a)) \int \frac{\cos(bx)}{x} dx}{2a} \\
&= \frac{b^2 \cos(a) \text{Ci}(bx)}{2a} - \frac{b^2 \text{Ci}(bx) \sin(a)}{2a^2} - \frac{b \sin(a + bx)}{2ax} - \frac{b^2 \cos(a) \text{Si}(bx)}{2a^2} - \frac{b^2 \sin(a) \text{Si}(bx)}{2a} + \frac{b^2 \text{Si}(a + bx)}{2a^2}
\end{aligned}$$

**Mathematica [A]** time = 0.331378, size = 84, normalized size = 0.76

$$\frac{a^2 \text{Si}(a + bx) - b^2 x^2 (a \cos(a) - \sin(a)) \text{CosIntegral}(bx) - b^2 x^2 \text{Si}(a + bx) + b^2 x^2 (a \sin(a) + \cos(a)) \text{Si}(bx) + abx \sin(a) + b^2 \text{Si}(a + bx)}{2a^2 x^2}$$

Antiderivative was successfully verified.

[In] Integrate[SinIntegral[a + b\*x]/x^3,x]

[Out]  $-\left(-\left(b^2 x^2 \operatorname{CosIntegral}[b x]\right) \left(a \operatorname{Cos}[a] - \operatorname{Sin}[a]\right)\right) + a b x \operatorname{Sin}[a + b x] + b^2 x^2 \left(\operatorname{Cos}[a] + a \operatorname{Sin}[a]\right) \operatorname{SinIntegral}[b x] + a^2 \operatorname{SinIntegral}[a + b x] - b^2 x^2 \operatorname{SinIntegral}[a + b x]\right) / \left(2 a^2 x^2\right)$

**Maple [A]** time = 0.06, size = 86, normalized size = 0.8

$$b^2 \left( -\frac{\operatorname{Si}(bx+a)}{2b^2x^2} + \frac{\operatorname{Si}(bx+a)}{2a^2} + \frac{1}{2a} \left( -\frac{\sin(bx+a)}{bx} - \operatorname{Si}(bx) \sin(a) + \operatorname{Ci}(bx) \cos(a) \right) - \frac{\operatorname{Si}(bx) \cos(a) + \operatorname{Ci}(bx) \sin(a)}{2a^2} \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Si(b\*x+a)/x^3,x)

[Out]  $b^2 \left( -1/2 \operatorname{Si}(b*x+a) / b^2 / x^2 + 1/2 / a^2 \operatorname{Si}(b*x+a) + 1/2 / a \left( -\sin(b*x+a) / b / x - \operatorname{Si}(b*x) \sin(a) + \operatorname{Ci}(b*x) \cos(a) \right) - 1/2 / a^2 \left( \operatorname{Si}(b*x) \cos(a) + \operatorname{Ci}(b*x) \sin(a) \right) \right)$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\operatorname{Si}(bx+a)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a)/x^3,x, algorithm="maxima")

[Out] integrate(Si(b\*x + a)/x^3, x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}\left(\frac{\operatorname{Si}(bx+a)}{x^3}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(b*x+a)/x^3,x, algorithm="fricas")
```

```
[Out] integral(sin_integral(b*x + a)/x^3, x)
```

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(a + bx)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(b*x+a)/x**3,x)
```

```
[Out] Integral(Si(a + b*x)/x**3, x)
```

**Giac [C]** time = 1.33659, size = 1092, normalized size = 9.84

result too large to display

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(b*x+a)/x^3,x, algorithm="giac")
```

```
[Out] -1/4*(a*b*x*real_part(cos_integral(b*x))*tan(1/2*b*x)^2*tan(1/2*a)^2 + a*b*x*real_part(cos_integral(-b*x))*tan(1/2*b*x)^2*tan(1/2*a)^2 + 2*a*b*x*imag_part(cos_integral(b*x))*tan(1/2*b*x)^2*tan(1/2*a) - 2*a*b*x*imag_part(cos_integral(-b*x))*tan(1/2*b*x)^2*tan(1/2*a) + 4*a*b*x*sin_integral(b*x)*tan(1/2*b*x)^2*tan(1/2*a) - b*x*imag_part(cos_integral(b*x + a))*tan(1/2*b*x)^2*tan(1/2*a)^2 - b*x*imag_part(cos_integral(b*x))*tan(1/2*b*x)^2*tan(1/2*a)^2 + b*x*imag_part(cos_integral(-b*x - a))*tan(1/2*b*x)^2*tan(1/2*a)^2 + b*x*imag_part(cos_integral(-b*x))*tan(1/2*b*x)^2*tan(1/2*a)^2 - 2*b*x*sin_integral(b*x + a)*tan(1/2*b*x)^2*tan(1/2*a)^2 - 2*b*x*sin_integral(b*x)*tan(1/2*b*x)^2*tan(1/2*a)^2 - a*b*x*real_part(cos_integral(b*x))*tan(1/2*b*x)^2 - a*b*x*real_part(cos_integral(-b*x))*tan(1/2*b*x)^2 + 2*b*x*real_part(cos_integral(b*x))*tan(1/2*b*x)^2*tan(1/2*a) + 2*b*x*real_part(cos_integral(-b*x))*tan(1/2*b*x)^2*tan(1/2*a) + a*b*x*real_part(cos_integral(b*x))*tan(1/2*a)^2 + a*b*x*real_part(cos_integral(-b*x))*tan(1/2*a)^2 - b*x*imag_part(cos_integral(b*x + a))*tan(1/2*b*x)^2 + b*x*imag_part(cos_integral(b*x))*tan(1/2*b*x)^2 + b*x*imag_part(cos_integral(-b*x - a))*tan(1/2*b*x)^2 - b*x*imag_part
```

$$\begin{aligned}
& t(\cos\_integral(-b*x))*\tan(1/2*b*x)^2 - 2*b*x*\sin\_integral(b*x + a)*\tan(1/2* \\
& b*x)^2 + 2*b*x*\sin\_integral(b*x)*\tan(1/2*b*x)^2 + 2*a*b*x*\text{imag\_part}(\cos\_int \\
& egral(b*x))*\tan(1/2*a) - 2*a*b*x*\text{imag\_part}(\cos\_integral(-b*x))*\tan(1/2*a) + \\
& 4*a*b*x*\sin\_integral(b*x)*\tan(1/2*a) - b*x*\text{imag\_part}(\cos\_integral(b*x + a) \\
& )*\tan(1/2*a)^2 - b*x*\text{imag\_part}(\cos\_integral(b*x))*\tan(1/2*a)^2 + b*x*\text{imag\_p} \\
& art(\cos\_integral(-b*x - a))*\tan(1/2*a)^2 + b*x*\text{imag\_part}(\cos\_integral(-b*x) \\
& )*\tan(1/2*a)^2 - 2*b*x*\sin\_integral(b*x + a)*\tan(1/2*a)^2 - 2*b*x*\sin\_integ \\
& ral(b*x)*\tan(1/2*a)^2 - a*b*x*\text{real\_part}(\cos\_integral(b*x)) - a*b*x*\text{real\_par} \\
& t(\cos\_integral(-b*x)) + 2*b*x*\text{real\_part}(\cos\_integral(b*x))*\tan(1/2*a) + 2*b \\
& *x*\text{real\_part}(\cos\_integral(-b*x))*\tan(1/2*a) - 4*a*\tan(1/2*b*x)^2*\tan(1/2*a) \\
& - 4*a*\tan(1/2*b*x)*\tan(1/2*a)^2 - b*x*\text{imag\_part}(\cos\_integral(b*x + a)) + b \\
& *x*\text{imag\_part}(\cos\_integral(b*x)) + b*x*\text{imag\_part}(\cos\_integral(-b*x - a)) - b \\
& *x*\text{imag\_part}(\cos\_integral(-b*x)) - 2*b*x*\sin\_integral(b*x + a) + 2*b*x*\sin\_ \\
& integral(b*x) + 4*a*\tan(1/2*b*x) + 4*a*\tan(1/2*a))*b/(a^2*x*\tan(1/2*b*x)^2* \\
& \tan(1/2*a)^2 + a^2*x*\tan(1/2*b*x)^2 + a^2*x*\tan(1/2*a)^2 + a^2*x) - 1/2*\sin \\
& \_integral(b*x + a)/x^2
\end{aligned}$$

### 3.25 $\int x^m \mathbf{Si}(a + bx)^2 dx$

Optimal. Leaf size=14

CannotIntegrate( $x^m \mathbf{Si}(a + bx)^2, x$ )

[Out] CannotIntegrate[x<sup>m</sup>\*SinIntegral[a + b\*x]<sup>2</sup>, x]

**Rubi [A]** time = 0.0437283, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int x^m \mathbf{Si}(a + bx)^2 dx$$

Verification is Not applicable to the result.

[In] Int[x<sup>m</sup>\*SinIntegral[a + b\*x]<sup>2</sup>,x]

[Out] Defer[Int][x<sup>m</sup>\*SinIntegral[a + b\*x]<sup>2</sup>, x]

Rubi steps

$$\int x^m \mathbf{Si}(a + bx)^2 dx = \int x^m \mathbf{Si}(a + bx)^2 dx$$

**Mathematica [A]** time = 5.25018, size = 0, normalized size = 0.

$$\int x^m \mathbf{Si}(a + bx)^2 dx$$

Verification is Not applicable to the result.

[In] Integrate[x<sup>m</sup>\*SinIntegral[a + b\*x]<sup>2</sup>,x]

[Out] Integrate[x<sup>m</sup>\*SinIntegral[a + b\*x]<sup>2</sup>, x]



**Maple [A]** time = 0.148, size = 0, normalized size = 0.

$$\int x^m (\text{Si}(bx + a))^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(x^m*Si(b*x+a)^2,x)`

[Out] `int(x^m*Si(b*x+a)^2,x)`

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int x^m \text{Si}(bx + a)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^m*Si(b*x+a)^2,x, algorithm="maxima")`

[Out] `integrate(x^m*Si(b*x + a)^2, x)`

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^m \text{Si}(bx + a)^2, x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^m*Si(b*x+a)^2,x, algorithm="fricas")`

[Out] `integral(x^m*sin_integral(b*x + a)^2, x)`

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int x^m \text{Si}^2(a + bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x**m*Si(b*x+a)**2,x)
```

```
[Out] Integral(x**m*Si(a + b*x)**2, x)
```

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int x^m \text{Si}(bx + a)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x^m*Si(b*x+a)^2,x, algorithm="giac")
```

```
[Out] integrate(x^m*Si(b*x + a)^2, x)
```

### 3.26 $\int x^2 \text{Si}(a + bx)^2 dx$

**Optimal.** Leaf size=329

$$\frac{a^2(a + bx)\text{Si}(a + bx)^2}{3b^3} - \frac{a^2\text{Si}(2a + 2bx)}{b^3} + \frac{2a^2\text{Si}(a + bx)\cos(a + bx)}{3b^3} + \frac{a\text{CosIntegral}(2a + 2bx)}{b^3} - \frac{ax(a + bx)\text{Si}(a + bx)}{3b^2}$$

```
[Out] (2*x)/(3*b^2) - (a*cos[2*a + 2*b*x])/(3*b^3) + (x*cos[2*a + 2*b*x])/(6*b^2)
+ (a*cosIntegral[2*a + 2*b*x])/b^3 - (a*log[a + b*x])/b^3 - (2*cos[a + b*x]
)*sin[a + b*x]/(3*b^3) - sin[2*a + 2*b*x]/(12*b^3) - (4*cos[a + b*x]*sinIn
tegral[a + b*x])/(3*b^3) + (2*a^2*cos[a + b*x]*sinIntegral[a + b*x])/(3*b^3
) - (2*a*x*cos[a + b*x]*sinIntegral[a + b*x])/(3*b^2) + (2*x^2*cos[a + b*x]
)*sinIntegral[a + b*x]/(3*b) + (2*a*sin[a + b*x]*sinIntegral[a + b*x])/(3*b
^3) - (4*x*sin[a + b*x]*sinIntegral[a + b*x])/(3*b^2) + (a^2*(a + b*x)*sinI
ntegral[a + b*x]^2)/(3*b^3) - (a*x*(a + b*x)*sinIntegral[a + b*x]^2)/(3*b^2
) + (x^2*(a + b*x)*sinIntegral[a + b*x]^2)/(3*b) + (2*sinIntegral[2*a + 2*b
*x])/(3*b^3) - (a^2*sinIntegral[2*a + 2*b*x])/b^3
```

---

**Rubi [A]** time = 1.49501, antiderivative size = 329, normalized size of antiderivative = 1., number of steps used = 39, number of rules used = 19, integrand size = 12,  $\frac{\text{number of rules}}{\text{integrand size}} = 1.583$ , Rules used = {6509, 6513, 4573, 6741, 6742, 2638, 3296, 2637, 3299, 6519, 2635, 8, 3312, 3302, 6511, 4406, 12, 6517, 6505}

$$\frac{a^2(a + bx)\text{Si}(a + bx)^2}{3b^3} - \frac{a^2\text{Si}(2a + 2bx)}{b^3} + \frac{2a^2\text{Si}(a + bx)\cos(a + bx)}{3b^3} + \frac{a\text{CosIntegral}(2a + 2bx)}{b^3} - \frac{ax(a + bx)\text{Si}(a + bx)}{3b^2}$$

Antiderivative was successfully verified.

```
[In] Int[x^2*sinIntegral[a + b*x]^2,x]
```

```
[Out] (2*x)/(3*b^2) - (a*cos[2*a + 2*b*x])/(3*b^3) + (x*cos[2*a + 2*b*x])/(6*b^2)
+ (a*cosIntegral[2*a + 2*b*x])/b^3 - (a*log[a + b*x])/b^3 - (2*cos[a + b*x]
)*sin[a + b*x]/(3*b^3) - sin[2*a + 2*b*x]/(12*b^3) - (4*cos[a + b*x]*sinIn
tegral[a + b*x])/(3*b^3) + (2*a^2*cos[a + b*x]*sinIntegral[a + b*x])/(3*b^3
) - (2*a*x*cos[a + b*x]*sinIntegral[a + b*x])/(3*b^2) + (2*x^2*cos[a + b*x]
)*sinIntegral[a + b*x]/(3*b) + (2*a*sin[a + b*x]*sinIntegral[a + b*x])/(3*b
^3) - (4*x*sin[a + b*x]*sinIntegral[a + b*x])/(3*b^2) + (a^2*(a + b*x)*sinI
ntegral[a + b*x]^2)/(3*b^3) - (a*x*(a + b*x)*sinIntegral[a + b*x]^2)/(3*b^2
) + (x^2*(a + b*x)*sinIntegral[a + b*x]^2)/(3*b) + (2*sinIntegral[2*a + 2*b
*x])/(3*b^3) - (a^2*sinIntegral[2*a + 2*b*x])/b^3
```

Rule 6509

```
Int[((c_.) + (d_.)*(x_))^(m_.)*SinIntegral[(a_) + (b_.)*(x_)]^2, x_Symbol]
:> Simp[((a + b*x)*(c + d*x)^m*SINIntegral[a + b*x]^2)/(b*(m + 1)), x] + (-
Dist[2/(m + 1), Int[(c + d*x)^m*SIN[a + b*x]*SINIntegral[a + b*x], x], x] +
Dist[((b*c - a*d)*m)/(b*(m + 1)), Int[(c + d*x)^(m - 1)*SINIntegral[a + b*
x]^2, x], x]) /; FreeQ[{a, b, c, d}, x] && IGtQ[m, 0]
```

### Rule 6513

```
Int[((e_.) + (f_.)*(x_))^(m_.)*Sin[(a_.) + (b_.)*(x_)]*SinIntegral[(c_.) +
(d_.)*(x_)], x_Symbol] :> -Simp[((e + f*x)^m*Cos[a + b*x]*SINIntegral[c + d
*x])/b, x] + (Dist[d/b, Int[(e + f*x)^m*Cos[a + b*x]*Sin[c + d*x]/(c + d*
x), x], x] + Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*Cos[a + b*x]*SINIntegral[c
+ d*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]
```

### Rule 4573

```
Int[Cos[w_]^(p_.)*(u_.)*Sin[v_]^(p_.), x_Symbol] :> Dist[1/2^p, Int[u*SIN[2
*v]^p, x], x] /; EqQ[w, v] && IntegerQ[p]
```

### Rule 6741

```
Int[u_, x_Symbol] :> With[{v = NormalizeIntegrand[u, x]}, Int[v, x] /; v !=
= u]
```

### Rule 6742

```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### Rule 2638

```
Int[sin[(c_.) + (d_.)*(x_)], x_Symbol] :> -Simp[Cos[c + d*x]/d, x] /; FreeQ
[{c, d}, x]
```

### Rule 3296

```
Int[((c_.) + (d_.)*(x_))^(m_.)*sin[(e_.) + (f_.)*(x_)], x_Symbol] :> -Simp[
((c + d*x)^m*Cos[e + f*x])/f, x] + Dist[(d*m)/f, Int[(c + d*x)^(m - 1)*Cos[
e + f*x], x], x] /; FreeQ[{c, d, e, f}, x] && GtQ[m, 0]
```

### Rule 2637

```
Int[sin[Pi/2 + (c_.) + (d_.)*(x_)], x_Symbol] :> Simp[SIN[c + d*x]/d, x] /;
FreeQ[{c, d}, x]
```

Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[SinIntegral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

Rule 6519

```
Int[Cos[(a_.) + (b_.)*(x_)]*((e_.) + (f_.)*(x_))^(m_.)*SinIntegral[(c_.) + (d_.)*(x_)], x_Symbol] := Simp[((e + f*x)^m*Sin[a + b*x]*SinIntegral[c + d*x])/b, x] + (-Dist[d/b, Int[((e + f*x)^m*Sin[a + b*x]*Sin[c + d*x])/(c + d*x), x], x] - Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*Sin[a + b*x]*SinIntegral[c + d*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]
```

Rule 2635

```
Int[((b_.)*sin[(c_.) + (d_.)*(x_)])^(n_), x_Symbol] := -Simp[(b*Cos[c + d*x])*(b*Sin[c + d*x])^(n - 1)/(d*n), x] + Dist[(b^2*(n - 1))/n, Int[(b*Sin[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1] && IntegerQ[2*n]
```

Rule 8

```
Int[a_, x_Symbol] := Simp[a*x, x] /; FreeQ[a, x]
```

Rule 3312

```
Int[((c_.) + (d_.)*(x_))^(m_.)*sin[(e_.) + (f_.)*(x_)]^(n_), x_Symbol] := Int[ExpandTrigReduce[(c + d*x)^m, Sin[e + f*x]^n, x], x] /; FreeQ[{c, d, e, f, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))
```

Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[CosIntegral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) - c*f, 0]
```

Rule 6511

```
Int[Sin[(a_.) + (b_.)*(x_)]*SinIntegral[(c_.) + (d_.)*(x_)], x_Symbol] := -Simp[(Cos[a + b*x]*SinIntegral[c + d*x])/b, x] + Dist[d/b, Int[(Cos[a + b*x]*Sin[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

Rule 4406

```
Int[Cos[(a_.) + (b_.)*(x_)]^(p_.)*((c_.) + (d_.)*(x_))^(m_.)*Sin[(a_.) + (b_.)*(x_)]^(n_.), x_Symbol] := Int[ExpandTrigReduce[(c + d*x)^m, Sin[a + b*x]^n*Cos[a + b*x]^p, x], x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IGtQ[p, 0]
```

### Rule 12

```
Int[(a_)*(u_), x_Symbol] := Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b_)*(v_)] /; FreeQ[b, x]
```

### Rule 6517

```
Int[Cos[(a_.) + (b_.)*(x_)]*SinIntegral[(c_.) + (d_.)*(x_)], x_Symbol] := Simp[(Sin[a + b*x]*SinIntegral[c + d*x])/b, x] - Dist[d/b, Int[(Sin[a + b*x]*Sin[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

### Rule 6505

```
Int[SinIntegral[(a_.) + (b_.)*(x_)]^2, x_Symbol] := Simp[((a + b*x)*SinIntegral[a + b*x]^2)/b, x] - Dist[2, Int[Sin[a + b*x]*SinIntegral[a + b*x], x], x] /; FreeQ[{a, b}, x]
```

### Rubi steps

$$\begin{aligned}
\int x^2 \text{Si}(a+bx)^2 dx &= \frac{x^2(a+bx)\text{Si}(a+bx)^2}{3b} - \frac{2}{3} \int x^2 \sin(a+bx)\text{Si}(a+bx) dx - \frac{(2a) \int x \text{Si}(a+bx)^2 dx}{3b} \\
&= \frac{2x^2 \cos(a+bx)\text{Si}(a+bx)}{3b} - \frac{ax(a+bx)\text{Si}(a+bx)^2}{3b^2} + \frac{x^2(a+bx)\text{Si}(a+bx)^2}{3b} - \frac{2}{3} \int \frac{x^2 \cos(a+bx)}{a+bx} dx \\
&= -\frac{2ax \cos(a+bx)\text{Si}(a+bx)}{3b^2} + \frac{2x^2 \cos(a+bx)\text{Si}(a+bx)}{3b} - \frac{4x \sin(a+bx)\text{Si}(a+bx)}{3b^2} + \frac{a^2(a+bx)\text{Si}(a+bx)}{3b^3} \\
&= -\frac{4 \cos(a+bx)\text{Si}(a+bx)}{3b^3} + \frac{2a^2 \cos(a+bx)\text{Si}(a+bx)}{3b^3} - \frac{2ax \cos(a+bx)\text{Si}(a+bx)}{3b^2} + \frac{2x^2 \cos(a+bx)}{3b^3} \\
&= -\frac{4 \cos(a+bx)\text{Si}(a+bx)}{3b^3} + \frac{2a^2 \cos(a+bx)\text{Si}(a+bx)}{3b^3} - \frac{2ax \cos(a+bx)\text{Si}(a+bx)}{3b^2} + \frac{2x^2 \cos(a+bx)}{3b^3} \\
&= -\frac{a \log(a+bx)}{3b^3} - \frac{2 \cos(a+bx) \sin(a+bx)}{3b^3} - \frac{4 \cos(a+bx)\text{Si}(a+bx)}{3b^3} + \frac{2a^2 \cos(a+bx)\text{Si}(a+bx)}{3b^3} \\
&= \frac{2x}{3b^2} - \frac{a \cos(2a+2bx)}{6b^3} + \frac{x \cos(2a+2bx)}{6b^2} + \frac{a \text{Ci}(2a+2bx)}{3b^3} - \frac{a \log(a+bx)}{b^3} - \frac{2 \cos(a+bx) \sin(a+bx)}{3b^3} \\
&= \frac{2x}{3b^2} - \frac{a \cos(2a+2bx)}{3b^3} + \frac{x \cos(2a+2bx)}{6b^2} + \frac{a \text{Ci}(2a+2bx)}{b^3} - \frac{a \log(a+bx)}{b^3} - \frac{2 \cos(a+bx) \sin(a+bx)}{3b^3}
\end{aligned}$$

**Mathematica [A]** time = 1.71065, size = 158, normalized size = 0.48

$$4(a^3 + b^3 x^3) \text{Si}(a+bx)^2 + 8\text{Si}(a+bx) \left( (a^2 - abx + b^2 x^2 - 2) \cos(a+bx) + (a - 2bx) \sin(a+bx) \right) - 12a^2 \text{Si}(2(a+bx))$$

Antiderivative was successfully verified.

[In] Integrate[x^2\*SinIntegral[a + b\*x]^2,x]

[Out] (8\*a + 8\*b\*x - 4\*a\*Cos[2\*(a + b\*x)] + 2\*b\*x\*Cos[2\*(a + b\*x)] + 12\*a\*CosIntegral[2\*(a + b\*x)] - 12\*a\*Log[a + b\*x] - 5\*Sin[2\*(a + b\*x)] + 8\*((-2 + a^2 - a\*b\*x + b^2\*x^2)\*Cos[a + b\*x] + (a - 2\*b\*x)\*Sin[a + b\*x])\*SinIntegral[a + b\*x] + 4\*(a^3 + b^3\*x^3)\*SinIntegral[a + b\*x]^2 + 8\*SinIntegral[2\*(a + b\*x)] - 12\*a^2\*SinIntegral[2\*(a + b\*x)])/(12\*b^3)

**Maple [F]** time = 0.056, size = 0, normalized size = 0.

$$\int x^2 (\text{Si}(bx+a))^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(x^2*Si(b*x+a)^2,x)`

[Out] `int(x^2*Si(b*x+a)^2,x)`

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \operatorname{Si}(bx + a)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Si(b*x+a)^2,x, algorithm="maxima")`

[Out] `integrate(x^2*Si(b*x + a)^2, x)`

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(x^2 \operatorname{Si}(bx + a)^2, x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Si(b*x+a)^2,x, algorithm="fricas")`

[Out] `integral(x^2*sin_integral(b*x + a)^2, x)`

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \operatorname{Si}^2(a + bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x**2*Si(b*x+a)**2,x)`

[Out] `Integral(x**2*Si(a + b*x)**2, x)`



---

**Giac [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \text{Si}(bx + a)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^2\*Si(b\*x+a)^2,x, algorithm="giac")

[Out] integrate(x^2\*Si(b\*x + a)^2, x)

### 3.27 $\int x \text{Si}(a + bx)^2 dx$

**Optimal.** Leaf size=154

$$-\frac{\text{CosIntegral}(2a + 2bx)}{2b^2} - \frac{a(a + bx)\text{Si}(a + bx)^2}{2b^2} + \frac{a\text{Si}(2a + 2bx)}{b^2} - \frac{\text{Si}(a + bx)\sin(a + bx)}{b^2} - \frac{a\text{Si}(a + bx)\cos(a + bx)}{b^2} +$$

```
[Out] Cos[2*a + 2*b*x]/(4*b^2) - CosIntegral[2*a + 2*b*x]/(2*b^2) + Log[a + b*x]/
(2*b^2) - (a*Cos[a + b*x]*SinIntegral[a + b*x])/b^2 + (x*Cos[a + b*x]*SinIn
tegral[a + b*x])/b - (Sin[a + b*x]*SinIntegral[a + b*x])/b^2 - (a*(a + b*x)
*SinIntegral[a + b*x]^2)/(2*b^2) + (x*(a + b*x)*SinIntegral[a + b*x]^2)/(2*
b) + (a*SinIntegral[2*a + 2*b*x])/b^2
```

---

**Rubi [A]** time = 0.333002, antiderivative size = 154, normalized size of antiderivative = 1., number of steps used = 17, number of rules used = 14, integrand size = 10,  $\frac{\text{number of rules}}{\text{integrand size}} = 1.4$ , Rules used = {6509, 6513, 4573, 6741, 6742, 2638, 3299, 6517, 3312, 3302, 6505, 6511, 4406, 12}

$$-\frac{\text{CosIntegral}(2a + 2bx)}{2b^2} - \frac{a(a + bx)\text{Si}(a + bx)^2}{2b^2} + \frac{a\text{Si}(2a + 2bx)}{b^2} - \frac{\text{Si}(a + bx)\sin(a + bx)}{b^2} - \frac{a\text{Si}(a + bx)\cos(a + bx)}{b^2} +$$

Antiderivative was successfully verified.

```
[In] Int[x*SinIntegral[a + b*x]^2,x]
```

```
[Out] Cos[2*a + 2*b*x]/(4*b^2) - CosIntegral[2*a + 2*b*x]/(2*b^2) + Log[a + b*x]/
(2*b^2) - (a*Cos[a + b*x]*SinIntegral[a + b*x])/b^2 + (x*Cos[a + b*x]*SinIn
tegral[a + b*x])/b - (Sin[a + b*x]*SinIntegral[a + b*x])/b^2 - (a*(a + b*x)
*SinIntegral[a + b*x]^2)/(2*b^2) + (x*(a + b*x)*SinIntegral[a + b*x]^2)/(2*
b) + (a*SinIntegral[2*a + 2*b*x])/b^2
```

#### Rule 6509

```
Int[((c_.) + (d_.)*(x_))^(m_.)*SinIntegral[(a_) + (b_.)*(x_)]^2, x_Symbol]
:> Simp[((a + b*x)*(c + d*x)^m*SinIntegral[a + b*x]^2)/(b*(m + 1)), x] + (-
Dist[2/(m + 1), Int[(c + d*x)^m*Sin[a + b*x]*SinIntegral[a + b*x], x], x] +
Dist[((b*c - a*d)*m)/(b*(m + 1)), Int[(c + d*x)^(m - 1)*SinIntegral[a + b*
x]^2, x], x]) /; FreeQ[{a, b, c, d}, x] && IGtQ[m, 0]
```

#### Rule 6513

```
Int[((e_.) + (f_.)*(x_))^(m_.)*Sin[(a_.) + (b_.)*(x_)]*SinIntegral[(c_.) +
(d_.)*(x_)], x_Symbol] :> -Simp[((e + f*x)^m*Cos[a + b*x]*SinIntegral[c + d
```

```
*x])/b, x] + (Dist[d/b, Int[((e + f*x)^m*Cos[a + b*x]*Sin[c + d*x])/(c + d*x), x], x] + Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*Cos[a + b*x]*SinIntegral[c + d*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]
```

Rule 4573

```
Int[Cos[w_]^(p_.)*(u_.)*Sin[v_]^(p_.), x_Symbol] :=> Dist[1/2^p, Int[u*Sin[2*v]^p, x], x] /; EqQ[w, v] && IntegerQ[p]
```

Rule 6741

```
Int[u_, x_Symbol] :=> With[{v = NormalizeIntegrand[u, x]}, Int[v, x] /; v != u]
```

Rule 6742

```
Int[u_, x_Symbol] :=> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
```

Rule 2638

```
Int[sin[(c_.) + (d_.)*(x_)], x_Symbol] :=> -Simp[Cos[c + d*x]/d, x] /; FreeQ[{c, d}, x]
```

Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] :=> Simp[SinIntegral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

Rule 6517

```
Int[Cos[(a_.) + (b_.)*(x_)]*SinIntegral[(c_.) + (d_.)*(x_)], x_Symbol] :=> Simp[(Sin[a + b*x]*SinIntegral[c + d*x])/b, x] - Dist[d/b, Int[(Sin[a + b*x]*Sin[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

Rule 3312

```
Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)]^(n_), x_Symbol] :=> Int[ExpandTrigReduce[(c + d*x)^m, Sin[e + f*x]^n, x], x] /; FreeQ[{c, d, e, f, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))
```

Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] :=> Simp[CosIntegral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) -
```

`c*f, 0]`

### Rule 6505

```
Int[SinIntegral[(a_.) + (b_.)*(x_)]^2, x_Symbol] := Simp[((a + b*x)*SinIntegral[a + b*x]^2)/b, x] - Dist[2, Int[Sin[a + b*x]*SinIntegral[a + b*x], x] /; FreeQ[{a, b}, x]
```

### Rule 6511

```
Int[Sin[(a_.) + (b_.)*(x_)]*SinIntegral[(c_.) + (d_.)*(x_)], x_Symbol] := -Simp[(Cos[a + b*x]*SinIntegral[c + d*x])/b, x] + Dist[d/b, Int[(Cos[a + b*x]*Sin[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

### Rule 4406

```
Int[Cos[(a_.) + (b_.)*(x_)]^(p_.)*((c_.) + (d_.)*(x_))^(m_.)*Sin[(a_.) + (b_.)*(x_)]^(n_.), x_Symbol] := Int[ExpandTrigReduce[(c + d*x)^m, Sin[a + b*x]^n*Cos[a + b*x]^p, x], x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IGtQ[p, 0]
```

### Rule 12

```
Int[(a_)*(u_), x_Symbol] := Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b_)*(v_)] /; FreeQ[b, x]
```

### Rubi steps

$$\begin{aligned}
\int x \operatorname{Si}(a+bx)^2 dx &= \frac{x(a+bx)\operatorname{Si}(a+bx)^2}{2b} - \frac{a \int \operatorname{Si}(a+bx)^2 dx}{2b} - \int x \sin(a+bx)\operatorname{Si}(a+bx) dx \\
&= \frac{x \cos(a+bx)\operatorname{Si}(a+bx)}{b} - \frac{a(a+bx)\operatorname{Si}(a+bx)^2}{2b^2} + \frac{x(a+bx)\operatorname{Si}(a+bx)^2}{2b} - \frac{\int \cos(a+bx)\operatorname{Si}(a+bx)}{b} \\
&= -\frac{a \cos(a+bx)\operatorname{Si}(a+bx)}{b^2} + \frac{x \cos(a+bx)\operatorname{Si}(a+bx)}{b} - \frac{\sin(a+bx)\operatorname{Si}(a+bx)}{b^2} - \frac{a(a+bx)\operatorname{Si}(a+bx)}{2b^2} \\
&= -\frac{a \cos(a+bx)\operatorname{Si}(a+bx)}{b^2} + \frac{x \cos(a+bx)\operatorname{Si}(a+bx)}{b} - \frac{\sin(a+bx)\operatorname{Si}(a+bx)}{b^2} - \frac{a(a+bx)\operatorname{Si}(a+bx)}{2b^2} \\
&= \frac{\log(a+bx)}{2b^2} - \frac{a \cos(a+bx)\operatorname{Si}(a+bx)}{b^2} + \frac{x \cos(a+bx)\operatorname{Si}(a+bx)}{b} - \frac{\sin(a+bx)\operatorname{Si}(a+bx)}{b^2} - \frac{a(a+bx)\operatorname{Si}(a+bx)}{2b^2} \\
&= -\frac{\operatorname{Ci}(2a+2bx)}{2b^2} + \frac{\log(a+bx)}{2b^2} - \frac{a \cos(a+bx)\operatorname{Si}(a+bx)}{b^2} + \frac{x \cos(a+bx)\operatorname{Si}(a+bx)}{b} - \frac{\sin(a+bx)\operatorname{Si}(a+bx)}{b^2} \\
&= \frac{\cos(2a+2bx)}{4b^2} - \frac{\operatorname{Ci}(2a+2bx)}{2b^2} + \frac{\log(a+bx)}{2b^2} - \frac{a \cos(a+bx)\operatorname{Si}(a+bx)}{b^2} + \frac{x \cos(a+bx)\operatorname{Si}(a+bx)}{b}
\end{aligned}$$

**Mathematica [A]** time = 0.280375, size = 95, normalized size = 0.62

$$\frac{-2(a^2 - b^2x^2) \operatorname{Si}(a+bx)^2 - 2\operatorname{CosIntegral}(2(a+bx)) + 4a\operatorname{Si}(2(a+bx)) - 4\operatorname{Si}(a+bx)(\sin(a+bx) + (a-bx)\cos(a+bx))}{4b^2}$$

Antiderivative was successfully verified.

[In] Integrate[x\*SinIntegral[a + b\*x]^2, x]

[Out] (Cos[2\*(a + b\*x)] - 2\*CosIntegral[2\*(a + b\*x)] + 2\*Log[a + b\*x] - 4\*((a - b\*x)\*Cos[a + b\*x] + Sin[a + b\*x])\*SinIntegral[a + b\*x] - 2\*(a^2 - b^2\*x^2)\*SinIntegral[a + b\*x]^2 + 4\*a\*SinIntegral[2\*(a + b\*x)])/(4\*b^2)

**Maple [A]** time = 0.066, size = 135, normalized size = 0.9

$$\frac{x^2 (\operatorname{Si}(bx+a))^2}{2} - \frac{(\operatorname{Si}(bx+a))^2 a^2}{2b^2} + \frac{x \cos(bx+a) \operatorname{Si}(bx+a)}{b} - \frac{a \cos(bx+a) \operatorname{Si}(bx+a)}{b^2} - \frac{\operatorname{Si}(bx+a) \sin(bx+a)}{b^2} + \dots$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x\*Si(b\*x+a)^2, x)

[Out]  $\frac{1}{2}x^2\text{Si}(bx+a)^2 - \frac{1}{2}x\text{Si}(bx+a)^2 + \frac{1}{2}x^2\cos(bx+a)\text{Si}(bx+a) - \frac{1}{2}x\cos(bx+a)\text{Si}(bx+a) - \frac{1}{2}\text{Si}(bx+a)^2 + \frac{1}{2}\ln(bx+a)\text{Si}(bx+a) - \frac{1}{2}\text{Ci}(2bx+2a) + \frac{1}{2}\text{Si}(2bx+2a)$

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x \text{Si}(bx + a)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*Si(b*x+a)^2,x, algorithm="maxima")`

[Out] `integrate(x*Si(b*x + a)^2, x)`

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x \text{Si}(bx + a)^2, x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*Si(b*x+a)^2,x, algorithm="fricas")`

[Out] `integral(x*sin_integral(b*x + a)^2, x)`

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x \text{Si}^2(a + bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*Si(b*x+a)**2,x)`

[Out] `Integral(x*Si(a + b*x)**2, x)`

---

**Giac [F]** time = 0., size = 0, normalized size = 0.

$$\int x \operatorname{Si}(bx + a)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x*Si(b*x+a)^2,x, algorithm="giac")
```

```
[Out] integrate(x*Si(b*x + a)^2, x)
```

### 3.28 $\int \text{Si}(a + bx)^2 dx$

**Optimal.** Leaf size=49

$$\frac{(a + bx)\text{Si}(a + bx)^2}{b} - \frac{\text{Si}(2a + 2bx)}{b} + \frac{2\text{Si}(a + bx)\cos(a + bx)}{b}$$

[Out] (2\*Cos[a + b\*x]\*SinIntegral[a + b\*x])/b + ((a + b\*x)\*SinIntegral[a + b\*x]^2)/b - SinIntegral[2\*a + 2\*b\*x]/b

**Rubi [A]** time = 0.0646836, antiderivative size = 49, normalized size of antiderivative = 1., number of steps used = 5, number of rules used = 5, integrand size = 8,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.625$ , Rules used = {6505, 6511, 4406, 12, 3299}

$$\frac{(a + bx)\text{Si}(a + bx)^2}{b} - \frac{\text{Si}(2a + 2bx)}{b} + \frac{2\text{Si}(a + bx)\cos(a + bx)}{b}$$

Antiderivative was successfully verified.

[In] Int[SinIntegral[a + b\*x]^2,x]

[Out] (2\*Cos[a + b\*x]\*SinIntegral[a + b\*x])/b + ((a + b\*x)\*SinIntegral[a + b\*x]^2)/b - SinIntegral[2\*a + 2\*b\*x]/b

#### Rule 6505

Int[SinIntegral[(a\_.) + (b\_.)\*(x\_)]^2, x\_Symbol] := Simp[((a + b\*x)\*SinIntegral[a + b\*x]^2)/b, x] - Dist[2, Int[Sin[a + b\*x]\*SinIntegral[a + b\*x], x], x] /; FreeQ[{a, b}, x]

#### Rule 6511

Int[Sin[(a\_.) + (b\_.)\*(x\_)]\*SinIntegral[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] := -Simp[(Cos[a + b\*x]\*SinIntegral[c + d\*x])/b, x] + Dist[d/b, Int[(Cos[a + b\*x]\*Sin[c + d\*x])/(c + d\*x), x], x] /; FreeQ[{a, b, c, d}, x]

#### Rule 4406

Int[Cos[(a\_.) + (b\_.)\*(x\_)]^(p\_.)\*((c\_.) + (d\_.)\*(x\_))^(m\_.)\*Sin[(a\_.) + (b\_.)\*(x\_)]^(n\_.), x\_Symbol] := Int[ExpandTrigReduce[(c + d\*x)^m, Sin[a + b\*x]^n\*Cos[a + b\*x]^p, x], x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IGtQ[p, 0]



Rule 12

`Int[(a_)*(u_), x_Symbol] := Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b_)*(v_)] /; FreeQ[b, x]`

Rule 3299

`Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[SinIntegral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]`

Rubi steps

$$\begin{aligned}
 \int \text{Si}(a + bx)^2 dx &= \frac{(a + bx)\text{Si}(a + bx)^2}{b} - 2 \int \sin(a + bx)\text{Si}(a + bx) dx \\
 &= \frac{2 \cos(a + bx)\text{Si}(a + bx)}{b} + \frac{(a + bx)\text{Si}(a + bx)^2}{b} - 2 \int \frac{\cos(a + bx) \sin(a + bx)}{a + bx} dx \\
 &= \frac{2 \cos(a + bx)\text{Si}(a + bx)}{b} + \frac{(a + bx)\text{Si}(a + bx)^2}{b} - 2 \int \frac{\sin(2a + 2bx)}{2(a + bx)} dx \\
 &= \frac{2 \cos(a + bx)\text{Si}(a + bx)}{b} + \frac{(a + bx)\text{Si}(a + bx)^2}{b} - \int \frac{\sin(2a + 2bx)}{a + bx} dx \\
 &= \frac{2 \cos(a + bx)\text{Si}(a + bx)}{b} + \frac{(a + bx)\text{Si}(a + bx)^2}{b} - \frac{\text{Si}(2a + 2bx)}{b}
 \end{aligned}$$

**Mathematica [A]** time = 0.0089927, size = 43, normalized size = 0.88

$$\frac{(a + bx)\text{Si}(a + bx)^2 - \text{Si}(2(a + bx)) + 2\text{Si}(a + bx) \cos(a + bx)}{b}$$

Antiderivative was successfully verified.

[In] Integrate[SinIntegral[a + b\*x]^2, x]

[Out] (2\*Cos[a + b\*x]\*SinIntegral[a + b\*x] + (a + b\*x)\*SinIntegral[a + b\*x]^2 - SinIntegral[2\*(a + b\*x)])/b

**Maple [A]** time = 0.049, size = 45, normalized size = 0.9

$$\frac{(bx + a) (\text{Si}(bx + a))^2 + 2 \cos(bx + a) \text{Si}(bx + a) - \text{Si}(2bx + 2a)}{b}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(Si(b*x+a)^2,x)`

[Out] `1/b*((b*x+a)*Si(b*x+a)^2+2*cos(b*x+a)*Si(b*x+a)-Si(2*b*x+2*a))`

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \operatorname{Si}(bx + a)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(b*x+a)^2,x, algorithm="maxima")`

[Out] `integrate(Si(b*x + a)^2, x)`

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(\operatorname{Si}(bx + a)^2, x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(b*x+a)^2,x, algorithm="fricas")`

[Out] `integral(sin_integral(b*x + a)^2, x)`

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \operatorname{Si}^2(a + bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(b*x+a)**2,x)`

[Out] `Integral(Si(a + b*x)**2, x)`

---

**Giac [F]** time = 0., size = 0, normalized size = 0.

$$\int \operatorname{Si}(bx + a)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a)^2,x, algorithm="giac")

[Out] integrate(Si(b\*x + a)^2, x)

$$3.29 \quad \int \frac{\text{Si}(a+bx)^2}{x} dx$$

**Optimal.** Leaf size=14

$$\text{CannotIntegrate}\left(\frac{\text{Si}(a+bx)^2}{x}, x\right)$$

[Out] CannotIntegrate[SinIntegral[a + b\*x]^2/x, x]

**Rubi [A]** time = 0.0341303, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\text{Si}(a+bx)^2}{x} dx$$

Verification is Not applicable to the result.

[In] Int[SinIntegral[a + b\*x]^2/x, x]

[Out] Defer[Int][SinIntegral[a + b\*x]^2/x, x]

Rubi steps

$$\int \frac{\text{Si}(a+bx)^2}{x} dx = \int \frac{\text{Si}(a+bx)^2}{x} dx$$

**Mathematica [A]** time = 3.30173, size = 0, normalized size = 0.

$$\int \frac{\text{Si}(a+bx)^2}{x} dx$$

Verification is Not applicable to the result.

[In] Integrate[SinIntegral[a + b\*x]^2/x, x]

[Out] Integrate[SinIntegral[a + b\*x]^2/x, x]

---

**Maple [A]** time = 0.051, size = 0, normalized size = 0.

$$\int \frac{(\text{Si}(bx + a))^2}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Si(b\*x+a)^2/x,x)

[Out] int(Si(b\*x+a)^2/x,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx + a)^2}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a)^2/x,x, algorithm="maxima")

[Out] integrate(Si(b\*x + a)^2/x, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Si}(bx + a)^2}{x}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a)^2/x,x, algorithm="fricas")

[Out] integral(sin\_integral(b\*x + a)^2/x, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}^2(a + bx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(b*x+a)**2/x,x)
```

```
[Out] Integral(Si(a + b*x)**2/x, x)
```

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx + a)^2}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(b*x+a)^2/x,x, algorithm="giac")
```

```
[Out] integrate(Si(b*x + a)^2/x, x)
```

$$3.30 \quad \int \frac{\text{Si}(a+bx)^2}{x^2} dx$$

Optimal. Leaf size=14

$$\text{CannotIntegrate}\left(\frac{\text{Si}(a+bx)^2}{x^2}, x\right)$$

[Out] CannotIntegrate[SinIntegral[a + b\*x]^2/x^2, x]

Rubi [A] time = 0.0338769, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\text{Si}(a+bx)^2}{x^2} dx$$

Verification is Not applicable to the result.

[In] Int[SinIntegral[a + b\*x]^2/x^2,x]

[Out] Defer[Int][SinIntegral[a + b\*x]^2/x^2, x]

Rubi steps

$$\int \frac{\text{Si}(a+bx)^2}{x^2} dx = \int \frac{\text{Si}(a+bx)^2}{x^2} dx$$

Mathematica [A] time = 5.05896, size = 0, normalized size = 0.

$$\int \frac{\text{Si}(a+bx)^2}{x^2} dx$$

Verification is Not applicable to the result.

[In] Integrate[SinIntegral[a + b\*x]^2/x^2,x]

[Out] Integrate[SinIntegral[a + b\*x]^2/x^2, x]

---

**Maple [A]** time = 0.056, size = 0, normalized size = 0.

$$\int \frac{(\text{Si}(bx + a))^2}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Si(b\*x+a)^2/x^2,x)

[Out] int(Si(b\*x+a)^2/x^2,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx + a)^2}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a)^2/x^2,x, algorithm="maxima")

[Out] integrate(Si(b\*x + a)^2/x^2, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Si}(bx + a)^2}{x^2}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a)^2/x^2,x, algorithm="fricas")

[Out] integral(sin\_integral(b\*x + a)^2/x^2, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}^2(a + bx)}{x^2} dx$$



Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a)\*\*2/x\*\*2,x)

[Out] Integral(Si(a + b\*x)\*\*2/x\*\*2, x)

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx + a)^2}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a)^2/x^2,x, algorithm="giac")

[Out] integrate(Si(b\*x + a)^2/x^2, x)

$$3.31 \quad \int \frac{\text{Si}(a+bx)^2}{x^3} dx$$

**Optimal.** Leaf size=14

$$\text{CannotIntegrate}\left(\frac{\text{Si}(a+bx)^2}{x^3}, x\right)$$

[Out] CannotIntegrate[SinIntegral[a + b\*x]^2/x^3, x]

**Rubi [A]** time = 0.0344856, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\text{Si}(a+bx)^2}{x^3} dx$$

Verification is Not applicable to the result.

[In] Int[SinIntegral[a + b\*x]^2/x^3,x]

[Out] Defer[Int][SinIntegral[a + b\*x]^2/x^3, x]

Rubi steps

$$\int \frac{\text{Si}(a+bx)^2}{x^3} dx = \int \frac{\text{Si}(a+bx)^2}{x^3} dx$$

**Mathematica [A]** time = 2.75319, size = 0, normalized size = 0.

$$\int \frac{\text{Si}(a+bx)^2}{x^3} dx$$

Verification is Not applicable to the result.

[In] Integrate[SinIntegral[a + b\*x]^2/x^3,x]

[Out] Integrate[SinIntegral[a + b\*x]^2/x^3, x]

---

**Maple [A]** time = 0.059, size = 0, normalized size = 0.

$$\int \frac{(\operatorname{Si}(bx + a))^2}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Si(b\*x+a)^2/x^3,x)

[Out] int(Si(b\*x+a)^2/x^3,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\operatorname{Si}(bx + a)^2}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a)^2/x^3,x, algorithm="maxima")

[Out] integrate(Si(b\*x + a)^2/x^3, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}\left(\frac{\operatorname{Si}(bx + a)^2}{x^3}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a)^2/x^3,x, algorithm="fricas")

[Out] integral(sin\_integral(b\*x + a)^2/x^3, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\operatorname{Si}^2(a + bx)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(b*x+a)**2/x**3,x)
```

```
[Out] Integral(Si(a + b*x)**2/x**3, x)
```

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\operatorname{Si}(bx + a)^2}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(b*x+a)^2/x^3,x, algorithm="giac")
```

```
[Out] integrate(Si(b*x + a)^2/x^3, x)
```

### 3.32 $\int x^2 \text{Si}(d(a + b \log(cx^n))) dx$

**Optimal.** Leaf size=137

$$-\frac{1}{6}ix^3e^{-\frac{3a}{bn}}(cx^n)^{-3/n}\text{ExpIntegralEi}\left(\frac{(3-ibdn)(a+b\log(cx^n))}{bn}\right) + \frac{1}{6}ix^3e^{-\frac{3a}{bn}}(cx^n)^{-3/n}\text{ExpIntegralEi}\left(\frac{(3+ibdn)(a+b\log(cx^n))}{bn}\right)$$

[Out]  $((-I/6)*x^3*\text{ExpIntegralEi}[(3 - I*b*d*n)*(a + b*\text{Log}[c*x^n])]/(b*n))/(\text{E}^{(3*a)/(b*n)}*(c*x^n)^{(3/n)}) + ((I/6)*x^3*\text{ExpIntegralEi}[(3 + I*b*d*n)*(a + b*\text{Log}[c*x^n])]/(b*n))/(\text{E}^{(3*a)/(b*n)}*(c*x^n)^{(3/n)}) + (x^3*\text{SinIntegral}[d*(a + b*\text{Log}[c*x^n])])/3$

**Rubi [A]** time = 0.276316, antiderivative size = 137, normalized size of antiderivative = 1., number of steps used = 7, number of rules used = 5, integrand size = 17,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.294$ , Rules used = {6526, 12, 4497, 2310, 2178}

$$-\frac{1}{6}ix^3e^{-\frac{3a}{bn}}(cx^n)^{-3/n}\text{Ei}\left(\frac{(3-ibdn)(a+b\log(cx^n))}{bn}\right) + \frac{1}{6}ix^3e^{-\frac{3a}{bn}}(cx^n)^{-3/n}\text{Ei}\left(\frac{(ibdn+3)(a+b\log(cx^n))}{bn}\right) + \frac{1}{3}x^3\text{Si}(d(a + b\log(cx^n)))$$

Antiderivative was successfully verified.

[In]  $\text{Int}[x^2*\text{SinIntegral}[d*(a + b*\text{Log}[c*x^n])], x]$

[Out]  $((-I/6)*x^3*\text{ExpIntegralEi}[(3 - I*b*d*n)*(a + b*\text{Log}[c*x^n])]/(b*n))/(\text{E}^{(3*a)/(b*n)}*(c*x^n)^{(3/n)}) + ((I/6)*x^3*\text{ExpIntegralEi}[(3 + I*b*d*n)*(a + b*\text{Log}[c*x^n])]/(b*n))/(\text{E}^{(3*a)/(b*n)}*(c*x^n)^{(3/n)}) + (x^3*\text{SinIntegral}[d*(a + b*\text{Log}[c*x^n])])/3$

#### Rule 6526

$\text{Int}[(e_*)*(x_)^{(m_*)}*\text{SinIntegral}[(a_*) + \text{Log}[(c_*)*(x_)^{(n_*)}]*b_*])*(d_*), x\_Symbol] :> \text{Simp}[(e*x)^{(m+1)}*\text{SinIntegral}[d*(a + b*\text{Log}[c*x^n])]/(e*(m+1)), x] - \text{Dist}[(b*d*n)/(m+1), \text{Int}[(e*x)^m*\text{Sin}[d*(a + b*\text{Log}[c*x^n])]]/(d*(a + b*\text{Log}[c*x^n])), x], x] /; \text{FreeQ}\{a, b, c, d, e, m, n\}, x] \&\& \text{NeQ}[m, -1]$

#### Rule 12

$\text{Int}[(a_*)*(u_), x\_Symbol] :> \text{Dist}[a, \text{Int}[u, x], x] /; \text{FreeQ}[a, x] \&\& !\text{MatchQ}[u, (b_*)*(v_)] /; \text{FreeQ}[b, x]$

#### Rule 4497

```
Int[(((e_.) + Log[(g_.)*(x_)^(m_.)]*(f_.))*(h_.))^(q_.)*((i_.)*(x_)^(r_.)*
Sin[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)], x_Symbol] :> Dist[(I*(i*x
)^(r))/(E^(I*a*d)*(c*x^n)^(I*b*d)*(2*x^(r - I*b*d*n))), Int[x^(r - I*b*d*n)*(
h*(e + f*Log[g*x^m]))^q, x], x] - Dist[(I*E^(I*a*d)*(i*x)^(r*(c*x^n)^(I*b*d
))/(2*x^(r + I*b*d*n)), Int[x^(r + I*b*d*n)*(h*(e + f*Log[g*x^m]))^q, x], x]
/; FreeQ[{a, b, c, d, e, f, g, h, i, m, n, q, r}, x]
```

### Rule 2310

```
Int[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))^(p_)*((d_.)*(x_)^(m_.), x_Symbol
] :> Dist[(d*x)^(m + 1)/(d*n*(c*x^n)^(m + 1)/n), Subst[Int[E^(((m + 1)*x
/n)*(a + b*x)^p, x], x, Log[c*x^n]], x] /; FreeQ[{a, b, c, d, m, n, p}, x]
```

### Rule 2178

```
Int[(F_)^((g_.)*((e_.) + (f_.)*(x_)))/((c_.) + (d_.)*(x_)), x_Symbol] :> Si
mp[(F^(g*(e - (c*f)/d))*ExpIntegralEi[(f*g*(c + d*x)*Log[F])/d])/d, x] /; F
reeQ[{F, c, d, e, f, g}, x] && !$UseGamma == True
```

### Rubi steps

$$\begin{aligned}
\int x^2 \operatorname{Si}(d(a + b \log(cx^n))) dx &= \frac{1}{3} x^3 \operatorname{Si}(d(a + b \log(cx^n))) - \frac{1}{3} (bdn) \int \frac{x^2 \sin(d(a + b \log(cx^n)))}{d(a + b \log(cx^n))} dx \\
&= \frac{1}{3} x^3 \operatorname{Si}(d(a + b \log(cx^n))) - \frac{1}{3} (bn) \int \frac{x^2 \sin(d(a + b \log(cx^n)))}{a + b \log(cx^n)} dx \\
&= \frac{1}{3} x^3 \operatorname{Si}(d(a + b \log(cx^n))) - \frac{1}{6} (ibe^{-iad} n x^{ibdn} (cx^n)^{-ibd}) \int \frac{x^{2-ibdn}}{a + b \log(cx^n)} dx + \frac{1}{6} (ibe^{iad} n \\
&= \frac{1}{3} x^3 \operatorname{Si}(d(a + b \log(cx^n))) - \frac{1}{6} (ibe^{-iad} x^3 (cx^n)^{-ibd-\frac{3-ibdn}{n}}) \operatorname{Subst}\left(\int \frac{e^{\frac{(3-ibdn)x}{n}}}{a + bx} dx, x, \log(cx^n)\right) \\
&= -\frac{1}{6} ie^{-\frac{3a}{bn}} x^3 (cx^n)^{-3/n} \operatorname{Ei}\left(\frac{(3-ibdn)(a + b \log(cx^n))}{bn}\right) + \frac{1}{6} ie^{-\frac{3a}{bn}} x^3 (cx^n)^{-3/n} \operatorname{Ei}\left(\frac{(3+ibdn)(a + b \log(cx^n))}{bn}\right)
\end{aligned}$$

**Mathematica [A]** time = 1.72639, size = 106, normalized size = 0.77

$$\frac{1}{6} x^3 \left( 2 \operatorname{Si}(d(a + b \log(cx^n))) - ie^{-\frac{3a}{bn}} (cx^n)^{-3/n} \left( \operatorname{ExpIntegralEi}\left(\frac{(3-ibdn)(a + b \log(cx^n))}{bn}\right) - \operatorname{ExpIntegralEi}\left(\frac{(3+ibdn)(a + b \log(cx^n))}{bn}\right) \right) \right)$$

Antiderivative was successfully verified.

```
[In] Integrate[x^2*SinIntegral[d*(a + b*Log[c*x^n]), x]
```

[Out]  $(x^3 * (((-1) * (\text{ExpIntegralEi} [((3 - I * b * d * n) * (a + b * \text{Log}[c * x^n])) / (b * n)] - \text{ExpIntegralEi} [((3 + I * b * d * n) * (a + b * \text{Log}[c * x^n])) / (b * n)])) / (E^{((3 * a) / (b * n)) * (c * x^n)^{(3/n)} + 2 * \text{SinIntegral}[d * (a + b * \text{Log}[c * x^n])])) / 6$

**Maple [F]** time = 0.097, size = 0, normalized size = 0.

$$\int x^2 \text{Si}(d(a + b \ln(cx^n))) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(x^2*Si(d*(a+b*ln(c*x^n))),x)`

[Out] `int(x^2*Si(d*(a+b*ln(c*x^n))),x)`

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \text{Si}((b \log(cx^n) + a)d) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Si(d*(a+b*log(c*x^n))),x, algorithm="maxima")`

[Out] `integrate(x^2*Si((b*log(c*x^n) + a)*d), x)`

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^2 \text{Si}(bd \log(cx^n) + ad), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Si(d*(a+b*log(c*x^n))),x, algorithm="fricas")`

[Out] `integral(x^2*sin_integral(b*d*log(c*x^n) + a*d), x)`

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \operatorname{Si}(ad + bd \log(cx^n)) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*\*2\*Si(d\*(a+b\*ln(c\*x\*\*n))),x)

[Out] Integral(x\*\*2\*Si(a\*d + b\*d\*log(c\*x\*\*n)), x)

**Giac [F(-1)]** time = 0., size = 0, normalized size = 0.

Timed out

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^2\*Si(d\*(a+b\*log(c\*x^n))),x, algorithm="giac")

[Out] Timed out



### 3.33 $\int x \text{Si}(d(a + b \log(cx^n))) dx$

**Optimal.** Leaf size=137

$$-\frac{1}{4}ix^2e^{-\frac{2a}{bn}}(cx^n)^{-2/n}\text{ExpIntegralEi}\left(\frac{(2-ibdn)(a+b\log(cx^n))}{bn}\right) + \frac{1}{4}ix^2e^{-\frac{2a}{bn}}(cx^n)^{-2/n}\text{ExpIntegralEi}\left(\frac{(2+ibdn)(a+b\log(cx^n))}{bn}\right)$$

[Out]  $((-I/4)*x^2*\text{ExpIntegralEi}[(2 - I*b*d*n)*(a + b*\text{Log}[c*x^n])]/(b*n))/(E^{(2*a)/(b*n)}*(c*x^n)^{(2/n)}) + ((I/4)*x^2*\text{ExpIntegralEi}[(2 + I*b*d*n)*(a + b*\text{Log}[c*x^n])]/(b*n))/(E^{(2*a)/(b*n)}*(c*x^n)^{(2/n)}) + (x^2*\text{SinIntegral}[d*(a + b*\text{Log}[c*x^n])])/2$

**Rubi [A]** time = 0.263112, antiderivative size = 137, normalized size of antiderivative = 1., number of steps used = 7, number of rules used = 5, integrand size = 15,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.333$ , Rules used = {6526, 12, 4497, 2310, 2178}

$$-\frac{1}{4}ix^2e^{-\frac{2a}{bn}}(cx^n)^{-2/n}\text{Ei}\left(\frac{(2-ibdn)(a+b\log(cx^n))}{bn}\right) + \frac{1}{4}ix^2e^{-\frac{2a}{bn}}(cx^n)^{-2/n}\text{Ei}\left(\frac{(ibdn+2)(a+b\log(cx^n))}{bn}\right) + \frac{1}{2}x^2\text{Si}(d(a + b\log(cx^n)))$$

Antiderivative was successfully verified.

[In]  $\text{Int}[x*\text{SinIntegral}[d*(a + b*\text{Log}[c*x^n])], x]$

[Out]  $((-I/4)*x^2*\text{ExpIntegralEi}[(2 - I*b*d*n)*(a + b*\text{Log}[c*x^n])]/(b*n))/(E^{(2*a)/(b*n)}*(c*x^n)^{(2/n)}) + ((I/4)*x^2*\text{ExpIntegralEi}[(2 + I*b*d*n)*(a + b*\text{Log}[c*x^n])]/(b*n))/(E^{(2*a)/(b*n)}*(c*x^n)^{(2/n)}) + (x^2*\text{SinIntegral}[d*(a + b*\text{Log}[c*x^n])])/2$

#### Rule 6526

$\text{Int}[(e_*)*(x_)^{(m_*)}*\text{SinIntegral}[(a_*) + \text{Log}[(c_*)*(x_)^{(n_*)}]*b_*])*(d_*)], x\_Symbol] :> \text{Simp}[(e*x)^{(m+1)}*\text{SinIntegral}[d*(a + b*\text{Log}[c*x^n])]/(e*(m+1)), x] - \text{Dist}[(b*d*n)/(m+1), \text{Int}[(e*x)^m*\text{Sin}[d*(a + b*\text{Log}[c*x^n])]]/(d*(a + b*\text{Log}[c*x^n])), x], x] /; \text{FreeQ}\{a, b, c, d, e, m, n\}, x] \&\& \text{Ne}\{m, -1\}$

#### Rule 12

$\text{Int}[(a_*)*(u_), x\_Symbol] :> \text{Dist}[a, \text{Int}[u, x], x] /; \text{FreeQ}[a, x] \&\& \text{!Match}\{Q[u, (b_*)*(v_)] /; \text{FreeQ}[b, x]\}$

#### Rule 4497

```
Int[(((e_.) + Log[(g_.)*(x_)^(m_.)]*(f_.))*(h_.))^(q_.)*((i_.)*(x_)^(r_.)*
Sin[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)], x_Symbol] :> Dist[(I*(i*x
)^r)/(E^(I*a*d)*(c*x^n)^(I*b*d)*(2*x^(r - I*b*d*n))), Int[x^(r - I*b*d*n)*(
h*(e + f*Log[g*x^m]))^q, x], x] - Dist[(I*E^(I*a*d)*(i*x)^r*(c*x^n)^(I*b*d
))/(2*x^(r + I*b*d*n)), Int[x^(r + I*b*d*n)*(h*(e + f*Log[g*x^m]))^q, x], x]
/; FreeQ[{a, b, c, d, e, f, g, h, i, m, n, q, r}, x]
```

### Rule 2310

```
Int[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))^(p_)*((d_.)*(x_)^(m_.), x_Symbol
] :> Dist[(d*x)^(m + 1)/(d*n*(c*x^n)^((m + 1)/n)), Subst[Int[E^(((m + 1)*x
/n)*(a + b*x)^p, x], x, Log[c*x^n]], x] /; FreeQ[{a, b, c, d, m, n, p}, x]
```

### Rule 2178

```
Int[(F_)^((g_.)*((e_.) + (f_.)*(x_)))/((c_.) + (d_.)*(x_)), x_Symbol] :> Si
mp[(F^(g*(e - (c*f)/d))*ExpIntegralEi[(f*g*(c + d*x)*Log[F])/d])/d, x] /; F
reeQ[{F, c, d, e, f, g}, x] && !$UseGamma == True
```

### Rubi steps

$$\begin{aligned}
 \int x \operatorname{Si}(d(a + b \log(cx^n))) dx &= \frac{1}{2} x^2 \operatorname{Si}(d(a + b \log(cx^n))) - \frac{1}{2} (bdn) \int \frac{x \sin(d(a + b \log(cx^n)))}{d(a + b \log(cx^n))} dx \\
 &= \frac{1}{2} x^2 \operatorname{Si}(d(a + b \log(cx^n))) - \frac{1}{2} (bn) \int \frac{x \sin(d(a + b \log(cx^n)))}{a + b \log(cx^n)} dx \\
 &= \frac{1}{2} x^2 \operatorname{Si}(d(a + b \log(cx^n))) - \frac{1}{4} \left( i b e^{-i a d} n x^{i b d n} (c x^n)^{-i b d} \right) \int \frac{x^{1-i b d n}}{a + b \log(cx^n)} dx + \frac{1}{4} \left( i b e^{i a d} n x^{i b d n} (c x^n)^{i b d} \right) \int \frac{x^{1-i b d n}}{a + b \log(cx^n)} dx \\
 &= \frac{1}{2} x^2 \operatorname{Si}(d(a + b \log(cx^n))) - \frac{1}{4} \left( i b e^{-i a d} x^2 (c x^n)^{-i b d - \frac{2-i b d n}{n}} \right) \operatorname{Subst} \left( \int \frac{e^{\frac{(2-i b d n)x}{n}}}{a + b x} dx, x, \log(cx^n) \right) \\
 &= -\frac{1}{4} i e^{-\frac{2a}{bn}} x^2 (c x^n)^{-2/n} \operatorname{Ei} \left( \frac{(2 - i b d n)(a + b \log(cx^n))}{bn} \right) + \frac{1}{4} i e^{-\frac{2a}{bn}} x^2 (c x^n)^{-2/n} \operatorname{Ei} \left( \frac{(2 + i b d n)(a + b \log(cx^n))}{bn} \right)
 \end{aligned}$$

**Mathematica [A]** time = 1.6937, size = 106, normalized size = 0.77

$$\frac{1}{4} x^2 \left( 2 \operatorname{Si}(d(a + b \log(cx^n))) - i e^{-\frac{2a}{bn}} (c x^n)^{-2/n} \left( \operatorname{ExpIntegralEi} \left( \frac{(2 - i b d n)(a + b \log(cx^n))}{bn} \right) - \operatorname{ExpIntegralEi} \left( \frac{(2 + i b d n)(a + b \log(cx^n))}{bn} \right) \right) \right)$$

Antiderivative was successfully verified.

```
[In] Integrate[x*SinIntegral[d*(a + b*Log[c*x^n])], x]
```

```
[Out] (x^2*(((-I)*(ExpIntegralEi[((2 - I*b*d*n)*(a + b*Log[c*x^n])]/(b*n)] - ExpIntegralEi[((2 + I*b*d*n)*(a + b*Log[c*x^n])]/(b*n)))]/(E^((2*a)/(b*n))*(c*x^n)^(2/n)) + 2*SinIntegral[d*(a + b*Log[c*x^n])]))/4
```

**Maple [F]** time = 0.095, size = 0, normalized size = 0.

$$\int x \operatorname{Si}(d(a + b \ln(cx^n))) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(x*Si(d*(a+b*ln(c*x^n))),x)
```

```
[Out] int(x*Si(d*(a+b*ln(c*x^n))),x)
```

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x \operatorname{Si}((b \log(cx^n) + a)d) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x*Si(d*(a+b*log(c*x^n))),x, algorithm="maxima")
```

```
[Out] integrate(x*Si((b*log(c*x^n) + a)*d), x)
```

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(x \operatorname{Si}(bd \log(cx^n) + ad), x)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x*Si(d*(a+b*log(c*x^n))),x, algorithm="fricas")
```

```
[Out] integral(x*sin_integral(b*d*log(c*x^n) + a*d), x)
```

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x \operatorname{Si}(ad + bd \log(cx^n)) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Si(d\*(a+b\*ln(c\*x\*\*n))),x)

[Out] Integral(x\*Si(a\*d + b\*d\*log(c\*x\*\*n)), x)

**Giac [F(-1)]** time = 0., size = 0, normalized size = 0.

Timed out

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Si(d\*(a+b\*log(c\*x^n))),x, algorithm="giac")

[Out] Timed out

### 3.34 $\int \text{Si}(d(a + b \log(cx^n))) dx$

**Optimal.** Leaf size=128

$$-\frac{1}{2}ixe^{-\frac{a}{bn}}(cx^n)^{-1/n} \text{ExpIntegralEi}\left(\frac{(1-ibdn)(a+b \log(cx^n))}{bn}\right) + \frac{1}{2}ixe^{-\frac{a}{bn}}(cx^n)^{-1/n} \text{ExpIntegralEi}\left(\frac{(1+ibdn)(a+b \log(cx^n))}{bn}\right)$$

[Out]  $((-I/2)*x*\text{ExpIntegralEi}[\frac{((1 - I*b*d*n)*(a + b*\text{Log}[c*x^n])}{(b*n))}]/(E^{(a/(b*n))}*(c*x^n)^n^{-1})) + ((I/2)*x*\text{ExpIntegralEi}[\frac{((1 + I*b*d*n)*(a + b*\text{Log}[c*x^n])}{(b*n))}]/(E^{(a/(b*n))}*(c*x^n)^n^{-1})) + x*\text{SinIntegral}[d*(a + b*\text{Log}[c*x^n])]$

**Rubi [A]** time = 0.238001, antiderivative size = 128, normalized size of antiderivative = 1., number of steps used = 7, number of rules used = 5, integrand size = 13,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.385$ , Rules used = {6523, 12, 4495, 2310, 2178}

$$-\frac{1}{2}ixe^{-\frac{a}{bn}}(cx^n)^{-1/n} \text{Ei}\left(\frac{(1-ibdn)(a+b \log(cx^n))}{bn}\right) + \frac{1}{2}ixe^{-\frac{a}{bn}}(cx^n)^{-1/n} \text{Ei}\left(\frac{(ibdn+1)(a+b \log(cx^n))}{bn}\right) + x\text{Si}(d(a + b \log(cx^n)))$$

Antiderivative was successfully verified.

[In]  $\text{Int}[\text{SinIntegral}[d*(a + b*\text{Log}[c*x^n])], x]$

[Out]  $((-I/2)*x*\text{ExpIntegralEi}[\frac{((1 - I*b*d*n)*(a + b*\text{Log}[c*x^n])}{(b*n))}]/(E^{(a/(b*n))}*(c*x^n)^n^{-1})) + ((I/2)*x*\text{ExpIntegralEi}[\frac{((1 + I*b*d*n)*(a + b*\text{Log}[c*x^n])}{(b*n))}]/(E^{(a/(b*n))}*(c*x^n)^n^{-1})) + x*\text{SinIntegral}[d*(a + b*\text{Log}[c*x^n])]$

#### Rule 6523

$\text{Int}[\text{SinIntegral}[(a_.) + \text{Log}[(c_.)*(x_)^{(n_.)}]*(b_.)]*(d_.)], x\_Symbol] \text{ :> } \text{Simp}[x*\text{SinIntegral}[d*(a + b*\text{Log}[c*x^n])], x] - \text{Dist}[b*d*n, \text{Int}[\text{Sin}[d*(a + b*\text{Log}[c*x^n])]/(d*(a + b*\text{Log}[c*x^n])], x], x] /; \text{FreeQ}\{a, b, c, d, n\}, x]$

#### Rule 12

$\text{Int}[(a_)*(u_), x\_Symbol] \text{ :> } \text{Dist}[a, \text{Int}[u, x], x] /; \text{FreeQ}[a, x] \ \&\& \ !\text{MatchQ}[u, (b_)*(v_)] /; \text{FreeQ}[b, x]$

#### Rule 4495

```
Int[(((e_.) + Log[(g_.)*(x_)^(m_.)]*(f_.))*(h_.))^(q_.)*Sin[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)], x_Symbol] := Dist[I/(E^(I*a*d)*(c*x^n)^(I*b*d)*(2/x^(I*b*d*n))), Int[(h*(e + f*Log[g*x^m]))^q/x^(I*b*d*n), x], x] - Dist[(I*E^(I*a*d)*(c*x^n)^(I*b*d))/(2*x^(I*b*d*n)), Int[x^(I*b*d*n)*(h*(e + f*Log[g*x^m]))^q, x], x] /; FreeQ[{a, b, c, d, e, f, g, h, m, n, q}, x]
```

### Rule 2310

```
Int[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))^(p_.)*((d_.)*(x_)^(m_.), x_Symbol] := Dist[(d*x)^(m + 1)/(d*n*(c*x^n)^(m + 1)/n), Subst[Int[E^((m + 1)*x/n)*(a + b*x)^p, x], x, Log[c*x^n]], x] /; FreeQ[{a, b, c, d, m, n, p}, x]
```

### Rule 2178

```
Int[(F_)^((g_.)*((e_.) + (f_.)*(x_)))/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[(F^(g*(e - (c*f)/d))*ExpIntegralEi[(f*g*(c + d*x)*Log[F])/d])/d, x] /; FreeQ[{F, c, d, e, f, g}, x] && !$UseGamma == True
```

### Rubi steps

$$\begin{aligned}
 \int \text{Si}(d(a + b \log(cx^n))) dx &= x \text{Si}(d(a + b \log(cx^n))) - (bdn) \int \frac{\sin(d(a + b \log(cx^n)))}{d(a + b \log(cx^n))} dx \\
 &= x \text{Si}(d(a + b \log(cx^n))) - (bn) \int \frac{\sin(d(a + b \log(cx^n)))}{a + b \log(cx^n)} dx \\
 &= x \text{Si}(d(a + b \log(cx^n))) - \frac{1}{2} \left( i b e^{-iad} n x^{ibdn} (cx^n)^{-ibd} \right) \int \frac{x^{-ibdn}}{a + b \log(cx^n)} dx + \frac{1}{2} \left( i b e^{iad} n x^{-ibdn} \right) \int \frac{x^{-ibdn}}{a + b \log(cx^n)} dx \\
 &= x \text{Si}(d(a + b \log(cx^n))) - \frac{1}{2} \left( i b e^{-iad} x (cx^n)^{-ibd - \frac{1-ibdn}{n}} \right) \text{Subst} \left( \int \frac{e^{\frac{(1-ibdn)x}{n}}}{a + bx} dx, x, \log(cx^n) \right) + \frac{1}{2} \left( i b e^{iad} x (cx^n)^{-ibd - \frac{1-ibdn}{n}} \right) \text{Subst} \left( \int \frac{e^{\frac{(1-ibdn)x}{n}}}{a + bx} dx, x, \log(cx^n) \right) \\
 &= -\frac{1}{2} i e^{-\frac{a}{bn}} x (cx^n)^{-1/n} \text{Ei} \left( \frac{(1 - ibdn)(a + b \log(cx^n))}{bn} \right) + \frac{1}{2} i e^{-\frac{a}{bn}} x (cx^n)^{-1/n} \text{Ei} \left( \frac{(1 + ibdn)(a + b \log(cx^n))}{bn} \right)
 \end{aligned}$$

**Mathematica [A]** time = 1.6419, size = 102, normalized size = 0.8

$$x \text{Si}(d(a + b \log(cx^n))) - \frac{1}{2} i x e^{-\frac{a}{bn}} (cx^n)^{-1/n} \left( \text{ExpIntegralEi} \left( \frac{(1 - ibdn)(a + b \log(cx^n))}{bn} \right) - \text{ExpIntegralEi} \left( \frac{(1 + ibdn)(a + b \log(cx^n))}{bn} \right) \right)$$

Antiderivative was successfully verified.

```
[In] Integrate[SinIntegral[d*(a + b*Log[c*x^n]), x]
```

```
[Out] ((-I/2)*x*(ExpIntegralEi[((1 - I*b*d*n)*(a + b*Log[c*x^n])/(b*n)] - ExpIntegralEi[((1 + I*b*d*n)*(a + b*Log[c*x^n])/(b*n)])])/(E^(a/(b*n))*(c*x^n)^n^(-1)) + x*SinIntegral[d*(a + b*Log[c*x^n])])
```

**Maple [F]** time = 0.069, size = 0, normalized size = 0.

$$\int \text{Si}(d(a + b \ln(cx^n))) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(Si(d*(a+b*ln(c*x^n))),x)
```

```
[Out] int(Si(d*(a+b*ln(c*x^n))),x)
```

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \text{Si}((b \log(cx^n) + a)d) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(d*(a+b*log(c*x^n))),x, algorithm="maxima")
```

```
[Out] integrate(Si((b*log(c*x^n) + a)*d), x)
```

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(\text{Si}(bd \log(cx^n) + ad), x)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(d*(a+b*log(c*x^n))),x, algorithm="fricas")
```

```
[Out] integral(sin_integral(b*d*log(c*x^n) + a*d), x)
```

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \text{Si}(d(a + b \log(cx^n))) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(d\*(a+b\*ln(c\*x\*\*n))),x)

[Out] Integral(Si(d\*(a + b\*log(c\*x\*\*n))), x)

**Giac [F(-1)]** time = 0., size = 0, normalized size = 0.

Timed out

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(d\*(a+b\*log(c\*x^n))),x, algorithm="giac")

[Out] Timed out



$$3.35 \quad \int \frac{\text{Si}(d(a+b \log(cx^n)))}{x} dx$$

**Optimal.** Leaf size=54

$$\frac{(a + b \log(cx^n)) \text{Si}(d(a + b \log(cx^n)))}{bn} + \frac{\cos(d(a + b \log(cx^n)))}{bdn}$$

[Out] Cos[d\*(a + b\*Log[c\*x^n])]/(b\*d\*n) + ((a + b\*Log[c\*x^n])\*SinIntegral[d\*(a + b\*Log[c\*x^n])])/(b\*n)

**Rubi [A]** time = 0.0309975, antiderivative size = 54, normalized size of antiderivative = 1., number of steps used = 3, number of rules used = 1, integrand size = 17,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.059$ , Rules used = {6499}

$$\frac{(a + b \log(cx^n)) \text{Si}(d(a + b \log(cx^n)))}{bn} + \frac{\cos(d(a + b \log(cx^n)))}{bdn}$$

Antiderivative was successfully verified.

[In] Int[SinIntegral[d\*(a + b\*Log[c\*x^n])]/x,x]

[Out] Cos[d\*(a + b\*Log[c\*x^n])]/(b\*d\*n) + ((a + b\*Log[c\*x^n])\*SinIntegral[d\*(a + b\*Log[c\*x^n])])/(b\*n)

### Rule 6499

Int[SinIntegral[(a\_.) + (b\_.)\*(x\_.)], x\_Symbol] :> Simp[((a + b\*x)\*SinIntegral[a + b\*x])/b, x] + Simp[Cos[a + b\*x]/b, x] /; FreeQ[{a, b}, x]

### Rubi steps

$$\begin{aligned} \int \frac{\text{Si}(d(a + b \log(cx^n)))}{x} dx &= \frac{\text{Subst}\left(\int \text{Si}(d(a + bx)) dx, x, \log(cx^n)\right)}{n} \\ &= \frac{\text{Subst}\left(\int \text{Si}(x) dx, x, ad + bd \log(cx^n)\right)}{bdn} \\ &= \frac{\cos(ad + bd \log(cx^n))}{bdn} + \frac{(a + b \log(cx^n)) \text{Si}(ad + bd \log(cx^n))}{bn} \end{aligned}$$

**Mathematica [A]** time = 0.0638797, size = 95, normalized size = 1.76

$$\frac{\log(cx^n) \operatorname{Si}(d(a + b \log(cx^n)))}{n} + \frac{a \operatorname{Si}(ad + b \log(cx^n) d)}{bn} - \frac{\sin(ad) \sin(bd \log(cx^n))}{bdn} + \frac{\cos(ad) \cos(bd \log(cx^n))}{bdn}$$

Antiderivative was successfully verified.

[In] Integrate[SinIntegral[d\*(a + b\*Log[c\*x^n])]/x,x]

[Out] (Cos[a\*d]\*Cos[b\*d\*Log[c\*x^n]])/(b\*d\*n) - (Sin[a\*d]\*Sin[b\*d\*Log[c\*x^n]])/(b\*d\*n) + (Log[c\*x^n]\*SinIntegral[d\*(a + b\*Log[c\*x^n])])/n + (a\*SinIntegral[a\*d + b\*d\*Log[c\*x^n]])/(b\*n)

**Maple [A]** time = 0.075, size = 72, normalized size = 1.3

$$\frac{\ln(cx^n) \operatorname{Si}(ad + bd \ln(cx^n))}{n} + \frac{\operatorname{Si}(ad + bd \ln(cx^n)) a}{bn} + \frac{\cos(ad + bd \ln(cx^n))}{bdn}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Si(d\*(a+b\*ln(c\*x^n)))/x,x)

[Out] 1/n\*ln(c\*x^n)\*Si(a\*d+b\*d\*ln(c\*x^n))+1/n/b\*Si(a\*d+b\*d\*ln(c\*x^n))\*a+1/n/b/d\*cos(a\*d+b\*d\*ln(c\*x^n))

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\operatorname{Si}((b \log(cx^n) + a)d)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(d\*(a+b\*log(c\*x^n)))/x,x, algorithm="maxima")

[Out] integrate(Si((b\*log(c\*x^n) + a)\*d)/x, x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}\left(\frac{\operatorname{Si}(bd \log(cx^n) + ad)}{x}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(d*(a+b*log(c*x^n)))/x,x, algorithm="fricas")`

[Out] `integral(sin_integral(b*d*log(c*x^n) + a*d)/x, x)`

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(ad + bd \log(cx^n))}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(d*(a+b*ln(c*x**n)))/x,x)`

[Out] `Integral(Si(a*d + b*d*log(c*x**n))/x, x)`

**Giac [A]** time = 1.57132, size = 80, normalized size = 1.48

$$\frac{(bdn \log(x) + bd \log(c) + ad) \text{Si}(bdn \log(x) + bd \log(c) + ad) + \cos(bdn \log(x) + bd \log(c) + ad)}{bdn}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(d*(a+b*log(c*x^n)))/x,x, algorithm="giac")`

[Out] `((b*d*n*log(x) + b*d*log(c) + a*d)*sin_integral(b*d*n*log(x) + b*d*log(c) + a*d) + cos(b*d*n*log(x) + b*d*log(c) + a*d))/(b*d*n)`

$$3.36 \quad \int \frac{\text{Si}(d(a+b \log(cx^n)))}{x^2} dx$$

**Optimal.** Leaf size=131

$$\frac{ie^{\frac{a}{bn}} (cx^n)^{\frac{1}{n}} \text{ExpIntegralEi}\left(-\frac{(1-ibdn)(a+b \log(cx^n))}{bn}\right)}{2x} + \frac{ie^{\frac{a}{bn}} (cx^n)^{\frac{1}{n}} \text{ExpIntegralEi}\left(-\frac{(1+ibdn)(a+b \log(cx^n))}{bn}\right)}{2x} - \frac{\text{Si}(d(a+b \log(cx^n)))}{x}$$

[Out]  $((-I/2)*E^{(a/(b*n))}*(c*x^n)^n^{(-1)}*\text{ExpIntegralEi}[-(((1 - I*b*d*n)*(a + b*\text{Log}[c*x^n]))/(b*n))])/x + ((I/2)*E^{(a/(b*n))}*(c*x^n)^n^{(-1)}*\text{ExpIntegralEi}[-(((1 + I*b*d*n)*(a + b*\text{Log}[c*x^n]))/(b*n))])/x - \text{SinIntegral}[d*(a + b*\text{Log}[c*x^n])]/x$

**Rubi [A]** time = 0.25396, antiderivative size = 131, normalized size of antiderivative = 1., number of steps used = 7, number of rules used = 5, integrand size = 17,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.294$ , Rules used = {6526, 12, 4497, 2310, 2178}

$$-\frac{ie^{\frac{a}{bn}} (cx^n)^{\frac{1}{n}} \text{Ei}\left(-\frac{(1-ibdn)(a+b \log(cx^n))}{bn}\right)}{2x} + \frac{ie^{\frac{a}{bn}} (cx^n)^{\frac{1}{n}} \text{Ei}\left(-\frac{(ibdn+1)(a+b \log(cx^n))}{bn}\right)}{2x} - \frac{\text{Si}(d(a+b \log(cx^n)))}{x}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[\text{SinIntegral}[d*(a + b*\text{Log}[c*x^n])]/x^2, x]$

[Out]  $((-I/2)*E^{(a/(b*n))}*(c*x^n)^n^{(-1)}*\text{ExpIntegralEi}[-(((1 - I*b*d*n)*(a + b*\text{Log}[c*x^n]))/(b*n))])/x + ((I/2)*E^{(a/(b*n))}*(c*x^n)^n^{(-1)}*\text{ExpIntegralEi}[-(((1 + I*b*d*n)*(a + b*\text{Log}[c*x^n]))/(b*n))])/x - \text{SinIntegral}[d*(a + b*\text{Log}[c*x^n])]/x$

### Rule 6526

$\text{Int}[(e^x)^m * \text{SinIntegral}[(a + \text{Log}[c*x^n]) * (b + d*x^m)], x\_Symbol] \rightarrow \text{Simp}[(e^x)^{m+1} * \text{SinIntegral}[d*(a + b*\text{Log}[c*x^n])]/(e^{m+1}), x] - \text{Dist}[(b*d*n)/(m+1), \text{Int}[(e^x)^m * \text{Sin}[d*(a + b*\text{Log}[c*x^n])]], x, x] /;$  FreeQ[{a, b, c, d, e, m, n}, x] && NeQ[m, -1]

### Rule 12

$\text{Int}[a*(u), x\_Symbol] \rightarrow \text{Dist}[a, \text{Int}[u, x], x] /;$  FreeQ[a, x] && !MatchQ[u, (b\_)\*(v\_)] /; FreeQ[b, x]

Rule 4497

```
Int[(((e_.) + Log[(g_.)*(x_)^(m_.)]*(f_.))*(h_.))^(q_.)*((i_.)*(x_)^(r_.)*
Sin[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)], x_Symbol] :> Dist[(I*(i*x
)^r)/(E^(I*a*d)*(c*x^n)^(I*b*d)*(2*x^(r - I*b*d*n))), Int[x^(r - I*b*d*n)*(
h*(e + f*Log[g*x^m]))^q, x], x] - Dist[(I*E^(I*a*d)*(i*x)^r*(c*x^n)^(I*b*d
))/(2*x^(r + I*b*d*n)), Int[x^(r + I*b*d*n)*(h*(e + f*Log[g*x^m]))^q, x], x]
/; FreeQ[{a, b, c, d, e, f, g, h, i, m, n, q, r}, x]
```

Rule 2310

```
Int[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))^(p_.)*((d_.)*(x_)^(m_.), x_Symbol
] :> Dist[(d*x)^(m + 1)/(d*n*(c*x^n)^((m + 1)/n)), Subst[Int[E^(((m + 1)*x
)/n)*(a + b*x)^p, x], x, Log[c*x^n]], x] /; FreeQ[{a, b, c, d, m, n, p}, x]
```

Rule 2178

```
Int[(F_)^((g_.)*((e_.) + (f_.)*(x_)))/((c_.) + (d_.)*(x_)), x_Symbol] :> Si
mp[(F^(g*(e - (c*f)/d))*ExpIntegralEi[(f*g*(c + d*x)*Log[F])/d])/d, x] /; F
reeQ[{F, c, d, e, f, g}, x] && !$UseGamma === True
```

Rubi steps

$$\begin{aligned}
\int \frac{\text{Si}(d(a + b \log(cx^n)))}{x^2} dx &= -\frac{\text{Si}(d(a + b \log(cx^n)))}{x} + (bdn) \int \frac{\sin(d(a + b \log(cx^n)))}{dx^2(a + b \log(cx^n))} dx \\
&= -\frac{\text{Si}(d(a + b \log(cx^n)))}{x} + (bn) \int \frac{\sin(d(a + b \log(cx^n)))}{x^2(a + b \log(cx^n))} dx \\
&= -\frac{\text{Si}(d(a + b \log(cx^n)))}{x} + \frac{1}{2} (ibe^{-iad} nx^{ibdn} (cx^n)^{-ibd}) \int \frac{x^{-2-ibdn}}{a + b \log(cx^n)} dx - \frac{1}{2} (ibe^{iad} nx^{-2-ibdn}) \int \frac{x^{-2-ibdn}}{a + b \log(cx^n)} dx \\
&= -\frac{\text{Si}(d(a + b \log(cx^n)))}{x} + \frac{(ibe^{-iad} (cx^n)^{-ibd-\frac{-1-ibdn}{n}}) \text{Subst}\left(\int \frac{e^{\frac{(-1-ibdn)x}{a+bx}}}{a+bx} dx, x, \log(cx^n)\right)}{2x} \\
&= -\frac{ie^{\frac{a}{bn}} (cx^n)^{\frac{1}{n}} \text{Ei}\left(-\frac{(1-ibdn)(a+b \log(cx^n))}{bn}\right)}{2x} + \frac{ie^{\frac{a}{bn}} (cx^n)^{\frac{1}{n}} \text{Ei}\left(-\frac{(1+ibdn)(a+b \log(cx^n))}{bn}\right)}{2x} - \frac{\text{Si}(d(a + b \log(cx^n)))}{x}
\end{aligned}$$

**Mathematica [A]** time = 1.68398, size = 107, normalized size = 0.82

$$\frac{-2\text{Si}(d(a + b \log(cx^n))) + ie^{\frac{a}{bn}} (cx^n)^{\frac{1}{n}} \left( \text{ExpIntegralEi}\left(-\frac{i(bdn-i)(a+b \log(cx^n))}{bn}\right) - \text{ExpIntegralEi}\left(\frac{i(bdn+i)(a+b \log(cx^n))}{bn}\right) \right)}{2x}$$

Antiderivative was successfully verified.

```
[In] Integrate[SinIntegral[d*(a + b*Log[c*x^n])/x^2,x]
```

```
[Out] (I*E^(a/(b*n))*(c*x^n)^n^(-1)*(ExpIntegralEi[((-I)*(-I + b*d*n)*(a + b*Log[
c*x^n]))/(b*n)] - ExpIntegralEi[(I*(I + b*d*n)*(a + b*Log[c*x^n]))/(b*n)])
- 2*SinIntegral[d*(a + b*Log[c*x^n])]/(2*x)
```

**Maple [F]** time = 0.092, size = 0, normalized size = 0.

$$\int \frac{\text{Si}(d(a + b \ln(cx^n)))}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(Si(d*(a+b*ln(c*x^n)))/x^2,x)
```

```
[Out] int(Si(d*(a+b*ln(c*x^n)))/x^2,x)
```

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}((b \log(cx^n) + a)d)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(d*(a+b*log(c*x^n)))/x^2,x, algorithm="maxima")
```

```
[Out] integrate(Si((b*log(c*x^n) + a)*d)/x^2, x)
```

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Si}(bd \log(cx^n) + ad)}{x^2}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(d*(a+b*log(c*x^n)))/x^2,x, algorithm="fricas")
```

[Out] `integral(sin_integral(b*d*log(c*x^n) + a*d)/x^2, x)`

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(ad + bd \log(cx^n))}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(d*(a+b*ln(c*x**n)))/x**2,x)`

[Out] `Integral(Si(a*d + b*d*log(c*x**n))/x**2, x)`

---

**Giac [F(-1)]** time = 0., size = 0, normalized size = 0.

Timed out

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(d*(a+b*log(c*x^n)))/x^2,x, algorithm="giac")`

[Out] Timed out

$$3.37 \quad \int \frac{\text{Si}(d(a+b \log(cx^n)))}{x^3} dx$$

**Optimal.** Leaf size=139

$$\frac{i e^{\frac{2a}{bn}} (cx^n)^{2/n} \text{ExpIntegralEi}\left(-\frac{(2-ibdn)(a+b \log(cx^n))}{bn}\right)}{4x^2} + \frac{i e^{\frac{2a}{bn}} (cx^n)^{2/n} \text{ExpIntegralEi}\left(-\frac{(2+ibdn)(a+b \log(cx^n))}{bn}\right)}{4x^2} - \frac{\text{Si}(d(a+b \log(cx^n)))}{2x^2}$$

[Out]  $((-I/4)*E^{((2*a)/(b*n))*(c*x^n)^{(2/n)*ExpIntegralEi[-(((2 - I*b*d*n)*(a + b*Log[c*x^n]))/(b*n))])}/x^2 + ((I/4)*E^{((2*a)/(b*n))*(c*x^n)^{(2/n)*ExpIntegralEi[-(((2 + I*b*d*n)*(a + b*Log[c*x^n]))/(b*n))])}/x^2 - SinIntegral[d*(a + b*Log[c*x^n])]/(2*x^2)$

**Rubi [A]** time = 0.251442, antiderivative size = 139, normalized size of antiderivative = 1., number of steps used = 7, number of rules used = 5, integrand size = 17,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.294$ , Rules used = {6526, 12, 4497, 2310, 2178}

$$\frac{i e^{\frac{2a}{bn}} (cx^n)^{2/n} \text{Ei}\left(-\frac{(2-ibdn)(a+b \log(cx^n))}{bn}\right)}{4x^2} + \frac{i e^{\frac{2a}{bn}} (cx^n)^{2/n} \text{Ei}\left(-\frac{(ibdn+2)(a+b \log(cx^n))}{bn}\right)}{4x^2} - \frac{\text{Si}(d(a+b \log(cx^n)))}{2x^2}$$

Antiderivative was successfully verified.

[In] Int[SinIntegral[d\*(a + b\*Log[c\*x^n])]/x^3,x]

[Out]  $((-I/4)*E^{((2*a)/(b*n))*(c*x^n)^{(2/n)*ExpIntegralEi[-(((2 - I*b*d*n)*(a + b*Log[c*x^n]))/(b*n))])}/x^2 + ((I/4)*E^{((2*a)/(b*n))*(c*x^n)^{(2/n)*ExpIntegralEi[-(((2 + I*b*d*n)*(a + b*Log[c*x^n]))/(b*n))])}/x^2 - SinIntegral[d*(a + b*Log[c*x^n])]/(2*x^2)$

### Rule 6526

Int[((e\_.)\*(x\_))^(m\_.)\*SinIntegral[((a\_.) + Log[(c\_.)\*(x\_)^(n\_.)]\*(b\_.))\*(d\_.)], x\_Symbol] := Simp[((e\*x)^(m + 1)\*SinIntegral[d\*(a + b\*Log[c\*x^n])]/(e\*(m + 1)), x] - Dist[(b\*d\*n)/(m + 1), Int[((e\*x)^m\*Sin[d\*(a + b\*Log[c\*x^n])])]/(d\*(a + b\*Log[c\*x^n])), x], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && NeQ[m, -1]

### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] := Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b\_)\*(v\_) /; FreeQ[b, x]]



Rule 4497

```
Int[(((e_.) + Log[(g_.)*(x_)^(m_.)]*(f_.))*(h_.))^(q_.)*((i_.)*(x_)^(r_.))*
Sin[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)], x_Symbol] :> Dist[(I*(i*x
)^r)/(E^(I*a*d)*(c*x^n)^(I*b*d)*(2*x^(r - I*b*d*n))), Int[x^(r - I*b*d*n)*(
h*(e + f*Log[g*x^m]))^q, x], x] - Dist[(I*E^(I*a*d)*(i*x)^r*(c*x^n)^(I*b*d
))/(2*x^(r + I*b*d*n)), Int[x^(r + I*b*d*n)*(h*(e + f*Log[g*x^m]))^q, x], x]
/; FreeQ[{a, b, c, d, e, f, g, h, i, m, n, q, r}, x]
```

Rule 2310

```
Int[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))^(p_.)*((d_.)*(x_)^(m_.), x_Symbol
] :> Dist[(d*x)^(m + 1)/(d*n*(c*x^n)^((m + 1)/n)), Subst[Int[E^(((m + 1)*x
)/n)*(a + b*x)^p, x], x, Log[c*x^n]], x] /; FreeQ[{a, b, c, d, m, n, p}, x]
```

Rule 2178

```
Int[(F_)^((g_.)*((e_.) + (f_.)*(x_)))/((c_.) + (d_.)*(x_)), x_Symbol] :> Si
mp[(F^(g*(e - (c*f)/d))*ExpIntegralEi[(f*g*(c + d*x)*Log[F])/d])/d, x] /; F
reeQ[{F, c, d, e, f, g}, x] && !$UseGamma === True
```

Rubi steps

$$\begin{aligned} \int \frac{\text{Si}(d(a + b \log(cx^n)))}{x^3} dx &= -\frac{\text{Si}(d(a + b \log(cx^n)))}{2x^2} + \frac{1}{2}(bdn) \int \frac{\sin(d(a + b \log(cx^n)))}{dx^3(a + b \log(cx^n))} dx \\ &= -\frac{\text{Si}(d(a + b \log(cx^n)))}{2x^2} + \frac{1}{2}(bn) \int \frac{\sin(d(a + b \log(cx^n)))}{x^3(a + b \log(cx^n))} dx \\ &= -\frac{\text{Si}(d(a + b \log(cx^n)))}{2x^2} + \frac{1}{4} \left( ibe^{-iad} n x^{ibdn} (cx^n)^{-ibd} \right) \int \frac{x^{-3-ibdn}}{a + b \log(cx^n)} dx - \frac{1}{4} \left( ibe^{iad} n x^{-3-ibdn} \right) \int \frac{x^{-3-ibdn}}{a + b \log(cx^n)} dx \\ &= -\frac{\text{Si}(d(a + b \log(cx^n)))}{2x^2} + \frac{\left( ibe^{-iad} (cx^n)^{-ibd - \frac{-2-ibdn}{n}} \right) \text{Subst} \left( \int \frac{e^{\frac{(-2-ibdn)x}{a+bx}}}{a+bx} dx, x, \log(cx^n) \right)}{4x^2} \\ &= -\frac{ie^{\frac{2a}{bn}} (cx^n)^{2/n} \text{Ei} \left( -\frac{(2-ibdn)(a+b \log(cx^n))}{bn} \right)}{4x^2} + \frac{ie^{\frac{2a}{bn}} (cx^n)^{2/n} \text{Ei} \left( -\frac{(2+ibdn)(a+b \log(cx^n))}{bn} \right)}{4x^2} - \frac{\text{Si}(d(a + b \log(cx^n)))}{4x^2} \end{aligned}$$

**Mathematica [A]** time = 1.6982, size = 111, normalized size = 0.8

$$\frac{i \left( e^{\frac{2a}{bn}} (cx^n)^{2/n} \left( \text{ExpIntegralEi} \left( -\frac{i(bdn-2i)(a+b \log(cx^n))}{bn} \right) - \text{ExpIntegralEi} \left( \frac{i(bdn+2i)(a+b \log(cx^n))}{bn} \right) \right) \right)}{4x^2} + 2i \text{Si}(d(a + b \log(cx^n)))$$

Antiderivative was successfully verified.

```
[In] Integrate[SinIntegral[d*(a + b*Log[c*x^n])]/x^3,x]
```

```
[Out] ((I/4)*(E^((2*a)/(b*n))*(c*x^n)^(2/n)*(ExpIntegralEi[((-I)*(-2*I + b*d*n)*(a + b*Log[c*x^n])]/(b*n)] - ExpIntegralEi[(I*(2*I + b*d*n)*(a + b*Log[c*x^n])/]/(b*n)])) + (2*I)*SinIntegral[d*(a + b*Log[c*x^n])]))/x^2
```

**Maple [F]** time = 0.092, size = 0, normalized size = 0.

$$\int \frac{\text{Si}(d(a + b \ln(cx^n)))}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(Si(d*(a+b*ln(c*x^n)))/x^3,x)
```

```
[Out] int(Si(d*(a+b*ln(c*x^n)))/x^3,x)
```

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}((b \log(cx^n) + a)d)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(d*(a+b*log(c*x^n)))/x^3,x, algorithm="maxima")
```

```
[Out] integrate(Si((b*log(c*x^n) + a)*d)/x^3, x)
```

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Si}(bd \log(cx^n) + ad)}{x^3}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(d*(a+b*log(c*x^n)))/x^3,x, algorithm="fricas")
```

[Out] `integral(sin_integral(b*d*log(c*x^n) + a*d)/x^3, x)`

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(ad + bd \log(cx^n))}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(d*(a+b*ln(c*x**n)))/x**3,x)`

[Out] `Integral(Si(a*d + b*d*log(c*x**n))/x**3, x)`

**Giac [F(-1)]** time = 0., size = 0, normalized size = 0.

Timed out

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(d*(a+b*log(c*x^n)))/x^3,x, algorithm="giac")`

[Out] Timed out

### 3.38 $\int (ex)^m \text{Si}(d(a + b \log(cx^n))) dx$

**Optimal.** Leaf size=176

$$\frac{ix(ex)^m e^{-\frac{a(m+1)}{bn}} (cx^n)^{-\frac{m+1}{n}} \text{ExpIntegralEi}\left(\frac{(-ibdn+m+1)(a+b \log(cx^n))}{bn}\right)}{2(m+1)} + \frac{ix(ex)^m e^{-\frac{a(m+1)}{bn}} (cx^n)^{-\frac{m+1}{n}} \text{ExpIntegralEi}\left(\frac{(ibdn+m+1)(a+b \log(cx^n))}{bn}\right)}{2(m+1)}$$

```
[Out] ((-I/2)*x*(e*x)^m*ExpIntegralEi[((1 + m - I*b*d*n)*(a + b*Log[c*x^n]))/(b*n
)])/E^((a*(1 + m))/(b*n))*(1 + m)*(c*x^n)^((1 + m)/n)) + ((I/2)*x*(e*x)^m*
ExpIntegralEi[((1 + m + I*b*d*n)*(a + b*Log[c*x^n]))/(b*n)])/E^((a*(1 + m)
)/(b*n))*(1 + m)*(c*x^n)^((1 + m)/n)) + ((e*x)^(1 + m)*SinIntegral[d*(a + b
*Log[c*x^n])])/(e*(1 + m))
```

**Rubi [A]** time = 0.314787, antiderivative size = 176, normalized size of antiderivative = 1., number of steps used = 7, number of rules used = 5, integrand size = 19,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.263$ , Rules used = {6526, 12, 4497, 2310, 2178}

$$\frac{ix(ex)^m e^{-\frac{a(m+1)}{bn}} (cx^n)^{-\frac{m+1}{n}} \text{Ei}\left(\frac{(m-ibdn+1)(a+b \log(cx^n))}{bn}\right)}{2(m+1)} + \frac{ix(ex)^m e^{-\frac{a(m+1)}{bn}} (cx^n)^{-\frac{m+1}{n}} \text{Ei}\left(\frac{(m+ibdn+1)(a+b \log(cx^n))}{bn}\right)}{2(m+1)} + \frac{(ex)^{m+1} \text{Si}(d(a + b \log(cx^n)))}{e}$$

Antiderivative was successfully verified.

```
[In] Int[(e*x)^m*SinIntegral[d*(a + b*Log[c*x^n])],x]
```

```
[Out] ((-I/2)*x*(e*x)^m*ExpIntegralEi[((1 + m - I*b*d*n)*(a + b*Log[c*x^n]))/(b*n
)])/E^((a*(1 + m))/(b*n))*(1 + m)*(c*x^n)^((1 + m)/n)) + ((I/2)*x*(e*x)^m*
ExpIntegralEi[((1 + m + I*b*d*n)*(a + b*Log[c*x^n]))/(b*n)])/E^((a*(1 + m)
)/(b*n))*(1 + m)*(c*x^n)^((1 + m)/n)) + ((e*x)^(1 + m)*SinIntegral[d*(a + b
*Log[c*x^n])])/(e*(1 + m))
```

#### Rule 6526

```
Int[((e_.)*(x_))^(m_.)*SinIntegral[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d
_.)], x_Symbol] := Simp[((e*x)^(m + 1)*SinIntegral[d*(a + b*Log[c*x^n])])/(
e*(m + 1)), x] - Dist[(b*d*n)/(m + 1), Int[((e*x)^m*Sin[d*(a + b*Log[c*x^n]
)])/d*(a + b*Log[c*x^n]), x], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && Ne
Q[m, -1]
```

#### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] := Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b\_)\*(v\_) /; FreeQ[b, x]]

### Rule 4497

Int[(((e\_.) + Log[(g\_.)\*(x\_)^(m\_.)]\*(f\_.))\*(h\_.))^(q\_.)\*((i\_.)\*(x\_)^(r\_.))\*Sin[(((a\_.) + Log[(c\_.)\*(x\_)^(n\_.)]\*(b\_.))\*(d\_.)], x\_Symbol] := Dist[(I\*(i\*x)^r)/(E^(I\*a\*d)\*(c\*x^n)^(I\*b\*d)\*(2\*x^(r - I\*b\*d\*n))), Int[x^(r - I\*b\*d\*n)\*(h\*(e + f\*Log[g\*x^m]))^q, x], x] - Dist[(I\*E^(I\*a\*d)\*(i\*x)^r\*(c\*x^n)^(I\*b\*d))/(2\*x^(r + I\*b\*d\*n)), Int[x^(r + I\*b\*d\*n)\*(h\*(e + f\*Log[g\*x^m]))^q, x], x] /; FreeQ[{a, b, c, d, e, f, g, h, i, m, n, q, r}, x]

### Rule 2310

Int[(((a\_.) + Log[(c\_.)\*(x\_)^(n\_.)]\*(b\_.))^(p\_.))\*((d\_.)\*(x\_)^(m\_.)), x\_Symbol] := Dist[(d\*x)^(m + 1)/(d\*n\*(c\*x^n)^(m + 1/n)), Subst[Int[E^((m + 1)\*x/n)\*(a + b\*x)^p, x], x, Log[c\*x^n]], x] /; FreeQ[{a, b, c, d, m, n, p}, x]

### Rule 2178

Int[(F\_)^((g\_.)\*((e\_.) + (f\_.)\*(x\_)))/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] := Simp[(F^(g\*(e - (c\*f)/d))\*ExpIntegralEi[(f\*g\*(c + d\*x)\*Log[F])/d])/d, x] /; FreeQ[{F, c, d, e, f, g}, x] && !\$UseGamma == True

### Rubi steps

$$\begin{aligned}
 \int (ex)^m \text{Si}(d(a + b \log(cx^n))) dx &= \frac{(ex)^{1+m} \text{Si}(d(a + b \log(cx^n)))}{e(1+m)} - \frac{(bdn) \int \frac{(ex)^m \sin(d(a+b \log(cx^n)))}{d(a+b \log(cx^n))} dx}{1+m} \\
 &= \frac{(ex)^{1+m} \text{Si}(d(a + b \log(cx^n)))}{e(1+m)} - \frac{(bn) \int \frac{(ex)^m \sin(d(a+b \log(cx^n)))}{a+b \log(cx^n)} dx}{1+m} \\
 &= \frac{(ex)^{1+m} \text{Si}(d(a + b \log(cx^n)))}{e(1+m)} - \frac{(ibe^{-iad} nx^{-m+ibdn} (ex)^m (cx^n)^{-ibd}) \int \frac{x^{m-ibdn}}{a+b \log(cx^n)} dx}{2(1+m)} + \\
 &= \frac{(ex)^{1+m} \text{Si}(d(a + b \log(cx^n)))}{e(1+m)} - \frac{(ibe^{-iad} x(ex)^m (cx^n)^{-ibd-\frac{1+m-ibdn}{n}}) \text{Subst}\left(\int \frac{e^{\frac{(1+m-ibdn)x}{a+bx}}}{a+bx} dx\right)}{2(1+m)} \\
 &= -\frac{ie^{-\frac{a(1+m)}{bn}} x(ex)^m (cx^n)^{-\frac{1+m}{n}} \text{Ei}\left(\frac{(1+m-ibdn)(a+b \log(cx^n))}{bn}\right)}{2(1+m)} + \frac{ie^{-\frac{a(1+m)}{bn}} x(ex)^m (cx^n)^{-\frac{1+m}{n}} \text{Ei}\left(\frac{(1+m-ibdn)(a+b \log(cx^n))}{bn}\right)}{2(1+m)}
 \end{aligned}$$

**Mathematica [A]** time = 3.01977, size = 128, normalized size = 0.73

$$\frac{(ex)^m \left( 2x \operatorname{Si}(d(a + b \log(cx^n))) - ix^{-m} \exp\left(-\frac{(m+1)(a+b \log(cx^n)) - bn \log(x)}{bn}\right) \left( \operatorname{ExpIntegralEi}\left(\frac{(-ibdn+m+1)(a+b \log(cx^n))}{bn}\right) - \operatorname{ExpIntegralEi}\left(\frac{(m+1)(a+b \log(cx^n)) - bn \log(x)}{bn}\right) \right) \right)}{2(m+1)}$$

Antiderivative was successfully verified.

[In] Integrate[(e\*x)^m\*SinIntegral[d\*(a + b\*Log[c\*x^n])],x]

[Out] ((e\*x)^m\*((( -I)\*(ExpIntegralEi[((1 + m - I\*b\*d\*n)\*(a + b\*Log[c\*x^n])]/(b\*n)) - ExpIntegralEi[((1 + m + I\*b\*d\*n)\*(a + b\*Log[c\*x^n])]/(b\*n)]]))/(E^(((1 + m)\*(a - b\*n\*Log[x] + b\*Log[c\*x^n])]/(b\*n))\*x^m) + 2\*x\*SinIntegral[d\*(a + b\*Log[c\*x^n])]))/(2\*(1 + m))

**Maple [F]** time = 0.093, size = 0, normalized size = 0.

$$\int (ex)^m \operatorname{Si}(d(a + b \ln(cx^n))) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int((e\*x)^m\*Si(d\*(a+b\*ln(c\*x^n))),x)

[Out] int((e\*x)^m\*Si(d\*(a+b\*ln(c\*x^n))),x)

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int (ex)^m \operatorname{Si}((b \log(cx^n) + a)d) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate((e\*x)^m\*Si(d\*(a+b\*log(c\*x^n))),x, algorithm="maxima")

[Out] integrate((e\*x)^m\*Si((b\*log(c\*x^n) + a)\*d), x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}((ex)^m \text{Si}(bd \log(cx^n) + ad), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate((e\*x)^m\*Si(d\*(a+b\*log(c\*x^n))),x, algorithm="fricas")

[Out] integral((e\*x)^m\*sin\_integral(b\*d\*log(c\*x^n) + a\*d), x)

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int (ex)^m \text{Si}(ad + bd \log(cx^n)) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate((e\*x)\*\*m\*Si(d\*(a+b\*ln(c\*x\*\*n))),x)

[Out] Integral((e\*x)\*\*m\*Si(a\*d + b\*d\*log(c\*x\*\*n)), x)

**Giac [F(-1)]** time = 0., size = 0, normalized size = 0.

Timed out

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate((e\*x)^m\*Si(d\*(a+b\*log(c\*x^n))),x, algorithm="giac")

[Out] Timed out

$$3.39 \quad \int \frac{\sin(bx)\text{Si}(bx)}{x^3} dx$$

**Optimal.** Leaf size=96

$$b^2\text{CosIntegral}(2bx) - \frac{1}{4}b^2\text{Si}(bx)^2 - \frac{\text{Si}(bx)\sin(bx)}{2x^2} - \frac{b\text{Si}(bx)\cos(bx)}{2x} - \frac{\sin^2(bx)}{4x^2} - \frac{b\sin(2bx)}{4x} - \frac{b\sin(bx)\cos(bx)}{2x}$$

[Out] b^2\*CosIntegral[2\*b\*x] - (b\*Cos[b\*x]\*Sin[b\*x])/(2\*x) - Sin[b\*x]^2/(4\*x^2) - (b\*Sin[2\*b\*x])/(4\*x) - (b\*Cos[b\*x]\*SinIntegral[b\*x])/(2\*x) - (Sin[b\*x]\*SinIntegral[b\*x])/(2\*x^2) - (b^2\*SinIntegral[b\*x]^2)/4

**Rubi [A]** time = 0.203468, antiderivative size = 96, normalized size of antiderivative = 1., number of steps used = 14, number of rules used = 10, integrand size = 12,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.833$ , Rules used = {6515, 6521, 6686, 12, 4406, 3297, 3302, 3314, 29, 3312}

$$b^2\text{CosIntegral}(2bx) - \frac{1}{4}b^2\text{Si}(bx)^2 - \frac{\text{Si}(bx)\sin(bx)}{2x^2} - \frac{b\text{Si}(bx)\cos(bx)}{2x} - \frac{\sin^2(bx)}{4x^2} - \frac{b\sin(2bx)}{4x} - \frac{b\sin(bx)\cos(bx)}{2x}$$

Antiderivative was successfully verified.

[In] Int[(Sin[b\*x]\*SinIntegral[b\*x])/x^3,x]

[Out] b^2\*CosIntegral[2\*b\*x] - (b\*Cos[b\*x]\*Sin[b\*x])/(2\*x) - Sin[b\*x]^2/(4\*x^2) - (b\*Sin[2\*b\*x])/(4\*x) - (b\*Cos[b\*x]\*SinIntegral[b\*x])/(2\*x) - (Sin[b\*x]\*SinIntegral[b\*x])/(2\*x^2) - (b^2\*SinIntegral[b\*x]^2)/4

### Rule 6515

Int[((e\_.) + (f\_.)\*(x\_))^(m\_)\*Sin[(a\_.) + (b\_.)\*(x\_)]\*SinIntegral[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] :> Simp[((e + f\*x)^(m + 1)\*Sin[a + b\*x]\*SinIntegral[c + d\*x])/(f\*(m + 1)), x] + (-Dist[b/(f\*(m + 1)), Int[(e + f\*x)^(m + 1)\*Cos[a + b\*x]\*SinIntegral[c + d\*x], x], x] - Dist[d/(f\*(m + 1)), Int[((e + f\*x)^(m + 1)\*Sin[a + b\*x]\*Sin[c + d\*x])/(c + d\*x), x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && ILtQ[m, -1]

### Rule 6521

Int[Cos[(a\_.) + (b\_.)\*(x\_)]\*((e\_.) + (f\_.)\*(x\_))^(m\_)\*SinIntegral[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] :> Simp[((e + f\*x)^(m + 1)\*Cos[a + b\*x]\*SinIntegral[c + d\*x])/(f\*(m + 1)), x] + (Dist[b/(f\*(m + 1)), Int[(e + f\*x)^(m + 1)\*Sin[a + b\*x]\*SinIntegral[c + d\*x], x], x] - Dist[d/(f\*(m + 1)), Int[((e + f\*x)^(m + 1)\*Cos[a + b\*x]\*Sin[c + d\*x])/(c + d\*x), x], x]) /; FreeQ[{a, b, c, d,



e, f}, x] && ILtQ[m, -1]

### Rule 6686

Int[(u\_)\*(y\_)^(m\_.), x\_Symbol] :=> With[{q = DerivativeDivides[y, u, x]}, Simp[(q\*y^(m + 1))/(m + 1), x] /; !FalseQ[q]] /; FreeQ[m, x] && NeQ[m, -1]

### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] :=> Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b\_)\*(v\_) /; FreeQ[b, x]]

### Rule 4406

Int[Cos[(a\_.) + (b\_.)\*(x\_)]^(p\_.)\*((c\_.) + (d\_.)\*(x\_))^(m\_.)\*Sin[(a\_.) + (b\_.)\*(x\_)]^(n\_.), x\_Symbol] :=> Int[ExpandTrigReduce[(c + d\*x)^m, Sin[a + b\*x]^n \* Cos[a + b\*x]^p, x], x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IGtQ[p, 0]

### Rule 3297

Int[((c\_.) + (d\_.)\*(x\_))^(m\_)\*sin[(e\_.) + (f\_.)\*(x\_)], x\_Symbol] :=> Simp[((c + d\*x)^(m + 1)\*Sin[e + f\*x])/(d\*(m + 1)), x] - Dist[f/(d\*(m + 1)), Int[(c + d\*x)^(m + 1)\*Cos[e + f\*x], x], x] /; FreeQ[{c, d, e, f}, x] && LtQ[m, -1]

### Rule 3302

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] :=> Simp[CosIntegral[e - Pi/2 + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*(e - Pi/2) - c\*f, 0]

### Rule 3314

Int[((c\_.) + (d\_.)\*(x\_))^(m\_)\*((b\_.)\*sin[(e\_.) + (f\_.)\*(x\_)])^(n\_), x\_Symbol] :=> Simp[((c + d\*x)^(m + 1)\*(b\*SIN[e + f\*x])^n)/(d\*(m + 1)), x] + (Dist[(b^2\*f^2\*n\*(n - 1))/(d^2\*(m + 1)\*(m + 2)), Int[(c + d\*x)^(m + 2)\*(b\*SIN[e + f\*x])^(n - 2), x], x] - Dist[(f^2\*n^2)/(d^2\*(m + 1)\*(m + 2)), Int[(c + d\*x)^(m + 2)\*(b\*SIN[e + f\*x])^n, x], x] - Simp[(b\*f\*n\*(c + d\*x)^(m + 2)\*Cos[e + f\*x]\*(b\*SIN[e + f\*x])^(n - 1))/(d^2\*(m + 1)\*(m + 2)), x]) /; FreeQ[{b, c, d, e, f}, x] && GtQ[n, 1] && LtQ[m, -2]

### Rule 29

```
Int[(x_)^(-1), x_Symbol] := Simp[Log[x], x]
```

### Rule 3312

```
Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)]^(n_), x_Symbol] := Int[ExpandTrigReduce[(c + d*x)^m, Sin[e + f*x]^n, x], x] /; FreeQ[{c, d, e, f, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))
```

### Rubi steps

$$\begin{aligned}
 \int \frac{\sin(bx)\text{Si}(bx)}{x^3} dx &= -\frac{\sin(bx)\text{Si}(bx)}{2x^2} + \frac{1}{2}b \int \frac{\sin^2(bx)}{bx^3} dx + \frac{1}{2}b \int \frac{\cos(bx)\text{Si}(bx)}{x^2} dx \\
 &= -\frac{b \cos(bx)\text{Si}(bx)}{2x} - \frac{\sin(bx)\text{Si}(bx)}{2x^2} + \frac{1}{2} \int \frac{\sin^2(bx)}{x^3} dx + \frac{1}{2}b^2 \int \frac{\cos(bx) \sin(bx)}{bx^2} dx - \frac{1}{2}b^2 \int \frac{\sin(bx)}{x^2} dx \\
 &= -\frac{b \cos(bx) \sin(bx)}{2x} - \frac{\sin^2(bx)}{4x^2} - \frac{b \cos(bx)\text{Si}(bx)}{2x} - \frac{\sin(bx)\text{Si}(bx)}{2x^2} - \frac{1}{4}b^2\text{Si}(bx)^2 + \frac{1}{2}b \int \frac{\cos(bx) \sin(bx)}{x^2} dx \\
 &= \frac{1}{2}b^2 \log(x) - \frac{b \cos(bx) \sin(bx)}{2x} - \frac{\sin^2(bx)}{4x^2} - \frac{b \cos(bx)\text{Si}(bx)}{2x} - \frac{\sin(bx)\text{Si}(bx)}{2x^2} - \frac{1}{4}b^2\text{Si}(bx)^2 + \frac{1}{2}b \int \frac{\cos(bx) \sin(bx)}{x^2} dx \\
 &= -\frac{b \cos(bx) \sin(bx)}{2x} - \frac{\sin^2(bx)}{4x^2} - \frac{b \cos(bx)\text{Si}(bx)}{2x} - \frac{\sin(bx)\text{Si}(bx)}{2x^2} - \frac{1}{4}b^2\text{Si}(bx)^2 + \frac{1}{4}b \int \frac{\sin(2bx)}{x^2} dx \\
 &= \frac{1}{2}b^2\text{Ci}(2bx) - \frac{b \cos(bx) \sin(bx)}{2x} - \frac{\sin^2(bx)}{4x^2} - \frac{b \sin(2bx)}{4x} - \frac{b \cos(bx)\text{Si}(bx)}{2x} - \frac{\sin(bx)\text{Si}(bx)}{2x^2} - \frac{1}{4}b^2\text{Si}(bx)^2 \\
 &= b^2\text{Ci}(2bx) - \frac{b \cos(bx) \sin(bx)}{2x} - \frac{\sin^2(bx)}{4x^2} - \frac{b \sin(2bx)}{4x} - \frac{b \cos(bx)\text{Si}(bx)}{2x} - \frac{\sin(bx)\text{Si}(bx)}{2x^2} - \frac{1}{4}b^2\text{Si}(bx)^2
 \end{aligned}$$

**Mathematica [F]** time = 1.00412, size = 0, normalized size = 0.

$$\int \frac{\sin(bx)\text{Si}(bx)}{x^3} dx$$

Verification is Not applicable to the result.

```
[In] Integrate[(Sin[b*x]*SinIntegral[b*x])/x^3,x]
```

```
[Out] Integrate[(Sin[b*x]*SinIntegral[b*x])/x^3, x]
```

**Maple [F]** time = 0.056, size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx) \sin(bx)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(Si(b*x)*sin(b*x)/x^3,x)`

[Out] `int(Si(b*x)*sin(b*x)/x^3,x)`

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx) \sin(bx)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(b*x)*sin(b*x)/x^3,x, algorithm="maxima")`

[Out] `integrate(Si(b*x)*sin(b*x)/x^3, x)`

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\sin(bx) \text{Si}(bx)}{x^3}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(b*x)*sin(b*x)/x^3,x, algorithm="fricas")`

[Out] `integral(sin(b*x)*sin_integral(b*x)/x^3, x)`

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\sin(bx) \text{Si}(bx)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(b*x)*sin(b*x)/x**3,x)`

[Out] Integral(sin(b\*x)\*Si(b\*x)/x\*\*3, x)

---

**Giac [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx) \sin(bx)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x)\*sin(b\*x)/x^3,x, algorithm="giac")

[Out] integrate(Si(b\*x)\*sin(b\*x)/x^3, x)

$$3.40 \quad \int \frac{\sin(bx)\text{Si}(bx)}{x^2} dx$$

**Optimal.** Leaf size=48

$$b\text{CannotIntegrate}\left(\frac{\text{Si}(bx)\cos(bx)}{x}, x\right) + b\text{Si}(2bx) - \frac{\text{Si}(bx)\sin(bx)}{x} - \frac{\sin^2(bx)}{x}$$

[Out] b\*CannotIntegrate[(Cos[b\*x]\*SinIntegral[b\*x])/x, x] - Sin[b\*x]^2/x - (Sin[b\*x]\*SinIntegral[b\*x])/x + b\*SinIntegral[2\*b\*x]

**Rubi [A]** time = 0.151637, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\sin(bx)\text{Si}(bx)}{x^2} dx$$

Verification is Not applicable to the result.

[In] Int[(Sin[b\*x]\*SinIntegral[b\*x])/x^2, x]

[Out] -(Sin[b\*x]^2/x) - (Sin[b\*x]\*SinIntegral[b\*x])/x + b\*SinIntegral[2\*b\*x] + b\*Defer[Int] [(Cos[b\*x]\*SinIntegral[b\*x])/x, x]

Rubi steps

$$\begin{aligned} \int \frac{\sin(bx)\text{Si}(bx)}{x^2} dx &= -\frac{\sin(bx)\text{Si}(bx)}{x} + b \int \frac{\sin^2(bx)}{bx^2} dx + b \int \frac{\cos(bx)\text{Si}(bx)}{x} dx \\ &= -\frac{\sin(bx)\text{Si}(bx)}{x} + b \int \frac{\cos(bx)\text{Si}(bx)}{x} dx + \int \frac{\sin^2(bx)}{x^2} dx \\ &= -\frac{\sin^2(bx)}{x} - \frac{\sin(bx)\text{Si}(bx)}{x} + b \int \frac{\cos(bx)\text{Si}(bx)}{x} dx + (2b) \int \frac{\sin(2bx)}{2x} dx \\ &= -\frac{\sin^2(bx)}{x} - \frac{\sin(bx)\text{Si}(bx)}{x} + b \int \frac{\sin(2bx)}{x} dx + b \int \frac{\cos(bx)\text{Si}(bx)}{x} dx \\ &= -\frac{\sin^2(bx)}{x} - \frac{\sin(bx)\text{Si}(bx)}{x} + b\text{Si}(2bx) + b \int \frac{\cos(bx)\text{Si}(bx)}{x} dx \end{aligned}$$

**Mathematica [A]** time = 0.82105, size = 0, normalized size = 0.

$$\int \frac{\sin(bx)\text{Si}(bx)}{x^2} dx$$

Verification is Not applicable to the result.

[In] Integrate[(Sin[b\*x]\*SinIntegral[b\*x])/x^2,x]

[Out] Integrate[(Sin[b\*x]\*SinIntegral[b\*x])/x^2, x]

---

**Maple [A]** time = 0.057, size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx) \sin(bx)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Si(b\*x)\*sin(b\*x)/x^2,x)

[Out] int(Si(b\*x)\*sin(b\*x)/x^2,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx) \sin(bx)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x)\*sin(b\*x)/x^2,x, algorithm="maxima")

[Out] integrate(Si(b\*x)\*sin(b\*x)/x^2, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\sin(bx) \text{Si}(bx)}{x^2}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x)\*sin(b\*x)/x^2,x, algorithm="fricas")

[Out] `integral(sin(b*x)*sin_integral(b*x)/x^2, x)`

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\sin(bx) \operatorname{Si}(bx)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(b*x)*sin(b*x)/x**2,x)`

[Out] `Integral(sin(b*x)*Si(b*x)/x**2, x)`

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\operatorname{Si}(bx) \sin(bx)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(b*x)*sin(b*x)/x^2,x, algorithm="giac")`

[Out] `integrate(Si(b*x)*sin(b*x)/x^2, x)`

$$3.41 \quad \int \frac{\sin(bx)\text{Si}(bx)}{x} dx$$

**Optimal.** Leaf size=10

$$\frac{\text{Si}(bx)^2}{2}$$

[Out] SinIntegral[b\*x]^2/2

**Rubi [A]** time = 0.020708, antiderivative size = 10, normalized size of antiderivative = 1., number of steps used = 1, number of rules used = 1, integrand size = 12,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.083$ , Rules used = {6686}

$$\frac{\text{Si}(bx)^2}{2}$$

Antiderivative was successfully verified.

[In] Int[(Sin[b\*x]\*SinIntegral[b\*x])/x,x]

[Out] SinIntegral[b\*x]^2/2

**Rule 6686**

Int[(u\_)\*(y\_)^(m\_.), x\_Symbol] := With[{q = DerivativeDivides[y, u, x]}, Si  
mp[(q\*y^(m + 1))/(m + 1), x] /; !FalseQ[q]] /; FreeQ[m, x] && NeQ[m, -1]

**Rubi steps**

$$\int \frac{\sin(bx)\text{Si}(bx)}{x} dx = \frac{\text{Si}(bx)^2}{2}$$

**Mathematica [C]** time = 0.0142256, size = 26, normalized size = 2.6

$$\frac{\text{Si}(bx)^2 \sin(bx)}{2bx\text{sinc}(bx)}$$

Warning: Unable to verify antiderivative.



[In] Integrate[(Sin[b\*x]\*SinIntegral[b\*x])/x,x]

[Out] (Sin[b\*x]\*SinIntegral[b\*x]^2)/(2\*b\*x\*Sinc[b\*x])

**Maple [A]** time = 0.041, size = 9, normalized size = 0.9

$$\frac{(\text{Si}(bx))^2}{2}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Si(b\*x)\*sin(b\*x)/x,x)

[Out] 1/2\*Si(b\*x)^2

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx) \sin(bx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x)\*sin(b\*x)/x,x, algorithm="maxima")

[Out] integrate(Si(b\*x)\*sin(b\*x)/x, x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\sin(bx) \text{Si}(bx)}{x}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x)\*sin(b\*x)/x,x, algorithm="fricas")

[Out] integral(sin(b\*x)\*sin\_integral(b\*x)/x, x)

---

**Sympy [A]** time = 1.06016, size = 7, normalized size = 0.7

$$\frac{\text{Si}^2(bx)}{2}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x)\*sin(b\*x)/x,x)

[Out] Si(b\*x)\*\*2/2

---

**Giac [A]** time = 1.14573, size = 11, normalized size = 1.1

$$\frac{1}{2} \text{Si}(bx)^2$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x)\*sin(b\*x)/x,x, algorithm="giac")

[Out] 1/2\*sin\_integral(b\*x)^2

### 3.42 $\int \sin(bx)\mathbf{Si}(bx) dx$

Optimal. Leaf size=26

$$\frac{\mathbf{Si}(2bx)}{2b} - \frac{\mathbf{Si}(bx) \cos(bx)}{b}$$

[Out]  $-\left(\frac{\cos[bx] \text{SinIntegral}[bx]}{b}\right) + \frac{\text{SinIntegral}[2bx]}{2b}$

**Rubi [A]** time = 0.0461413, antiderivative size = 26, normalized size of antiderivative = 1., number of steps used = 5, number of rules used = 4, integrand size = 9,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.444$ , Rules used = {6511, 12, 4406, 3299}

$$\frac{\mathbf{Si}(2bx)}{2b} - \frac{\mathbf{Si}(bx) \cos(bx)}{b}$$

Antiderivative was successfully verified.

[In] `Int[Sin[b*x]*SinIntegral[b*x],x]`

[Out]  $-\left(\frac{\cos[bx] \text{SinIntegral}[bx]}{b}\right) + \frac{\text{SinIntegral}[2bx]}{2b}$

#### Rule 6511

`Int[Sin[(a_.) + (b_.)*(x_)]*SinIntegral[(c_.) + (d_.)*(x_)], x_Symbol] := -Simp[(Cos[a + b*x]*SinIntegral[c + d*x])/b, x] + Dist[d/b, Int[(Cos[a + b*x]*Sin[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]`

#### Rule 12

`Int[(a_)*(u_), x_Symbol] := Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b_.)*(v_) /; FreeQ[b, x]]`

#### Rule 4406

`Int[Cos[(a_.) + (b_.)*(x_)]^(p_.)*((c_.) + (d_.)*(x_))^(m_.)*Sin[(a_.) + (b_.)*(x_)]^(n_.), x_Symbol] := Int[ExpandTrigReduce[(c + d*x)^m, Sin[a + b*x]^(n)*Cos[a + b*x]^p, x], x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IGtQ[p, 0]`

#### Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[SinInte
gral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

### Rubi steps

$$\begin{aligned}
 \int \sin(bx)\text{Si}(bx) dx &= -\frac{\cos(bx)\text{Si}(bx)}{b} + \int \frac{\cos(bx)\sin(bx)}{bx} dx \\
 &= -\frac{\cos(bx)\text{Si}(bx)}{b} + \frac{\int \frac{\cos(bx)\sin(bx)}{x} dx}{b} \\
 &= -\frac{\cos(bx)\text{Si}(bx)}{b} + \frac{\int \frac{\sin(2bx)}{2x} dx}{b} \\
 &= -\frac{\cos(bx)\text{Si}(bx)}{b} + \frac{\int \frac{\sin(2bx)}{x} dx}{2b} \\
 &= -\frac{\cos(bx)\text{Si}(bx)}{b} + \frac{\text{Si}(2bx)}{2b}
 \end{aligned}$$

**Mathematica [A]** time = 0.0114716, size = 26, normalized size = 1.

$$\frac{\text{Si}(2bx)}{2b} - \frac{\text{Si}(bx)\cos(bx)}{b}$$

Antiderivative was successfully verified.

```
[In] Integrate[Sin[b*x]*SinIntegral[b*x],x]
```

```
[Out] -((Cos[b*x]*SinIntegral[b*x])/b) + SinIntegral[2*b*x]/(2*b)
```

**Maple [A]** time = 0.05, size = 23, normalized size = 0.9

$$\frac{1}{b} \left( -\cos(bx)\text{Si}(bx) + \frac{\text{Si}(2bx)}{2} \right)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(Si(b*x)*sin(b*x),x)
```

```
[Out] 1/b*(-cos(b*x)*Si(b*x)+1/2*Si(2*b*x))
```

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \operatorname{Si}(bx) \sin(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(b*x)*sin(b*x),x, algorithm="maxima")`

[Out] `integrate(Si(b*x)*sin(b*x), x)`

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(\sin(bx) \operatorname{Si}(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(b*x)*sin(b*x),x, algorithm="fricas")`

[Out] `integral(sin(b*x)*sin_integral(b*x), x)`

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \sin(bx) \operatorname{Si}(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Si(b*x)*sin(b*x),x)`

[Out] `Integral(sin(b*x)*Si(b*x), x)`

---

**Giac [C]** time = 1.22423, size = 55, normalized size = 2.12

$$-\frac{\cos(bx) \operatorname{Si}(bx)}{b} + \frac{\Im(\operatorname{Ci}(2bx)) - \Im(\operatorname{Ci}(-2bx)) + 2 \operatorname{Si}(2bx)}{4b}$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(b*x)*sin(b*x),x, algorithm="giac")
```

```
[Out] -cos(b*x)*sin_integral(b*x)/b + 1/4*(imag_part(cos_integral(2*b*x)) - imag_
part(cos_integral(-2*b*x)) + 2*sin_integral(2*b*x))/b
```

### 3.43 $\int x \sin(bx) \mathbf{Si}(bx) dx$

**Optimal.** Leaf size=61

$$\frac{\text{CosIntegral}(2bx)}{2b^2} + \frac{\text{Si}(bx) \sin(bx)}{b^2} - \frac{\log(x)}{2b^2} + \frac{\sin^2(bx)}{2b^2} - \frac{x \text{Si}(bx) \cos(bx)}{b}$$

[Out] CosIntegral[2\*b\*x]/(2\*b^2) - Log[x]/(2\*b^2) + Sin[b\*x]^2/(2\*b^2) - (x\*Cos[b\*x]\*SinIntegral[b\*x])/b + (Sin[b\*x]\*SinIntegral[b\*x])/b^2

**Rubi [A]** time = 0.0812445, antiderivative size = 61, normalized size of antiderivative = 1., number of steps used = 9, number of rules used = 7, integrand size = 10,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.7$ , Rules used = {6513, 12, 2564, 30, 6517, 3312, 3302}

$$\frac{\text{CosIntegral}(2bx)}{2b^2} + \frac{\text{Si}(bx) \sin(bx)}{b^2} - \frac{\log(x)}{2b^2} + \frac{\sin^2(bx)}{2b^2} - \frac{x \text{Si}(bx) \cos(bx)}{b}$$

Antiderivative was successfully verified.

[In] Int[x\*Sin[b\*x]\*SinIntegral[b\*x],x]

[Out] CosIntegral[2\*b\*x]/(2\*b^2) - Log[x]/(2\*b^2) + Sin[b\*x]^2/(2\*b^2) - (x\*Cos[b\*x]\*SinIntegral[b\*x])/b + (Sin[b\*x]\*SinIntegral[b\*x])/b^2

#### Rule 6513

Int[((e\_.) + (f\_.)\*(x\_))^(m\_.)\*Sin[(a\_.) + (b\_.)\*(x\_)]\*SinIntegral[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] :> -Simp[((e + f\*x)^m\*Cos[a + b\*x]\*SinIntegral[c + d\*x])/b, x] + (Dist[d/b, Int[((e + f\*x)^m\*Cos[a + b\*x]\*Sin[c + d\*x])/(c + d\*x), x], x] + Dist[(f\*m)/b, Int[(e + f\*x)^(m - 1)\*Cos[a + b\*x]\*SinIntegral[c + d\*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]

#### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] :> Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b\_)\*(v\_) /; FreeQ[b, x]]

#### Rule 2564

Int[cos[(e\_.) + (f\_.)\*(x\_)]^(n\_.)\*((a\_.)\*sin[(e\_.) + (f\_.)\*(x\_)]^(m\_.), x\_Symbol] :> Dist[1/(a\*f), Subst[Int[x^m\*(1 - x^2/a^2)^((n - 1)/2), x], x, a\*Sin[e + f\*x]], x] /; FreeQ[{a, e, f, m}, x] && IntegerQ[(n - 1)/2] && !(In

tegerQ[(m - 1)/2] && LtQ[0, m, n])

### Rule 30

Int[(x\_)^(m\_.), x\_Symbol] :> Simp[x^(m + 1)/(m + 1), x] /; FreeQ[m, x] && NeQ[m, -1]

### Rule 6517

Int[Cos[(a\_.) + (b\_.)\*(x\_)]\*SinIntegral[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] :> Simp[(Sin[a + b\*x]\*SinIntegral[c + d\*x])/b, x] - Dist[d/b, Int[(Sin[a + b\*x]\*SinIntegral[c + d\*x])/(c + d\*x), x], x] /; FreeQ[{a, b, c, d}, x]

### Rule 3312

Int[((c\_.) + (d\_.)\*(x\_))^(m\_)\*sin[(e\_.) + (f\_.)\*(x\_)]^(n\_), x\_Symbol] :> Int[ExpandTrigReduce[(c + d\*x)^m, Sin[e + f\*x]^n, x], x] /; FreeQ[{c, d, e, f, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))

### Rule 3302

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] :> Simp[CosIntegral[e - Pi/2 + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*(e - Pi/2) - c\*f, 0]

### Rubi steps

$$\begin{aligned}
 \int x \sin(bx) \text{Si}(bx) dx &= -\frac{x \cos(bx) \text{Si}(bx)}{b} + \frac{\int \cos(bx) \text{Si}(bx) dx}{b} + \int \frac{\cos(bx) \sin(bx)}{b} dx \\
 &= -\frac{x \cos(bx) \text{Si}(bx)}{b} + \frac{\sin(bx) \text{Si}(bx)}{b^2} + \frac{\int \cos(bx) \sin(bx) dx}{b} - \frac{\int \frac{\sin^2(bx)}{bx} dx}{b} \\
 &= -\frac{x \cos(bx) \text{Si}(bx)}{b} + \frac{\sin(bx) \text{Si}(bx)}{b^2} - \frac{\int \frac{\sin^2(bx)}{x} dx}{b^2} + \frac{\text{Subst}(\int x dx, x, \sin(bx))}{b^2} \\
 &= \frac{\sin^2(bx)}{2b^2} - \frac{x \cos(bx) \text{Si}(bx)}{b} + \frac{\sin(bx) \text{Si}(bx)}{b^2} - \frac{\int \left( \frac{1}{2x} - \frac{\cos(2bx)}{2x} \right) dx}{b^2} \\
 &= -\frac{\log(x)}{2b^2} + \frac{\sin^2(bx)}{2b^2} - \frac{x \cos(bx) \text{Si}(bx)}{b} + \frac{\sin(bx) \text{Si}(bx)}{b^2} + \frac{\int \frac{\cos(2bx)}{x} dx}{2b^2} \\
 &= \frac{\text{Ci}(2bx)}{2b^2} - \frac{\log(x)}{2b^2} + \frac{\sin^2(bx)}{2b^2} - \frac{x \cos(bx) \text{Si}(bx)}{b} + \frac{\sin(bx) \text{Si}(bx)}{b^2}
 \end{aligned}$$



**Mathematica [A]** time = 0.0789173, size = 44, normalized size = 0.72

$$\frac{-2\text{CosIntegral}(2bx) + 4\text{Si}(bx)(bx \cos(bx) - \sin(bx)) + \cos(2bx) + 2 \log(x)}{4b^2}$$

Antiderivative was successfully verified.

[In] Integrate[x\*Sin[b\*x]\*SinIntegral[b\*x],x]

[Out]  $-(\text{Cos}[2*b*x] - 2*\text{CosIntegral}[2*b*x] + 2*\text{Log}[x] + 4*(b*x*\text{Cos}[b*x] - \text{Sin}[b*x])*\text{SinIntegral}[b*x])/(4*b^2)$

**Maple [A]** time = 0.062, size = 58, normalized size = 1.

$$-\frac{x \cos(bx) \text{Si}(bx)}{b} + \frac{\text{Si}(bx) \sin(bx)}{b^2} - \frac{(\cos(bx))^2}{2b^2} - \frac{\ln(bx)}{2b^2} + \frac{\text{Ci}(2bx)}{2b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x\*Si(b\*x)\*sin(b\*x),x)

[Out]  $-x*\cos(b*x)*\text{Si}(b*x)/b+\text{Si}(b*x)*\sin(b*x)/b^2-1/2/b^2*\cos(b*x)^2-1/2/b^2*\ln(b*x)+1/2*\text{Ci}(2*b*x)/b^2$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x \text{Si}(bx) \sin(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Si(b\*x)\*sin(b\*x),x, algorithm="maxima")

[Out] integrate(x\*Si(b\*x)\*sin(b\*x), x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x \sin(bx) \text{Si}(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x*Si(b*x)*sin(b*x),x, algorithm="fricas")
```

```
[Out] integral(x*sin(b*x)*sin_integral(b*x), x)
```

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x \sin(bx) \operatorname{Si}(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x*Si(b*x)*sin(b*x),x)
```

```
[Out] Integral(x*sin(b*x)*Si(b*x), x)
```

**Giac [A]** time = 1.16351, size = 62, normalized size = 1.02

$$-\left(\frac{x \cos(bx)}{b} - \frac{\sin(bx)}{b^2}\right) \operatorname{Si}(bx) + \frac{\operatorname{Ci}(2bx) + \operatorname{Ci}(-2bx) - 2 \log(x)}{4b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x*Si(b*x)*sin(b*x),x, algorithm="giac")
```

```
[Out] -(x*cos(b*x)/b - sin(b*x)/b^2)*sin_integral(b*x) + 1/4*(cos_integral(2*b*x)
+ cos_integral(-2*b*x) - 2*log(x))/b^2
```

### 3.44 $\int x^2 \sin(bx) \mathbf{Si}(bx) dx$

**Optimal.** Leaf size=91

$$-\frac{\text{Si}(2bx)}{b^3} + \frac{2x\text{Si}(bx)\sin(bx)}{b^2} + \frac{2\text{Si}(bx)\cos(bx)}{b^3} - \frac{5x}{4b^2} + \frac{x\sin^2(bx)}{2b^2} + \frac{5\sin(bx)\cos(bx)}{4b^3} - \frac{x^2\text{Si}(bx)\cos(bx)}{b}$$

[Out]  $(-5*x)/(4*b^2) + (5*\text{Cos}[b*x]*\text{Sin}[b*x])/(4*b^3) + (x*\text{Sin}[b*x]^2)/(2*b^2) + (2*\text{Cos}[b*x]*\text{SinIntegral}[b*x])/b^3 - (x^2*\text{Cos}[b*x]*\text{SinIntegral}[b*x])/b + (2*x*\text{Sin}[b*x]*\text{SinIntegral}[b*x])/b^2 - \text{SinIntegral}[2*b*x]/b^3$

**Rubi [A]** time = 0.111096, antiderivative size = 91, normalized size of antiderivative = 1., number of steps used = 14, number of rules used = 9, integrand size = 12,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.75$ , Rules used = {6513, 12, 3443, 2635, 8, 6519, 6511, 4406, 3299}

$$-\frac{\text{Si}(2bx)}{b^3} + \frac{2x\text{Si}(bx)\sin(bx)}{b^2} + \frac{2\text{Si}(bx)\cos(bx)}{b^3} - \frac{5x}{4b^2} + \frac{x\sin^2(bx)}{2b^2} + \frac{5\sin(bx)\cos(bx)}{4b^3} - \frac{x^2\text{Si}(bx)\cos(bx)}{b}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[x^2*\text{Sin}[b*x]*\text{SinIntegral}[b*x], x]$

[Out]  $(-5*x)/(4*b^2) + (5*\text{Cos}[b*x]*\text{Sin}[b*x])/(4*b^3) + (x*\text{Sin}[b*x]^2)/(2*b^2) + (2*\text{Cos}[b*x]*\text{SinIntegral}[b*x])/b^3 - (x^2*\text{Cos}[b*x]*\text{SinIntegral}[b*x])/b + (2*x*\text{Sin}[b*x]*\text{SinIntegral}[b*x])/b^2 - \text{SinIntegral}[2*b*x]/b^3$

#### Rule 6513

$\text{Int}[(e_. + (f_.)*(x_.))^(m_.)*\text{Sin}[(a_.) + (b_.)*(x_.)]*\text{SinIntegral}[(c_.) + (d_.)*(x_.)], x\_Symbol] \rightarrow -\text{Simp}[(e + f*x)^m*\text{Cos}[a + b*x]*\text{SinIntegral}[c + d*x])/b, x] + (\text{Dist}[d/b, \text{Int}[(e + f*x)^m*\text{Cos}[a + b*x]*\text{Sin}[c + d*x]]/(c + d*x), x], x] + \text{Dist}[(f*m)/b, \text{Int}[(e + f*x)^(m-1)*\text{Cos}[a + b*x]*\text{SinIntegral}[c + d*x], x], x) /; \text{FreeQ}\{a, b, c, d, e, f\}, x] \&\& \text{IGtQ}[m, 0]$

#### Rule 12

$\text{Int}[(a_)*(u_), x\_Symbol] \rightarrow \text{Dist}[a, \text{Int}[u, x], x] /; \text{FreeQ}[a, x] \&\& !\text{MatchQ}[u, (b_)*(v_) /; \text{FreeQ}[b, x]]$

#### Rule 3443

$\text{Int}[\text{Cos}[(a_.) + (b_.)*(x_.)^(n_.)]*(x_.)^(m_.)*\text{Sin}[(a_.) + (b_.)*(x_.)^(n_.)]^(p_.), x\_Symbol] \rightarrow \text{Simp}[(x^(m-n+1)*\text{Sin}[a + b*x^n]^(p+1))/(b*n*(p+1))$

)), x] - Dist[(m - n + 1)/(b\*n\*(p + 1)), Int[x^(m - n)\*Sin[a + b\*x^n]^(p + 1), x], x] /; FreeQ[{a, b, p}, x] && LtQ[0, n, m + 1] && NeQ[p, -1]

### Rule 2635

Int[((b\_.)\*sin[(c\_.) + (d\_.)\*(x\_)]^(n\_), x\_Symbol] := -Simp[(b\*Cos[c + d\*x]\*(b\*SIN[c + d\*x])^(n - 1))/(d\*n), x] + Dist[(b^2\*(n - 1))/n, Int[(b\*SIN[c + d\*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1] && IntegerQ[2\*n]

### Rule 8

Int[a\_, x\_Symbol] := Simp[a\*x, x] /; FreeQ[a, x]

### Rule 6519

Int[Cos[(a\_.) + (b\_.)\*(x\_)]\*((e\_.) + (f\_.)\*(x\_))^(m\_.)\*SinIntegral[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] := Simp[((e + f\*x)^m\*SIN[a + b\*x]\*SinIntegral[c + d\*x])/b, x] + (-Dist[d/b, Int[((e + f\*x)^m\*SIN[a + b\*x]\*Sin[c + d\*x])/(c + d\*x), x], x] - Dist[(f\*m)/b, Int[(e + f\*x)^(m - 1)\*SIN[a + b\*x]\*SinIntegral[c + d\*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]

### Rule 6511

Int[SIN[(a\_.) + (b\_.)\*(x\_)]\*SinIntegral[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] := -Simp[(Cos[a + b\*x]\*SinIntegral[c + d\*x])/b, x] + Dist[d/b, Int[(Cos[a + b\*x]\*SIN[c + d\*x])/(c + d\*x), x], x] /; FreeQ[{a, b, c, d}, x]

### Rule 4406

Int[Cos[(a\_.) + (b\_.)\*(x\_)]^(p\_.)\*((c\_.) + (d\_.)\*(x\_))^(m\_.)\*SIN[(a\_.) + (b\_.)\*(x\_)]^(n\_.), x\_Symbol] := Int[ExpandTrigReduce[(c + d\*x)^m, SIN[a + b\*x]^n\*Cos[a + b\*x]^p, x], x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IGtQ[p, 0]

### Rule 3299

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] := Simp[SINIntegral[e + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*e - c\*f, 0]

### Rubi steps

$$\begin{aligned}
\int x^2 \sin(bx) \text{Si}(bx) dx &= -\frac{x^2 \cos(bx) \text{Si}(bx)}{b} + \frac{2 \int x \cos(bx) \text{Si}(bx) dx}{b} + \int \frac{x \cos(bx) \sin(bx)}{b} dx \\
&= -\frac{x^2 \cos(bx) \text{Si}(bx)}{b} + \frac{2x \sin(bx) \text{Si}(bx)}{b^2} - \frac{2 \int \sin(bx) \text{Si}(bx) dx}{b^2} + \frac{\int x \cos(bx) \sin(bx) dx}{b} - \frac{2 \int \cos(bx) \text{Si}(bx) dx}{b^2} \\
&= \frac{x \sin^2(bx)}{2b^2} + \frac{2 \cos(bx) \text{Si}(bx)}{b^3} - \frac{x^2 \cos(bx) \text{Si}(bx)}{b} + \frac{2x \sin(bx) \text{Si}(bx)}{b^2} - \frac{\int \sin^2(bx) dx}{2b^2} - \frac{2 \int \cos(bx) \text{Si}(bx) dx}{b^2} \\
&= \frac{5 \cos(bx) \sin(bx)}{4b^3} + \frac{x \sin^2(bx)}{2b^2} + \frac{2 \cos(bx) \text{Si}(bx)}{b^3} - \frac{x^2 \cos(bx) \text{Si}(bx)}{b} + \frac{2x \sin(bx) \text{Si}(bx)}{b^2} - \frac{2 \int \cos(bx) \text{Si}(bx) dx}{b^2} \\
&= -\frac{5x}{4b^2} + \frac{5 \cos(bx) \sin(bx)}{4b^3} + \frac{x \sin^2(bx)}{2b^2} + \frac{2 \cos(bx) \text{Si}(bx)}{b^3} - \frac{x^2 \cos(bx) \text{Si}(bx)}{b} + \frac{2x \sin(bx) \text{Si}(bx)}{b^2} \\
&= -\frac{5x}{4b^2} + \frac{5 \cos(bx) \sin(bx)}{4b^3} + \frac{x \sin^2(bx)}{2b^2} + \frac{2 \cos(bx) \text{Si}(bx)}{b^3} - \frac{x^2 \cos(bx) \text{Si}(bx)}{b} + \frac{2x \sin(bx) \text{Si}(bx)}{b^2} \\
&= -\frac{5x}{4b^2} + \frac{5 \cos(bx) \sin(bx)}{4b^3} + \frac{x \sin^2(bx)}{2b^2} + \frac{2 \cos(bx) \text{Si}(bx)}{b^3} - \frac{x^2 \cos(bx) \text{Si}(bx)}{b} + \frac{2x \sin(bx) \text{Si}(bx)}{b^2}
\end{aligned}$$

**Mathematica [A]** time = 0.103689, size = 64, normalized size = 0.7

$$-\frac{8\text{Si}(bx) \left( (b^2x^2 - 2) \cos(bx) - 2bx \sin(bx) \right) + 8\text{Si}(2bx) + 8bx - 5 \sin(2bx) + 2bx \cos(2bx)}{8b^3}$$

Antiderivative was successfully verified.

[In] Integrate[x^2\*Sin[b\*x]\*SinIntegral[b\*x],x]

[Out]  $-(8*b*x + 2*b*x*\text{Cos}[2*b*x] - 5*\text{Sin}[2*b*x] + 8*((-2 + b^2*x^2)*\text{Cos}[b*x] - 2*b*x*\text{Sin}[b*x])*\text{SinIntegral}[b*x] + 8*\text{SinIntegral}[2*b*x])/(8*b^3)$

**Maple [A]** time = 0.059, size = 69, normalized size = 0.8

$$\frac{1}{b^3} \left( \text{Si}(bx) \left( -b^2x^2 \cos(bx) + 2 \cos(bx) + 2 \sin(bx) bx \right) - \frac{bx (\cos(bx))^2}{2} + \frac{5 \sin(bx) \cos(bx)}{4} - \frac{3bx}{4} - \text{Si}(2bx) \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x^2\*Si(b\*x)\*sin(b\*x),x)

[Out]  $1/b^3*(\text{Si}(b*x)*(-b^2*x^2*\cos(b*x)+2*\cos(b*x)+2*\sin(b*x)*b*x)-1/2*b*x*\cos(b*x)^2+5/4*\sin(b*x)*\cos(b*x)-3/4*b*x-\text{Si}(2*b*x))$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \text{Si}(bx) \sin(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Si(b*x)*sin(b*x),x, algorithm="maxima")`

[Out] `integrate(x^2*Si(b*x)*sin(b*x), x)`

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^2 \sin(bx) \text{Si}(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Si(b*x)*sin(b*x),x, algorithm="fricas")`

[Out] `integral(x^2*sin(b*x)*sin_integral(b*x), x)`

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \sin(bx) \text{Si}(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x**2*Si(b*x)*sin(b*x),x)`

[Out] `Integral(x**2*sin(b*x)*Si(b*x), x)`

**Giac [C]** time = 1.16074, size = 89, normalized size = 0.98

$$\left( \frac{2x \sin(bx)}{b^2} - \frac{(b^2x^2 - 2) \cos(bx)}{b^3} \right) \text{Si}(bx) - \frac{2bx + \Im(\text{Ci}(2bx)) - \Im(\text{Ci}(-2bx)) + 2 \text{Si}(2bx)}{2b^3}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^2\*Si(b\*x)\*sin(b\*x),x, algorithm="giac")

[Out] (2\*x\*sin(b\*x)/b^2 - (b^2\*x^2 - 2)\*cos(b\*x)/b^3)\*sin\_integral(b\*x) - 1/2\*(2\*b\*x + imag\_part(cos\_integral(2\*b\*x)) - imag\_part(cos\_integral(-2\*b\*x)) + 2\*sin\_integral(2\*b\*x))/b^3

### 3.45 $\int x^3 \sin(bx) \mathbf{Si}(bx) dx$

**Optimal.** Leaf size=126

$$-\frac{3\text{CosIntegral}(2bx)}{b^4} + \frac{3x^2\text{Si}(bx)\sin(bx)}{b^2} - \frac{6\text{Si}(bx)\sin(bx)}{b^4} + \frac{6x\text{Si}(bx)\cos(bx)}{b^3} - \frac{x^2}{b^2} + \frac{x^2\sin^2(bx)}{2b^2} + \frac{3\log(x)}{b^4} - \frac{4\sin^2}{b^4}$$

[Out]  $-(x^2/b^2) - (3*\text{CosIntegral}[2*b*x])/b^4 + (3*\text{Log}[x])/b^4 + (2*x*\text{Cos}[b*x]*\text{Sin}[b*x])/b^3 - (4*\text{Sin}[b*x]^2)/b^4 + (x^2*\text{Sin}[b*x]^2)/(2*b^2) + (6*x*\text{Cos}[b*x]*\text{SinIntegral}[b*x])/b^3 - (x^3*\text{Cos}[b*x]*\text{SinIntegral}[b*x])/b - (6*\text{Sin}[b*x]*\text{SinIntegral}[b*x])/b^4 + (3*x^2*\text{Sin}[b*x]*\text{SinIntegral}[b*x])/b^2$

**Rubi [A]** time = 0.193518, antiderivative size = 126, normalized size of antiderivative = 1., number of steps used = 18, number of rules used = 10, integrand size = 12,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.833$ , Rules used = {6513, 12, 3443, 3310, 30, 6519, 2564, 6517, 3312, 3302}

$$-\frac{3\text{CosIntegral}(2bx)}{b^4} + \frac{3x^2\text{Si}(bx)\sin(bx)}{b^2} - \frac{6\text{Si}(bx)\sin(bx)}{b^4} + \frac{6x\text{Si}(bx)\cos(bx)}{b^3} - \frac{x^2}{b^2} + \frac{x^2\sin^2(bx)}{2b^2} + \frac{3\log(x)}{b^4} - \frac{4\sin^2}{b^4}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[x^3*\text{Sin}[b*x]*\text{SinIntegral}[b*x], x]$

[Out]  $-(x^2/b^2) - (3*\text{CosIntegral}[2*b*x])/b^4 + (3*\text{Log}[x])/b^4 + (2*x*\text{Cos}[b*x]*\text{Sin}[b*x])/b^3 - (4*\text{Sin}[b*x]^2)/b^4 + (x^2*\text{Sin}[b*x]^2)/(2*b^2) + (6*x*\text{Cos}[b*x]*\text{SinIntegral}[b*x])/b^3 - (x^3*\text{Cos}[b*x]*\text{SinIntegral}[b*x])/b - (6*\text{Sin}[b*x]*\text{SinIntegral}[b*x])/b^4 + (3*x^2*\text{Sin}[b*x]*\text{SinIntegral}[b*x])/b^2$

#### Rule 6513

$\text{Int}[(e_.) + (f_.)*(x_)^m_.)*\text{Sin}[(a_.) + (b_.)*(x_)]*\text{SinIntegral}[(c_.) + (d_.)*(x_)], x\_Symbol] \rightarrow -\text{Simp}[(e + f*x)^m*\text{Cos}[a + b*x]*\text{SinIntegral}[c + d*x])/b, x] + (\text{Dist}[d/b, \text{Int}[(e + f*x)^m*\text{Cos}[a + b*x]*\text{Sin}[c + d*x]]/(c + d*x), x], x] + \text{Dist}[(f*m)/b, \text{Int}[(e + f*x)^{m-1}*\text{Cos}[a + b*x]*\text{SinIntegral}[c + d*x], x], x) /; \text{FreeQ}\{a, b, c, d, e, f\}, x] \&\& \text{IGtQ}[m, 0]$

#### Rule 12

$\text{Int}[(a_)*(u_), x\_Symbol] \rightarrow \text{Dist}[a, \text{Int}[u, x], x] /; \text{FreeQ}[a, x] \&\& !\text{MatchQ}[u, (b_)*(v_)] /; \text{FreeQ}[b, x]$

#### Rule 3443



```
Int[Cos[(a_.) + (b_.)*(x_)^(n_.)]*(x_)^(m_.)*Sin[(a_.) + (b_.)*(x_)^(n_.)]^(p_.), x_Symbol] := Simp[(x^(m - n + 1)*Sin[a + b*x^n]^(p + 1))/(b*n*(p + 1)), x] - Dist[(m - n + 1)/(b*n*(p + 1)), Int[x^(m - n)*Sin[a + b*x^n]^(p + 1), x], x] /; FreeQ[{a, b, p}, x] && LtQ[0, n, m + 1] && NeQ[p, -1]
```

### Rule 3310

```
Int[((c_.) + (d_.)*(x_))*((b_.)*sin[(e_.) + (f_.)*(x_)])^(n_), x_Symbol] := Simp[(d*(b*Sine[e + f*x])^n)/(f^2*n^2), x] + (Dist[(b^2*(n - 1))/n, Int[(c + d*x)*(b*Sine[e + f*x])^(n - 2), x], x] - Simp[(b*(c + d*x)*Cos[e + f*x]*(b*Sine[e + f*x])^(n - 1))/(f*n), x]) /; FreeQ[{b, c, d, e, f}, x] && GtQ[n, 1]
```

### Rule 30

```
Int[(x_)^(m_.), x_Symbol] := Simp[x^(m + 1)/(m + 1), x] /; FreeQ[m, x] && NeQ[m, -1]
```

### Rule 6519

```
Int[Cos[(a_.) + (b_.)*(x_)]*((e_.) + (f_.)*(x_))^(m_.)*SinIntegral[(c_.) + (d_.)*(x_)], x_Symbol] := Simp[((e + f*x)^m*Sine[a + b*x]*SinIntegral[c + d*x])/b, x] + (-Dist[d/b, Int[((e + f*x)^m*Sine[a + b*x]*Sin[c + d*x])/(c + d*x), x], x] - Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*Sine[a + b*x]*SinIntegral[c + d*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]
```

### Rule 2564

```
Int[cos[(e_.) + (f_.)*(x_)]^(n_.)*((a_.)*sin[(e_.) + (f_.)*(x_)])^(m_.), x_Symbol] := Dist[1/(a*f), Subst[Int[x^m*(1 - x^2/a^2)^((n - 1)/2), x], x, a*Sine[e + f*x]], x] /; FreeQ[{a, e, f, m}, x] && IntegerQ[(n - 1)/2] && !(IntegerQ[(m - 1)/2] && LtQ[0, m, n])
```

### Rule 6517

```
Int[Cos[(a_.) + (b_.)*(x_)]*SinIntegral[(c_.) + (d_.)*(x_)], x_Symbol] := Simp[(Sine[a + b*x]*SinIntegral[c + d*x])/b, x] - Dist[d/b, Int[(Sine[a + b*x]*Sin[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

### Rule 3312

```
Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)]^(n_), x_Symbol] := Int[ExpandTrigReduce[(c + d*x)^m, Sine[e + f*x]^n, x], x] /; FreeQ[{c, d, e, f, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))
```

Rule 3302

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] := Simp[CosIntegral[e - Pi/2 + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*(e - Pi/2) - c\*f, 0]

Rubi steps

$$\begin{aligned}
 \int x^3 \sin(bx) \text{Si}(bx) dx &= -\frac{x^3 \cos(bx) \text{Si}(bx)}{b} + \frac{3 \int x^2 \cos(bx) \text{Si}(bx) dx}{b} + \int \frac{x^2 \cos(bx) \sin(bx)}{b} dx \\
 &= -\frac{x^3 \cos(bx) \text{Si}(bx)}{b} + \frac{3x^2 \sin(bx) \text{Si}(bx)}{b^2} - \frac{6 \int x \sin(bx) \text{Si}(bx) dx}{b^2} + \frac{\int x^2 \cos(bx) \sin(bx) dx}{b} - \frac{3 \int x \cos(bx) \text{Si}(bx) dx}{b^2} \\
 &= \frac{x^2 \sin^2(bx)}{2b^2} + \frac{6x \cos(bx) \text{Si}(bx)}{b^3} - \frac{x^3 \cos(bx) \text{Si}(bx)}{b} + \frac{3x^2 \sin(bx) \text{Si}(bx)}{b^2} - \frac{6 \int \cos(bx) \text{Si}(bx) dx}{b^3} \\
 &= \frac{2x \cos(bx) \sin(bx)}{b^3} - \frac{\sin^2(bx)}{b^4} + \frac{x^2 \sin^2(bx)}{2b^2} + \frac{6x \cos(bx) \text{Si}(bx)}{b^3} - \frac{x^3 \cos(bx) \text{Si}(bx)}{b} - \frac{6 \sin(bx)}{b^4} \\
 &= -\frac{x^2}{b^2} + \frac{2x \cos(bx) \sin(bx)}{b^3} - \frac{\sin^2(bx)}{b^4} + \frac{x^2 \sin^2(bx)}{2b^2} + \frac{6x \cos(bx) \text{Si}(bx)}{b^3} - \frac{x^3 \cos(bx) \text{Si}(bx)}{b} - \frac{6 \sin(bx)}{b^4} \\
 &= -\frac{x^2}{b^2} + \frac{2x \cos(bx) \sin(bx)}{b^3} - \frac{4 \sin^2(bx)}{b^4} + \frac{x^2 \sin^2(bx)}{2b^2} + \frac{6x \cos(bx) \text{Si}(bx)}{b^3} - \frac{x^3 \cos(bx) \text{Si}(bx)}{b} - \frac{6 \sin(bx)}{b^4} \\
 &= -\frac{x^2}{b^2} + \frac{3 \log(x)}{b^4} + \frac{2x \cos(bx) \sin(bx)}{b^3} - \frac{4 \sin^2(bx)}{b^4} + \frac{x^2 \sin^2(bx)}{2b^2} + \frac{6x \cos(bx) \text{Si}(bx)}{b^3} - \frac{x^3 \cos(bx) \text{Si}(bx)}{b} - \frac{6 \sin(bx)}{b^4} \\
 &= -\frac{x^2}{b^2} - \frac{3 \text{Ci}(2bx)}{b^4} + \frac{3 \log(x)}{b^4} + \frac{2x \cos(bx) \sin(bx)}{b^3} - \frac{4 \sin^2(bx)}{b^4} + \frac{x^2 \sin^2(bx)}{2b^2} + \frac{6x \cos(bx) \text{Si}(bx)}{b^3} - \frac{x^3 \cos(bx) \text{Si}(bx)}{b} - \frac{6 \sin(bx)}{b^4}
 \end{aligned}$$

**Mathematica [A]** time = 0.176824, size = 93, normalized size = 0.74

$$\frac{4 \text{Si}(bx) (bx (b^2 x^2 - 6) \cos(bx) - 3 (b^2 x^2 - 2) \sin(bx)) + 3b^2 x^2 + b^2 x^2 \cos(2bx) + 12 \text{CosIntegral}(2bx) - 4bx \sin(2bx) - 6 \sin(bx)}{4b^4}$$

Antiderivative was successfully verified.

[In] Integrate[x^3\*Sin[b\*x]\*SinIntegral[b\*x],x]

[Out] -(3\*b^2\*x^2 - 8\*Cos[2\*b\*x] + b^2\*x^2\*Cos[2\*b\*x] + 12\*CosIntegral[2\*b\*x] - 12\*Log[x] - 4\*b\*x\*Sin[2\*b\*x] + 4\*(b\*x\*(-6 + b^2\*x^2)\*Cos[b\*x] - 3\*(-2 + b^2\*x^2)\*Sin[b\*x]))\*SinIntegral[b\*x]/(4\*b^4)

---

**Maple [A]** time = 0.059, size = 138, normalized size = 1.1

$$-\frac{x^3 \cos(bx) \operatorname{Si}(bx)}{b} + 3 \frac{x^2 \operatorname{Si}(bx) \sin(bx)}{b^2} + 6 \frac{x \cos(bx) \operatorname{Si}(bx)}{b^3} - 6 \frac{\operatorname{Si}(bx) \sin(bx)}{b^4} - \frac{x^2 (\cos(bx))^2}{2b^2} + 2 \frac{x \cos(bx) \sin(bx)}{b^3}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(x^3*Si(b*x)*sin(b*x),x)`

[Out]  $-x^3 \cos(bx) \operatorname{Si}(bx) / b + 3x^2 \operatorname{Si}(bx) \sin(bx) / b^2 + 6x \cos(bx) \operatorname{Si}(bx) / b^3 - 6 \operatorname{Si}(bx) \sin(bx) / b^4 - 1/2 b^{-2} x^2 \cos(bx)^2 + 2x \cos(bx) \sin(bx) / b^3 - 1/2 x^2 / b^2 - \sin(bx)^2 / b^4 + 3 \cos(bx)^2 / b^4 + 3 / b^4 \ln(bx) - 3 \operatorname{Ci}(2bx) / b^4$

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^3 \operatorname{Si}(bx) \sin(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^3*Si(b*x)*sin(b*x),x, algorithm="maxima")`

[Out] `integrate(x^3*Si(b*x)*sin(b*x), x)`

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(x^3 \sin(bx) \operatorname{Si}(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^3*Si(b*x)*sin(b*x),x, algorithm="fricas")`

[Out] `integral(x^3*sin(b*x)*sin_integral(b*x), x)`

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x^3 \sin(bx) \operatorname{Si}(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*\*3\*Si(b\*x)\*sin(b\*x),x)

[Out] Integral(x\*\*3\*sin(b\*x)\*Si(b\*x), x)

**Giac [A]** time = 1.17674, size = 104, normalized size = 0.83

$$-\left(\frac{(b^3x^3 - 6bx)\cos(bx)}{b^4} - \frac{3(b^2x^2 - 2)\sin(bx)}{b^4}\right)\text{Si}(bx) - \frac{3(b^2x^2 + 2\text{Ci}(2bx) + 2\text{Ci}(-2bx) - 4\log(x))}{4b^4}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^3\*Si(b\*x)\*sin(b\*x),x, algorithm="giac")

[Out] -((b^3\*x^3 - 6\*b\*x)\*cos(b\*x)/b^4 - 3\*(b^2\*x^2 - 2)\*sin(b\*x)/b^4)\*sin\_integral(b\*x) - 3/4\*(b^2\*x^2 + 2\*cos\_integral(2\*b\*x) + 2\*cos\_integral(-2\*b\*x) - 4\*log(x))/b^4

$$3.46 \quad \int \frac{\cos(bx)\text{Si}(bx)}{x^3} dx$$

**Optimal.** Leaf size=102

$$-\frac{1}{2}b^2\text{CannotIntegrate}\left(\frac{\text{Si}(bx)\cos(bx)}{x}, x\right) - b^2\text{Si}(2bx) - \frac{\text{Si}(bx)\cos(bx)}{2x^2} + \frac{b\text{Si}(bx)\sin(bx)}{2x} - \frac{\sin(2bx)}{8x^2} + \frac{b\sin^2(bx)}{2x} -$$

[Out]  $-(b^2\text{CannotIntegrate}[(\text{Cos}[b*x]*\text{SinIntegral}[b*x])/x, x])/2 - (b*\text{Cos}[2*b*x])/(4*x) + (b*\text{Sin}[b*x]^2)/(2*x) - \text{Sin}[2*b*x]/(8*x^2) - (\text{Cos}[b*x]*\text{SinIntegral}[b*x])/(2*x^2) + (b*\text{Sin}[b*x]*\text{SinIntegral}[b*x])/(2*x) - b^2*\text{SinIntegral}[2*b*x]$

**Rubi [A]** time = 0.188222, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\cos(bx)\text{Si}(bx)}{x^3} dx$$

Verification is Not applicable to the result.

[In]  $\text{Int}[(\text{Cos}[b*x]*\text{SinIntegral}[b*x])/x^3, x]$

[Out]  $-(b*\text{Cos}[2*b*x])/(4*x) + (b*\text{Sin}[b*x]^2)/(2*x) - \text{Sin}[2*b*x]/(8*x^2) - (\text{Cos}[b*x]*\text{SinIntegral}[b*x])/(2*x^2) + (b*\text{Sin}[b*x]*\text{SinIntegral}[b*x])/(2*x) - b^2*\text{SinIntegral}[2*b*x] - (b^2*\text{Defer}[\text{Int}[(\text{Cos}[b*x]*\text{SinIntegral}[b*x])/x, x])/2$

Rubi steps

$$\begin{aligned}
\int \frac{\cos(bx)\text{Si}(bx)}{x^3} dx &= -\frac{\cos(bx)\text{Si}(bx)}{2x^2} + \frac{1}{2}b \int \frac{\cos(bx)\sin(bx)}{bx^3} dx - \frac{1}{2}b \int \frac{\sin(bx)\text{Si}(bx)}{x^2} dx \\
&= -\frac{\cos(bx)\text{Si}(bx)}{2x^2} + \frac{b \sin(bx)\text{Si}(bx)}{2x} + \frac{1}{2} \int \frac{\cos(bx)\sin(bx)}{x^3} dx - \frac{1}{2}b^2 \int \frac{\sin^2(bx)}{bx^2} dx - \frac{1}{2}b^2 \int \frac{\cos(bx)\text{Si}(bx)}{x} dx \\
&= -\frac{\cos(bx)\text{Si}(bx)}{2x^2} + \frac{b \sin(bx)\text{Si}(bx)}{2x} + \frac{1}{2} \int \frac{\sin(2bx)}{2x^3} dx - \frac{1}{2}b \int \frac{\sin^2(bx)}{x^2} dx - \frac{1}{2}b^2 \int \frac{\cos(bx)\text{Si}(bx)}{x} dx \\
&= \frac{b \sin^2(bx)}{2x} - \frac{\cos(bx)\text{Si}(bx)}{2x^2} + \frac{b \sin(bx)\text{Si}(bx)}{2x} + \frac{1}{4} \int \frac{\sin(2bx)}{x^3} dx - \frac{1}{2}b^2 \int \frac{\cos(bx)\text{Si}(bx)}{x} dx - b^2 \int \frac{\sin^2(bx)}{2x^2} dx \\
&= \frac{b \sin^2(bx)}{2x} - \frac{\sin(2bx)}{8x^2} - \frac{\cos(bx)\text{Si}(bx)}{2x^2} + \frac{b \sin(bx)\text{Si}(bx)}{2x} + \frac{1}{4}b \int \frac{\cos(2bx)}{x^2} dx - \frac{1}{2}b^2 \int \frac{\sin(2bx)}{x} dx \\
&= -\frac{b \cos(2bx)}{4x} + \frac{b \sin^2(bx)}{2x} - \frac{\sin(2bx)}{8x^2} - \frac{\cos(bx)\text{Si}(bx)}{2x^2} + \frac{b \sin(bx)\text{Si}(bx)}{2x} - \frac{1}{2}b^2 \text{Si}(2bx) - \frac{1}{2}b^2 \int \frac{\sin(2bx)}{x} dx \\
&= -\frac{b \cos(2bx)}{4x} + \frac{b \sin^2(bx)}{2x} - \frac{\sin(2bx)}{8x^2} - \frac{\cos(bx)\text{Si}(bx)}{2x^2} + \frac{b \sin(bx)\text{Si}(bx)}{2x} - b^2 \text{Si}(2bx) - \frac{1}{2}b^2 \int \frac{\sin(2bx)}{x} dx
\end{aligned}$$

**Mathematica [A]** time = 0.828828, size = 0, normalized size = 0.

$$\int \frac{\cos(bx)\text{Si}(bx)}{x^3} dx$$

Verification is Not applicable to the result.

[In] Integrate[(Cos[b\*x]\*SinIntegral[b\*x])/x^3,x]

[Out] Integrate[(Cos[b\*x]\*SinIntegral[b\*x])/x^3, x]

**Maple [A]** time = 0.084, size = 0, normalized size = 0.

$$\int \frac{\cos(bx)\text{Si}(bx)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(cos(b\*x)\*Si(b\*x)/x^3,x)

[Out] int(cos(b\*x)\*Si(b\*x)/x^3,x)

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx) \cos(bx)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(cos(b\*x)\*Si(b\*x)/x^3,x, algorithm="maxima")

[Out] integrate(Si(b\*x)\*cos(b\*x)/x^3, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\cos(bx) \text{Si}(bx)}{x^3}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(cos(b\*x)\*Si(b\*x)/x^3,x, algorithm="fricas")

[Out] integral(cos(b\*x)\*sin\_integral(b\*x)/x^3, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\cos(bx) \text{Si}(bx)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(cos(b\*x)\*Si(b\*x)/x\*\*3,x)

[Out] Integral(cos(b\*x)\*Si(b\*x)/x\*\*3, x)

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx) \cos(bx)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(cos(b*x)*Si(b*x)/x^3,x, algorithm="giac")
```

```
[Out] integrate(Si(b*x)*cos(b*x)/x^3, x)
```



$$3.47 \quad \int \frac{\cos(bx)\text{Si}(bx)}{x^2} dx$$

**Optimal.** Leaf size=44

$$b\text{CosIntegral}(2bx) - \frac{1}{2}b\text{Si}(bx)^2 - \frac{\text{Si}(bx)\cos(bx)}{x} - \frac{\sin(2bx)}{2x}$$

[Out] b\*CosIntegral[2\*b\*x] - Sin[2\*b\*x]/(2\*x) - (Cos[b\*x]\*SinIntegral[b\*x])/x - (b\*SinIntegral[b\*x]^2)/2

**Rubi [A]** time = 0.0946792, antiderivative size = 44, normalized size of antiderivative = 1., number of steps used = 7, number of rules used = 6, integrand size = 12,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.5$ , Rules used = {6521, 6686, 12, 4406, 3297, 3302}

$$b\text{CosIntegral}(2bx) - \frac{1}{2}b\text{Si}(bx)^2 - \frac{\text{Si}(bx)\cos(bx)}{x} - \frac{\sin(2bx)}{2x}$$

Antiderivative was successfully verified.

[In] Int[(Cos[b\*x]\*SinIntegral[b\*x])/x^2,x]

[Out] b\*CosIntegral[2\*b\*x] - Sin[2\*b\*x]/(2\*x) - (Cos[b\*x]\*SinIntegral[b\*x])/x - (b\*SinIntegral[b\*x]^2)/2

### Rule 6521

Int[Cos[(a\_.) + (b\_.)\*(x\_.)]\*((e\_.) + (f\_.)\*(x\_.))^(m\_.)\*SinIntegral[(c\_.) + (d\_.)\*(x\_.)], x\_Symbol] :> Simp[((e + f\*x)^(m + 1)\*Cos[a + b\*x]\*SinIntegral[c + d\*x])/(f\*(m + 1)), x] + (Dist[b/(f\*(m + 1)), Int[(e + f\*x)^(m + 1)\*Sin[a + b\*x]\*SinIntegral[c + d\*x], x], x] - Dist[d/(f\*(m + 1)), Int[((e + f\*x)^(m + 1)\*Cos[a + b\*x]\*Sin[c + d\*x])/(c + d\*x), x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && ILtQ[m, -1]

### Rule 6686

Int[(u\_)\*(y\_)^(m\_.), x\_Symbol] :> With[{q = DerivativeDivides[y, u, x]}, Simp[(q\*y^(m + 1))/(m + 1), x] /; !FalseQ[q]] /; FreeQ[m, x] && NeQ[m, -1]

### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] :> Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b\_)\*(v\_)] /; FreeQ[b, x]

Rule 4406

```
Int[Cos[(a_.) + (b_.)*(x_)]^(p_.)*((c_.) + (d_.)*(x_))^(m_.)*Sin[(a_.) + (b_.)*(x_)]^(n_.), x_Symbol] :> Int[ExpandTrigReduce[(c + d*x)^m, Sin[a + b*x]^n*Cos[a + b*x]^p, x], x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IGtQ[p, 0]
```

Rule 3297

```
Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)], x_Symbol] :> Simp[((c + d*x)^(m + 1)*Sin[e + f*x])/(d*(m + 1)), x] - Dist[f/(d*(m + 1)), Int[(c + d*x)^(m + 1)*Cos[e + f*x], x], x] /; FreeQ[{c, d, e, f}, x] && LtQ[m, -1]
```

Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] :> Simp[CosIntegral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) - c*f, 0]
```

Rubi steps

$$\begin{aligned}
\int \frac{\cos(bx)\text{Si}(bx)}{x^2} dx &= -\frac{\cos(bx)\text{Si}(bx)}{x} + b \int \frac{\cos(bx)\sin(bx)}{bx^2} dx - b \int \frac{\sin(bx)\text{Si}(bx)}{x} dx \\
&= -\frac{\cos(bx)\text{Si}(bx)}{x} - \frac{1}{2}b\text{Si}(bx)^2 + \int \frac{\cos(bx)\sin(bx)}{x^2} dx \\
&= -\frac{\cos(bx)\text{Si}(bx)}{x} - \frac{1}{2}b\text{Si}(bx)^2 + \int \frac{\sin(2bx)}{2x^2} dx \\
&= -\frac{\cos(bx)\text{Si}(bx)}{x} - \frac{1}{2}b\text{Si}(bx)^2 + \frac{1}{2} \int \frac{\sin(2bx)}{x^2} dx \\
&= -\frac{\sin(2bx)}{2x} - \frac{\cos(bx)\text{Si}(bx)}{x} - \frac{1}{2}b\text{Si}(bx)^2 + b \int \frac{\cos(2bx)}{x} dx \\
&= b\text{Ci}(2bx) - \frac{\sin(2bx)}{2x} - \frac{\cos(bx)\text{Si}(bx)}{x} - \frac{1}{2}b\text{Si}(bx)^2
\end{aligned}$$

**Mathematica [F]** time = 0.617386, size = 0, normalized size = 0.

$$\int \frac{\cos(bx)\text{Si}(bx)}{x^2} dx$$

Verification is Not applicable to the result.

```
[In] Integrate[(Cos[b*x]*SinIntegral[b*x])/x^2,x]
```

[Out] Integrate[(Cos[b\*x]\*SinIntegral[b\*x])/x^2, x]

---

**Maple [F]** time = 0.062, size = 0, normalized size = 0.

$$\int \frac{\cos(bx) \operatorname{Si}(bx)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(cos(b\*x)\*Si(b\*x)/x^2,x)

[Out] int(cos(b\*x)\*Si(b\*x)/x^2,x)

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\operatorname{Si}(bx) \cos(bx)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(cos(b\*x)\*Si(b\*x)/x^2,x, algorithm="maxima")

[Out] integrate(Si(b\*x)\*cos(b\*x)/x^2, x)

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}\left(\frac{\cos(bx) \operatorname{Si}(bx)}{x^2}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(cos(b\*x)\*Si(b\*x)/x^2,x, algorithm="fricas")

[Out] integral(cos(b\*x)\*sin\_integral(b\*x)/x^2, x)

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\cos(bx) \operatorname{Si}(bx)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(cos(b\*x)\*Si(b\*x)/x\*\*2,x)

[Out] Integral(cos(b\*x)\*Si(b\*x)/x\*\*2, x)

**Giac [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\operatorname{Si}(bx) \cos(bx)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(cos(b\*x)\*Si(b\*x)/x^2,x, algorithm="giac")

[Out] integrate(Si(b\*x)\*cos(b\*x)/x^2, x)

$$3.48 \quad \int \frac{\cos(bx)\text{Si}(bx)}{x} dx$$

**Optimal.** Leaf size=14

$$\text{CannotIntegrate}\left(\frac{\text{Si}(bx)\cos(bx)}{x}, x\right)$$

[Out] CannotIntegrate[(Cos[b\*x]\*SinIntegral[b\*x])/x, x]

**Rubi [A]** time = 0.0258647, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\cos(bx)\text{Si}(bx)}{x} dx$$

Verification is Not applicable to the result.

[In] Int[(Cos[b\*x]\*SinIntegral[b\*x])/x, x]

[Out] Defer[Int] [(Cos[b\*x]\*SinIntegral[b\*x])/x, x]

Rubi steps

$$\int \frac{\cos(bx)\text{Si}(bx)}{x} dx = \int \frac{\cos(bx)\text{Si}(bx)}{x} dx$$

**Mathematica [A]** time = 0.953999, size = 0, normalized size = 0.

$$\int \frac{\cos(bx)\text{Si}(bx)}{x} dx$$

Verification is Not applicable to the result.

[In] Integrate[(Cos[b\*x]\*SinIntegral[b\*x])/x, x]

[Out] Integrate[(Cos[b\*x]\*SinIntegral[b\*x])/x, x]

**Maple [A]** time = 0.056, size = 0, normalized size = 0.

$$\int \frac{\cos(bx) \operatorname{Si}(bx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(cos(b\*x)\*Si(b\*x)/x,x)

[Out] int(cos(b\*x)\*Si(b\*x)/x,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\operatorname{Si}(bx) \cos(bx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(cos(b\*x)\*Si(b\*x)/x,x, algorithm="maxima")

[Out] integrate(Si(b\*x)\*cos(b\*x)/x, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}\left(\frac{\cos(bx) \operatorname{Si}(bx)}{x}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(cos(b\*x)\*Si(b\*x)/x,x, algorithm="fricas")

[Out] integral(cos(b\*x)\*sin\_integral(b\*x)/x, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\cos(bx) \operatorname{Si}(bx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(cos(b*x)*Si(b*x)/x,x)
```

```
[Out] Integral(cos(b*x)*Si(b*x)/x, x)
```

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx) \cos(bx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(cos(b*x)*Si(b*x)/x,x, algorithm="giac")
```

```
[Out] integrate(Si(b*x)*cos(b*x)/x, x)
```

### 3.49 $\int \cos(bx) \text{Si}(bx) dx$

**Optimal.** Leaf size=34

$$\frac{\text{CosIntegral}(2bx)}{2b} + \frac{\text{Si}(bx) \sin(bx)}{b} - \frac{\log(x)}{2b}$$

[Out] CosIntegral[2\*b\*x]/(2\*b) - Log[x]/(2\*b) + (Sin[b\*x]\*SinIntegral[b\*x])/b

**Rubi [A]** time = 0.0577979, antiderivative size = 34, normalized size of antiderivative = 1., number of steps used = 5, number of rules used = 4, integrand size = 9,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.444$ , Rules used = {6517, 12, 3312, 3302}

$$\frac{\text{CosIntegral}(2bx)}{2b} + \frac{\text{Si}(bx) \sin(bx)}{b} - \frac{\log(x)}{2b}$$

Antiderivative was successfully verified.

[In] Int[Cos[b\*x]\*SinIntegral[b\*x],x]

[Out] CosIntegral[2\*b\*x]/(2\*b) - Log[x]/(2\*b) + (Sin[b\*x]\*SinIntegral[b\*x])/b

#### Rule 6517

Int[Cos[(a\_.) + (b\_.)\*(x\_)]\*SinIntegral[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] :> Simp[(Sin[a + b\*x]\*SinIntegral[c + d\*x])/b, x] - Dist[d/b, Int[(Sin[a + b\*x]\*Sin[c + d\*x])/(c + d\*x), x], x] /; FreeQ[{a, b, c, d}, x]

#### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] :> Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b\_)\*(v\_) /; FreeQ[b, x]]

#### Rule 3312

Int[((c\_.) + (d\_.)\*(x\_))^(m\_)\*sin[(e\_.) + (f\_.)\*(x\_)]^(n\_), x\_Symbol] :> Int[ExpandTrigReduce[(c + d\*x)^m, Sin[e + f\*x]^n, x], x] /; FreeQ[{c, d, e, f, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))

#### Rule 3302

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] :> Simp[CosIntegral[e - Pi/2 + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*(e - Pi/2) -



c\*f, 0]

### Rubi steps

$$\begin{aligned}
 \int \cos(bx)\text{Si}(bx) dx &= \frac{\sin(bx)\text{Si}(bx)}{b} - \int \frac{\sin^2(bx)}{bx} dx \\
 &= \frac{\sin(bx)\text{Si}(bx)}{b} - \frac{\int \frac{\sin^2(bx)}{x} dx}{b} \\
 &= \frac{\sin(bx)\text{Si}(bx)}{b} - \frac{\int \left(\frac{1}{2x} - \frac{\cos(2bx)}{2x}\right) dx}{b} \\
 &= -\frac{\log(x)}{2b} + \frac{\sin(bx)\text{Si}(bx)}{b} + \frac{\int \frac{\cos(2bx)}{x} dx}{2b} \\
 &= \frac{\text{Ci}(2bx)}{2b} - \frac{\log(x)}{2b} + \frac{\sin(bx)\text{Si}(bx)}{b}
 \end{aligned}$$

**Mathematica [A]** time = 0.0129354, size = 36, normalized size = 1.06

$$\frac{\text{CosIntegral}(2bx)}{2b} + \frac{\text{Si}(bx) \sin(bx)}{b} - \frac{\log(bx)}{2b}$$

Warning: Unable to verify antiderivative.

[In] Integrate[Cos[b\*x]\*SinIntegral[b\*x],x]

[Out] CosIntegral[2\*b\*x]/(2\*b) - Log[b\*x]/(2\*b) + (Sin[b\*x]\*SinIntegral[b\*x])/b

**Maple [A]** time = 0.053, size = 33, normalized size = 1.

$$\frac{\text{Si}(bx) \sin(bx)}{b} - \frac{\ln(bx)}{2b} + \frac{\text{Ci}(2bx)}{2b}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(cos(b\*x)\*Si(b\*x),x)

[Out] Si(b\*x)\*sin(b\*x)/b-1/2/b\*ln(b\*x)+1/2\*Ci(2\*b\*x)/b

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \operatorname{Si}(bx) \cos(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(cos(b*x)*Si(b*x),x, algorithm="maxima")`

[Out] `integrate(Si(b*x)*cos(b*x), x)`

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(\cos(bx) \operatorname{Si}(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(cos(b*x)*Si(b*x),x, algorithm="fricas")`

[Out] `integral(cos(b*x)*sin_integral(b*x), x)`

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \cos(bx) \operatorname{Si}(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(cos(b*x)*Si(b*x),x)`

[Out] `Integral(cos(b*x)*Si(b*x), x)`

---

**Giac [A]** time = 1.18222, size = 45, normalized size = 1.32

$$\frac{\sin(bx) \operatorname{Si}(bx)}{b} + \frac{\operatorname{Ci}(2bx) + \operatorname{Ci}(-2bx) - 2 \log(x)}{4b}$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(cos(b*x)*Si(b*x),x, algorithm="giac")
```

```
[Out] sin(b*x)*sin_integral(b*x)/b + 1/4*(cos_integral(2*b*x) + cos_integral(-2*b*x) - 2*log(x))/b
```

### 3.50 $\int x \cos(bx) \mathbf{Si}(bx) dx$

**Optimal.** Leaf size=61

$$-\frac{\text{Si}(2bx)}{2b^2} + \frac{\text{Si}(bx) \cos(bx)}{b^2} + \frac{\sin(bx) \cos(bx)}{2b^2} + \frac{x \text{Si}(bx) \sin(bx)}{b} - \frac{x}{2b}$$

[Out]  $-x/(2*b) + (\text{Cos}[b*x]*\text{Sin}[b*x])/(2*b^2) + (\text{Cos}[b*x]*\text{SinIntegral}[b*x])/b^2 + (x*\text{Sin}[b*x]*\text{SinIntegral}[b*x])/b - \text{SinIntegral}[2*b*x]/(2*b^2)$

**Rubi [A]** time = 0.0659373, antiderivative size = 61, normalized size of antiderivative = 1., number of steps used = 9, number of rules used = 7, integrand size = 10,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.7$ , Rules used = {6519, 12, 2635, 8, 6511, 4406, 3299}

$$-\frac{\text{Si}(2bx)}{2b^2} + \frac{\text{Si}(bx) \cos(bx)}{b^2} + \frac{\sin(bx) \cos(bx)}{2b^2} + \frac{x \text{Si}(bx) \sin(bx)}{b} - \frac{x}{2b}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[x*\text{Cos}[b*x]*\text{SinIntegral}[b*x], x]$

[Out]  $-x/(2*b) + (\text{Cos}[b*x]*\text{Sin}[b*x])/(2*b^2) + (\text{Cos}[b*x]*\text{SinIntegral}[b*x])/b^2 + (x*\text{Sin}[b*x]*\text{SinIntegral}[b*x])/b - \text{SinIntegral}[2*b*x]/(2*b^2)$

#### Rule 6519

```
Int[Cos[(a_.) + (b_.)*(x_)]*((e_.) + (f_.)*(x_))^(m_.)*SinIntegral[(c_.) + (d_.)*(x_)], x_Symbol] :> Simp[((e + f*x)^m*Sin[a + b*x]*SinIntegral[c + d*x])/b, x] + (-Dist[d/b, Int[((e + f*x)^m*Sin[a + b*x]*Sin[c + d*x])/(c + d*x), x], x] - Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*Sin[a + b*x]*SinIntegral[c + d*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]
```

#### Rule 12

```
Int[(a_)*(u_), x_Symbol] :> Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b_)*(v_)] /; FreeQ[b, x]
```

#### Rule 2635

```
Int[((b_.)*sin[(c_.) + (d_.)*(x_)]^(n_), x_Symbol] :> -Simp[(b*Cos[c + d*x] * (b*Sin[c + d*x])^(n - 1))/(d*n), x] + Dist[(b^2*(n - 1))/n, Int[(b*Sin[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1] && IntegerQ[2*n]
```

]

Rule 8

```
Int[a_, x_Symbol] := Simp[a*x, x] /; FreeQ[a, x]
```

Rule 6511

```
Int[Sin[(a_.) + (b_.)*(x_)]*SinIntegral[(c_.) + (d_.)*(x_)], x_Symbol] := -
Simp[(Cos[a + b*x]*SinIntegral[c + d*x])/b, x] + Dist[d/b, Int[(Cos[a + b*x]
]*Sin[c + d*x]/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

Rule 4406

```
Int[Cos[(a_.) + (b_.)*(x_)]^(p_.)*((c_.) + (d_.)*(x_))^(m_.)*Sin[(a_.) + (b
_.)*(x_)]^(n_.), x_Symbol] := Int[ExpandTrigReduce[(c + d*x)^m, Sin[a + b*x]
]^(n)*Cos[a + b*x]^p, x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IG
tQ[p, 0]
```

Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[SinInte
gral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

Rubi steps

$$\begin{aligned}
\int x \cos(bx) \operatorname{Si}(bx) dx &= \frac{x \sin(bx) \operatorname{Si}(bx)}{b} - \frac{\int \sin(bx) \operatorname{Si}(bx) dx}{b} - \int \frac{\sin^2(bx)}{b} dx \\
&= \frac{\cos(bx) \operatorname{Si}(bx)}{b^2} + \frac{x \sin(bx) \operatorname{Si}(bx)}{b} - \frac{\int \frac{\cos(bx) \sin(bx)}{bx} dx}{b} - \frac{\int \sin^2(bx) dx}{b} \\
&= \frac{\cos(bx) \sin(bx)}{2b^2} + \frac{\cos(bx) \operatorname{Si}(bx)}{b^2} + \frac{x \sin(bx) \operatorname{Si}(bx)}{b} - \frac{\int \frac{\cos(bx) \sin(bx)}{x} dx}{b^2} - \frac{\int 1 dx}{2b} \\
&= -\frac{x}{2b} + \frac{\cos(bx) \sin(bx)}{2b^2} + \frac{\cos(bx) \operatorname{Si}(bx)}{b^2} + \frac{x \sin(bx) \operatorname{Si}(bx)}{b} - \frac{\int \frac{\sin(2bx)}{2x} dx}{b^2} \\
&= -\frac{x}{2b} + \frac{\cos(bx) \sin(bx)}{2b^2} + \frac{\cos(bx) \operatorname{Si}(bx)}{b^2} + \frac{x \sin(bx) \operatorname{Si}(bx)}{b} - \frac{\int \frac{\sin(2bx)}{x} dx}{2b^2} \\
&= -\frac{x}{2b} + \frac{\cos(bx) \sin(bx)}{2b^2} + \frac{\cos(bx) \operatorname{Si}(bx)}{b^2} + \frac{x \sin(bx) \operatorname{Si}(bx)}{b} - \frac{\operatorname{Si}(2bx)}{2b^2}
\end{aligned}$$

**Mathematica [A]** time = 0.0492865, size = 42, normalized size = 0.69

$$\frac{-2\text{Si}(2bx) + 4\text{Si}(bx)(bx \sin(bx) + \cos(bx)) - 2bx + \sin(2bx)}{4b^2}$$

Antiderivative was successfully verified.

[In] Integrate[x\*Cos[b\*x]\*SinIntegral[b\*x],x]

[Out] (-2\*b\*x + Sin[2\*b\*x] + 4\*(Cos[b\*x] + b\*x\*Sin[b\*x])\*SinIntegral[b\*x] - 2\*SinIntegral[2\*b\*x])/(4\*b^2)

**Maple [A]** time = 0.056, size = 44, normalized size = 0.7

$$\frac{1}{b^2} \left( \text{Si}(bx) (\sin(bx) bx + \cos(bx)) + \frac{\sin(bx) \cos(bx)}{2} - \frac{bx}{2} - \frac{\text{Si}(2bx)}{2} \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x\*cos(b\*x)\*Si(b\*x),x)

[Out] 1/b^2\*(Si(b\*x)\*(sin(b\*x)\*b\*x+cos(b\*x))+1/2\*sin(b\*x)\*cos(b\*x)-1/2\*b\*x-1/2\*Si(2\*b\*x))

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x \text{Si}(bx) \cos(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*cos(b\*x)\*Si(b\*x),x, algorithm="maxima")

[Out] integrate(x\*Si(b\*x)\*cos(b\*x), x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x \cos(bx) \text{Si}(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x*cos(b*x)*Si(b*x),x, algorithm="fricas")
```

```
[Out] integral(x*cos(b*x)*sin_integral(b*x), x)
```

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x \cos(bx) \operatorname{Si}(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x*cos(b*x)*Si(b*x),x)
```

```
[Out] Integral(x*cos(b*x)*Si(b*x), x)
```

**Giac [C]** time = 1.1768, size = 74, normalized size = 1.21

$$\left( \frac{x \sin(bx)}{b} + \frac{\cos(bx)}{b^2} \right) \operatorname{Si}(bx) - \frac{2bx + \Im(\operatorname{Ci}(2bx)) - \Im(\operatorname{Ci}(-2bx)) + 2 \operatorname{Si}(2bx)}{4b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x*cos(b*x)*Si(b*x),x, algorithm="giac")
```

```
[Out] (x*sin(b*x)/b + cos(b*x)/b^2)*sin_integral(b*x) - 1/4*(2*b*x + imag_part(cos_integral(2*b*x)) - imag_part(cos_integral(-2*b*x)) + 2*sin_integral(2*b*x))/b^2
```

### 3.51 $\int x^2 \cos(bx) \text{Si}(bx) dx$

**Optimal.** Leaf size=98

$$-\frac{\text{CosIntegral}(2bx)}{b^3} - \frac{2\text{Si}(bx) \sin(bx)}{b^3} + \frac{2x\text{Si}(bx) \cos(bx)}{b^2} + \frac{\log(x)}{b^3} - \frac{5 \sin^2(bx)}{4b^3} + \frac{x \sin(bx) \cos(bx)}{2b^2} + \frac{x^2 \text{Si}(bx) \sin(bx)}{b}$$

[Out]  $-x^2/(4*b) - \text{CosIntegral}[2*b*x]/b^3 + \text{Log}[x]/b^3 + (x*\text{Cos}[b*x]*\text{Sin}[b*x])/(2*b^2) - (5*\text{Sin}[b*x]^2)/(4*b^3) + (2*x*\text{Cos}[b*x]*\text{SinIntegral}[b*x])/b^2 - (2*\text{Sin}[b*x]*\text{SinIntegral}[b*x])/b^3 + (x^2*\text{Sin}[b*x]*\text{SinIntegral}[b*x])/b$

**Rubi [A]** time = 0.122718, antiderivative size = 98, normalized size of antiderivative = 1., number of steps used = 13, number of rules used = 9, integrand size = 12,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.75$ , Rules used = {6519, 12, 3310, 30, 6513, 2564, 6517, 3312, 3302}

$$-\frac{\text{CosIntegral}(2bx)}{b^3} - \frac{2\text{Si}(bx) \sin(bx)}{b^3} + \frac{2x\text{Si}(bx) \cos(bx)}{b^2} + \frac{\log(x)}{b^3} - \frac{5 \sin^2(bx)}{4b^3} + \frac{x \sin(bx) \cos(bx)}{2b^2} + \frac{x^2 \text{Si}(bx) \sin(bx)}{b}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[x^2*\text{Cos}[b*x]*\text{SinIntegral}[b*x], x]$

[Out]  $-x^2/(4*b) - \text{CosIntegral}[2*b*x]/b^3 + \text{Log}[x]/b^3 + (x*\text{Cos}[b*x]*\text{Sin}[b*x])/(2*b^2) - (5*\text{Sin}[b*x]^2)/(4*b^3) + (2*x*\text{Cos}[b*x]*\text{SinIntegral}[b*x])/b^2 - (2*\text{Sin}[b*x]*\text{SinIntegral}[b*x])/b^3 + (x^2*\text{Sin}[b*x]*\text{SinIntegral}[b*x])/b$

#### Rule 6519

$\text{Int}[\text{Cos}[(a_.) + (b_.)*(x_.)]*((e_.) + (f_.)*(x_.))^{(m_.)*\text{SinIntegral}[(c_.) + (d_.)*(x_.)]}, x\_Symbol] \rightarrow \text{Simp}[(e + f*x)^m*\text{Sin}[a + b*x]*\text{SinIntegral}[c + d*x])/b, x] + (-\text{Dist}[d/b, \text{Int}[(e + f*x)^m*\text{Sin}[a + b*x]*\text{Sin}[c + d*x]]/(c + d*x), x], x) - \text{Dist}[(f*m)/b, \text{Int}[(e + f*x)^{(m-1)}*\text{Sin}[a + b*x]*\text{SinIntegral}[c + d*x], x], x) /; \text{FreeQ}\{a, b, c, d, e, f\}, x] \&\& \text{IGtQ}[m, 0]$

#### Rule 12

$\text{Int}[(a_)*(u_), x\_Symbol] \rightarrow \text{Dist}[a, \text{Int}[u, x], x] /; \text{FreeQ}[a, x] \&\& \text{!MatchQ}[u, (b_)*(v_)] /; \text{FreeQ}[b, x]$

#### Rule 3310

$\text{Int}[(c_.) + (d_.)*(x_.)]*((b_.)*\text{sin}[(e_.) + (f_.)*(x_.)])^{(n_.)}, x\_Symbol] \rightarrow \text{Simp}[(d*(b*\text{Sin}[e + f*x])^n)/(f^2*n^2), x] + (\text{Dist}[(b^2*(n-1))/n, \text{Int}[(c$



```
+ d*x)*(b*SIN[e + f*x])^(n - 2), x], x] - Simp[(b*(c + d*x)*Cos[e + f*x]*(b
*SIN[e + f*x])^(n - 1))/(f*n), x] /; FreeQ[{b, c, d, e, f}, x] && GtQ[n, 1
]
```

### Rule 30

```
Int[(x_)^(m_), x_Symbol] := Simp[x^(m + 1)/(m + 1), x] /; FreeQ[m, x] && N
eQ[m, -1]
```

### Rule 6513

```
Int[((e_) + (f_)*(x_))^(m_)*Sin[(a_) + (b_)*(x_)]*SinIntegral[(c_) +
(d_)*(x_)], x_Symbol] := -Simp[((e + f*x)^m*cos[a + b*x]*SinIntegral[c + d
*x])/b, x] + (Dist[d/b, Int[((e + f*x)^m*cos[a + b*x]*Sin[c + d*x])/(c + d*
x), x], x] + Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*Cos[a + b*x]*SinIntegral[c
+ d*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]
```

### Rule 2564

```
Int[cos[(e_) + (f_)*(x_)]^(n_)*((a_)*sin[(e_) + (f_)*(x_)]^(m_), x_
Symbol] := Dist[1/(a*f), Subst[Int[x^m*(1 - x^2/a^2)^((n - 1)/2), x], x, a*
Sin[e + f*x]], x] /; FreeQ[{a, e, f, m}, x] && IntegerQ[(n - 1)/2] && !(In
tegerQ[(m - 1)/2] && LtQ[0, m, n])
```

### Rule 6517

```
Int[Cos[(a_) + (b_)*(x_)]*SinIntegral[(c_) + (d_)*(x_)], x_Symbol] := S
imp[(Sin[a + b*x]*SinIntegral[c + d*x])/b, x] - Dist[d/b, Int[(Sin[a + b*x]
*Sin[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

### Rule 3312

```
Int[((c_) + (d_)*(x_))^(m_)*sin[(e_) + (f_)*(x_)]^(n_), x_Symbol] := In
t[ExpandTrigReduce[(c + d*x)^m, Sin[e + f*x]^n, x], x] /; FreeQ[{c, d, e, f
, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))
```

### Rule 3302

```
Int[sin[(e_) + (f_)*(x_)]/((c_) + (d_)*(x_)), x_Symbol] := Simp[CosInte
gral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) -
c*f, 0]
```

### Rubi steps

$$\begin{aligned}
\int x^2 \cos(bx) \text{Si}(bx) dx &= \frac{x^2 \sin(bx) \text{Si}(bx)}{b} - \frac{2 \int x \sin(bx) \text{Si}(bx) dx}{b} - \int \frac{x \sin^2(bx)}{b} dx \\
&= \frac{2x \cos(bx) \text{Si}(bx)}{b^2} + \frac{x^2 \sin(bx) \text{Si}(bx)}{b} - \frac{2 \int \cos(bx) \text{Si}(bx) dx}{b^2} - \frac{\int x \sin^2(bx) dx}{b} - \frac{2 \int \frac{\cos(bx) \sin(bx)}{b}}{b} \\
&= \frac{x \cos(bx) \sin(bx)}{2b^2} - \frac{\sin^2(bx)}{4b^3} + \frac{2x \cos(bx) \text{Si}(bx)}{b^2} - \frac{2 \sin(bx) \text{Si}(bx)}{b^3} + \frac{x^2 \sin(bx) \text{Si}(bx)}{b} - \frac{2 \int \cos(bx) \text{Si}(bx) dx}{b} \\
&= -\frac{x^2}{4b} + \frac{x \cos(bx) \sin(bx)}{2b^2} - \frac{\sin^2(bx)}{4b^3} + \frac{2x \cos(bx) \text{Si}(bx)}{b^2} - \frac{2 \sin(bx) \text{Si}(bx)}{b^3} + \frac{x^2 \sin(bx) \text{Si}(bx)}{b} + \dots \\
&= -\frac{x^2}{4b} + \frac{x \cos(bx) \sin(bx)}{2b^2} - \frac{5 \sin^2(bx)}{4b^3} + \frac{2x \cos(bx) \text{Si}(bx)}{b^2} - \frac{2 \sin(bx) \text{Si}(bx)}{b^3} + \frac{x^2 \sin(bx) \text{Si}(bx)}{b} + \dots \\
&= -\frac{x^2}{4b} + \frac{\log(x)}{b^3} + \frac{x \cos(bx) \sin(bx)}{2b^2} - \frac{5 \sin^2(bx)}{4b^3} + \frac{2x \cos(bx) \text{Si}(bx)}{b^2} - \frac{2 \sin(bx) \text{Si}(bx)}{b^3} + \frac{x^2 \sin(bx) \text{Si}(bx)}{b} + \dots \\
&= -\frac{x^2}{4b} - \frac{\text{Ci}(2bx)}{b^3} + \frac{\log(x)}{b^3} + \frac{x \cos(bx) \sin(bx)}{2b^2} - \frac{5 \sin^2(bx)}{4b^3} + \frac{2x \cos(bx) \text{Si}(bx)}{b^2} - \frac{2 \sin(bx) \text{Si}(bx)}{b^3} + \dots
\end{aligned}$$

**Mathematica [A]** time = 0.0967561, size = 72, normalized size = 0.73

$$\frac{8\text{Si}(bx) \left( (b^2 x^2 - 2) \sin(bx) + 2bx \cos(bx) \right) - 2b^2 x^2 - 8\text{CosIntegral}(2bx) + 2bx \sin(2bx) + 5 \cos(2bx) + 8 \log(x)}{8b^3}$$

Antiderivative was successfully verified.

[In] Integrate[x^2\*cos[b\*x]\*SinIntegral[b\*x],x]

[Out] (-2\*b^2\*x^2 + 5\*Cos[2\*b\*x] - 8\*CosIntegral[2\*b\*x] + 8\*Log[x] + 2\*b\*x\*Sin[2\*b\*x] + 8\*(2\*b\*x\*Cos[b\*x] + (-2 + b^2\*x^2)\*Sin[b\*x])\*SinIntegral[b\*x])/(8\*b^3)

**Maple [A]** time = 0.065, size = 105, normalized size = 1.1

$$\frac{x^2 \text{Si}(bx) \sin(bx)}{b} + 2 \frac{x \cos(bx) \text{Si}(bx)}{b^2} - 2 \frac{\text{Si}(bx) \sin(bx)}{b^3} + \frac{x \cos(bx) \sin(bx)}{2b^2} - \frac{x^2}{4b} - \frac{(\sin(bx))^2}{4b^3} + \frac{\ln(bx)}{b^3} - \frac{\text{Ci}(2bx)}{b^3}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x^2\*cos(b\*x)\*Si(b\*x),x)

```
[Out] x^2*Si(b*x)*sin(b*x)/b+2*x*cos(b*x)*Si(b*x)/b^2-2*Si(b*x)*sin(b*x)/b^3+1/2*
x*cos(b*x)*sin(b*x)/b^2-1/4*x^2/b-1/4*sin(b*x)^2/b^3+1/b^3*ln(b*x)-Ci(2*b*x
)/b^3+cos(b*x)^2/b^3
```

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \text{Si}(bx) \cos(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x^2*cos(b*x)*Si(b*x),x, algorithm="maxima")
```

```
[Out] integrate(x^2*Si(b*x)*cos(b*x), x)
```

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^2 \cos(bx) \text{Si}(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x^2*cos(b*x)*Si(b*x),x, algorithm="fricas")
```

```
[Out] integral(x^2*cos(b*x)*sin_integral(b*x), x)
```

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \cos(bx) \text{Si}(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x**2*cos(b*x)*Si(b*x),x)
```

```
[Out] Integral(x**2*cos(b*x)*Si(b*x), x)
```

**Giac [A]** time = 1.17171, size = 88, normalized size = 0.9

$$\left( \frac{2x \cos(bx)}{b^2} + \frac{(b^2x^2 - 2) \sin(bx)}{b^3} \right) \text{Si}(bx) - \frac{b^2x^2 + 2 \text{Ci}(2bx) + 2 \text{Ci}(-2bx) - 4 \log(x)}{4b^3}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^2\*cos(b\*x)\*Si(b\*x),x, algorithm="giac")

[Out] (2\*x\*cos(b\*x)/b^2 + (b^2\*x^2 - 2)\*sin(b\*x)/b^3)\*sin\_integral(b\*x) - 1/4\*(b^2\*x^2 + 2\*cos\_integral(2\*b\*x) + 2\*cos\_integral(-2\*b\*x) - 4\*log(x))/b^3

### 3.52 $\int x^3 \cos(bx) \mathbf{Si}(bx) dx$

**Optimal.** Leaf size=128

$$\frac{3x^2 \mathbf{Si}(bx) \cos(bx)}{b^2} + \frac{3 \mathbf{Si}(2bx)}{b^4} - \frac{6x \mathbf{Si}(bx) \sin(bx)}{b^3} - \frac{6 \mathbf{Si}(bx) \cos(bx)}{b^4} + \frac{x^2 \sin(bx) \cos(bx)}{2b^2} + \frac{4x}{b^3} - \frac{2x \sin^2(bx)}{b^3} - \frac{4 \sin(bx)}{b^3}$$

[Out] (4\*x)/b^3 - x^3/(6\*b) - (4\*Cos[b\*x]\*Sin[b\*x])/b^4 + (x^2\*Cos[b\*x]\*Sin[b\*x])/(2\*b^2) - (2\*x\*Sin[b\*x]^2)/b^3 - (6\*Cos[b\*x]\*SinIntegral[b\*x])/b^4 + (3\*x^2\*Cos[b\*x]\*SinIntegral[b\*x])/b^2 - (6\*x\*Sin[b\*x]\*SinIntegral[b\*x])/b^3 + (x^3\*Sin[b\*x]\*SinIntegral[b\*x])/b + (3\*SinIntegral[2\*b\*x])/b^4

**Rubi [A]** time = 0.179184, antiderivative size = 128, normalized size of antiderivative = 1., number of steps used = 20, number of rules used = 11, integrand size = 12,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.917$ , Rules used = {6519, 12, 3311, 30, 2635, 8, 6513, 3443, 6511, 4406, 3299}

$$\frac{3x^2 \mathbf{Si}(bx) \cos(bx)}{b^2} + \frac{3 \mathbf{Si}(2bx)}{b^4} - \frac{6x \mathbf{Si}(bx) \sin(bx)}{b^3} - \frac{6 \mathbf{Si}(bx) \cos(bx)}{b^4} + \frac{x^2 \sin(bx) \cos(bx)}{2b^2} + \frac{4x}{b^3} - \frac{2x \sin^2(bx)}{b^3} - \frac{4 \sin(bx)}{b^3}$$

Antiderivative was successfully verified.

[In] Int[x^3\*Cos[b\*x]\*SinIntegral[b\*x],x]

[Out] (4\*x)/b^3 - x^3/(6\*b) - (4\*Cos[b\*x]\*Sin[b\*x])/b^4 + (x^2\*Cos[b\*x]\*Sin[b\*x])/(2\*b^2) - (2\*x\*Sin[b\*x]^2)/b^3 - (6\*Cos[b\*x]\*SinIntegral[b\*x])/b^4 + (3\*x^2\*Cos[b\*x]\*SinIntegral[b\*x])/b^2 - (6\*x\*Sin[b\*x]\*SinIntegral[b\*x])/b^3 + (x^3\*Sin[b\*x]\*SinIntegral[b\*x])/b + (3\*SinIntegral[2\*b\*x])/b^4

#### Rule 6519

Int[Cos[(a\_.) + (b\_.)\*(x\_.)]\*((e\_.) + (f\_.)\*(x\_.))^(m\_.)\*SinIntegral[(c\_.) + (d\_.)\*(x\_.)], x\_Symbol] :> Simp[((e + f\*x)^m\*Sin[a + b\*x]\*SinIntegral[c + d\*x])/b, x] + (-Dist[d/b, Int[((e + f\*x)^m\*Sin[a + b\*x]\*Sin[c + d\*x])/(c + d\*x), x], x] - Dist[(f\*m)/b, Int[(e + f\*x)^(m - 1)\*Sin[a + b\*x]\*SinIntegral[c + d\*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]

#### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] :> Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b\_)\*(v\_) /; FreeQ[b, x]]

#### Rule 3311

```
Int[((c_.) + (d_.)*(x_))^(m_)*((b_.)*sin[(e_.) + (f_.)*(x_)])^(n_), x_Symbol]
:> Simp[(d*m*(c + d*x)^(m - 1)*(b*Sine[e + f*x])^n)/(f^2*n^2), x] + (Dist
[(b^2*(n - 1))/n, Int[(c + d*x)^(m - 1)*(b*Sine[e + f*x])^(n - 2), x], x] - Dist
[d^2*m*(m - 1)/(f^2*n^2), Int[(c + d*x)^(m - 2)*(b*Sine[e + f*x])^n, x], x]
- Simp[(b*(c + d*x)^m*Cos[e + f*x]*(b*Sine[e + f*x])^(n - 1))/(f*n), x]) /;
FreeQ[{b, c, d, e, f}, x] && GtQ[n, 1] && GtQ[m, 1]
```

### Rule 30

```
Int[(x_)^(m_.), x_Symbol] :> Simp[x^(m + 1)/(m + 1), x] /; FreeQ[m, x] && NeQ[m, -1]
```

### Rule 2635

```
Int[((b_.)*sin[(c_.) + (d_.)*(x_)])^(n_), x_Symbol] :> -Simp[(b*Cos[c + d*x]
*(b*Sine[c + d*x])^(n - 1))/(d*n), x] + Dist[(b^2*(n - 1))/n, Int[(b*Sine[c
+ d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1] && IntegerQ[2*n]
```

### Rule 8

```
Int[a_, x_Symbol] :> Simp[a*x, x] /; FreeQ[a, x]
```

### Rule 6513

```
Int[((e_.) + (f_.)*(x_))^(m_.)*Sin[(a_.) + (b_.)*(x_)]*SinIntegral[(c_.) +
(d_.)*(x_)], x_Symbol] :> -Simp[((e + f*x)^m*Cos[a + b*x]*SinIntegral[c + d
*x])/b, x] + (Dist[d/b, Int[((e + f*x)^m*Cos[a + b*x]*Sin[c + d*x])/(c + d
*x), x], x] + Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*Cos[a + b*x]*SinIntegral[c
+ d*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]
```

### Rule 3443

```
Int[Cos[(a_.) + (b_.)*(x_)^(n_.)]*(x_)^(m_.)*Sin[(a_.) + (b_.)*(x_)^(n_.)]^(
p_.), x_Symbol] :> Simp[(x^(m - n + 1)*Sin[a + b*x^n]^(p + 1))/(b*n*(p + 1
)), x] - Dist[(m - n + 1)/(b*n*(p + 1)), Int[x^(m - n)*Sin[a + b*x^n]^(p +
1), x], x] /; FreeQ[{a, b, p}, x] && LtQ[0, n, m + 1] && NeQ[p, -1]
```

### Rule 6511

```
Int[Sin[(a_.) + (b_.)*(x_)]*SinIntegral[(c_.) + (d_.)*(x_)], x_Symbol] :> -
Simp[(Cos[a + b*x]*SinIntegral[c + d*x])/b, x] + Dist[d/b, Int[(Cos[a + b*x]
]*Sin[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

Rule 4406

```
Int[Cos[(a_.) + (b_.)*(x_)]^(p_.)*((c_.) + (d_.)*(x_))^(m_.)*Sin[(a_.) + (b_.)*(x_)]^(n_.), x_Symbol] :> Int[ExpandTrigReduce[(c + d*x)^m, Sin[a + b*x]]^n*Cos[a + b*x]^p, x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IGtQ[p, 0]
```

Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] :> Simp[SinIntegral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

Rubi steps

$$\begin{aligned}
\int x^3 \cos(bx) \operatorname{Si}(bx) dx &= \frac{x^3 \sin(bx) \operatorname{Si}(bx)}{b} - \frac{3 \int x^2 \sin(bx) \operatorname{Si}(bx) dx}{b} - \int \frac{x^2 \sin^2(bx)}{b} dx \\
&= \frac{3x^2 \cos(bx) \operatorname{Si}(bx)}{b^2} + \frac{x^3 \sin(bx) \operatorname{Si}(bx)}{b} - \frac{6 \int x \cos(bx) \operatorname{Si}(bx) dx}{b^2} - \frac{\int x^2 \sin^2(bx) dx}{b} - \frac{3 \int \frac{x \cos(bx)}{b} dx}{b} \\
&= \frac{x^2 \cos(bx) \sin(bx)}{2b^2} - \frac{x \sin^2(bx)}{2b^3} + \frac{3x^2 \cos(bx) \operatorname{Si}(bx)}{b^2} - \frac{6x \sin(bx) \operatorname{Si}(bx)}{b^3} + \frac{x^3 \sin(bx) \operatorname{Si}(bx)}{b} + \frac{x^2 \cos(bx)}{2b} \\
&= -\frac{x^3}{6b} - \frac{\cos(bx) \sin(bx)}{4b^4} + \frac{x^2 \cos(bx) \sin(bx)}{2b^2} - \frac{2x \sin^2(bx)}{b^3} - \frac{6 \cos(bx) \operatorname{Si}(bx)}{b^4} + \frac{3x^2 \cos(bx) \operatorname{Si}(bx)}{b^2} \\
&= \frac{x}{4b^3} - \frac{x^3}{6b} - \frac{4 \cos(bx) \sin(bx)}{b^4} + \frac{x^2 \cos(bx) \sin(bx)}{2b^2} - \frac{2x \sin^2(bx)}{b^3} - \frac{6 \cos(bx) \operatorname{Si}(bx)}{b^4} + \frac{3x^2 \cos(bx) \operatorname{Si}(bx)}{b^2} \\
&= \frac{4x}{b^3} - \frac{x^3}{6b} - \frac{4 \cos(bx) \sin(bx)}{b^4} + \frac{x^2 \cos(bx) \sin(bx)}{2b^2} - \frac{2x \sin^2(bx)}{b^3} - \frac{6 \cos(bx) \operatorname{Si}(bx)}{b^4} + \frac{3x^2 \cos(bx) \operatorname{Si}(bx)}{b^2} \\
&= \frac{4x}{b^3} - \frac{x^3}{6b} - \frac{4 \cos(bx) \sin(bx)}{b^4} + \frac{x^2 \cos(bx) \sin(bx)}{2b^2} - \frac{2x \sin^2(bx)}{b^3} - \frac{6 \cos(bx) \operatorname{Si}(bx)}{b^4} + \frac{3x^2 \cos(bx) \operatorname{Si}(bx)}{b^2}
\end{aligned}$$

**Mathematica [A]** time = 0.104526, size = 94, normalized size = 0.73

$$\frac{12 \operatorname{Si}(bx) (bx (b^2 x^2 - 6) \sin(bx) + 3 (b^2 x^2 - 2) \cos(bx)) - 2b^3 x^3 + 3b^2 x^2 \sin(2bx) + 36 \operatorname{Si}(2bx) + 36bx - 24 \sin(2bx) + 12}{12b^4}$$

Antiderivative was successfully verified.

```
[In] Integrate[x^3*Cos[b*x]*SinIntegral[b*x], x]
```

[Out]  $(36bx - 2b^3x^3 + 12bx\cos[2bx] - 24\sin[2bx] + 3b^2x^2\sin[2bx] + 12(3(-2 + b^2x^2)\cos[bx] + bx(-6 + b^2x^2)\sin[bx])\sin\text{Integral}[bx] + 36\sin\text{Integral}[2bx]) / (12b^4)$

**Maple [A]** time = 0.078, size = 111, normalized size = 0.9

$\frac{1}{b^4} \left( \text{Si}(bx) (\sin(bx)b^3x^3 + 3b^2x^2\cos(bx) - 6\cos(bx) - 6\sin(bx)bx) - b^2x^2 \left( -\frac{\sin(bx)\cos(bx)}{2} + \frac{bx}{2} \right) + 2bx(\cos(bx)) \right)$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(x^3*cos(b*x)*Si(b*x), x)`

[Out]  $1/b^4 * (\text{Si}(b*x) * (\sin(b*x) * b^3 * x^3 + 3 * b^2 * x^2 * \cos(b*x) - 6 * \cos(b*x) - 6 * \sin(b*x) * b * x) - b^2 * x^2 * (-1/2 * \sin(b*x) * \cos(b*x) + 1/2 * b * x) + 2 * b * x * \cos(b*x)^2 - 4 * \sin(b*x) * \cos(b*x) + 2 * b * x + 1/3 * x^3 * b^3 + 3 * \text{Si}(2 * b * x))$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^3 \text{Si}(bx) \cos(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^3*cos(b*x)*Si(b*x), x, algorithm="maxima")`

[Out] `integrate(x^3*Si(b*x)*cos(b*x), x)`

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^3 \cos(bx) \text{Si}(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^3*cos(b*x)*Si(b*x), x, algorithm="fricas")`

[Out] `integral(x^3*cos(b*x)*sin_integral(b*x), x)`



---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x^3 \cos(bx) \operatorname{Si}(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x**3*cos(b*x)*Si(b*x),x)`

[Out] `Integral(x**3*cos(b*x)*Si(b*x), x)`

---

**Giac [C]** time = 1.19029, size = 115, normalized size = 0.9

$$\left( \frac{3(b^2x^2 - 2)\cos(bx)}{b^4} + \frac{(b^3x^3 - 6bx)\sin(bx)}{b^4} \right) \operatorname{Si}(bx) - \frac{b^3x^3 - 18bx - 9\Im(\operatorname{Ci}(2bx)) + 9\Im(\operatorname{Ci}(-2bx)) - 18\operatorname{Si}(2bx)}{6b^4}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^3*cos(b*x)*Si(b*x),x, algorithm="giac")`

[Out] `(3*(b^2*x^2 - 2)*cos(b*x)/b^4 + (b^3*x^3 - 6*b*x)*sin(b*x)/b^4)*sin_integrals(b*x) - 1/6*(b^3*x^3 - 18*b*x - 9*imag_part(cos_integral(2*b*x)) + 9*imag_part(cos_integral(-2*b*x)) - 18*sin_integral(2*b*x))/b^4`

### 3.53 $\int \sin(5x)\text{Si}(2x) dx$

**Optimal.** Leaf size=29

$$-\frac{\text{Si}(3x)}{10} + \frac{\text{Si}(7x)}{10} - \frac{1}{5}\text{Si}(2x)\cos(5x)$$

[Out]  $-(\text{Cos}[5*x]*\text{SinIntegral}[2*x])/5 - \text{SinIntegral}[3*x]/10 + \text{SinIntegral}[7*x]/10$

**Rubi [A]** time = 0.0550338, antiderivative size = 29, normalized size of antiderivative = 1., number of steps used = 6, number of rules used = 4, integrand size = 9,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.444$ , Rules used = {6511, 12, 4430, 3299}

$$-\frac{\text{Si}(3x)}{10} + \frac{\text{Si}(7x)}{10} - \frac{1}{5}\text{Si}(2x)\cos(5x)$$

Antiderivative was successfully verified.

[In]  $\text{Int}[\text{Sin}[5*x]*\text{SinIntegral}[2*x], x]$

[Out]  $-(\text{Cos}[5*x]*\text{SinIntegral}[2*x])/5 - \text{SinIntegral}[3*x]/10 + \text{SinIntegral}[7*x]/10$

#### Rule 6511

```
Int[Sin[(a_.) + (b_.)*(x_)]*SinIntegral[(c_.) + (d_.)*(x_)], x_Symbol] :> -
Simp[(Cos[a + b*x]*SinIntegral[c + d*x])/b, x] + Dist[d/b, Int[(Cos[a + b*x]
]*Sin[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

#### Rule 12

```
Int[(a_)*(u_), x_Symbol] :> Dist[a, Int[u, x], x] /; FreeQ[a, x] && !Match
Q[u, (b_)*(v_)] /; FreeQ[b, x]
```

#### Rule 4430

```
Int[Cos[(c_.) + (d_.)*(x_)]^(q_.)*((e_.) + (f_.)*(x_))^(m_.)*Sin[(a_.) + (b
_.)*(x_)]^(p_.), x_Symbol] :> Int[ExpandTrigReduce[(e + f*x)^m, Sin[a + b*x]
]^(p)*Cos[c + d*x]^q, x], x] /; FreeQ[{a, b, c, d, e, f, m}, x] && IGtQ[p, 0]
&& IGtQ[q, 0]
```

#### Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_.)]/((c_.) + (d_.)*(x_.)), x_Symbol] := Simp[SinInte
gral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

### Rubi steps

$$\begin{aligned}
 \int \sin(5x)\text{Si}(2x) dx &= -\frac{1}{5} \cos(5x)\text{Si}(2x) + \frac{2}{5} \int \frac{\cos(5x) \sin(2x)}{2x} dx \\
 &= -\frac{1}{5} \cos(5x)\text{Si}(2x) + \frac{1}{5} \int \frac{\cos(5x) \sin(2x)}{x} dx \\
 &= -\frac{1}{5} \cos(5x)\text{Si}(2x) + \frac{1}{5} \int \left( -\frac{\sin(3x)}{2x} + \frac{\sin(7x)}{2x} \right) dx \\
 &= -\frac{1}{5} \cos(5x)\text{Si}(2x) - \frac{1}{10} \int \frac{\sin(3x)}{x} dx + \frac{1}{10} \int \frac{\sin(7x)}{x} dx \\
 &= -\frac{1}{5} \cos(5x)\text{Si}(2x) - \frac{\text{Si}(3x)}{10} + \frac{\text{Si}(7x)}{10}
 \end{aligned}$$

**Mathematica [A]** time = 0.0260674, size = 25, normalized size = 0.86

$$\frac{1}{10}(-\text{Si}(3x) + \text{Si}(7x) - 2\text{Si}(2x) \cos(5x))$$

Antiderivative was successfully verified.

```
[In] Integrate[Sin[5*x]*SinIntegral[2*x],x]
```

```
[Out] (-2*Cos[5*x]*SinIntegral[2*x] - SinIntegral[3*x] + SinIntegral[7*x])/10
```

**Maple [A]** time = 0.124, size = 24, normalized size = 0.8

$$-\frac{\cos(5x) \text{Si}(2x)}{5} - \frac{\text{Si}(3x)}{10} + \frac{\text{Si}(7x)}{10}$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(Si(2*x)*sin(5*x),x)
```

```
[Out] -1/5*cos(5*x)*Si(2*x)-1/10*Si(3*x)+1/10*Si(7*x)
```

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \operatorname{Si}(2x) \sin(5x) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(2\*x)\*sin(5\*x),x, algorithm="maxima")

[Out] integrate(Si(2\*x)\*sin(5\*x), x)

---

**Fricas [F(-2)]** time = 0., size = 0, normalized size = 0.

Exception raised: UnboundLocalError

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(2\*x)\*sin(5\*x),x, algorithm="fricas")

[Out] Exception raised: UnboundLocalError

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \sin(5x) \operatorname{Si}(2x) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(2\*x)\*sin(5\*x),x)

[Out] Integral(sin(5\*x)\*Si(2\*x), x)

---

**Giac [A]** time = 1.20063, size = 31, normalized size = 1.07

$$-\frac{1}{5} \cos(5x) \operatorname{Si}(2x) + \frac{1}{10} \operatorname{Si}(7x) - \frac{1}{10} \operatorname{Si}(3x)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(2*x)*sin(5*x),x, algorithm="giac")
```

```
[Out] -1/5*cos(5*x)*sin_integral(2*x) + 1/10*sin_integral(7*x) - 1/10*sin_integra  
l(3*x)
```

### 3.54 $\int \cos(5x)\mathbf{Si}(2x) dx$

**Optimal.** Leaf size=29

$$-\frac{1}{10}\text{CosIntegral}(3x) + \frac{1}{10}\text{CosIntegral}(7x) + \frac{1}{5}\text{Si}(2x)\sin(5x)$$

[Out]  $-\text{CosIntegral}[3*x]/10 + \text{CosIntegral}[7*x]/10 + (\text{Sin}[5*x]*\text{SinIntegral}[2*x])/5$

**Rubi [A]** time = 0.0556862, antiderivative size = 29, normalized size of antiderivative = 1., number of steps used = 6, number of rules used = 4, integrand size = 9,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.444$ , Rules used = {6517, 12, 4428, 3302}

$$-\frac{1}{10}\text{CosIntegral}(3x) + \frac{1}{10}\text{CosIntegral}(7x) + \frac{1}{5}\text{Si}(2x)\sin(5x)$$

Antiderivative was successfully verified.

[In]  $\text{Int}[\text{Cos}[5*x]*\text{SinIntegral}[2*x], x]$

[Out]  $-\text{CosIntegral}[3*x]/10 + \text{CosIntegral}[7*x]/10 + (\text{Sin}[5*x]*\text{SinIntegral}[2*x])/5$

#### Rule 6517

$\text{Int}[\text{Cos}[(a_.) + (b_.)*(x_.)]*\text{SinIntegral}[(c_.) + (d_.)*(x_.)], x\_Symbol] \text{ :> S imp}[(\text{Sin}[a + b*x]*\text{SinIntegral}[c + d*x])/b, x] - \text{Dist}[d/b, \text{Int}[(\text{Sin}[a + b*x]*\text{Sin}[c + d*x])/(c + d*x), x], x] \text{ /; FreeQ}\{a, b, c, d\}, x]$

#### Rule 12

$\text{Int}[(a_)*(u_), x\_Symbol] \text{ :> Dist}[a, \text{Int}[u, x], x] \text{ /; FreeQ}[a, x] \ \&\& \ !\text{Match} Q[u, (b_)*(v_) \text{ /; FreeQ}[b, x]]]$

#### Rule 4428

$\text{Int}[((e_.) + (f_.)*(x_.))^{(m_.)}*\text{Sin}[(a_.) + (b_.)*(x_.)]^{(p_.)}*\text{Sin}[(c_.) + (d_.)*(x_.)]^{(q_.)}, x\_Symbol] \text{ :> Int}[\text{ExpandTrigReduce}[(e + f*x)^m, \text{Sin}[a + b*x]^{p*}\text{Sin}[c + d*x]^q, x], x] \text{ /; FreeQ}\{a, b, c, d, e, f\}, x] \ \&\& \ \text{IGtQ}[p, 0] \ \&\& \ \text{IGtQ}[q, 0] \ \&\& \ \text{IntegerQ}[m]$

#### Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[CosIntegral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) - c*f, 0]
```

### Rubi steps

$$\begin{aligned}
 \int \cos(5x)\text{Si}(2x) dx &= \frac{1}{5} \sin(5x)\text{Si}(2x) - \frac{2}{5} \int \frac{\sin(2x) \sin(5x)}{2x} dx \\
 &= \frac{1}{5} \sin(5x)\text{Si}(2x) - \frac{1}{5} \int \frac{\sin(2x) \sin(5x)}{x} dx \\
 &= \frac{1}{5} \sin(5x)\text{Si}(2x) - \frac{1}{5} \int \left( \frac{\cos(3x)}{2x} - \frac{\cos(7x)}{2x} \right) dx \\
 &= \frac{1}{5} \sin(5x)\text{Si}(2x) - \frac{1}{10} \int \frac{\cos(3x)}{x} dx + \frac{1}{10} \int \frac{\cos(7x)}{x} dx \\
 &= -\frac{\text{Ci}(3x)}{10} + \frac{\text{Ci}(7x)}{10} + \frac{1}{5} \sin(5x)\text{Si}(2x)
 \end{aligned}$$

**Mathematica [A]** time = 0.0258747, size = 25, normalized size = 0.86

$$\frac{1}{10}(-\text{CosIntegral}(3x) + \text{CosIntegral}(7x) + 2\text{Si}(2x) \sin(5x))$$

Antiderivative was successfully verified.

```
[In] Integrate[Cos[5*x]*SinIntegral[2*x], x]
```

```
[Out] (-CosIntegral[3*x] + CosIntegral[7*x] + 2*Sin[5*x]*SinIntegral[2*x])/10
```

**Maple [A]** time = 0.131, size = 24, normalized size = 0.8

$$-\frac{\text{Ci}(3x)}{10} + \frac{\text{Ci}(7x)}{10} + \frac{\text{Si}(2x) \sin(5x)}{5}$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(cos(5*x)*Si(2*x), x)
```

```
[Out] -1/10*Ci(3*x)+1/10*Ci(7*x)+1/5*Si(2*x)*sin(5*x)
```

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \operatorname{Si}(2x) \cos(5x) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(cos(5\*x)\*Si(2\*x),x, algorithm="maxima")

[Out] integrate(Si(2\*x)\*cos(5\*x), x)

---

**Fricas [F(-2)]** time = 0., size = 0, normalized size = 0.

Exception raised: UnboundLocalError

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(cos(5\*x)\*Si(2\*x),x, algorithm="fricas")

[Out] Exception raised: UnboundLocalError

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \cos(5x) \operatorname{Si}(2x) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(cos(5\*x)\*Si(2\*x),x)

[Out] Integral(cos(5\*x)\*Si(2\*x), x)

---

**Giac [A]** time = 1.18164, size = 31, normalized size = 1.07

$$\frac{1}{5} \sin(5x) \operatorname{Si}(2x) + \frac{1}{10} \operatorname{Ci}(7x) - \frac{1}{10} \operatorname{Ci}(3x)$$



Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(cos(5*x)*Si(2*x),x, algorithm="giac")
```

```
[Out] 1/5*sin(5*x)*sin_integral(2*x) + 1/10*cos_integral(7*x) - 1/10*cos_integral(3*x)
```

### 3.55 $\int x^2 \sin(a + bx) \mathbf{Si}(a + bx) dx$

**Optimal.** Leaf size=187

$$\frac{a^2 \text{Si}(2a + 2bx)}{2b^3} - \frac{a \text{CosIntegral}(2a + 2bx)}{b^3} - \frac{\text{Si}(2a + 2bx)}{b^3} + \frac{2x \text{Si}(a + bx) \sin(a + bx)}{b^2} + \frac{2 \text{Si}(a + bx) \cos(a + bx)}{b^3} + \frac{a \log}{b^3}$$

[Out]  $-(x/b^2) + (a \text{Cos}[2a + 2b*x])/(4*b^3) - (x \text{Cos}[2a + 2b*x])/(4*b^2) - (a \text{CosIntegral}[2a + 2b*x])/b^3 + (a \text{Log}[a + b*x])/b^3 + (\text{Cos}[a + b*x] \text{Sin}[a + b*x])/b^3 + \text{Sin}[2a + 2b*x]/(8*b^3) + (2 \text{Cos}[a + b*x] \text{SinIntegral}[a + b*x])/b^3 - (x^2 \text{Cos}[a + b*x] \text{SinIntegral}[a + b*x])/b + (2*x \text{Sin}[a + b*x] \text{SinIntegral}[a + b*x])/b^2 - \text{SinIntegral}[2a + 2b*x]/b^3 + (a^2 \text{SinIntegral}[2a + 2b*x])/(2*b^3)$

**Rubi [A]** time = 0.708193, antiderivative size = 187, normalized size of antiderivative = 1., number of steps used = 21, number of rules used = 16, integrand size = 16,  $\frac{\text{number of rules}}{\text{integrand size}} = 1.$ , Rules used = {6513, 4573, 6741, 6742, 2638, 3296, 2637, 3299, 6519, 2635, 8, 3312, 3302, 6511, 4406, 12}

$$\frac{a^2 \text{Si}(2a + 2bx)}{2b^3} - \frac{a \text{CosIntegral}(2a + 2bx)}{b^3} - \frac{\text{Si}(2a + 2bx)}{b^3} + \frac{2x \text{Si}(a + bx) \sin(a + bx)}{b^2} + \frac{2 \text{Si}(a + bx) \cos(a + bx)}{b^3} + \frac{a \log}{b^3}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[x^2 \text{Sin}[a + b*x] \text{SinIntegral}[a + b*x], x]$

[Out]  $-(x/b^2) + (a \text{Cos}[2a + 2b*x])/(4*b^3) - (x \text{Cos}[2a + 2b*x])/(4*b^2) - (a \text{CosIntegral}[2a + 2b*x])/b^3 + (a \text{Log}[a + b*x])/b^3 + (\text{Cos}[a + b*x] \text{Sin}[a + b*x])/b^3 + \text{Sin}[2a + 2b*x]/(8*b^3) + (2 \text{Cos}[a + b*x] \text{SinIntegral}[a + b*x])/b^3 - (x^2 \text{Cos}[a + b*x] \text{SinIntegral}[a + b*x])/b + (2*x \text{Sin}[a + b*x] \text{SinIntegral}[a + b*x])/b^2 - \text{SinIntegral}[2a + 2b*x]/b^3 + (a^2 \text{SinIntegral}[2a + 2b*x])/(2*b^3)$

#### Rule 6513

$\text{Int}[(e_. + (f_.)(x_.))^{(m_.)} \text{Sin}[(a_.) + (b_.)(x_.)] \text{SinIntegral}[(c_.) + (d_.)(x_.)], x\_Symbol] \text{ :> } -\text{Simp}[(e + f*x)^m \text{Cos}[a + b*x] \text{SinIntegral}[c + d*x])/b, x] + (\text{Dist}[d/b, \text{Int}[(e + f*x)^m \text{Cos}[a + b*x] \text{Sin}[c + d*x]]/(c + d*x), x], x] + \text{Dist}[(f*m)/b, \text{Int}[(e + f*x)^{(m-1)} \text{Cos}[a + b*x] \text{SinIntegral}[c + d*x], x], x) /; \text{FreeQ}\{a, b, c, d, e, f\}, x] \ \&\& \ \text{IGtQ}[m, 0]$

#### Rule 4573

$\text{Int}[\text{Cos}[w\_ ]^{\text{p}\_ } * (u\_ ) * \text{Sin}[v\_ ]^{\text{p}\_ }, x\_ \text{Symbol}] \text{ :> Dist}[1/2^{\text{p}\_ }, \text{Int}[u * \text{Sin}[2 * v]^{\text{p}\_ }, x], x] \text{ /; EqQ}[w, v] \ \&\& \ \text{IntegerQ}[\text{p}]$

#### Rule 6741

$\text{Int}[u\_ , x\_ \text{Symbol}] \text{ :> With}[\{v = \text{NormalizeIntegrand}[u, x]\}, \text{Int}[v, x] \text{ /; } v \neq u]$

#### Rule 6742

$\text{Int}[u\_ , x\_ \text{Symbol}] \text{ :> With}[\{v = \text{ExpandIntegrand}[u, x]\}, \text{Int}[v, x] \text{ /; SumQ}[v]]$

#### Rule 2638

$\text{Int}[\text{sin}[(c\_ ) + (d\_ ) * (x\_ )], x\_ \text{Symbol}] \text{ :> -Simp}[\text{Cos}[c + d * x] / d, x] \text{ /; FreeQ}[\{c, d\}, x]$

#### Rule 3296

$\text{Int}[(c\_ ) + (d\_ ) * (x\_ )]^{\text{m}\_ } * \text{sin}[(e\_ ) + (f\_ ) * (x\_ )], x\_ \text{Symbol}] \text{ :> -Simp}[(c + d * x)^{\text{m}\_ } * \text{Cos}[e + f * x] / f, x] + \text{Dist}[(d * \text{m}\_ ) / f, \text{Int}[(c + d * x)^{\text{m}\_ - 1} * \text{Cos}[e + f * x], x], x] \text{ /; FreeQ}[\{c, d, e, f\}, x] \ \&\& \ \text{GtQ}[\text{m}, 0]$

#### Rule 2637

$\text{Int}[\text{sin}[\text{Pi}/2 + (c\_ ) + (d\_ ) * (x\_ )], x\_ \text{Symbol}] \text{ :> Simp}[\text{Sin}[c + d * x] / d, x] \text{ /; FreeQ}[\{c, d\}, x]$

#### Rule 3299

$\text{Int}[\text{sin}[(e\_ ) + (f\_ ) * (x\_ )] / ((c\_ ) + (d\_ ) * (x\_ )), x\_ \text{Symbol}] \text{ :> Simp}[\text{SinIntegral}[e + f * x] / d, x] \text{ /; FreeQ}[\{c, d, e, f\}, x] \ \&\& \ \text{EqQ}[d * e - c * f, 0]$

#### Rule 6519

$\text{Int}[\text{Cos}[(a\_ ) + (b\_ ) * (x\_ )] * ((e\_ ) + (f\_ ) * (x\_ ))^{\text{m}\_ } * \text{SinIntegral}[(c\_ ) + (d\_ ) * (x\_ )], x\_ \text{Symbol}] \text{ :> Simp}[(e + f * x)^{\text{m}\_ } * \text{Sin}[a + b * x] * \text{SinIntegral}[c + d * x] / b, x] + (-\text{Dist}[d / b, \text{Int}[(e + f * x)^{\text{m}\_ } * \text{Sin}[a + b * x] * \text{Sin}[c + d * x] / (c + d * x), x], x] - \text{Dist}[(f * \text{m}\_ ) / b, \text{Int}[(e + f * x)^{\text{m}\_ - 1} * \text{Sin}[a + b * x] * \text{SinIntegral}[c + d * x], x], x]) \text{ /; FreeQ}[\{a, b, c, d, e, f\}, x] \ \&\& \ \text{IGtQ}[\text{m}, 0]$

#### Rule 2635

```
Int[((b_.)*sin[(c_.) + (d_.)*(x_)])^(n_), x_Symbol] := -Simp[(b*Cos[c + d*x]
)*(b*Ssin[c + d*x])^(n - 1))/(d*n), x] + Dist[(b^2*(n - 1))/n, Int[(b*Ssin[c
+ d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1] && IntegerQ[2*n
]
```

### Rule 8

```
Int[a_, x_Symbol] := Simp[a*x, x] /; FreeQ[a, x]
```

### Rule 3312

```
Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)]^(n_), x_Symbol] := In
t[ExpandTrigReduce[(c + d*x)^m, Sin[e + f*x]^n, x], x] /; FreeQ[{c, d, e, f
, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))
```

### Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[CosInte
gral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) -
c*f, 0]
```

### Rule 6511

```
Int[Sin[(a_.) + (b_.)*(x_)]*SinIntegral[(c_.) + (d_.)*(x_)], x_Symbol] := -
Simp[(Cos[a + b*x]*SinIntegral[c + d*x])/b, x] + Dist[d/b, Int[(Cos[a + b*x]
)*Sin[c + d*x]/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

### Rule 4406

```
Int[Cos[(a_.) + (b_.)*(x_)]^(p_.)*((c_.) + (d_.)*(x_))^(m_.)*Sin[(a_.) + (b
_.)*(x_)]^(n_.), x_Symbol] := Int[ExpandTrigReduce[(c + d*x)^m, Sin[a + b*x]
]^(n)*Cos[a + b*x]^p, x], x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IG
tQ[p, 0]
```

### Rule 12

```
Int[(a_)*(u_), x_Symbol] := Dist[a, Int[u, x], x] /; FreeQ[a, x] && !Match
Q[u, (b_)*(v_)] /; FreeQ[b, x]
```

### Rubi steps

$$\begin{aligned}
\int x^2 \sin(a + bx) \text{Si}(a + bx) dx &= -\frac{x^2 \cos(a + bx) \text{Si}(a + bx)}{b} + \frac{2 \int x \cos(a + bx) \text{Si}(a + bx) dx}{b} + \int \frac{x^2 \cos(a + bx) \sin(a + bx)}{a + bx} dx \\
&= -\frac{x^2 \cos(a + bx) \text{Si}(a + bx)}{b} + \frac{2x \sin(a + bx) \text{Si}(a + bx)}{b^2} + \frac{1}{2} \int \frac{x^2 \sin(2(a + bx))}{a + bx} dx - \frac{2}{b} \int \frac{x \cos(a + bx) \text{Si}(a + bx)}{a + bx} dx \\
&= \frac{2 \cos(a + bx) \text{Si}(a + bx)}{b^3} - \frac{x^2 \cos(a + bx) \text{Si}(a + bx)}{b} + \frac{2x \sin(a + bx) \text{Si}(a + bx)}{b^2} + \frac{1}{2} \int \frac{x^2 \sin(2(a + bx))}{a + bx} dx \\
&= \frac{2 \cos(a + bx) \text{Si}(a + bx)}{b^3} - \frac{x^2 \cos(a + bx) \text{Si}(a + bx)}{b} + \frac{2x \sin(a + bx) \text{Si}(a + bx)}{b^2} + \frac{1}{2} \int \frac{x^2 \sin(2(a + bx))}{a + bx} dx \\
&= \frac{\cos(a + bx) \sin(a + bx)}{b^3} + \frac{2 \cos(a + bx) \text{Si}(a + bx)}{b^3} - \frac{x^2 \cos(a + bx) \text{Si}(a + bx)}{b} + \frac{2x \sin(a + bx) \text{Si}(a + bx)}{b^2} \\
&= -\frac{x}{b^2} + \frac{a \cos(2a + 2bx)}{4b^3} - \frac{x \cos(2a + 2bx)}{4b^2} + \frac{a \log(a + bx)}{b^3} + \frac{\cos(a + bx) \sin(a + bx)}{b^3} + \frac{2x \sin(a + bx) \text{Si}(a + bx)}{b^2} \\
&= -\frac{x}{b^2} + \frac{a \cos(2a + 2bx)}{4b^3} - \frac{x \cos(2a + 2bx)}{4b^2} - \frac{a \text{Ci}(2a + 2bx)}{b^3} + \frac{a \log(a + bx)}{b^3} + \frac{\cos(a + bx) \sin(a + bx)}{b^3}
\end{aligned}$$

**Mathematica [A]** time = 0.326212, size = 123, normalized size = 0.66

$$\frac{4a^2 \text{Si}(2(a + bx)) - 8 \text{Si}(a + bx) \left( (b^2 x^2 - 2) \cos(a + bx) - 2bx \sin(a + bx) \right) - 8a \text{CosIntegral}(2(a + bx)) - 8 \text{Si}(2(a + bx))}{8b^3}$$

Antiderivative was successfully verified.

[In] Integrate[x^2\*Sin[a + b\*x]\*SinIntegral[a + b\*x],x]

[Out]  $(-8bx + 2a \cos[2(a + bx)] - 2bx \cos[2(a + bx)] - 8a \text{CosIntegral}[2(a + bx)] + 8a \log[a + bx] + 5 \sin[2(a + bx)] - 8((-2 + b^2 x^2) \cos[a + bx] - 2bx \sin[a + bx]) \text{SinIntegral}[a + bx] - 8 \text{SinIntegral}[2(a + bx)] + 4a^2 \text{SinIntegral}[2(a + bx)]) / (8b^3)$

**Maple [A]** time = 0.063, size = 171, normalized size = 0.9

$$-\frac{x^2 \cos(bx + a) \text{Si}(bx + a)}{b} + 2 \frac{x \text{Si}(bx + a) \sin(bx + a)}{b^2} + 2 \frac{\cos(bx + a) \text{Si}(bx + a)}{b^3} - \frac{(\cos(bx + a))^2 x}{2b^2} + \frac{a \cos(bx + a)}{2b^3}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(x^2*Si(b*x+a)*sin(b*x+a),x)`

[Out] 
$$-x^2 \cos(bx+a) \operatorname{Si}(bx+a) / b + 2x \operatorname{Si}(bx+a) \sin(bx+a) / b^2 + 2 \cos(bx+a) \operatorname{Si}(bx+a) / b^3 - 1/2 / b^2 \cos(bx+a)^2 x + 1/2 / b^3 a \cos(bx+a)^2 + 5/4 \cos(bx+a) \sin(bx+a) / b^3 - 3/4 x / b^2 - 3/4 / b^3 a + 1/2 a^2 \operatorname{Si}(2bx+2a) / b^3 - a \operatorname{Ci}(2bx+2a) / b^3 + a \ln(bx+a) / b^3 - \operatorname{Si}(2bx+2a) / b^3$$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \operatorname{Si}(bx+a) \sin(bx+a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Si(b*x+a)*sin(b*x+a),x, algorithm="maxima")`

[Out] `integrate(x^2*Si(b*x + a)*sin(b*x + a), x)`

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(x^2 \sin(bx+a) \operatorname{Si}(bx+a), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Si(b*x+a)*sin(b*x+a),x, algorithm="fricas")`

[Out] `integral(x^2*sin(b*x + a)*sin_integral(b*x + a), x)`

**Sympy [F(-1)]** time = 0., size = 0, normalized size = 0.

Timed out

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x**2*Si(b*x+a)*sin(b*x+a),x)`

[Out] Timed out

---

**Giac [C]** time = 1.22913, size = 223, normalized size = 1.19

$$\left( \frac{2x \sin(bx + a)}{b^2} - \frac{(b^2x^2 - 2) \cos(bx + a)}{b^3} \right) \text{Si}(bx + a) + \frac{a^2 \Im(\text{Ci}(2bx + 2a)) - a^2 \Im(\text{Ci}(-2bx - 2a)) + 2a^2 \text{Si}(2bx + 2a)}{b^3}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Si(b*x+a)*sin(b*x+a),x, algorithm="giac")`

[Out] `(2*x*sin(b*x + a)/b^2 - (b^2*x^2 - 2)*cos(b*x + a)/b^3)*sin_integral(b*x + a) + 1/4*(a^2*imag_part(cos_integral(2*b*x + 2*a)) - a^2*imag_part(cos_integral(-2*b*x - 2*a)) + 2*a^2*sin_integral(2*b*x + 2*a) - 4*b*x + 4*a*log(abs(b*x + a)) - 2*a*real_part(cos_integral(2*b*x + 2*a)) - 2*a*real_part(cos_integral(-2*b*x - 2*a)) - 2*imag_part(cos_integral(2*b*x + 2*a)) + 2*imag_part(cos_integral(-2*b*x - 2*a)) - 4*sin_integral(2*b*x + 2*a))/b^3`

### 3.56 $\int x \sin(a + bx) \mathbf{Si}(a + bx) dx$

**Optimal.** Leaf size=97

$$\frac{\text{CosIntegral}(2a + 2bx)}{2b^2} - \frac{a\text{Si}(2a + 2bx)}{2b^2} + \frac{\text{Si}(a + bx) \sin(a + bx)}{b^2} - \frac{\log(a + bx)}{2b^2} - \frac{\cos(2a + 2bx)}{4b^2} - \frac{x\text{Si}(a + bx) \cos(a + bx)}{b}$$

[Out]  $-\text{Cos}[2*a + 2*b*x]/(4*b^2) + \text{CosIntegral}[2*a + 2*b*x]/(2*b^2) - \text{Log}[a + b*x]/(2*b^2) - (x*\text{Cos}[a + b*x]*\text{SinIntegral}[a + b*x])/b + (\text{Sin}[a + b*x]*\text{SinIntegral}[a + b*x])/b^2 - (a*\text{SinIntegral}[2*a + 2*b*x])/(2*b^2)$

**Rubi [A]** time = 0.274699, antiderivative size = 97, normalized size of antiderivative = 1., number of steps used = 11, number of rules used = 9, integrand size = 14,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.643$ , Rules used = {6513, 4573, 6741, 6742, 2638, 3299, 6517, 3312, 3302}

$$\frac{\text{CosIntegral}(2a + 2bx)}{2b^2} - \frac{a\text{Si}(2a + 2bx)}{2b^2} + \frac{\text{Si}(a + bx) \sin(a + bx)}{b^2} - \frac{\log(a + bx)}{2b^2} - \frac{\cos(2a + 2bx)}{4b^2} - \frac{x\text{Si}(a + bx) \cos(a + bx)}{b}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[x*\text{Sin}[a + b*x]*\text{SinIntegral}[a + b*x], x]$

[Out]  $-\text{Cos}[2*a + 2*b*x]/(4*b^2) + \text{CosIntegral}[2*a + 2*b*x]/(2*b^2) - \text{Log}[a + b*x]/(2*b^2) - (x*\text{Cos}[a + b*x]*\text{SinIntegral}[a + b*x])/b + (\text{Sin}[a + b*x]*\text{SinIntegral}[a + b*x])/b^2 - (a*\text{SinIntegral}[2*a + 2*b*x])/(2*b^2)$

#### Rule 6513

$\text{Int}[(e_. + (f_.)*(x_.))^(m_.)*\text{Sin}[(a_.) + (b_.)*(x_.)]*\text{SinIntegral}[(c_.) + (d_.)*(x_.)], x\_Symbol] \rightarrow -\text{Simp}[(e + f*x)^m*\text{Cos}[a + b*x]*\text{SinIntegral}[c + d*x])/b, x] + (\text{Dist}[d/b, \text{Int}[(e + f*x)^m*\text{Cos}[a + b*x]*\text{Sin}[c + d*x]]/(c + d*x), x], x) + \text{Dist}[(f*m)/b, \text{Int}[(e + f*x)^(m - 1)*\text{Cos}[a + b*x]*\text{SinIntegral}[c + d*x], x], x) /; \text{FreeQ}\{a, b, c, d, e, f\}, x] \&\& \text{IGtQ}[m, 0]$

#### Rule 4573

$\text{Int}[\text{Cos}[w_]^(p_.)*(u_.)*\text{Sin}[v_]^(p_.), x\_Symbol] \rightarrow \text{Dist}[1/2^p, \text{Int}[u*\text{Sin}[2*v]^p, x], x] /; \text{EqQ}[w, v] \&\& \text{IntegerQ}[p]$

#### Rule 6741



```
Int[u_, x_Symbol] :=> With[{v = NormalizeIntegrand[u, x]}, Int[v, x] /; v !=
= u]
```

### Rule 6742

```
Int[u_, x_Symbol] :=> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### Rule 2638

```
Int[sin[(c_.) + (d_.)*(x_)], x_Symbol] :=> -Simp[Cos[c + d*x]/d, x] /; FreeQ
[{c, d}, x]
```

### Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] :=> Simp[SinInte
gral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

### Rule 6517

```
Int[Cos[(a_.) + (b_.)*(x_)]*SinIntegral[(c_.) + (d_.)*(x_)], x_Symbol] :=> S
imp[(Sin[a + b*x]*SinIntegral[c + d*x])/b, x] - Dist[d/b, Int[(Sin[a + b*x]
*Sin[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

### Rule 3312

```
Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)]^(n_), x_Symbol] :=> In
t[ExpandTrigReduce[(c + d*x)^m, Sin[e + f*x]^n, x], x] /; FreeQ[{c, d, e, f
, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))
```

### Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] :=> Simp[CosInte
gral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) -
c*f, 0]
```

### Rubi steps

$$\begin{aligned}
\int x \sin(a + bx) \text{Si}(a + bx) dx &= -\frac{x \cos(a + bx) \text{Si}(a + bx)}{b} + \frac{\int \cos(a + bx) \text{Si}(a + bx) dx}{b} + \int \frac{x \cos(a + bx) \sin(a + bx)}{a + bx} dx \\
&= -\frac{x \cos(a + bx) \text{Si}(a + bx)}{b} + \frac{\sin(a + bx) \text{Si}(a + bx)}{b^2} + \frac{1}{2} \int \frac{x \sin(2(a + bx))}{a + bx} dx - \frac{\int \frac{\sin^2(a + bx)}{a + bx} dx}{b} \\
&= -\frac{x \cos(a + bx) \text{Si}(a + bx)}{b} + \frac{\sin(a + bx) \text{Si}(a + bx)}{b^2} + \frac{1}{2} \int \frac{x \sin(2a + 2bx)}{a + bx} dx - \frac{\int \left( \frac{1}{2(a + bx)} \right)}{b} \\
&= -\frac{\log(a + bx)}{2b^2} - \frac{x \cos(a + bx) \text{Si}(a + bx)}{b} + \frac{\sin(a + bx) \text{Si}(a + bx)}{b^2} + \frac{1}{2} \int \left( \frac{\sin(2a + 2bx)}{b} \right) \\
&= \frac{\text{Ci}(2a + 2bx)}{2b^2} - \frac{\log(a + bx)}{2b^2} - \frac{x \cos(a + bx) \text{Si}(a + bx)}{b} + \frac{\sin(a + bx) \text{Si}(a + bx)}{b^2} + \frac{\int \sin(2a + 2bx)}{2b} \\
&= -\frac{\cos(2a + 2bx)}{4b^2} + \frac{\text{Ci}(2a + 2bx)}{2b^2} - \frac{\log(a + bx)}{2b^2} - \frac{x \cos(a + bx) \text{Si}(a + bx)}{b} + \frac{\sin(a + bx) \text{Si}(a + bx)}{b^2}
\end{aligned}$$

**Mathematica [A]** time = 0.237806, size = 71, normalized size = 0.73

$$\frac{-2\text{CosIntegral}(2(a + bx)) + 2a\text{Si}(2(a + bx)) + 4\text{Si}(a + bx)(bx \cos(a + bx) - \sin(a + bx)) + 2 \log(a + bx) + \cos(2(a + bx))}{4b^2}$$

Antiderivative was successfully verified.

[In] Integrate[x\*Sin[a + b\*x]\*SinIntegral[a + b\*x],x]

[Out] -(Cos[2\*(a + b\*x)] - 2\*CosIntegral[2\*(a + b\*x)] + 2\*Log[a + b\*x] + 4\*(b\*x\*Cos[a + b\*x] - Sin[a + b\*x])\*SinIntegral[a + b\*x] + 2\*a\*SinIntegral[2\*(a + b\*x)])/(4\*b^2)

**Maple [A]** time = 0.057, size = 89, normalized size = 0.9

$$-\frac{x \cos(bx + a) \text{Si}(bx + a)}{b} + \frac{\text{Si}(bx + a) \sin(bx + a)}{b^2} - \frac{(\cos(bx + a))^2}{2b^2} - \frac{a \text{Si}(2bx + 2a)}{2b^2} - \frac{\ln(bx + a)}{2b^2} + \frac{\text{Ci}(2bx + 2a)}{2b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x\*Si(b\*x+a)\*sin(b\*x+a),x)

[Out] -x\*cos(b\*x+a)\*Si(b\*x+a)/b+Si(b\*x+a)\*sin(b\*x+a)/b^2-1/2/b^2\*cos(b\*x+a)^2-1/2\*a\*Si(2\*b\*x+2\*a)/b^2-1/2\*ln(b\*x+a)/b^2+1/2\*Ci(2\*b\*x+2\*a)/b^2

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x \operatorname{Si}(bx + a) \sin(bx + a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Si(b\*x+a)\*sin(b\*x+a),x, algorithm="maxima")

[Out] integrate(x\*Si(b\*x + a)\*sin(b\*x + a), x)

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(x \sin(bx + a) \operatorname{Si}(bx + a), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Si(b\*x+a)\*sin(b\*x+a),x, algorithm="fricas")

[Out] integral(x\*sin(b\*x + a)\*sin\_integral(b\*x + a), x)

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x \sin(a + bx) \operatorname{Si}(a + bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Si(b\*x+a)\*sin(b\*x+a),x)

[Out] Integral(x\*sin(a + b\*x)\*Si(a + b\*x), x)

---

**Giac [C]** time = 1.18991, size = 146, normalized size = 1.51

$$-\left(\frac{x \cos(bx + a)}{b} - \frac{\sin(bx + a)}{b^2}\right) \operatorname{Si}(bx + a) - \frac{a \Im(\operatorname{Ci}(2bx + 2a)) - a \Im(\operatorname{Ci}(-2bx - 2a)) + 2a \operatorname{Si}(2bx + 2a) + 2 \log(|)}{4b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x*Si(b*x+a)*sin(b*x+a),x, algorithm="giac")
```

```
[Out] -(x*cos(b*x + a)/b - sin(b*x + a)/b^2)*sin_integral(b*x + a) - 1/4*(a*imag_
part(cos_integral(2*b*x + 2*a)) - a*imag_part(cos_integral(-2*b*x - 2*a)) +
  2*a*sin_integral(2*b*x + 2*a) + 2*log(abs(b*x + a)) - real_part(cos_integr
al(2*b*x + 2*a)) - real_part(cos_integral(-2*b*x - 2*a)))/b^2
```

### 3.57 $\int \sin(a + bx) \text{Si}(a + bx) dx$

**Optimal.** Leaf size=34

$$\frac{\text{Si}(2a + 2bx)}{2b} - \frac{\text{Si}(a + bx) \cos(a + bx)}{b}$$

[Out]  $-\left(\frac{\cos(a + bx) \text{Si}(a + bx)}{b}\right) + \frac{\text{Si}(2a + 2bx)}{2b}$

**Rubi [A]** time = 0.0541703, antiderivative size = 34, normalized size of antiderivative = 1., number of steps used = 4, number of rules used = 4, integrand size = 13,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.308$ , Rules used = {6511, 4406, 12, 3299}

$$\frac{\text{Si}(2a + 2bx)}{2b} - \frac{\text{Si}(a + bx) \cos(a + bx)}{b}$$

Antiderivative was successfully verified.

[In] Int[Sin[a + b\*x]\*SinIntegral[a + b\*x], x]

[Out]  $-\left(\frac{\cos(a + bx) \text{Si}(a + bx)}{b}\right) + \frac{\text{Si}(2a + 2bx)}{2b}$

#### Rule 6511

Int[Sin[(a\_.) + (b\_.)\*(x\_)]\*SinIntegral[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] :> -  
Simp[(Cos[a + b\*x]\*SinIntegral[c + d\*x])/b, x] + Dist[d/b, Int[(Cos[a + b\*x]  
]\*Sin[c + d\*x]/(c + d\*x), x], x] /; FreeQ[{a, b, c, d}, x]

#### Rule 4406

Int[Cos[(a\_.) + (b\_.)\*(x\_)]^(p\_.)\*((c\_.) + (d\_.)\*(x\_))^(m\_.)\*Sin[(a\_.) + (b  
\_.)\*(x\_)]^(n\_.), x\_Symbol] :> Int[ExpandTrigReduce[(c + d\*x)^m, Sin[a + b\*x  
]^(n)\*Cos[a + b\*x]^p, x], x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IG  
tQ[p, 0]

#### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] :> Dist[a, Int[u, x], x] /; FreeQ[a, x] && !Match  
Q[u, (b\_)\*(v\_)] /; FreeQ[b, x]

#### Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[SinInte
gral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

### Rubi steps

$$\begin{aligned} \int \sin(a + bx) \operatorname{Si}(a + bx) dx &= -\frac{\cos(a + bx) \operatorname{Si}(a + bx)}{b} + \int \frac{\cos(a + bx) \sin(a + bx)}{a + bx} dx \\ &= -\frac{\cos(a + bx) \operatorname{Si}(a + bx)}{b} + \int \frac{\sin(2a + 2bx)}{2(a + bx)} dx \\ &= -\frac{\cos(a + bx) \operatorname{Si}(a + bx)}{b} + \frac{1}{2} \int \frac{\sin(2a + 2bx)}{a + bx} dx \\ &= -\frac{\cos(a + bx) \operatorname{Si}(a + bx)}{b} + \frac{\operatorname{Si}(2a + 2bx)}{2b} \end{aligned}$$

**Mathematica [A]** time = 0.01693, size = 33, normalized size = 0.97

$$\frac{\operatorname{Si}(2(a + bx))}{2b} - \frac{\operatorname{Si}(a + bx) \cos(a + bx)}{b}$$

Antiderivative was successfully verified.

```
[In] Integrate[Sin[a + b*x]*SinIntegral[a + b*x], x]
```

```
[Out] -((Cos[a + b*x]*SinIntegral[a + b*x])/b) + SinIntegral[2*(a + b*x)]/(2*b)
```

**Maple [A]** time = 0.049, size = 31, normalized size = 0.9

$$\frac{1}{b} \left( -\cos(bx + a) \operatorname{Si}(bx + a) + \frac{\operatorname{Si}(2bx + 2a)}{2} \right)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(Si(b*x+a)*sin(b*x+a), x)
```

```
[Out] 1/b*(-cos(b*x+a)*Si(b*x+a)+1/2*Si(2*b*x+2*a))
```

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \operatorname{Si}(bx + a) \sin(bx + a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a)\*sin(b\*x+a),x, algorithm="maxima")

[Out] integrate(Si(b\*x + a)\*sin(b\*x + a), x)

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(\sin(bx + a) \operatorname{Si}(bx + a), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a)\*sin(b\*x+a),x, algorithm="fricas")

[Out] integral(sin(b\*x + a)\*sin\_integral(b\*x + a), x)

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \sin(a + bx) \operatorname{Si}(a + bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a)\*sin(b\*x+a),x)

[Out] Integral(sin(a + b\*x)\*Si(a + b\*x), x)

---

**Giac [C]** time = 1.19919, size = 77, normalized size = 2.26

$$-\frac{\cos(bx + a) \operatorname{Si}(bx + a)}{b} + \frac{\Im(\operatorname{Ci}(2bx + 2a)) - \Im(\operatorname{Ci}(-2bx - 2a)) + 2 \operatorname{Si}(2bx + 2a)}{4b}$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(b*x+a)*sin(b*x+a),x, algorithm="giac")
```

```
[Out] -cos(b*x + a)*sin_integral(b*x + a)/b + 1/4*(imag_part(cos_integral(2*b*x +  
2*a)) - imag_part(cos_integral(-2*b*x - 2*a)) + 2*sin_integral(2*b*x + 2*a  
))/b
```



$$3.58 \quad \int \frac{\sin(ax)\text{Si}(ax)}{x} dx$$

Optimal. Leaf size=18

$$\text{CannotIntegrate}\left(\frac{\text{Si}(a + bx) \sin(a + bx)}{x}, x\right)$$

[Out] CannotIntegrate[(Sin[a + b\*x]\*SinIntegral[a + b\*x])/x, x]

**Rubi [A]** time = 0.122967, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\sin(a + bx)\text{Si}(a + bx)}{x} dx$$

Verification is Not applicable to the result.

[In] Int[(Sin[a + b\*x]\*SinIntegral[a + b\*x])/x, x]

[Out] Defer[Int] [(Sin[a + b\*x]\*SinIntegral[a + b\*x])/x, x]

Rubi steps

$$\int \frac{\sin(a + bx)\text{Si}(a + bx)}{x} dx = \int \frac{\sin(a + bx)\text{Si}(a + bx)}{x} dx$$

**Mathematica [A]** time = 4.92098, size = 0, normalized size = 0.

$$\int \frac{\sin(a + bx)\text{Si}(a + bx)}{x} dx$$

Verification is Not applicable to the result.

[In] Integrate[(Sin[a + b\*x]\*SinIntegral[a + b\*x])/x, x]

[Out] Integrate[(Sin[a + b\*x]\*SinIntegral[a + b\*x])/x, x]

**Maple [A]** time = 0.081, size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx + a) \sin(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Si(b\*x+a)\*sin(b\*x+a)/x,x)

[Out] int(Si(b\*x+a)\*sin(b\*x+a)/x,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx + a) \sin(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a)\*sin(b\*x+a)/x,x, algorithm="maxima")

[Out] integrate(Si(b\*x + a)\*sin(b\*x + a)/x, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\sin(bx + a) \text{Si}(bx + a)}{x}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a)\*sin(b\*x+a)/x,x, algorithm="fricas")

[Out] integral(sin(b\*x + a)\*sin\_integral(b\*x + a)/x, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\sin(a + bx) \text{Si}(a + bx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a)\*sin(b\*x+a)/x,x)

[Out] Integral(sin(a + b\*x)\*Si(a + b\*x)/x, x)

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx + a) \sin(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(b\*x+a)\*sin(b\*x+a)/x,x, algorithm="giac")

[Out] integrate(Si(b\*x + a)\*sin(b\*x + a)/x, x)

### 3.59 $\int x^2 \cos(a + bx) \mathbf{Si}(a + bx) dx$

**Optimal.** Leaf size=218

$$\frac{a^2 \text{CosIntegral}(2a + 2bx)}{2b^3} - \frac{a^2 \log(a + bx)}{2b^3} - \frac{\text{CosIntegral}(2a + 2bx)}{b^3} + \frac{a \text{Si}(2a + 2bx)}{b^3} - \frac{2 \text{Si}(a + bx) \sin(a + bx)}{b^3} + \frac{2x \text{Si}(a + bx) \sin(a + bx)}{b^3}$$

[Out] (a\*x)/(2\*b^2) - x^2/(4\*b) + Cos[2\*a + 2\*b\*x]/(2\*b^3) - CosIntegral[2\*a + 2\*b\*x]/b^3 + (a^2\*CosIntegral[2\*a + 2\*b\*x])/(2\*b^3) + Log[a + b\*x]/b^3 - (a^2\*Log[a + b\*x])/(2\*b^3) - (a\*Cos[a + b\*x]\*Sin[a + b\*x])/(2\*b^3) + (x\*Cos[a + b\*x]\*Sin[a + b\*x])/(2\*b^2) - Sin[a + b\*x]^2/(4\*b^3) + (2\*x\*Cos[a + b\*x]\*SinIntegral[a + b\*x])/b^2 - (2\*Sin[a + b\*x]\*SinIntegral[a + b\*x])/b^3 + (x^2\*Sin[a + b\*x]\*SinIntegral[a + b\*x])/b + (a\*SinIntegral[2\*a + 2\*b\*x])/b^3

**Rubi [A]** time = 0.659721, antiderivative size = 218, normalized size of antiderivative = 1., number of steps used = 21, number of rules used = 14, integrand size = 16,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.875$ , Rules used = {6519, 6742, 2635, 8, 3310, 30, 3312, 3302, 6513, 4573, 6741, 2638, 3299, 6517}

$$\frac{a^2 \text{CosIntegral}(2a + 2bx)}{2b^3} - \frac{a^2 \log(a + bx)}{2b^3} - \frac{\text{CosIntegral}(2a + 2bx)}{b^3} + \frac{a \text{Si}(2a + 2bx)}{b^3} - \frac{2 \text{Si}(a + bx) \sin(a + bx)}{b^3} + \frac{2x \text{Si}(a + bx) \sin(a + bx)}{b^3}$$

Antiderivative was successfully verified.

[In] Int[x^2\*Cos[a + b\*x]\*SinIntegral[a + b\*x],x]

[Out] (a\*x)/(2\*b^2) - x^2/(4\*b) + Cos[2\*a + 2\*b\*x]/(2\*b^3) - CosIntegral[2\*a + 2\*b\*x]/b^3 + (a^2\*CosIntegral[2\*a + 2\*b\*x])/(2\*b^3) + Log[a + b\*x]/b^3 - (a^2\*Log[a + b\*x])/(2\*b^3) - (a\*Cos[a + b\*x]\*Sin[a + b\*x])/(2\*b^3) + (x\*Cos[a + b\*x]\*Sin[a + b\*x])/(2\*b^2) - Sin[a + b\*x]^2/(4\*b^3) + (2\*x\*Cos[a + b\*x]\*SinIntegral[a + b\*x])/b^2 - (2\*Sin[a + b\*x]\*SinIntegral[a + b\*x])/b^3 + (x^2\*Sin[a + b\*x]\*SinIntegral[a + b\*x])/b + (a\*SinIntegral[2\*a + 2\*b\*x])/b^3

#### Rule 6519

Int[Cos[(a\_.) + (b\_.)\*(x\_)]\*((e\_.) + (f\_.)\*(x\_))^(m\_.)\*SinIntegral[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] :> Simp[((e + f\*x)^m\*Sin[a + b\*x]\*SinIntegral[c + d\*x])/b, x] + (-Dist[d/b, Int[((e + f\*x)^m\*Sin[a + b\*x]\*Sin[c + d\*x])/(c + d\*x), x], x] - Dist[(f\*m)/b, Int[(e + f\*x)^(m - 1)\*Sin[a + b\*x]\*SinIntegral[c + d\*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]

#### Rule 6742

```
Int[u_, x_Symbol] := With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### Rule 2635

```
Int[((b_.)*sin[(c_.) + (d_.)*(x_)])^(n_), x_Symbol] := -Simp[(b*Cos[c + d*x]
)*(b*Sin[c + d*x])^(n - 1))/(d*n), x] + Dist[(b^2*(n - 1))/n, Int[(b*Sin[c
+ d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1] && IntegerQ[2*n
]
```

### Rule 8

```
Int[a_, x_Symbol] := Simp[a*x, x] /; FreeQ[a, x]
```

### Rule 3310

```
Int[((c_.) + (d_.)*(x_))*((b_.)*sin[(e_.) + (f_.)*(x_)])^(n_), x_Symbol] :=
Simp[(d*(b*Sin[e + f*x])^n)/(f^2*n^2), x] + (Dist[(b^2*(n - 1))/n, Int[(c
+ d*x)*(b*Sin[e + f*x])^(n - 2), x], x] - Simp[(b*(c + d*x)*Cos[e + f*x]*(b
*Sin[e + f*x])^(n - 1))/(f*n), x]) /; FreeQ[{b, c, d, e, f}, x] && GtQ[n, 1
]
```

### Rule 30

```
Int[(x_)^(m_.), x_Symbol] := Simp[x^(m + 1)/(m + 1), x] /; FreeQ[m, x] && N
eQ[m, -1]
```

### Rule 3312

```
Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)]^(n_), x_Symbol] := In
t[ExpandTrigReduce[(c + d*x)^m, Sin[e + f*x]^n, x], x] /; FreeQ[{c, d, e, f
, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))
```

### Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[CosInte
gral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) -
c*f, 0]
```

### Rule 6513

```
Int[((e_.) + (f_.)*(x_))^(m_)*Sin[(a_.) + (b_.)*(x_)]*SinIntegral[(c_.) +
(d_.)*(x_)], x_Symbol] := -Simp[((e + f*x)^m*Cos[a + b*x]*SinIntegral[c + d
*x])/b, x] + (Dist[d/b, Int[((e + f*x)^m*Cos[a + b*x]*Sin[c + d*x])/(c + d*
x), x], x] + Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*Cos[a + b*x]*SinIntegral[c
```

+ d\*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]

### Rule 4573

Int[Cos[w\_]^(p\_.)\*(u\_.)\*Sin[v\_]^(p\_.), x\_Symbol] := Dist[1/2^p, Int[u\*Sin[2\*v]^p, x], x] /; EqQ[w, v] && IntegerQ[p]

### Rule 6741

Int[u\_, x\_Symbol] := With[{v = NormalizeIntegrand[u, x]}, Int[v, x] /; v != u]

### Rule 2638

Int[sin[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] := -Simp[Cos[c + d\*x]/d, x] /; FreeQ[{c, d}, x]

### Rule 3299

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] := Simp[SinIntegral[e + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*e - c\*f, 0]

### Rule 6517

Int[Cos[(a\_.) + (b\_.)\*(x\_)]\*SinIntegral[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] := Simp[(Sin[a + b\*x]\*SinIntegral[c + d\*x])/b, x] - Dist[d/b, Int[(Sin[a + b\*x]\*Sin[c + d\*x])/(c + d\*x), x], x] /; FreeQ[{a, b, c, d}, x]

### Rubi steps

$$\begin{aligned}
\int x^2 \cos(a + bx) \text{Si}(a + bx) dx &= \frac{x^2 \sin(a + bx) \text{Si}(a + bx)}{b} - \frac{2 \int x \sin(a + bx) \text{Si}(a + bx) dx}{b} - \int \frac{x^2 \sin^2(a + bx)}{a + bx} dx \\
&= \frac{2x \cos(a + bx) \text{Si}(a + bx)}{b^2} + \frac{x^2 \sin(a + bx) \text{Si}(a + bx)}{b} - \frac{2 \int \cos(a + bx) \text{Si}(a + bx) dx}{b^2} \\
&= \frac{2x \cos(a + bx) \text{Si}(a + bx)}{b^2} - \frac{2 \sin(a + bx) \text{Si}(a + bx)}{b^3} + \frac{x^2 \sin(a + bx) \text{Si}(a + bx)}{b} + \frac{2 \int \cos(a + bx) \text{Si}(a + bx) dx}{b^2} \\
&= -\frac{a \cos(a + bx) \sin(a + bx)}{2b^3} + \frac{x \cos(a + bx) \sin(a + bx)}{2b^2} - \frac{\sin^2(a + bx)}{4b^3} + \frac{2x \cos(a + bx) \text{Si}(a + bx)}{b^2} \\
&= \frac{ax}{2b^2} - \frac{x^2}{4b} + \frac{\log(a + bx)}{b^3} - \frac{a^2 \log(a + bx)}{2b^3} - \frac{a \cos(a + bx) \sin(a + bx)}{2b^3} + \frac{x \cos(a + bx) \sin(a + bx)}{2b^2} \\
&= \frac{ax}{2b^2} - \frac{x^2}{4b} - \frac{\text{Ci}(2a + 2bx)}{b^3} + \frac{a^2 \text{Ci}(2a + 2bx)}{2b^3} + \frac{\log(a + bx)}{b^3} - \frac{a^2 \log(a + bx)}{2b^3} - \frac{a \cos(a + bx) \sin(a + bx)}{2b^3} \\
&= \frac{ax}{2b^2} - \frac{x^2}{4b} + \frac{\cos(2a + 2bx)}{2b^3} - \frac{\text{Ci}(2a + 2bx)}{b^3} + \frac{a^2 \text{Ci}(2a + 2bx)}{2b^3} + \frac{\log(a + bx)}{b^3} - \frac{a^2 \log(a + bx)}{2b^3}
\end{aligned}$$

**Mathematica [A]** time = 0.343218, size = 134, normalized size = 0.61

$$\frac{4(a^2 - 2) \text{CosIntegral}(2(a + bx)) - 4a^2 \log(a + bx) + 8\text{Si}(a + bx) \left( (b^2 x^2 - 2) \sin(a + bx) + 2bx \cos(a + bx) \right) + 8a\text{Si}(2(a + bx))}{8b^3}$$

Antiderivative was successfully verified.

[In] Integrate[x^2\*Cos[a + b\*x]\*SinIntegral[a + b\*x],x]

[Out] (4\*a\*b\*x - 2\*b^2\*x^2 + 5\*Cos[2\*(a + b\*x)]) + 4\*(-2 + a^2)\*CosIntegral[2\*(a + b\*x)] + 8\*Log[a + b\*x] - 4\*a^2\*Log[a + b\*x] - 2\*a\*Sin[2\*(a + b\*x)] + 2\*b\*x\*Sin[2\*(a + b\*x)] + 8\*(2\*b\*x\*Cos[a + b\*x] + (-2 + b^2\*x^2)\*Sin[a + b\*x])\*SinIntegral[a + b\*x] + 8\*a\*SinIntegral[2\*(a + b\*x)]/(8\*b^3)

**Maple [A]** time = 0.068, size = 209, normalized size = 1.

$$\frac{x^2 \text{Si}(bx + a) \sin(bx + a)}{b} + 2 \frac{x \cos(bx + a) \text{Si}(bx + a)}{b^2} - 2 \frac{\text{Si}(bx + a) \sin(bx + a)}{b^3} + \frac{x \cos(bx + a) \sin(bx + a)}{2b^2} - \frac{a \cos(bx + a) \sin(bx + a)}{2b^3}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(x^2*cos(b*x+a)*Si(b*x+a),x)`

[Out]  $x^2\text{Si}(b*x+a)*\sin(b*x+a)/b+2*x*\cos(b*x+a)*\text{Si}(b*x+a)/b^2-2*\text{Si}(b*x+a)*\sin(b*x+a)/b^3+1/2*x*\cos(b*x+a)*\sin(b*x+a)/b^2-1/2*a*\cos(b*x+a)*\sin(b*x+a)/b^3-1/4*x^2/b+1/2*a*x/b^2+3/4/b^3*a^2-1/4*\sin(b*x+a)^2/b^3-1/2*a^2*\ln(b*x+a)/b^3+1/2*a^2*\text{Ci}(2*b*x+2*a)/b^3+\cos(b*x+a)^2/b^3+a*\text{Si}(2*b*x+2*a)/b^3+\ln(b*x+a)/b^3-\text{Ci}(2*b*x+2*a)/b^3$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \text{Si}(bx + a) \cos(bx + a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*cos(b*x+a)*Si(b*x+a),x, algorithm="maxima")`

[Out] `integrate(x^2*Si(b*x + a)*cos(b*x + a), x)`

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^2 \cos(bx + a) \text{Si}(bx + a), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*cos(b*x+a)*Si(b*x+a),x, algorithm="fricas")`

[Out] `integral(x^2*cos(b*x + a)*sin_integral(b*x + a), x)`

**Sympy [F(-1)]** time = 0., size = 0, normalized size = 0.

Timed out

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x**2*cos(b*x+a)*Si(b*x+a),x)`



[Out] Timed out

**Giac [C]** time = 1.21811, size = 231, normalized size = 1.06

$$\left( \frac{2x \cos(bx + a)}{b^2} + \frac{(b^2x^2 - 2) \sin(bx + a)}{b^3} \right) \text{Si}(bx + a) - \frac{b^2x^2 - 2abx + 2a^2 \log(|bx + a|) - a^2 \Re(\text{Ci}(2bx + 2a)) - a^2 \Im(\text{Ci}(2bx + 2a))}{b^3}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^2\*cos(b\*x+a)\*Si(b\*x+a),x, algorithm="giac")

[Out] (2\*x\*cos(b\*x + a)/b^2 + (b^2\*x^2 - 2)\*sin(b\*x + a)/b^3)\*sin\_integral(b\*x + a) - 1/4\*(b^2\*x^2 - 2\*a\*b\*x + 2\*a^2\*log(abs(b\*x + a)) - a^2\*real\_part(cos\_integral(2\*b\*x + 2\*a)) - a^2\*real\_part(cos\_integral(-2\*b\*x - 2\*a)) - 2\*a\*imag\_part(cos\_integral(2\*b\*x + 2\*a)) + 2\*a\*imag\_part(cos\_integral(-2\*b\*x - 2\*a))) - 4\*a\*sin\_integral(2\*b\*x + 2\*a) - 4\*log(abs(b\*x + a)) + 2\*real\_part(cos\_integral(2\*b\*x + 2\*a)) + 2\*real\_part(cos\_integral(-2\*b\*x - 2\*a)))/b^3

### 3.60 $\int x \cos(a + bx) \text{Si}(a + bx) dx$

**Optimal.** Leaf size=108

$$-\frac{a \text{CosIntegral}(2a + 2bx)}{2b^2} - \frac{\text{Si}(2a + 2bx)}{2b^2} + \frac{\text{Si}(a + bx) \cos(a + bx)}{b^2} + \frac{a \log(a + bx)}{2b^2} + \frac{\sin(a + bx) \cos(a + bx)}{2b^2} + \frac{x \text{Si}(a + bx)}{b}$$

```
[Out] -x/(2*b) - (a*CosIntegral[2*a + 2*b*x])/(2*b^2) + (a*Log[a + b*x])/(2*b^2)
+ (Cos[a + b*x]*Sin[a + b*x])/(2*b^2) + (Cos[a + b*x]*SinIntegral[a + b*x])
/b^2 + (x*Sin[a + b*x]*SinIntegral[a + b*x])/b - SinIntegral[2*a + 2*b*x]/(
2*b^2)
```

---

**Rubi [A]** time = 0.231651, antiderivative size = 108, normalized size of antiderivative = 1., number of steps used = 12, number of rules used = 10, integrand size = 14,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.714$ , Rules used = {6519, 6742, 2635, 8, 3312, 3302, 6511, 4406, 12, 3299}

$$-\frac{a \text{CosIntegral}(2a + 2bx)}{2b^2} - \frac{\text{Si}(2a + 2bx)}{2b^2} + \frac{\text{Si}(a + bx) \cos(a + bx)}{b^2} + \frac{a \log(a + bx)}{2b^2} + \frac{\sin(a + bx) \cos(a + bx)}{2b^2} + \frac{x \text{Si}(a + bx)}{b}$$

Antiderivative was successfully verified.

```
[In] Int[x*Cos[a + b*x]*SinIntegral[a + b*x], x]
```

```
[Out] -x/(2*b) - (a*CosIntegral[2*a + 2*b*x])/(2*b^2) + (a*Log[a + b*x])/(2*b^2)
+ (Cos[a + b*x]*Sin[a + b*x])/(2*b^2) + (Cos[a + b*x]*SinIntegral[a + b*x])
/b^2 + (x*Sin[a + b*x]*SinIntegral[a + b*x])/b - SinIntegral[2*a + 2*b*x]/(
2*b^2)
```

#### Rule 6519

```
Int[Cos[(a_.) + (b_.)*(x_)]*((e_.) + (f_.)*(x_))^(m_.)*SinIntegral[(c_.) +
(d_.)*(x_)], x_Symbol] := Simp[((e + f*x)^m*Sin[a + b*x]*SinIntegral[c + d*
x])/b, x] + (-Dist[d/b, Int[((e + f*x)^m*Sin[a + b*x]*Sin[c + d*x])/(c + d*
x), x], x] - Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*Sin[a + b*x]*SinIntegral[c
+ d*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]
```

#### Rule 6742

```
Int[u_, x_Symbol] := With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

#### Rule 2635

```
Int[((b_.)*sin[(c_.) + (d_.)*(x_)])^(n_), x_Symbol] := -Simp[(b*cos[c + d*x]
)*(b*sin[c + d*x])^(n - 1))/(d*n), x] + Dist[(b^2*(n - 1))/n, Int[(b*sin[c
+ d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1] && IntegerQ[2*n]
]
```

### Rule 8

```
Int[a_, x_Symbol] := Simp[a*x, x] /; FreeQ[a, x]
```

### Rule 3312

```
Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)]^(n_), x_Symbol] := In
t[ExpandTrigReduce[(c + d*x)^m, Sin[e + f*x]^n, x], x] /; FreeQ[{c, d, e, f
, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))
```

### Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[CosInte
gral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) -
c*f, 0]
```

### Rule 6511

```
Int[Sin[(a_.) + (b_.)*(x_)]*SinIntegral[(c_.) + (d_.)*(x_)], x_Symbol] := -
Simp[(Cos[a + b*x]*SinIntegral[c + d*x])/b, x] + Dist[d/b, Int[(Cos[a + b*x]
)*Sin[c + d*x]/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

### Rule 4406

```
Int[Cos[(a_.) + (b_.)*(x_)]^(p_.)*((c_.) + (d_.)*(x_))^(m_.)*Sin[(a_.) + (b
_.)*(x_)]^(n_.), x_Symbol] := Int[ExpandTrigReduce[(c + d*x)^m, Sin[a + b*x]
]^n*cos[a + b*x]^p, x], x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IG
tQ[p, 0]
```

### Rule 12

```
Int[(a_)*(u_), x_Symbol] := Dist[a, Int[u, x], x] /; FreeQ[a, x] && !Match
Q[u, (b_)*(v_)] /; FreeQ[b, x]
```

### Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[SinInte
gral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

Rubi steps

$$\begin{aligned}
\int x \cos(a + bx) \text{Si}(a + bx) dx &= \frac{x \sin(a + bx) \text{Si}(a + bx)}{b} - \frac{\int \sin(a + bx) \text{Si}(a + bx) dx}{b} - \int \frac{x \sin^2(a + bx)}{a + bx} dx \\
&= \frac{\cos(a + bx) \text{Si}(a + bx)}{b^2} + \frac{x \sin(a + bx) \text{Si}(a + bx)}{b} - \frac{\int \frac{\cos(a+bx) \sin(a+bx)}{a+bx} dx}{b} - \int \left( \frac{\sin^2(a + bx)}{b} \right) dx \\
&= \frac{\cos(a + bx) \text{Si}(a + bx)}{b^2} + \frac{x \sin(a + bx) \text{Si}(a + bx)}{b} - \frac{\int \sin^2(a + bx) dx}{b} - \frac{\int \frac{\sin(2a+2bx)}{2(a+bx)} dx}{b} \\
&= \frac{\cos(a + bx) \sin(a + bx)}{2b^2} + \frac{\cos(a + bx) \text{Si}(a + bx)}{b^2} + \frac{x \sin(a + bx) \text{Si}(a + bx)}{b} - \frac{\int 1 dx}{2b} - \frac{\int \frac{\sin(2a+2bx)}{2(a+bx)} dx}{b} \\
&= -\frac{x}{2b} + \frac{a \log(a + bx)}{2b^2} + \frac{\cos(a + bx) \sin(a + bx)}{2b^2} + \frac{\cos(a + bx) \text{Si}(a + bx)}{b^2} + \frac{x \sin(a + bx) \text{Si}(a + bx)}{b} \\
&= -\frac{x}{2b} - \frac{a \text{Ci}(2a + 2bx)}{2b^2} + \frac{a \log(a + bx)}{2b^2} + \frac{\cos(a + bx) \sin(a + bx)}{2b^2} + \frac{\cos(a + bx) \text{Si}(a + bx)}{b^2}
\end{aligned}$$

**Mathematica [A]** time = 0.198282, size = 74, normalized size = 0.69

$$\frac{-2a \text{CosIntegral}(2(a + bx)) - 2\text{Si}(2(a + bx)) + 4\text{Si}(a + bx)(bx \sin(a + bx) + \cos(a + bx)) + 2a \log(a + bx) + \sin(2(a + bx))}{4b^2}$$

Antiderivative was successfully verified.

[In] Integrate[x\*Cos[a + b\*x]\*SinIntegral[a + b\*x], x]

[Out] (-2\*b\*x - 2\*a\*CosIntegral[2\*(a + b\*x)] + 2\*a\*Log[a + b\*x] + Sin[2\*(a + b\*x)] + 4\*(Cos[a + b\*x] + b\*x\*Sin[a + b\*x])\*SinIntegral[a + b\*x] - 2\*SinIntegral[2\*(a + b\*x)])/(4\*b^2)

**Maple [A]** time = 0.061, size = 105, normalized size = 1.

$$\frac{x \text{Si}(bx + a) \sin(bx + a)}{b} + \frac{\cos(bx + a) \text{Si}(bx + a)}{b^2} + \frac{\cos(bx + a) \sin(bx + a)}{2b^2} - \frac{x}{2b} - \frac{a}{2b^2} - \frac{\text{Si}(2bx + 2a)}{2b^2} + \frac{a \ln(bx + a)}{2b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x\*cos(b\*x+a)\*Si(b\*x+a), x)

[Out]  $x \operatorname{Si}(bx+a) \sin(bx+a) / b + \cos(bx+a) \operatorname{Si}(bx+a) / b^2 + 1/2 \cos(bx+a) \sin(bx+a) / b^2 - 1/2 x / b - 1/2 / b^2 a - 1/2 \operatorname{Si}(2bx+2a) / b^2 + 1/2 a \ln(bx+a) / b^2 - 1/2 a \operatorname{Ci}(2bx+2a) / b^2$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x \operatorname{Si}(bx+a) \cos(bx+a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*cos(b*x+a)*Si(b*x+a),x, algorithm="maxima")`

[Out] `integrate(x*Si(b*x + a)*cos(b*x + a), x)`

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(x \cos(bx+a) \operatorname{Si}(bx+a), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*cos(b*x+a)*Si(b*x+a),x, algorithm="fricas")`

[Out] `integral(x*cos(b*x + a)*sin_integral(b*x + a), x)`

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x \cos(a+bx) \operatorname{Si}(a+bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*cos(b*x+a)*Si(b*x+a),x)`

[Out] `Integral(x*cos(a + b*x)*Si(a + b*x), x)`

**Giac [C]** time = 1.20177, size = 144, normalized size = 1.33

$$\left( \frac{x \sin(bx + a)}{b} + \frac{\cos(bx + a)}{b^2} \right) \text{Si}(bx + a) - \frac{2bx - 2a \log(|bx + a|) + a\Re(\text{Ci}(2bx + 2a)) + a\Re(\text{Ci}(-2bx - 2a)) + \Im(\text{Ci}(2bx + 2a)) + \Im(\text{Ci}(-2bx - 2a))}{4b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*cos(b\*x+a)\*Si(b\*x+a),x, algorithm="giac")

[Out] (x\*sin(b\*x + a)/b + cos(b\*x + a)/b^2)\*sin\_integral(b\*x + a) - 1/4\*(2\*b\*x - 2\*a\*log(abs(b\*x + a)) + a\*real\_part(cos\_integral(2\*b\*x + 2\*a)) + a\*real\_part(cos\_integral(-2\*b\*x - 2\*a)) + imag\_part(cos\_integral(2\*b\*x + 2\*a)) - imag\_part(cos\_integral(-2\*b\*x - 2\*a)) + 2\*sin\_integral(2\*b\*x + 2\*a))/b^2

### 3.61 $\int \cos(a + bx) \mathbf{Si}(a + bx) dx$

**Optimal.** Leaf size=46

$$\frac{\text{CosIntegral}(2a + 2bx)}{2b} + \frac{\text{Si}(a + bx) \sin(a + bx)}{b} - \frac{\log(a + bx)}{2b}$$

[Out] CosIntegral[2\*a + 2\*b\*x]/(2\*b) - Log[a + b\*x]/(2\*b) + (Sin[a + b\*x]\*SinIntegral[a + b\*x])/b

**Rubi [A]** time = 0.074803, antiderivative size = 46, normalized size of antiderivative = 1., number of steps used = 4, number of rules used = 3, integrand size = 13,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.231$ , Rules used = {6517, 3312, 3302}

$$\frac{\text{CosIntegral}(2a + 2bx)}{2b} + \frac{\text{Si}(a + bx) \sin(a + bx)}{b} - \frac{\log(a + bx)}{2b}$$

Antiderivative was successfully verified.

[In] Int[Cos[a + b\*x]\*SinIntegral[a + b\*x], x]

[Out] CosIntegral[2\*a + 2\*b\*x]/(2\*b) - Log[a + b\*x]/(2\*b) + (Sin[a + b\*x]\*SinIntegral[a + b\*x])/b

#### Rule 6517

Int[Cos[(a\_.) + (b\_.)\*(x\_)]\*SinIntegral[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] := Simp[(Sin[a + b\*x]\*SinIntegral[c + d\*x])/b, x] - Dist[d/b, Int[(Sin[a + b\*x]\*Sin[c + d\*x])/(c + d\*x), x], x] /; FreeQ[{a, b, c, d}, x]

#### Rule 3312

Int[((c\_.) + (d\_.)\*(x\_))^(m\_)\*sin[(e\_.) + (f\_.)\*(x\_)]^(n\_), x\_Symbol] := Int[ExpandTrigReduce[(c + d\*x)^m, Sin[e + f\*x]^n, x], x] /; FreeQ[{c, d, e, f, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))

#### Rule 3302

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] := Simp[CosIntegral[e - Pi/2 + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*(e - Pi/2) - c\*f, 0]

Rubi steps

$$\begin{aligned}
\int \cos(a + bx)\text{Si}(a + bx) dx &= \frac{\sin(a + bx)\text{Si}(a + bx)}{b} - \int \frac{\sin^2(a + bx)}{a + bx} dx \\
&= \frac{\sin(a + bx)\text{Si}(a + bx)}{b} - \int \left( \frac{1}{2(a + bx)} - \frac{\cos(2a + 2bx)}{2(a + bx)} \right) dx \\
&= -\frac{\log(a + bx)}{2b} + \frac{\sin(a + bx)\text{Si}(a + bx)}{b} + \frac{1}{2} \int \frac{\cos(2a + 2bx)}{a + bx} dx \\
&= \frac{\text{Ci}(2a + 2bx)}{2b} - \frac{\log(a + bx)}{2b} + \frac{\sin(a + bx)\text{Si}(a + bx)}{b}
\end{aligned}$$

**Mathematica [A]** time = 0.020974, size = 45, normalized size = 0.98

$$\frac{\text{CosIntegral}(2(a + bx))}{2b} + \frac{\text{Si}(a + bx) \sin(a + bx)}{b} - \frac{\log(a + bx)}{2b}$$

Antiderivative was successfully verified.

[In] Integrate[Cos[a + b\*x]\*SinIntegral[a + b\*x], x]

[Out] CosIntegral[2\*(a + b\*x)]/(2\*b) - Log[a + b\*x]/(2\*b) + (Sin[a + b\*x]\*SinIntegral[a + b\*x])/b

**Maple [A]** time = 0.055, size = 43, normalized size = 0.9

$$\frac{\text{Ci}(2bx + 2a)}{2b} - \frac{\ln(bx + a)}{2b} + \frac{\text{Si}(bx + a) \sin(bx + a)}{b}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(cos(b\*x+a)\*Si(b\*x+a), x)

[Out] 1/2\*Ci(2\*b\*x+2\*a)/b-1/2\*ln(b\*x+a)/b+Si(b\*x+a)\*sin(b\*x+a)/b

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \text{Si}(bx + a) \cos(bx + a) dx$$



Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(cos(b*x+a)*Si(b*x+a),x, algorithm="maxima")`

[Out] `integrate(Si(b*x + a)*cos(b*x + a), x)`

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(\cos(bx + a) \text{Si}(bx + a), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(cos(b*x+a)*Si(b*x+a),x, algorithm="fricas")`

[Out] `integral(cos(b*x + a)*sin_integral(b*x + a), x)`

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \cos(a + bx) \text{Si}(a + bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(cos(b*x+a)*Si(b*x+a),x)`

[Out] `Integral(cos(a + b*x)*Si(a + b*x), x)`

**Giac [B]** time = 1.17286, size = 128, normalized size = 2.78

$$\frac{\sin(bx + a) \text{Si}(bx + a)}{b} + \frac{\cos(2a)^2 \text{Ci}(2bx + 2a) + \cos(2a)^2 \text{Ci}(-2bx - 2a) + \text{Ci}(2bx + 2a) \sin(2a)^2 + \text{Ci}(-2bx - 2a) \sin(2a)^2}{4b}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(cos(b*x+a)*Si(b*x+a),x, algorithm="giac")`

[Out] `sin(b*x + a)*sin_integral(b*x + a)/b + 1/4*(cos(2*a)^2*cos_integral(2*b*x + 2*a) + cos(2*a)^2*cos_integral(-2*b*x - 2*a) + cos_integral(2*b*x + 2*a)*s`

$$\ln(2a)^2 + \frac{\operatorname{Ci}(-2bx - 2a)\sin(2a)^2 - 2\log(bx + a)}{b}$$

$$3.62 \quad \int \frac{\cos(a+bx)\text{Si}(a+bx)}{x} dx$$

**Optimal.** Leaf size=18

$$\text{CannotIntegrate}\left(\frac{\text{Si}(a+bx)\cos(a+bx)}{x}, x\right)$$

[Out] CannotIntegrate[(Cos[a + b\*x]\*SinIntegral[a + b\*x])/x, x]

**Rubi [A]** time = 0.124983, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\cos(a+bx)\text{Si}(a+bx)}{x} dx$$

Verification is Not applicable to the result.

[In] Int[(Cos[a + b\*x]\*SinIntegral[a + b\*x])/x, x]

[Out] Defer[Int] [(Cos[a + b\*x]\*SinIntegral[a + b\*x])/x, x]

Rubi steps

$$\int \frac{\cos(a+bx)\text{Si}(a+bx)}{x} dx = \int \frac{\cos(a+bx)\text{Si}(a+bx)}{x} dx$$

**Mathematica [A]** time = 2.61414, size = 0, normalized size = 0.

$$\int \frac{\cos(a+bx)\text{Si}(a+bx)}{x} dx$$

Verification is Not applicable to the result.

[In] Integrate[(Cos[a + b\*x]\*SinIntegral[a + b\*x])/x, x]

[Out] Integrate[(Cos[a + b\*x]\*SinIntegral[a + b\*x])/x, x]

**Maple [A]** time = 0.086, size = 0, normalized size = 0.

$$\int \frac{\cos(bx + a) \operatorname{Si}(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(cos(b\*x+a)\*Si(b\*x+a)/x,x)

[Out] int(cos(b\*x+a)\*Si(b\*x+a)/x,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\operatorname{Si}(bx + a) \cos(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(cos(b\*x+a)\*Si(b\*x+a)/x,x, algorithm="maxima")

[Out] integrate(Si(b\*x + a)\*cos(b\*x + a)/x, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}\left(\frac{\cos(bx + a) \operatorname{Si}(bx + a)}{x}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(cos(b\*x+a)\*Si(b\*x+a)/x,x, algorithm="fricas")

[Out] integral(cos(b\*x + a)\*sin\_integral(b\*x + a)/x, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\cos(a + bx) \operatorname{Si}(a + bx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(cos(b*x+a)*Si(b*x+a)/x,x)`

[Out] `Integral(cos(a + b*x)*Si(a + b*x)/x, x)`

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(bx + a) \cos(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(cos(b*x+a)*Si(b*x+a)/x,x, algorithm="giac")`

[Out] `integrate(Si(b*x + a)*cos(b*x + a)/x, x)`

### 3.63 $\int x \sin(a + bx) \mathbf{Si}(c + dx) dx$

**Optimal.** Leaf size=371

$$\frac{\cos\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b-d)}{d} + x(b-d)\right)}{2b^2} + \frac{\cos\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b+d)}{d} + x(b+d)\right)}{2b^2} + \frac{\sin\left(a - \frac{bc}{d}\right) \mathbf{Si}\left(x(b-d)\right)}{2b^2}$$

```
[Out] Cos[a - c + (b - d)*x]/(2*b*(b - d)) - Cos[a + c + (b + d)*x]/(2*b*(b + d))
- (Cos[a - (b*c)/d]*CosIntegral[(c*(b - d))/d + (b - d)*x])/(2*b^2) + (Cos
[a - (b*c)/d]*CosIntegral[(c*(b + d))/d + (b + d)*x])/(2*b^2) + (c*CosInteg
ral[(c*(b - d))/d + (b - d)*x]*Sin[a - (b*c)/d])/(2*b*d) - (c*CosIntegral[(
c*(b + d))/d + (b + d)*x]*Sin[a - (b*c)/d])/(2*b*d) + (c*Cos[a - (b*c)/d]*S
inIntegral[(c*(b - d))/d + (b - d)*x])/(2*b*d) + (Sin[a - (b*c)/d]*SinInteg
ral[(c*(b - d))/d + (b - d)*x])/(2*b^2) - (x*Cos[a + b*x]*SinIntegral[c + d
*x])/b + (Sin[a + b*x]*SinIntegral[c + d*x])/b^2 - (c*Cos[a - (b*c)/d]*SinI
ntegral[(c*(b + d))/d + (b + d)*x])/(2*b*d) - (Sin[a - (b*c)/d]*SinIntegral
[(c*(b + d))/d + (b + d)*x])/(2*b^2)
```

**Rubi [A]** time = 0.920128, antiderivative size = 371, normalized size of antiderivative = 1., number of steps used = 24, number of rules used = 10, integrand size = 14,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.714$ , Rules used = {6513, 6742, 4574, 2638, 4430, 3303, 3299, 3302, 6517, 4428}

$$\frac{\cos\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b-d)}{d} + x(b-d)\right)}{2b^2} + \frac{\cos\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b+d)}{d} + x(b+d)\right)}{2b^2} + \frac{\sin\left(a - \frac{bc}{d}\right) \mathbf{Si}\left(x(b-d)\right)}{2b^2}$$

Antiderivative was successfully verified.

```
[In] Int[x*Sin[a + b*x]*SinIntegral[c + d*x],x]
```

```
[Out] Cos[a - c + (b - d)*x]/(2*b*(b - d)) - Cos[a + c + (b + d)*x]/(2*b*(b + d))
- (Cos[a - (b*c)/d]*CosIntegral[(c*(b - d))/d + (b - d)*x])/(2*b^2) + (Cos
[a - (b*c)/d]*CosIntegral[(c*(b + d))/d + (b + d)*x])/(2*b^2) + (c*CosInteg
ral[(c*(b - d))/d + (b - d)*x]*Sin[a - (b*c)/d])/(2*b*d) - (c*CosIntegral[(
c*(b + d))/d + (b + d)*x]*Sin[a - (b*c)/d])/(2*b*d) + (c*Cos[a - (b*c)/d]*S
inIntegral[(c*(b - d))/d + (b - d)*x])/(2*b*d) + (Sin[a - (b*c)/d]*SinInteg
ral[(c*(b - d))/d + (b - d)*x])/(2*b^2) - (x*Cos[a + b*x]*SinIntegral[c + d
*x])/b + (Sin[a + b*x]*SinIntegral[c + d*x])/b^2 - (c*Cos[a - (b*c)/d]*SinI
ntegral[(c*(b + d))/d + (b + d)*x])/(2*b*d) - (Sin[a - (b*c)/d]*SinIntegral
[(c*(b + d))/d + (b + d)*x])/(2*b^2)
```

Rule 6513

```
Int[((e_.) + (f_.)*(x_))^(m_.)*Sin[(a_.) + (b_.)*(x_)]*SinIntegral[(c_.) +
(d_.)*(x_)], x_Symbol] := -Simp[((e + f*x)^m*Cos[a + b*x]*SinIntegral[c + d
*x])/b, x] + (Dist[d/b, Int[((e + f*x)^m*Cos[a + b*x]*Sin[c + d*x])/(c + d*
x), x], x] + Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*Cos[a + b*x]*SinIntegral[c
+ d*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]
```

Rule 6742

```
Int[u_, x_Symbol] := With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

Rule 4574

```
Int[Cos[w_]^(q_.)*Sin[v_]^(p_.), x_Symbol] := Int[ExpandTrigReduce[Sin[v]^p
*Cos[w]^q, x], x] /; IGtQ[p, 0] && IGtQ[q, 0] && ((PolynomialQ[v, x] && Pol
ynomialQ[w, x]) || (BinomialQ[{v, w}, x] && IndependentQ[Cancel[v/w], x]))
```

Rule 2638

```
Int[sin[(c_.) + (d_.)*(x_)], x_Symbol] := -Simp[Cos[c + d*x]/d, x] /; FreeQ
[{c, d}, x]
```

Rule 4430

```
Int[Cos[(c_.) + (d_.)*(x_)]^(q_.)*((e_.) + (f_.)*(x_))^(m_.)*Sin[(a_.) + (b
_.)*(x_)]^(p_.), x_Symbol] := Int[ExpandTrigReduce[(e + f*x)^m, Sin[a + b*x
]^p*Cos[c + d*x]^q, x], x] /; FreeQ[{a, b, c, d, e, f, m}, x] && IGtQ[p, 0]
&& IGtQ[q, 0]
```

Rule 3303

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Dist[Cos[(d*
e - c*f)/d], Int[Sin[(c*f)/d + f*x]/(c + d*x), x], x] + Dist[Sin[(d*e - c*f
)/d], Int[Cos[(c*f)/d + f*x]/(c + d*x), x], x] /; FreeQ[{c, d, e, f}, x] &&
NeQ[d*e - c*f, 0]
```

Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[SinInte
gral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[CosIntegral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) - c*f, 0]
```

### Rule 6517

```
Int[Cos[(a_.) + (b_.)*(x_)]*SinIntegral[(c_.) + (d_.)*(x_)], x_Symbol] := Simp[(Sin[a + b*x]*SinIntegral[c + d*x])/b, x] - Dist[d/b, Int[(Sin[a + b*x]*Sin[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

### Rule 4428

```
Int[((e_.) + (f_.)*(x_))^(m_.)*Sin[(a_.) + (b_.)*(x_)]^(p_.)*Sin[(c_.) + (d_.)*(x_)]^(q_.), x_Symbol] := Int[ExpandTrigReduce[(e + f*x)^m, Sin[a + b*x]^p*Sin[c + d*x]^q, x], x] /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[p, 0] && IGtQ[q, 0] && IntegerQ[m]
```

### Rubi steps

$$\begin{aligned}
 \int x \sin(a + bx) \operatorname{Si}(c + dx) dx &= -\frac{x \cos(a + bx) \operatorname{Si}(c + dx)}{b} + \frac{\int \cos(a + bx) \operatorname{Si}(c + dx) dx}{b} + \frac{d \int \frac{x \cos(a + bx) \sin(c + dx)}{c + dx} dx}{b} \\
 &= -\frac{x \cos(a + bx) \operatorname{Si}(c + dx)}{b} + \frac{\sin(a + bx) \operatorname{Si}(c + dx)}{b^2} - \frac{d \int \frac{\sin(a + bx) \sin(c + dx)}{c + dx} dx}{b^2} + \frac{d \int \left( \frac{\cos(a + bx)}{c + dx} \right) dx}{b} \\
 &= -\frac{x \cos(a + bx) \operatorname{Si}(c + dx)}{b} + \frac{\sin(a + bx) \operatorname{Si}(c + dx)}{b^2} + \frac{\int \cos(a + bx) \sin(c + dx) dx}{b} - \frac{c \int \frac{\cos(a + bx)}{c + dx} dx}{b} \\
 &= -\frac{x \cos(a + bx) \operatorname{Si}(c + dx)}{b} + \frac{\sin(a + bx) \operatorname{Si}(c + dx)}{b^2} + \frac{\int \left( -\frac{1}{2} \sin(a - c + (b - d)x) + \frac{1}{2} \sin(a + c + (b + d)x) \right) dx}{b} \\
 &= -\frac{x \cos(a + bx) \operatorname{Si}(c + dx)}{b} + \frac{\sin(a + bx) \operatorname{Si}(c + dx)}{b^2} - \frac{\int \sin(a - c + (b - d)x) dx}{2b} + \frac{\int \sin(a + c + (b + d)x) dx}{2b} \\
 &= \frac{\cos(a - c + (b - d)x)}{2b(b - d)} - \frac{\cos(a + c + (b + d)x)}{2b(b + d)} - \frac{\cos\left(a - \frac{bc}{d}\right) \operatorname{Ci}\left(\frac{c(b-d)}{d} + (b-d)x\right)}{2b^2} + \frac{\cos\left(a + \frac{bc}{d}\right) \operatorname{Ci}\left(\frac{c(b+d)}{d} + (b+d)x\right)}{2b^2} \\
 &= \frac{\cos(a - c + (b - d)x)}{2b(b - d)} - \frac{\cos(a + c + (b + d)x)}{2b(b + d)} - \frac{\cos\left(a - \frac{bc}{d}\right) \operatorname{Ci}\left(\frac{c(b-d)}{d} + (b-d)x\right)}{2b^2} + \frac{\cos\left(a + \frac{bc}{d}\right) \operatorname{Ci}\left(\frac{c(b+d)}{d} + (b+d)x\right)}{2b^2}
 \end{aligned}$$



**Mathematica [C]** time = 5.31338, size = 345, normalized size = 0.93

$$\frac{e^{-i(a+c)} \left( -i(bc - id) e^{\frac{i(d(2a+c)-bc)}{d}} \text{ExpIntegralEi} \left( \frac{i(b-d)(c+dx)}{d} \right) + bd \left( \frac{e^{i(2a+bx-dx)}}{b-d} - \frac{e^{-ix(b+d)}}{b+d} \right) + (d - ibc) e^{\frac{ic(b+d)}{d}} \text{ExpIntegralEi} \left( \frac{ic(b+d)}{d} \right) \right)}{4b^2d}$$

Warning: Unable to verify antiderivative.

[In] Integrate[x\*Sin[a + b\*x]\*SinIntegral[c + d\*x], x]

[Out] (b\*d\*(-(1/((b + d)\*E^(I\*(b + d)\*x))) + E^(I\*(2\*a + b\*x - d\*x))/(b - d)) - I\*(b\*c - I\*d)\*E^((I\*(-(b\*c) + (2\*a + c)\*d))/d)\*ExpIntegralEi[(I\*(b - d)\*(c + d\*x))/d] + ((-I)\*b\*c + d)\*E^((I\*c\*(b + d))/d)\*ExpIntegralEi[((-I)\*(b + d)\*(c + d\*x))/d]/(4\*b^2\*d\*E^(I\*(a + c))) + (b\*d\*(1/((b - d)\*E^(I\*(b - d)\*x)) - E^(I\*(2\*a + (b + d)\*x))/(b + d)) + I\*(b\*c + I\*d)\*E^((I\*c\*(b - d))/d)\*ExpIntegralEi[((-I)\*(b - d)\*(c + d\*x))/d] + ((I\*b\*c + d)\*ExpIntegralEi[(I\*(b + d)\*(c + d\*x))/d])/E^((I\*(b\*c - 2\*a\*d + c\*d))/d)/(4\*b^2\*d\*E^(I\*(a - c))) - ((b\*x\*Cos[a + b\*x] - Sin[a + b\*x])\*SinIntegral[c + d\*x])/b^2

**Maple [B]** time = 0.108, size = 1212, normalized size = 3.3

result too large to display

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x\*Si(d\*x+c)\*sin(b\*x+a), x)

[Out] (Si(d\*x+c)/b\*(1/b\*d\*(-(b/d\*(d\*x+c)+(a\*d-b\*c)/d)\*cos(b/d\*(d\*x+c)+(a\*d-b\*c)/d)+sin(b/d\*(d\*x+c)+(a\*d-b\*c)/d)+a\*d/b\*cos(b/d\*(d\*x+c)+(a\*d-b\*c)/d))-1/b\*(-1/2/(b-d)\*d\*cos((b-d)/d\*(d\*x+c)+(a\*d-b\*c)/d)+1/2\*(a\*d-b\*c)\*d/(b-d)\*(Si((b-d)/d\*(d\*x+c)+(a\*d-b\*c)/d+(-a\*d+b\*c)/d)\*cos((-a\*d+b\*c)/d)/d-Ci((b-d)/d\*(d\*x+c)+(a\*d-b\*c)/d+(-a\*d+b\*c)/d)\*sin((-a\*d+b\*c)/d)/d)-1/2/(b-d)\*d^2\*a\*(Si((b-d)/d\*(d\*x+c)+(a\*d-b\*c)/d+(-a\*d+b\*c)/d)\*cos((-a\*d+b\*c)/d)/d-Ci((b-d)/d\*(d\*x+c)+(a\*d-b\*c)/d+(-a\*d+b\*c)/d)\*sin((-a\*d+b\*c)/d)/d)+1/2/(b-d)\*c\*d^2\*(Si((b-d)/d\*(d\*x+c)+(a\*d-b\*c)/d+(-a\*d+b\*c)/d)\*cos((-a\*d+b\*c)/d)/d-Ci((b-d)/d\*(d\*x+c)+(a\*d-b\*c)/d+(-a\*d+b\*c)/d)\*sin((-a\*d+b\*c)/d)/d)+1/2/(b+d)\*d\*cos((b+d)/d\*(d\*x+c)+(a\*d-b\*c)/d)-1/2\*(a\*d-b\*c)\*d/(b+d)\*(Si((b+d)/d\*(d\*x+c)+(a\*d-b\*c)/d+(-a\*d+b\*c)/d)\*cos((-a\*d+b\*c)/d)/d-Ci((b+d)/d\*(d\*x+c)+(a\*d-b\*c)/d+(-a\*d+b\*c)/d)\*sin((-a\*d+b\*c)/d)/d)+1/2/(b+d)\*d^2\*a\*(Si((b+d)/d\*(d\*x+c)+(a\*d-b\*c)/d+(-a\*d+b\*c)/d)\*cos((-a\*d+b\*c)/d)/d-Ci((b+d)/d\*(d\*x+c)+(a\*d-b\*c)/d+(-a\*d+b\*c)/d)\*sin((-a\*d+b\*c)/d)/d)+1/2/(b+d)\*c\*d^2\*(Si((b+d)/d\*(d\*x+c)+(a\*d-b\*c)/d+(-a\*d+b\*c)/d)\*cos((-a\*d+b\*c)/d)/d-Ci((b+d)/d\*(d\*x+c)+(a\*d-b\*c)/d+(-a\*d+b\*c)/d)\*sin((-a

$$\frac{\frac{d+bc}{d} + \frac{1}{2}bd^2 \left( \operatorname{Si}\left(\frac{b-d}{d}(dx+c) + \frac{a-d-bc}{d} + \frac{-a+d+bc}{d}\right) \sin\left(\frac{-a+d+bc}{d} + \frac{b-d}{d} + \operatorname{Ci}\left(\frac{b-d}{d}(dx+c) + \frac{a-d-bc}{d} + \frac{-a+d+bc}{d}\right) \cos\left(\frac{-a+d+bc}{d} + \frac{b-d}{d}\right) - \frac{1}{2}bd^2 \left( \operatorname{Si}\left(\frac{b+d}{d}(dx+c) + \frac{a-d-bc}{d} + \frac{-a+d+bc}{d}\right) \sin\left(\frac{-a+d+bc}{d} + \frac{b+d}{d} + \operatorname{Ci}\left(\frac{b+d}{d}(dx+c) + \frac{a-d-bc}{d} + \frac{-a+d+bc}{d}\right) \cos\left(\frac{-a+d+bc}{d} + \frac{b+d}{d}\right) \right) \right)}{d}$$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x \operatorname{Si}(dx + c) \sin(bx + a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Si(d\*x+c)\*sin(b\*x+a),x, algorithm="maxima")

[Out] integrate(x\*Si(d\*x + c)\*sin(b\*x + a), x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(x \sin(bx + a) \operatorname{Si}(dx + c), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Si(d\*x+c)\*sin(b\*x+a),x, algorithm="fricas")

[Out] integral(x\*sin(b\*x + a)\*sin\_integral(d\*x + c), x)

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x \sin(a + bx) \operatorname{Si}(c + dx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Si(d\*x+c)\*sin(b\*x+a),x)

[Out] Integral(x\*sin(a + b\*x)\*Si(c + d\*x), x)

---

**Giac [F(-1)]** time = 0., size = 0, normalized size = 0.

Timed out

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*Si(d*x+c)*sin(b*x+a),x, algorithm="giac")`

[Out] Timed out

### 3.64 $\int \sin(a + bx) \mathbf{Si}(c + dx) dx$

**Optimal.** Leaf size=154

$$-\frac{\sin\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b-d)}{d} + x(b-d)\right)}{2b} + \frac{\sin\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b+d)}{d} + x(b+d)\right)}{2b} - \frac{\cos\left(a - \frac{bc}{d}\right) \mathbf{Si}\left(x(b-d)\right)}{2b}$$

[Out] -(CosIntegral[(c\*(b - d))/d + (b - d)\*x]\*Sin[a - (b\*c)/d])/(2\*b) + (CosIntegral[(c\*(b + d))/d + (b + d)\*x]\*Sin[a - (b\*c)/d])/(2\*b) - (Cos[a - (b\*c)/d]\*SinIntegral[(c\*(b - d))/d + (b - d)\*x])/(2\*b) - (Cos[a + b\*x]\*SinIntegral[c + d\*x])/b + (Cos[a - (b\*c)/d]\*SinIntegral[(c\*(b + d))/d + (b + d)\*x])/(2\*b)

**Rubi [A]** time = 0.228481, antiderivative size = 154, normalized size of antiderivative = 1., number of steps used = 9, number of rules used = 5, integrand size = 13,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.385$ , Rules used = {6511, 4430, 3303, 3299, 3302}

$$-\frac{\sin\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b-d)}{d} + x(b-d)\right)}{2b} + \frac{\sin\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b+d)}{d} + x(b+d)\right)}{2b} - \frac{\cos\left(a - \frac{bc}{d}\right) \mathbf{Si}\left(x(b-d)\right)}{2b}$$

Antiderivative was successfully verified.

[In] Int[Sin[a + b\*x]\*SinIntegral[c + d\*x], x]

[Out] -(CosIntegral[(c\*(b - d))/d + (b - d)\*x]\*Sin[a - (b\*c)/d])/(2\*b) + (CosIntegral[(c\*(b + d))/d + (b + d)\*x]\*Sin[a - (b\*c)/d])/(2\*b) - (Cos[a - (b\*c)/d]\*SinIntegral[(c\*(b - d))/d + (b - d)\*x])/(2\*b) - (Cos[a + b\*x]\*SinIntegral[c + d\*x])/b + (Cos[a - (b\*c)/d]\*SinIntegral[(c\*(b + d))/d + (b + d)\*x])/(2\*b)

#### Rule 6511

Int[Sin[(a\_.) + (b\_.)\*(x\_)]\*SinIntegral[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] :> Simp[(Cos[a + b\*x]\*SinIntegral[c + d\*x])/b, x] + Dist[d/b, Int[(Cos[a + b\*x]\*Sin[c + d\*x])/(c + d\*x), x], x] /; FreeQ[{a, b, c, d}, x]

#### Rule 4430

Int[Cos[(c\_.) + (d\_.)\*(x\_)]^(q\_.)\*((e\_.) + (f\_.)\*(x\_))^(m\_.)\*Sin[(a\_.) + (b\_.)\*(x\_)]^(p\_.), x\_Symbol] :> Int[ExpandTrigReduce[(e + f\*x)^m, Sin[a + b\*x]^p\*cos[c + d\*x]^q, x], x] /; FreeQ[{a, b, c, d, e, f, m}, x] && IGtQ[p, 0]

&& IGtQ[q, 0]

### Rule 3303

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] :> Dist[Cos[(d\*e - c\*f)/d], Int[Sin[(c\*f)/d + f\*x]/(c + d\*x), x], x] + Dist[Sin[(d\*e - c\*f)/d], Int[Cos[(c\*f)/d + f\*x]/(c + d\*x), x], x] /; FreeQ[{c, d, e, f}, x] && NeQ[d\*e - c\*f, 0]

### Rule 3299

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] :> Simp[SinIntegral[e + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*e - c\*f, 0]

### Rule 3302

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] :> Simp[CosIntegral[e - Pi/2 + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*(e - Pi/2) - c\*f, 0]

### Rubi steps

$$\begin{aligned}
 \int \sin(a + bx)\text{Si}(c + dx) dx &= -\frac{\cos(a + bx)\text{Si}(c + dx)}{b} + \frac{d \int \frac{\cos(a+bx)\sin(c+dx)}{c+dx} dx}{b} \\
 &= -\frac{\cos(a + bx)\text{Si}(c + dx)}{b} + \frac{d \int \left( -\frac{\sin(a-c+(b-d)x)}{2(c+dx)} + \frac{\sin(a+c+(b+d)x)}{2(c+dx)} \right) dx}{b} \\
 &= -\frac{\cos(a + bx)\text{Si}(c + dx)}{b} - \frac{d \int \frac{\sin(a-c+(b-d)x)}{c+dx} dx}{2b} + \frac{d \int \frac{\sin(a+c+(b+d)x)}{c+dx} dx}{2b} \\
 &= -\frac{\cos(a + bx)\text{Si}(c + dx)}{b} - \frac{\left( d \cos\left(a - \frac{bc}{d}\right) \right) \int \frac{\sin\left(\frac{c(b-d)}{d} + (b-d)x\right)}{c+dx} dx}{2b} + \frac{\left( d \cos\left(a - \frac{bc}{d}\right) \right) \int \frac{\sin\left(\frac{c(b+d)}{d} + (b+d)x\right)}{c+dx} dx}{2b} \\
 &= -\frac{\text{Ci}\left(\frac{c(b-d)}{d} + (b-d)x\right) \sin\left(a - \frac{bc}{d}\right)}{2b} + \frac{\text{Ci}\left(\frac{c(b+d)}{d} + (b+d)x\right) \sin\left(a - \frac{bc}{d}\right)}{2b} - \frac{\cos\left(a - \frac{bc}{d}\right) \text{Si}\left(\frac{c(b+d)}{d} + (b+d)x\right)}{2b}
 \end{aligned}$$

**Mathematica [C]** time = 1.9715, size = 168, normalized size = 1.09

$$ie^{-\frac{i(ad+bc)}{d}} \left( e^{2ia} \text{ExpIntegralEi}\left(\frac{i(b-d)(c+dx)}{d}\right) - e^{2ia} \text{ExpIntegralEi}\left(\frac{i(b+d)(c+dx)}{d}\right) \right) + 4ie^{\frac{i(ad+bc)}{d}} \cos(a + bx)\text{Si}(c + dx) - e^{\frac{2ibc}{d}} \text{Ei}\left(\frac{c(b+d)}{d} + (b+d)x\right)$$

4b

Warning: Unable to verify antiderivative.

[In] Integrate[Sin[a + b\*x]\*SinIntegral[c + d\*x],x]

[Out]  $\left(\frac{I}{4}\right) \left(-E^{\left(\frac{(2I)bc}{d}\right)} \text{ExpIntegralEi}\left[\frac{(-I)(b-d)(c+dx)}{d}\right] + E^{\left(\frac{(2I)a}{d}\right)} \text{ExpIntegralEi}\left[\frac{I(b-d)(c+dx)}{d}\right] + E^{\left(\frac{(2I)bc}{d}\right)} \text{ExpIntegralEi}\left[\frac{(-I)(b+d)(c+dx)}{d}\right] - E^{\left(\frac{(2I)a}{d}\right)} \text{ExpIntegralEi}\left[\frac{I(b+d)(c+dx)}{d}\right] + (4I)E^{\left(\frac{I(bc+ad)}{d}\right)} \cos[a + b*x] \text{SinIntegral}[c + d*x]\right) / (bE^{\left(\frac{I(bc+ad)}{d}\right)})$

**Maple [A]** time = 0.072, size = 282, normalized size = 1.8

$$\frac{1}{d} \left( -\frac{\text{Si}(dx+c)d}{b} \cos\left(\frac{b(dx+c)}{d} + \frac{ad-bc}{d}\right) + \frac{d}{b} \left( -\frac{d}{2} \left( \frac{1}{d} \text{Si}\left(\frac{(b-d)(dx+c)}{d} + \frac{ad-bc}{d} + \frac{-ad+bc}{d}\right) \cos\left(\frac{-ad+bc}{d}\right) - \frac{1}{d} \right) \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Si(d\*x+c)\*sin(b\*x+a),x)

[Out]  $\left(-\text{Si}(d*x+c)/b*d*\cos(b/d*(d*x+c)+(a*d-b*c)/d)+1/b*d*(-1/2*d*(\text{Si}((b-d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*\cos((-a*d+b*c)/d)/d-\text{Ci}((b-d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*\sin((-a*d+b*c)/d)/d)+1/2*d*(\text{Si}((b+d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*\cos((-a*d+b*c)/d)/d-\text{Ci}((b+d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*\sin((-a*d+b*c)/d)/d)\right)/d$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \text{Si}(dx+c) \sin(bx+a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(d\*x+c)\*sin(b\*x+a),x, algorithm="maxima")

[Out] integrate(Si(d\*x + c)\*sin(b\*x + a), x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(\sin(bx+a) \text{Si}(dx+c), x)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(d*x+c)*sin(b*x+a),x, algorithm="fricas")
```

```
[Out] integral(sin(b*x + a)*sin_integral(d*x + c), x)
```

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \sin(a + bx) \operatorname{Si}(c + dx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(d*x+c)*sin(b*x+a),x)
```

```
[Out] Integral(sin(a + b*x)*Si(c + d*x), x)
```

**Giac [C]** time = 2.03416, size = 12880, normalized size = 83.64

result too large to display

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Si(d*x+c)*sin(b*x+a),x, algorithm="giac")
```

```
[Out] 1/4*(imag_part(cos_integral(b*x + d*x + c + b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d)^2 - imag_part(cos_integral(b*x - d*x - c + b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d)^2 + imag_part(cos_integral(-b*x + d*x + c - b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d)^2 - imag_part(cos_integral(-b*x - d*x - c - b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d)^2 + 2*sin_integral((b*d*x + d^2*x + b*c + c*d)/d)*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d)^2 - 2*sin_integral((b*d*x - d^2*x + b*c - c*d)/d)*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d)^2 - 2*real_part(cos_integral(b*x - d*x - c + b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d) - 2*real_part(cos_integral(-b*x + d*x + c - b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c
```

$$\begin{aligned}
& *d)/d) + 2*\text{real\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\text{tan}(1/2*a + 1/2*c) \\
& )^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)*\text{tan}(1/2*(b*c - c*d)/d)^2 + \\
& 2*\text{real\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}( \\
& 1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)*\text{tan}(1/2*(b*c - c*d)/d)^2 + 2*\text{real\_p} \\
& \text{art}(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1 \\
& /2*c)*\text{tan}(1/2*(b*c + c*d)/d)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 + 2*\text{real\_part}(\text{cos\_i} \\
& \text{ntegral}(-b*x + d*x + c - b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)*\text{ta} \\
& \text{n}(1/2*(b*c + c*d)/d)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 - 2*\text{real\_part}(\text{cos\_integral}( \\
& b*x + d*x + c + b*c/d))*\text{tan}(1/2*a + 1/2*c)*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b* \\
& c + c*d)/d)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 - 2*\text{real\_part}(\text{cos\_integral}(-b*x - d* \\
& x - c - b*c/d))*\text{tan}(1/2*a + 1/2*c)*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d) \\
& /d)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 + \text{imag\_part}(\text{cos\_integral}(b*x + d*x + c + b*c \\
& /d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)^2 + i \\
& \text{mag\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2* \\
& a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)^2 - \text{imag\_part}(\text{cos\_integral}(-b*x + d*x + \\
& c - b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/ \\
& d)^2 - \text{imag\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d))*\text{tan}(1/2*a + 1/2*c)^2 \\
& *\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)^2 + 2*\text{sin\_integral}((b*d*x + d^ \\
& 2*x + b*c + c*d)/d)*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c \\
& + c*d)/d)^2 + 2*\text{sin\_integral}((b*d*x - d^2*x + b*c - c*d)/d)*\text{tan}(1/2*a + 1/2 \\
& *c)^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)^2 - 4*\text{imag\_part}(\text{cos\_integ} \\
& \text{ral}(b*x - d*x - c + b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)*\text{tan}(1/2 \\
& *(b*c + c*d)/d)^2*\text{tan}(1/2*(b*c - c*d)/d) + 4*\text{imag\_part}(\text{cos\_integral}(-b*x + \\
& d*x + c - b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)*\text{tan}(1/2*(b*c + c* \\
& d)/d)^2*\text{tan}(1/2*(b*c - c*d)/d) - 8*\text{sin\_integral}((b*d*x - d^2*x + b*c - c*d) \\
& /d)*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)*\text{tan}(1/2*(b*c + c*d)/d)^2*\text{tan}(1/ \\
& 2*(b*c - c*d)/d) - \text{imag\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\text{tan}(1/2*a \\
& + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 - \text{imag\_part}(\text{cos\_i} \\
& \text{ntegral}(b*x - d*x - c + b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)^2*\text{t} \\
& \text{an}(1/2*(b*c - c*d)/d)^2 + \text{imag\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\text{t} \\
& \text{an}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 + \text{imag\_pa} \\
& \text{rt}(\text{cos\_integral}(-b*x - d*x - c - b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1 \\
& /2*c)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 - 2*\text{sin\_integral}((b*d*x + d^2*x + b*c + c* \\
& d)/d)*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 - \\
& 2*\text{sin\_integral}((b*d*x - d^2*x + b*c - c*d)/d)*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2* \\
& a - 1/2*c)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 + 4*\text{imag\_part}(\text{cos\_integral}(b*x + d*x \\
& + c + b*c/d))*\text{tan}(1/2*a + 1/2*c)*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d \\
& )*\text{tan}(1/2*(b*c - c*d)/d)^2 - 4*\text{imag\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/ \\
& d))*\text{tan}(1/2*a + 1/2*c)*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)*\text{tan}(1/2* \\
& (b*c - c*d)/d)^2 + 8*\text{sin\_integral}((b*d*x + d^2*x + b*c + c*d)/d)*\text{tan}(1/2*a \\
& + 1/2*c)*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)*\text{tan}(1/2*(b*c - c*d)/d) \\
& ^2 + \text{imag\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{ta} \\
& \text{n}(1/2*(b*c + c*d)/d)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 + \text{imag\_part}(\text{cos\_integral}(b* \\
& x - d*x - c + b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)^2*\text{tan}(1/2 \\
& *(b*c - c*d)/d)^2 - \text{imag\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\text{tan}(1/2
\end{aligned}$$



$$\begin{aligned}
& *a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d)^2 - \text{imag\_part} \\
& (\text{cos\_integral}(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c + \\
& c*d)/d)^2*\tan(1/2*(b*c - c*d)/d)^2 + 2*\sin\_integral((b*d*x + d^2*x + b*c + \\
& c*d)/d)*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d \\
& )^2 + 2*\sin\_integral((b*d*x - d^2*x + b*c - c*d)/d)*\tan(1/2*a + 1/2*c)^2*\tan \\
& (1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d)^2 - \text{imag\_part}(\text{cos\_integral}(b*x \\
& + d*x + c + b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2 \\
& *(b*c - c*d)/d)^2 - \text{imag\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\tan(1/2*a \\
& - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d)^2 + \text{imag\_part} \\
& (\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c \\
& *d)/d)^2*\tan(1/2*(b*c - c*d)/d)^2 + \text{imag\_part}(\text{cos\_integral}(-b*x - d*x - c - \\
& b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/ \\
& d)^2 - 2*\sin\_integral((b*d*x + d^2*x + b*c + c*d)/d)*\tan(1/2*a - 1/2*c)^2*\tan \\
& (1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d)^2 - 2*\sin\_integral((b*d*x - \\
& d^2*x + b*c - c*d)/d)*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2 \\
& *(b*c - c*d)/d)^2 + 2*\text{real\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\tan(1/ \\
& 2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d) + 2*\text{real\_part}(\text{co} \\
& s\_integral(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c) \\
& ^2*\tan(1/2*(b*c + c*d)/d) - 2*\text{real\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d) \\
& )*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c + c*d)/d)^2 - 2*\text{real} \\
& \_part(\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a \\
& - 1/2*c)*\tan(1/2*(b*c + c*d)/d)^2 - 2*\text{real\_part}(\text{cos\_integral}(b*x + d*x + c \\
& + b*c/d))*\tan(1/2*a + 1/2*c)*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 \\
& - 2*\text{real\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)*\tan( \\
& 1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 - 2*\text{real\_part}(\text{cos\_integral}(b*x - \\
& d*x - c + b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c - \\
& c*d)/d) - 2*\text{real\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\tan(1/2*a + 1/2 \\
& *c)^2*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c - c*d)/d) + 2*\text{real\_part}(\text{cos\_integra} \\
& l(b*x - d*x - c + b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan \\
& (1/2*(b*c - c*d)/d) + 2*\text{real\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\tan \\
& (1/2*a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d) - 2*\text{real} \\
& \_part(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c \\
& + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d) - 2*\text{real\_part}(\text{cos\_integral}(-b*x + d*x + \\
& c - b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c \\
& *d)/d) + 2*\text{real\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\tan(1/2*a + 1/2*c \\
& )^2*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c - c*d)/d)^2 + 2*\text{real\_part}(\text{cos\_integral} \\
& (-b*x + d*x + c - b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)*\tan(1/2*(b \\
& *c - c*d)/d)^2 + 2*\text{real\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\tan(1/2*a \\
& + 1/2*c)*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c - c*d)/d)^2 + 2*\text{real\_part}(\text{cos\_i} \\
& ntegral(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)*\tan(1/2*a - 1/2*c)^2*\tan \\
& (1/2*(b*c - c*d)/d)^2 + 2*\text{real\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\tan \\
& (1/2*a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)*\tan(1/2*(b*c - c*d)/d)^2 + 2*\text{rea} \\
& l\_part(\text{cos\_integral}(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*( \\
& b*c + c*d)/d)*\tan(1/2*(b*c - c*d)/d)^2 - 2*\text{real\_part}(\text{cos\_integral}(b*x + d*x \\
& + c + b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)*\tan(1/2*(b*c - c
\end{aligned}$$

$$\begin{aligned}
& *d)/d)^2 - 2*\text{real\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d))*\tan(1/2*a - 1/ \\
& 2*c)^2*\tan(1/2*(b*c + c*d)/d)*\tan(1/2*(b*c - c*d)/d)^2 - 2*\text{real\_part}(\text{cos\_in} \\
& \text{tegral}(b*x + d*x + c + b*c/d))*\tan(1/2*a + 1/2*c)*\tan(1/2*(b*c + c*d)/d)^2* \\
& \tan(1/2*(b*c - c*d)/d)^2 - 2*\text{real\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d) \\
& )*\tan(1/2*a + 1/2*c)*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d)^2 + 2* \\
& \text{real\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\tan(1/2*a - 1/2*c)*\tan(1/2*( \\
& b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d)^2 + 2*\text{real\_part}(\text{cos\_integral}(-b*x + \\
& d*x + c - b*c/d))*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c \\
& - c*d)/d)^2 - \text{imag\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\tan(1/2*a + 1/ \\
& 2*c)^2*\tan(1/2*a - 1/2*c)^2 + \text{imag\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d) \\
& )*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2 - \text{imag\_part}(\text{cos\_integral}(-b*x + \\
& d*x + c - b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2 + \text{imag\_part}(\text{co} \\
& \text{s\_integral}(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c) \\
& ^2 - 2*\text{sin\_integral}((b*d*x + d^2*x + b*c + c*d)/d)*\tan(1/2*a + 1/2*c)^2*\tan \\
& (1/2*a - 1/2*c)^2 + 2*\text{sin\_integral}((b*d*x - d^2*x + b*c - c*d)/d)*\tan(1/2*a \\
& + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2 + 4*\text{imag\_part}(\text{cos\_integral}(b*x + d*x + c + \\
& b*c/d))*\tan(1/2*a + 1/2*c)*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d) - 4 \\
& *\text{imag\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)*\tan(1/2 \\
& *a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d) + 8*\text{sin\_integral}((b*d*x + d^2*x + b*c \\
& + c*d)/d)*\tan(1/2*a + 1/2*c)*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d) + \\
& \text{imag\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2 \\
& *(b*c + c*d)/d)^2 - \text{imag\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\tan(1/2* \\
& a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 + \text{imag\_part}(\text{cos\_integral}(-b*x + d*x + \\
& c - b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 - \text{imag\_part}(\text{cos\_} \\
& \text{integral}(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/ \\
& d)^2 + 2*\text{sin\_integral}((b*d*x + d^2*x + b*c + c*d)/d)*\tan(1/2*a + 1/2*c)^2*\tan \\
& (1/2*(b*c + c*d)/d)^2 - 2*\text{sin\_integral}((b*d*x - d^2*x + b*c - c*d)/d)*\tan \\
& (1/2*a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 - \text{imag\_part}(\text{cos\_integral}(b*x + d \\
& *x + c + b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 + \text{imag\_part}(\text{c} \\
& \text{os\_integral}(b*x - d*x - c + b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c* \\
& d)/d)^2 - \text{imag\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\tan(1/2*a - 1/2*c \\
& )^2*\tan(1/2*(b*c + c*d)/d)^2 + \text{imag\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/ \\
& d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 - 2*\text{sin\_integral}((b*d*x + \\
& d^2*x + b*c + c*d)/d)*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 + 2*\text{si} \\
& \text{n\_integral}((b*d*x - d^2*x + b*c - c*d)/d)*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c \\
& + c*d)/d)^2 - 4*\text{imag\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\tan(1/2*a + \\
& 1/2*c)^2*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c - c*d)/d) + 4*\text{imag\_part}(\text{cos\_integ} \\
& \text{ral}(-b*x + d*x + c - b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)*\tan(1/ \\
& 2*(b*c - c*d)/d) - 8*\text{sin\_integral}((b*d*x - d^2*x + b*c - c*d)/d)*\tan(1/2*a \\
& + 1/2*c)^2*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c - c*d)/d) - 4*\text{imag\_part}(\text{cos\_inte} \\
& \text{gral}(b*x - d*x - c + b*c/d))*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c + c*d)/d)^2*\tan \\
& (1/2*(b*c - c*d)/d) + 4*\text{imag\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\tan \\
& (1/2*a - 1/2*c)*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d) - 8*\text{sin\_in} \\
& \text{tegral}((b*d*x - d^2*x + b*c - c*d)/d)*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c + c*d \\
& )/d)^2*\tan(1/2*(b*c - c*d)/d) - \text{imag\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/
\end{aligned}$$

$$\begin{aligned}
& d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d)^2 + \text{imag\_part}(\cos\_integral( \\
& b*x - d*x - c + b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d)^2 - \text{ima} \\
& g\_part(\cos\_integral(-b*x + d*x + c - b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*( \\
& b*c - c*d)/d)^2 + \text{imag\_part}(\cos\_integral(-b*x - d*x - c - b*c/d)) * \tan(1/2*a \\
& + 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d)^2 - 2 * \sin\_integral((b*d*x + d^2*x + b*c \\
& + c*d)/d) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d)^2 + 2 * \sin\_integral((b \\
& *d*x - d^2*x + b*c - c*d)/d) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d)^2 \\
& + \text{imag\_part}(\cos\_integral(b*x + d*x + c + b*c/d)) * \tan(1/2*a - 1/2*c)^2 * \tan(1 \\
& /2*(b*c - c*d)/d)^2 - \text{imag\_part}(\cos\_integral(b*x - d*x - c + b*c/d)) * \tan(1/ \\
& 2*a - 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d)^2 + \text{imag\_part}(\cos\_integral(-b*x + d*x \\
& + c - b*c/d)) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d)^2 - \text{imag\_part}(\cos \\
& s\_integral(-b*x - d*x - c - b*c/d)) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c - c*d \\
& )/d)^2 + 2 * \sin\_integral((b*d*x + d^2*x + b*c + c*d)/d) * \tan(1/2*a - 1/2*c)^2 \\
& * \tan(1/2*(b*c - c*d)/d)^2 - 2 * \sin\_integral((b*d*x - d^2*x + b*c - c*d)/d) * \tan \\
& an(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d)^2 + 4 * \text{imag\_part}(\cos\_integral(b*x \\
& + d*x + c + b*c/d)) * \tan(1/2*a + 1/2*c) * \tan(1/2*(b*c + c*d)/d) * \tan(1/2*(b*c \\
& - c*d)/d)^2 - 4 * \text{imag\_part}(\cos\_integral(-b*x - d*x - c - b*c/d)) * \tan(1/2*a \\
& + 1/2*c) * \tan(1/2*(b*c + c*d)/d) * \tan(1/2*(b*c - c*d)/d)^2 + 8 * \sin\_integral(( \\
& b*d*x + d^2*x + b*c + c*d)/d) * \tan(1/2*a + 1/2*c) * \tan(1/2*(b*c + c*d)/d) * \tan \\
& (1/2*(b*c - c*d)/d)^2 - \text{imag\_part}(\cos\_integral(b*x + d*x + c + b*c/d)) * \tan( \\
& 1/2*(b*c + c*d)/d)^2 * \tan(1/2*(b*c - c*d)/d)^2 + \text{imag\_part}(\cos\_integral(b*x \\
& - d*x - c + b*c/d)) * \tan(1/2*(b*c + c*d)/d)^2 * \tan(1/2*(b*c - c*d)/d)^2 - \text{ima} \\
& g\_part(\cos\_integral(-b*x + d*x + c - b*c/d)) * \tan(1/2*(b*c + c*d)/d)^2 * \tan(1 \\
& /2*(b*c - c*d)/d)^2 + \text{imag\_part}(\cos\_integral(-b*x - d*x - c - b*c/d)) * \tan(1 \\
& /2*(b*c + c*d)/d)^2 * \tan(1/2*(b*c - c*d)/d)^2 - 2 * \sin\_integral((b*d*x + d^2*x \\
& x + b*c + c*d)/d) * \tan(1/2*(b*c + c*d)/d)^2 * \tan(1/2*(b*c - c*d)/d)^2 + 2 * \sin \\
& \_integral((b*d*x - d^2*x + b*c - c*d)/d) * \tan(1/2*(b*c + c*d)/d)^2 * \tan(1/2*( \\
& b*c - c*d)/d)^2 - 2 * \text{real\_part}(\cos\_integral(b*x - d*x - c + b*c/d)) * \tan(1/2* \\
& a + 1/2*c)^2 * \tan(1/2*a - 1/2*c) - 2 * \text{real\_part}(\cos\_integral(-b*x + d*x + c - \\
& b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*a - 1/2*c) + 2 * \text{real\_part}(\cos\_integral \\
& (b*x + d*x + c + b*c/d)) * \tan(1/2*a + 1/2*c) * \tan(1/2*a - 1/2*c)^2 + 2 * \text{real\_p} \\
& art(\cos\_integral(-b*x - d*x - c - b*c/d)) * \tan(1/2*a + 1/2*c) * \tan(1/2*a - 1/ \\
& 2*c)^2 + 2 * \text{real\_part}(\cos\_integral(b*x + d*x + c + b*c/d)) * \tan(1/2*a + 1/2*c \\
& )^2 * \tan(1/2*(b*c + c*d)/d) + 2 * \text{real\_part}(\cos\_integral(-b*x - d*x - c - b*c/ \\
& d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d) - 2 * \text{real\_part}(\cos\_integral( \\
& b*x + d*x + c + b*c/d)) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d) - 2 * \text{rea} \\
& l\_part(\cos\_integral(-b*x - d*x - c - b*c/d)) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*( \\
& b*c + c*d)/d) - 2 * \text{real\_part}(\cos\_integral(b*x + d*x + c + b*c/d)) * \tan(1/2*a \\
& + 1/2*c) * \tan(1/2*(b*c + c*d)/d)^2 - 2 * \text{real\_part}(\cos\_integral(-b*x - d*x - c \\
& - b*c/d)) * \tan(1/2*a + 1/2*c) * \tan(1/2*(b*c + c*d)/d)^2 - 2 * \text{real\_part}(\cos\_in \\
& tegral(b*x - d*x - c + b*c/d)) * \tan(1/2*a - 1/2*c) * \tan(1/2*(b*c + c*d)/d)^2 \\
& - 2 * \text{real\_part}(\cos\_integral(-b*x + d*x + c - b*c/d)) * \tan(1/2*a - 1/2*c) * \tan( \\
& 1/2*(b*c + c*d)/d)^2 + 2 * \text{real\_part}(\cos\_integral(b*x - d*x - c + b*c/d)) * \tan \\
& (1/2*a + 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d) + 2 * \text{real\_part}(\cos\_integral(-b*x + \\
& d*x + c - b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d) - 2 * \text{real\_part}
\end{aligned}$$

$$\begin{aligned}
& (\cos\_integral(b*x - d*x - c + b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c - c*d)/d) - 2*real\_part(\cos\_integral(-b*x + d*x + c - b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c - c*d)/d) + 2*real\_part(\cos\_integral(b*x - d*x - c + b*c/d))*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d) + 2*real\_part(\cos\_integral(-b*x + d*x + c - b*c/d))*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d) \\
& + 2*real\_part(\cos\_integral(b*x + d*x + c + b*c/d))*\tan(1/2*a + 1/2*c)*\tan(1/2*(b*c - c*d)/d)^2 + 2*real\_part(\cos\_integral(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)*\tan(1/2*(b*c - c*d)/d)^2 + 2*real\_part(\cos\_integral(b*x - d*x - c + b*c/d))*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c - c*d)/d)^2 + 2*real\_part(\cos\_integral(-b*x + d*x + c - b*c/d))*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c - c*d)/d)^2 - 2*real\_part(\cos\_integral(b*x + d*x + c + b*c/d))*\tan(1/2*(b*c + c*d)/d)*\tan(1/2*(b*c - c*d)/d)^2 - 2*real\_part(\cos\_integral(-b*x - d*x - c - b*c/d))*\tan(1/2*(b*c + c*d)/d)*\tan(1/2*(b*c - c*d)/d)^2 - imag\_part(\cos\_integral(b*x + d*x + c + b*c/d))*\tan(1/2*a + 1/2*c)^2 - imag\_part(\cos\_integral(b*x - d*x - c + b*c/d))*\tan(1/2*a + 1/2*c)^2 + imag\_part(\cos\_integral(-b*x + d*x + c - b*c/d))*\tan(1/2*a + 1/2*c)^2 + imag\_part(\cos\_integral(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)^2 - 2*\sin\_integral((b*d*x + d^2*x + b*c + c*d)/d)*\tan(1/2*a + 1/2*c)^2 - 2*\sin\_integral((b*d*x - d^2*x + b*c - c*d)/d)*\tan(1/2*a + 1/2*c)^2 + imag\_part(\cos\_integral(b*x + d*x + c + b*c/d))*\tan(1/2*a - 1/2*c)^2 + imag\_part(\cos\_integral(b*x - d*x - c + b*c/d))*\tan(1/2*a - 1/2*c)^2 - imag\_part(\cos\_integral(-b*x + d*x + c - b*c/d))*\tan(1/2*a - 1/2*c)^2 - imag\_part(\cos\_integral(-b*x - d*x - c - b*c/d))*\tan(1/2*a - 1/2*c)^2 + 2*\sin\_integral((b*d*x + d^2*x + b*c + c*d)/d)*\tan(1/2*a - 1/2*c)^2 + 2*\sin\_integral((b*d*x - d^2*x + b*c - c*d)/d)*\tan(1/2*a - 1/2*c)^2 + 4*imag\_part(\cos\_integral(b*x + d*x + c + b*c/d))*\tan(1/2*a + 1/2*c)*\tan(1/2*(b*c + c*d)/d) - 4*imag\_part(\cos\_integral(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)*\tan(1/2*(b*c + c*d)/d) + 8*\sin\_integral((b*d*x + d^2*x + b*c + c*d)/d)*\tan(1/2*a + 1/2*c)*\tan(1/2*(b*c + c*d)/d) - imag\_part(\cos\_integral(b*x + d*x + c + b*c/d))*\tan(1/2*(b*c + c*d)/d)^2 - imag\_part(\cos\_integral(b*x - d*x - c + b*c/d))*\tan(1/2*(b*c + c*d)/d)^2 + imag\_part(\cos\_integral(-b*x + d*x + c - b*c/d))*\tan(1/2*(b*c + c*d)/d)^2 + imag\_part(\cos\_integral(-b*x - d*x - c - b*c/d))*\tan(1/2*(b*c + c*d)/d)^2 - 2*\sin\_integral((b*d*x + d^2*x + b*c + c*d)/d)*\tan(1/2*(b*c + c*d)/d)^2 - 2*\sin\_integral((b*d*x - d^2*x + b*c - c*d)/d)*\tan(1/2*(b*c + c*d)/d)^2 - 4*imag\_part(\cos\_integral(b*x - d*x - c + b*c/d))*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c - c*d)/d) + 4*imag\_part(\cos\_integral(-b*x + d*x + c - b*c/d))*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c - c*d)/d) - 8*\sin\_integral((b*d*x - d^2*x + b*c - c*d)/d)*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c - c*d)/d) + imag\_part(\cos\_integral(b*x + d*x + c + b*c/d))*\tan(1/2*(b*c - c*d)/d)^2 + imag\_part(\cos\_integral(b*x - d*x - c + b*c/d))*\tan(1/2*(b*c - c*d)/d)^2 - imag\_part(\cos\_integral(-b*x + d*x + c - b*c/d))*\tan(1/2*(b*c - c*d)/d)^2 - imag\_part(\cos\_integral(-b*x - d*x - c - b*c/d))*\tan(1/2*(b*c - c*d)/d)^2 + 2*\sin\_integral((b*d*x + d^2*x + b*c + c*d)/d)*\tan(1/2*(b*c - c*d)/d)^2 + 2*\sin\_integral((b*d*x - d^2*x + b*c - c*d)/d)*\tan(1/2*(b*c - c*d)/d)^2 + 2*real\_part(\cos\_integral(b*x + d*x + c + b*c/d))*\tan(1/2*a + 1/2*c) + 2*real\_part(\cos\_integral(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1
\end{aligned}$$

$$\begin{aligned}
& /2*c) - 2*\text{real\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\tan(1/2*a - 1/2*c) \\
& - 2*\text{real\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\tan(1/2*a - 1/2*c) - 2 \\
& *\text{real\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\tan(1/2*(b*c + c*d)/d) - 2* \\
& \text{real\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d))*\tan(1/2*(b*c + c*d)/d) + 2* \\
& \text{real\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\tan(1/2*(b*c - c*d)/d) + 2*r \\
& \text{eal\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\tan(1/2*(b*c - c*d)/d) + \text{ima} \\
& \text{g\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d)) - \text{imag\_part}(\text{cos\_integral}(b*x - \\
& d*x - c + b*c/d)) + \text{imag\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d)) - \text{imag\_} \\
& \text{part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d)) + 2*\text{sin\_integral}((b*d*x + d^2*x \\
& + b*c + c*d)/d) - 2*\text{sin\_integral}((b*d*x - d^2*x + b*c - c*d)/d))*d/(b*d*\tan \\
& (1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b* \\
& c - c*d)/d)^2 + b*d*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c \\
& + c*d)/d)^2 + b*d*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c - \\
& c*d)/d)^2 + b*d*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c \\
& - c*d)/d)^2 + b*d*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b* \\
& c - c*d)/d)^2 + b*d*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2 + b*d*\tan(1/2 \\
& *a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 + b*d*\tan(1/2*a - 1/2*c)^2*\tan(1/2*( \\
& b*c + c*d)/d)^2 + b*d*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c - c*d)/d)^2 + b*d*t \\
& \text{an}(1/2*a - 1/2*c)^2*\tan(1/2*(b*c - c*d)/d)^2 + b*d*\tan(1/2*(b*c + c*d)/d)^2 \\
& *\tan(1/2*(b*c - c*d)/d)^2 + b*d*\tan(1/2*a + 1/2*c)^2 + b*d*\tan(1/2*a - 1/2* \\
& c)^2 + b*d*\tan(1/2*(b*c + c*d)/d)^2 + b*d*\tan(1/2*(b*c - c*d)/d)^2 + b*d) - \\
& \text{cos}(b*x + a)*\text{sin\_integral}(d*x + c)/b
\end{aligned}$$

$$3.65 \quad \int \frac{\sin(a+bx)\text{Si}(c+dx)}{x} dx$$

**Optimal.** Leaf size=18

$$\text{CannotIntegrate}\left(\frac{\sin(a+bx)\text{Si}(c+dx)}{x}, x\right)$$

[Out] CannotIntegrate[(Sin[a + b\*x]\*SinIntegral[c + d\*x])/x, x]

**Rubi [A]** time = 0.142027, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\sin(a+bx)\text{Si}(c+dx)}{x} dx$$

Verification is Not applicable to the result.

[In] Int[(Sin[a + b\*x]\*SinIntegral[c + d\*x])/x,x]

[Out] Defer[Int] [(Sin[a + b\*x]\*SinIntegral[c + d\*x])/x, x]

Rubi steps

$$\int \frac{\sin(a+bx)\text{Si}(c+dx)}{x} dx = \int \frac{\sin(a+bx)\text{Si}(c+dx)}{x} dx$$

**Mathematica [A]** time = 28.787, size = 0, normalized size = 0.

$$\int \frac{\sin(a+bx)\text{Si}(c+dx)}{x} dx$$

Verification is Not applicable to the result.

[In] Integrate[(Sin[a + b\*x]\*SinIntegral[c + d\*x])/x,x]

[Out] Integrate[(Sin[a + b\*x]\*SinIntegral[c + d\*x])/x, x]

**Maple [A]** time = 0.088, size = 0, normalized size = 0.

$$\int \frac{\text{Si}(dx + c) \sin(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Si(d\*x+c)\*sin(b\*x+a)/x,x)

[Out] int(Si(d\*x+c)\*sin(b\*x+a)/x,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(dx + c) \sin(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(d\*x+c)\*sin(b\*x+a)/x,x, algorithm="maxima")

[Out] integrate(Si(d\*x + c)\*sin(b\*x + a)/x, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\sin(bx + a) \text{Si}(dx + c)}{x}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(d\*x+c)\*sin(b\*x+a)/x,x, algorithm="fricas")

[Out] integral(sin(b\*x + a)\*sin\_integral(d\*x + c)/x, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\sin(a + bx) \text{Si}(c + dx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(d\*x+c)\*sin(b\*x+a)/x,x)

[Out] Integral(sin(a + b\*x)\*Si(c + d\*x)/x, x)

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(dx + c) \sin(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Si(d\*x+c)\*sin(b\*x+a)/x,x, algorithm="giac")

[Out] integrate(Si(d\*x + c)\*sin(b\*x + a)/x, x)



### 3.66 $\int x \cos(a + bx) \mathbf{Si}(c + dx) dx$

**Optimal.** Leaf size=370

$$\frac{\sin\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b-d)}{d} + x(b-d)\right)}{2b^2} - \frac{\sin\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b+d)}{d} + x(b+d)\right)}{2b^2} + \frac{\cos\left(a - \frac{bc}{d}\right) \mathbf{Si}\left(x(b-d)\right)}{2b^2}$$

```
[Out] (c*cos[a - (b*c)/d]*CosIntegral[(c*(b - d))/d + (b - d)*x])/(2*b*d) - (c*cos[a - (b*c)/d]*CosIntegral[(c*(b + d))/d + (b + d)*x])/(2*b*d) + (CosIntegral[(c*(b - d))/d + (b - d)*x]*Sin[a - (b*c)/d])/(2*b^2) - (CosIntegral[(c*(b + d))/d + (b + d)*x]*Sin[a - (b*c)/d])/(2*b^2) - Sin[a - c + (b - d)*x]/(2*b*(b - d)) + Sin[a + c + (b + d)*x]/(2*b*(b + d)) + (Cos[a - (b*c)/d]*SinIntegral[(c*(b - d))/d + (b - d)*x])/(2*b^2) - (c*sin[a - (b*c)/d]*SinIntegral[(c*(b - d))/d + (b - d)*x])/(2*b*d) + (Cos[a + b*x]*SinIntegral[c + d*x])/b^2 + (x*sin[a + b*x]*SinIntegral[c + d*x])/b - (Cos[a - (b*c)/d]*SinIntegral[(c*(b + d))/d + (b + d)*x])/(2*b^2) + (c*sin[a - (b*c)/d]*SinIntegral[(c*(b + d))/d + (b + d)*x])/(2*b*d)
```

**Rubi [A]** time = 1.24023, antiderivative size = 370, normalized size of antiderivative = 1., number of steps used = 24, number of rules used = 9, integrand size = 14,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.643$ , Rules used = {6519, 4608, 6742, 2637, 3303, 3299, 3302, 6511, 4430}

$$\frac{\sin\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b-d)}{d} + x(b-d)\right)}{2b^2} - \frac{\sin\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b+d)}{d} + x(b+d)\right)}{2b^2} + \frac{\cos\left(a - \frac{bc}{d}\right) \mathbf{Si}\left(x(b-d)\right)}{2b^2}$$

Antiderivative was successfully verified.

```
[In] Int[x*cos[a + b*x]*SinIntegral[c + d*x],x]
```

```
[Out] (c*cos[a - (b*c)/d]*CosIntegral[(c*(b - d))/d + (b - d)*x])/(2*b*d) - (c*cos[a - (b*c)/d]*CosIntegral[(c*(b + d))/d + (b + d)*x])/(2*b*d) + (CosIntegral[(c*(b - d))/d + (b - d)*x]*Sin[a - (b*c)/d])/(2*b^2) - (CosIntegral[(c*(b + d))/d + (b + d)*x]*Sin[a - (b*c)/d])/(2*b^2) - Sin[a - c + (b - d)*x]/(2*b*(b - d)) + Sin[a + c + (b + d)*x]/(2*b*(b + d)) + (Cos[a - (b*c)/d]*SinIntegral[(c*(b - d))/d + (b - d)*x])/(2*b^2) - (c*sin[a - (b*c)/d]*SinIntegral[(c*(b - d))/d + (b - d)*x])/(2*b*d) + (Cos[a + b*x]*SinIntegral[c + d*x])/b^2 + (x*sin[a + b*x]*SinIntegral[c + d*x])/b - (Cos[a - (b*c)/d]*SinIntegral[(c*(b + d))/d + (b + d)*x])/(2*b^2) + (c*sin[a - (b*c)/d]*SinIntegral[(c*(b + d))/d + (b + d)*x])/(2*b*d)
```

Rule 6519

```
Int[Cos[(a_.) + (b_.)*(x_)]*((e_.) + (f_.)*(x_))^(m_.)*SinIntegral[(c_.) +
(d_.)*(x_)], x_Symbol] := Simp[((e + f*x)^m*Sin[a + b*x]*SinIntegral[c + d*
x])/b, x] + (-Dist[d/b, Int[((e + f*x)^m*Sin[a + b*x]*Sin[c + d*x])/(c + d*
x), x], x] - Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*Sin[a + b*x]*SinIntegral[c
+ d*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]
```

Rule 4608

```
Int[(u_.)*Sin[(a_.) + (b_.)*(x_)]^(m_.)*Sin[(c_.) + (d_.)*(x_)]^(n_.), x_Sy
mbol] := Int[ExpandTrigReduce[u, Sin[a + b*x]^m*Sin[c + d*x]^n, x], x] /; F
reeQ[{a, b, c, d}, x] && IGtQ[m, 0] && IGtQ[n, 0]
```

Rule 6742

```
Int[u_, x_Symbol] := With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

Rule 2637

```
Int[sin[Pi/2 + (c_.) + (d_.)*(x_)], x_Symbol] := Simp[Sin[c + d*x]/d, x] /;
FreeQ[{c, d}, x]
```

Rule 3303

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Dist[Cos[(d*
e - c*f)/d], Int[Sin[(c*f)/d + f*x]/(c + d*x), x], x] + Dist[Sin[(d*e - c*f
)/d], Int[Cos[(c*f)/d + f*x]/(c + d*x), x], x] /; FreeQ[{c, d, e, f}, x] &&
NeQ[d*e - c*f, 0]
```

Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[SinInte
gral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[CosInte
gral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) -
c*f, 0]
```

Rule 6511

```
Int[Sin[(a_.) + (b_.)*(x_)]*SinIntegral[(c_.) + (d_.)*(x_)], x_Symbol] := -
Simp[(Cos[a + b*x]*SinIntegral[c + d*x])/b, x] + Dist[d/b, Int[(Cos[a + b*x]
]*Sin[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

### Rule 4430

```
Int[Cos[(c_.) + (d_.)*(x_)]^(q_.)*((e_.) + (f_.)*(x_))^(m_.)*Sin[(a_.) + (b
_.)*(x_)]^(p_.), x_Symbol] := Int[ExpandTrigReduce[(e + f*x)^m, Sin[a + b*x
]^(p)*Cos[c + d*x]^q, x], x] /; FreeQ[{a, b, c, d, e, f, m}, x] && IGtQ[p, 0]
&& IGtQ[q, 0]
```

### Rubi steps

$$\begin{aligned}
\int x \cos(a + bx) \operatorname{Si}(c + dx) dx &= \frac{x \sin(a + bx) \operatorname{Si}(c + dx)}{b} - \frac{\int \sin(a + bx) \operatorname{Si}(c + dx) dx}{b} - \frac{d \int \frac{x \sin(a + bx) \sin(c + dx)}{c + dx} dx}{b} \\
&= \frac{\cos(a + bx) \operatorname{Si}(c + dx)}{b^2} + \frac{x \sin(a + bx) \operatorname{Si}(c + dx)}{b} - \frac{d \int \frac{\cos(a + bx) \sin(c + dx)}{c + dx} dx}{b^2} - \frac{d \int \left( \frac{x \cos(a + bx)}{2} \right)}{b^2} \\
&= \frac{\cos(a + bx) \operatorname{Si}(c + dx)}{b^2} + \frac{x \sin(a + bx) \operatorname{Si}(c + dx)}{b} - \frac{d \int \left( -\frac{\sin(a - c + (b - d)x)}{2(c + dx)} + \frac{\sin(a + c + (b + d)x)}{2(c + dx)} \right) dx}{b^2} \\
&= \frac{\cos(a + bx) \operatorname{Si}(c + dx)}{b^2} + \frac{x \sin(a + bx) \operatorname{Si}(c + dx)}{b} + \frac{d \int \frac{\sin(a - c + (b - d)x)}{c + dx} dx}{2b^2} - \frac{d \int \frac{\sin(a + c + (b + d)x)}{c + dx} dx}{2b^2} \\
&= \frac{\cos(a + bx) \operatorname{Si}(c + dx)}{b^2} + \frac{x \sin(a + bx) \operatorname{Si}(c + dx)}{b} - \frac{\int \cos(a - c + (b - d)x) dx}{2b} + \frac{\int \cos(a + c + (b + d)x) dx}{2b} \\
&= \frac{\operatorname{Ci}\left(\frac{c(b-d)}{d} + (b-d)x\right) \sin\left(a - \frac{bc}{d}\right)}{2b^2} - \frac{\operatorname{Ci}\left(\frac{c(b+d)}{d} + (b+d)x\right) \sin\left(a - \frac{bc}{d}\right)}{2b^2} - \frac{\sin(a - c + (b - d)x)}{2b(b - d)} + \frac{\sin(a + c + (b + d)x)}{2b(b + d)} \\
&= \frac{c \cos\left(a - \frac{bc}{d}\right) \operatorname{Ci}\left(\frac{c(b-d)}{d} + (b-d)x\right)}{2bd} - \frac{c \cos\left(a - \frac{bc}{d}\right) \operatorname{Ci}\left(\frac{c(b+d)}{d} + (b+d)x\right)}{2bd} + \frac{\operatorname{Ci}\left(\frac{c(b-d)}{d}\right)}{2bd}
\end{aligned}$$

**Mathematica [C]** time = 4.21426, size = 393, normalized size = 1.06

$$\frac{e^{-\frac{i(d(a-dx)+b(c+dx))}{d}} \left( -(b^2 - d^2)(bc - id)e^{i(2a+bx(b-d))} \operatorname{ExpIntegralEi}\left(\frac{i(b+d)(c+dx)}{d}\right) - ibde^{\frac{ic(b+d)}{d}} \left( -de^{2i(a+bx)} + be^{2i(a+bx)} + b + d \right) \right)}{4b^2d(b-d)(b+d)}$$

Warning: Unable to verify antiderivative.

```
[In] Integrate[x*cos[a + b*x]*SinIntegral[c + d*x],x]
```

```
[Out] -((-I)*b*d*(1/((b + d)*E^(I*(b + d)*x)) + E^(I*(2*a + (b - d)*x))/(b - d))
+ ((-b*c) + I*d)*E^((I*(-b*c) + (2*a + c)*d)/d)*ExpIntegralEi[(I*(b - d)*
(c + d*x))/d] + (b*c + I*d)*E^((I*c*(b + d))/d)*ExpIntegralEi[((-I)*(b + d)
*(c + d*x))/d)]/(4*b^2*d*E^(I*(a + c))) + ((-I)*b*d*E^((I*c*(b + d))/d)*(b
+ d + b*E^((2*I)*(a + b*x)) - d*E^((2*I)*(a + b*x))) + (b*c + I*d)*(b^2 - d
^2)*E^((-I)*d*x + I*b*((2*c)/d + x))*ExpIntegralEi[((-I)*(b - d)*(c + d*x)
)/d] - (b*c - I*d)*(b^2 - d^2)*E^(I*(2*a + (b - d)*x))*ExpIntegralEi[(I*(b +
d)*(c + d*x))/d)]/(4*b^2*(b - d)*d*(b + d)*E^((I*(d*(a - d*x) + b*(c + d*x
)))/d)) + ((Cos[a + b*x] + b*x*SIN[a + b*x])*SinIntegral[c + d*x])/b^2
```

**Maple [B]** time = 0.107, size = 1208, normalized size = 3.3

result too large to display

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(x*cos(b*x+a)*Si(d*x+c),x)
```

```
[Out] (Si(d*x+c)/b*(1/b*d*(sin(b/d*(d*x+c)+(a*d-b*c)/d)*(b/d*(d*x+c)+(a*d-b*c)/d)
+cos(b/d*(d*x+c)+(a*d-b*c)/d)-a*d/b*sin(b/d*(d*x+c)+(a*d-b*c)/d))-1/b*(1/2
/(b-d)*d*sin((b-d)/d*(d*x+c)+(a*d-b*c)/d)+1/2*(a*d-b*c)*d/(b-d)*(Si((b-d)/d
*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*sin((-a*d+b*c)/d)/d+Ci((b-d)/d*(d*x+c)+(
a*d-b*c)/d+(-a*d+b*c)/d)*cos((-a*d+b*c)/d)/d)-1/2/(b-d)*d^2*a*(Si((b-d)/d*(
d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*sin((-a*d+b*c)/d)/d+Ci((b-d)/d*(d*x+c)+(a*
d-b*c)/d+(-a*d+b*c)/d)*cos((-a*d+b*c)/d)/d)+1/2/(b-d)*c*d^2*(Si((b-d)/d*(d*
x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*sin((-a*d+b*c)/d)/d+Ci((b-d)/d*(d*x+c)+(a*d-
b*c)/d+(-a*d+b*c)/d)*cos((-a*d+b*c)/d)/d)-1/2/(b+d)*d*sin((b+d)/d*(d*x+c)+(
a*d-b*c)/d)-1/2*(a*d-b*c)*d/(b+d)*(Si((b+d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c
)/d)*sin((-a*d+b*c)/d)/d+Ci((b+d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*cos((
-a*d+b*c)/d)/d)+1/2/(b+d)*d^2*a*(Si((b+d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/
d)*sin((-a*d+b*c)/d)/d+Ci((b+d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*cos((
-a*d+b*c)/d)/d)+1/2/(b+d)*c*d^2*(Si((b+d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)
*sin((-a*d+b*c)/d)/d+Ci((b+d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*cos((
-a*d+b*c)/d)/d)-1/2/b*d^2*(Si((b-d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*cos((
-a*d+b*c)/d)/d-Ci((b-d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*sin((-a*d+b*c)/d
)/d)+1/2/b*d^2*(Si((b+d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*cos((-a*d+b*c)/
d)/d-Ci((b+d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*sin((-a*d+b*c)/d)/d)))/d
```

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x \operatorname{Si}(dx + c) \cos(bx + a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*cos(b*x+a)*Si(d*x+c),x, algorithm="maxima")`

[Out] `integrate(x*Si(d*x + c)*cos(b*x + a), x)`

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(x \cos(bx + a) \operatorname{Si}(dx + c), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*cos(b*x+a)*Si(d*x+c),x, algorithm="fricas")`

[Out] `integral(x*cos(b*x + a)*sin_integral(d*x + c), x)`

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x \cos(a + bx) \operatorname{Si}(c + dx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*cos(b*x+a)*Si(d*x+c),x)`

[Out] `Integral(x*cos(a + b*x)*Si(c + d*x), x)`

---

**Giac [F(-1)]** time = 0., size = 0, normalized size = 0.

Timed out

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x*cos(b*x+a)*Si(d*x+c),x, algorithm="giac")
```

```
[Out] Timed out
```

### 3.67 $\int \cos(a + bx) \mathbf{Si}(c + dx) dx$

**Optimal.** Leaf size=153

$$\frac{\cos\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b-d)}{d} + x(b-d)\right)}{2b} + \frac{\cos\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b+d)}{d} + x(b+d)\right)}{2b} + \frac{\sin\left(a - \frac{bc}{d}\right) \text{Si}\left(x(b-d)\right)}{2b}$$

[Out]  $-(\text{Cos}[a - (b*c)/d]*\text{CosIntegral}[(c*(b - d))/d + (b - d)*x])/(2*b) + (\text{Cos}[a - (b*c)/d]*\text{CosIntegral}[(c*(b + d))/d + (b + d)*x])/(2*b) + (\text{Sin}[a - (b*c)/d]*\text{SinIntegral}[(c*(b - d))/d + (b - d)*x])/(2*b) + (\text{Sin}[a + b*x]*\text{SinIntegral}[c + d*x])/b - (\text{Sin}[a - (b*c)/d]*\text{SinIntegral}[(c*(b + d))/d + (b + d)*x])/(2*b)$

**Rubi [A]** time = 0.222689, antiderivative size = 153, normalized size of antiderivative = 1., number of steps used = 9, number of rules used = 5, integrand size = 13,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.385$ , Rules used = {6517, 4428, 3303, 3299, 3302}

$$\frac{\cos\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b-d)}{d} + x(b-d)\right)}{2b} + \frac{\cos\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b+d)}{d} + x(b+d)\right)}{2b} + \frac{\sin\left(a - \frac{bc}{d}\right) \text{Si}\left(x(b-d)\right)}{2b}$$

Antiderivative was successfully verified.

[In] `Int[Cos[a + b*x]*SinIntegral[c + d*x], x]`

[Out]  $-(\text{Cos}[a - (b*c)/d]*\text{CosIntegral}[(c*(b - d))/d + (b - d)*x])/(2*b) + (\text{Cos}[a - (b*c)/d]*\text{CosIntegral}[(c*(b + d))/d + (b + d)*x])/(2*b) + (\text{Sin}[a - (b*c)/d]*\text{SinIntegral}[(c*(b - d))/d + (b - d)*x])/(2*b) + (\text{Sin}[a + b*x]*\text{SinIntegral}[c + d*x])/b - (\text{Sin}[a - (b*c)/d]*\text{SinIntegral}[(c*(b + d))/d + (b + d)*x])/(2*b)$

#### Rule 6517

`Int[Cos[(a_.) + (b_.)*(x_)]*SinIntegral[(c_.) + (d_.)*(x_)], x_Symbol] := Simp[(Sin[a + b*x]*SinIntegral[c + d*x])/b, x] - Dist[d/b, Int[(Sin[a + b*x]*Sin[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]`

#### Rule 4428

`Int[((e_.) + (f_.)*(x_))^(m_.)*Sin[(a_.) + (b_.)*(x_)]^(p_.)*Sin[(c_.) + (d_.)*(x_)]^(q_.), x_Symbol] := Int[ExpandTrigReduce[(e + f*x)^m, Sin[a + b*x]^(p)*Sin[c + d*x]^q, x], x] /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[p, 0] &&`

IGtQ[q, 0] && IntegerQ[m]

### Rule 3303

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] := Dist[Cos[(d\*e - c\*f)/d], Int[Sin[(c\*f)/d + f\*x]/(c + d\*x), x], x] + Dist[Sin[(d\*e - c\*f)/d], Int[Cos[(c\*f)/d + f\*x]/(c + d\*x), x], x] /; FreeQ[{c, d, e, f}, x] && NeQ[d\*e - c\*f, 0]

### Rule 3299

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] := Simp[SinIntegral[e + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*e - c\*f, 0]

### Rule 3302

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] := Simp[CosIntegral[e - Pi/2 + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*(e - Pi/2) - c\*f, 0]

### Rubi steps

$$\begin{aligned}
 \int \cos(a + bx) \operatorname{Si}(c + dx) dx &= \frac{\sin(a + bx) \operatorname{Si}(c + dx)}{b} - \frac{d \int \frac{\sin(a + bx) \sin(c + dx)}{c + dx} dx}{b} \\
 &= \frac{\sin(a + bx) \operatorname{Si}(c + dx)}{b} - \frac{d \int \left( \frac{\cos(a - c + (b - d)x)}{2(c + dx)} - \frac{\cos(a + c + (b + d)x)}{2(c + dx)} \right) dx}{b} \\
 &= \frac{\sin(a + bx) \operatorname{Si}(c + dx)}{b} - \frac{d \int \frac{\cos(a - c + (b - d)x)}{c + dx} dx}{2b} + \frac{d \int \frac{\cos(a + c + (b + d)x)}{c + dx} dx}{2b} \\
 &= \frac{\sin(a + bx) \operatorname{Si}(c + dx)}{b} - \frac{\left( d \cos \left( a - \frac{bc}{d} \right) \right) \int \frac{\cos \left( \frac{c(b - d)}{d} + (b - d)x \right)}{c + dx} dx}{2b} + \frac{\left( d \cos \left( a - \frac{bc}{d} \right) \right) \int \frac{\cos \left( \frac{c(b + d)}{d} + (b + d)x \right)}{c + dx} dx}{2b} \\
 &= -\frac{\cos \left( a - \frac{bc}{d} \right) \operatorname{Ci} \left( \frac{c(b - d)}{d} + (b - d)x \right)}{2b} + \frac{\cos \left( a - \frac{bc}{d} \right) \operatorname{Ci} \left( \frac{c(b + d)}{d} + (b + d)x \right)}{2b} + \frac{\sin \left( a - \frac{bc}{d} \right) \operatorname{Si} \left( \frac{c(b + d)}{d} + (b + d)x \right)}{2b}
 \end{aligned}$$

**Mathematica [C]** time = 1.74471, size = 164, normalized size = 1.07

$$\frac{e^{-\frac{i(ad+bc)}{d}} \left( -e^{2ia} \operatorname{ExpIntegralEi} \left( \frac{i(b-d)(c+dx)}{d} \right) + e^{2ia} \operatorname{ExpIntegralEi} \left( \frac{i(b+d)(c+dx)}{d} \right) + 4e^{\frac{i(ad+bc)}{d}} \sin(a + bx) \operatorname{Si}(c + dx) - e^{\frac{2ibc}{d}} \operatorname{ExpIntegralEi} \left( \frac{c(b+d)}{d} + (b+d)x \right) \right)}{4b}$$

Warning: Unable to verify antiderivative.



[In] Integrate[Cos[a + b\*x]\*SinIntegral[c + d\*x],x]

[Out]  $(-E^{((2*I)*b*c)/d} \text{ExpIntegralEi}[((-I)*(b-d)*(c+d*x))/d]) - E^{((2*I)*a) \text{ExpIntegralEi}[(I*(b-d)*(c+d*x))/d] + E^{((2*I)*b*c)/d} \text{ExpIntegralEi}[((-I)*(b+d)*(c+d*x))/d] + E^{((2*I)*a) \text{ExpIntegralEi}[(I*(b+d)*(c+d*x))/d] + 4 * E^{(I*(b*c+a*d))/d} \text{Sin}[a + b*x] \text{SinIntegral}[c + d*x]) / (4*b * E^{(I*(b*c+a*d))/d})$

**Maple [A]** time = 0.079, size = 280, normalized size = 1.8

$$\frac{1}{d} \left( \frac{\text{Si}(dx+c)d}{b} \sin\left(\frac{b(dx+c)}{d} + \frac{ad-bc}{d}\right) - \frac{d}{b} \left( \frac{1}{2} \frac{\text{Si}\left(\frac{(b-d)(dx+c)}{d} + \frac{ad-bc}{d} + \frac{-ad+bc}{d}\right) \sin\left(\frac{-ad+bc}{d}\right) + \frac{1}{d} \text{Ci}\left(\frac{(b-d)(dx+c)}{d} + \frac{ad-bc}{d} + \frac{-ad+bc}{d}\right) \right) \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(cos(b\*x+a)\*Si(d\*x+c),x)

[Out]  $(\text{Si}(d*x+c)/b*d*\sin(b/d*(d*x+c)+(a*d-b*c)/d) - 1/b*d*(1/2*d*(\text{Si}((b-d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*\sin((-a*d+b*c)/d)/d + \text{Ci}((b-d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*\cos((-a*d+b*c)/d)/d - 1/2*d*(\text{Si}((b+d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*\sin((-a*d+b*c)/d)/d + \text{Ci}((b+d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*\cos((-a*d+b*c)/d)/d))/d$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \text{Si}(dx+c) \cos(bx+a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(cos(b\*x+a)\*Si(d\*x+c),x, algorithm="maxima")

[Out] integrate(Si(d\*x + c)\*cos(b\*x + a), x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(\cos(bx+a) \text{Si}(dx+c), x)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(cos(b*x+a)*Si(d*x+c),x, algorithm="fricas")
```

```
[Out] integral(cos(b*x + a)*sin_integral(d*x + c), x)
```

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \cos(a + bx) \operatorname{Si}(c + dx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(cos(b*x+a)*Si(d*x+c),x)
```

```
[Out] Integral(cos(a + b*x)*Si(c + d*x), x)
```

**Giac [C]** time = 1.97024, size = 12439, normalized size = 81.3

result too large to display

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(cos(b*x+a)*Si(d*x+c),x, algorithm="giac")
```

```
[Out] 1/4*(real_part(cos_integral(b*x + d*x + c + b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d)^2 - real_part(cos_integral(b*x - d*x - c + b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d)^2 - real_part(cos_integral(-b*x + d*x + c - b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d)^2 + real_part(cos_integral(-b*x - d*x - c - b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d)^2 + 2*imag_part(cos_integral(b*x - d*x - c + b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d) - 2*imag_part(cos_integral(-b*x + d*x + c - b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d) + 4*sin_integral((b*d*x - d^2*x + b*c - c*d)/d)*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d) - 2*imag_part(cos_integral(b*x + d*x + c + b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)*tan(1/2*(b*c - c*d)
```

$$\begin{aligned}
& /d)^2 + 2*\text{imag\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d))*\text{tan}(1/2*a + 1/2*c) \\
& )^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)*\text{tan}(1/2*(b*c - c*d)/d)^2 - \\
& 4*\text{sin\_integral}((b*d*x + d^2*x + b*c + c*d)/d)*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2* \\
& a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)*\text{tan}(1/2*(b*c - c*d)/d)^2 - 2*\text{imag\_part}( \\
& \text{cos\_integral}(b*x - d*x - c + b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c) \\
& )*\text{tan}(1/2*(b*c + c*d)/d)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 + 2*\text{imag\_part}(\text{cos\_integ} \\
& \text{ral}(-b*x + d*x + c - b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)*\text{tan}(1/ \\
& 2*(b*c + c*d)/d)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 - 4*\text{sin\_integral}((b*d*x - d^2*x \\
& + b*c - c*d)/d)*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)*\text{tan}(1/2*(b*c + c*d) \\
& )/d)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 + 2*\text{imag\_part}(\text{cos\_integral}(b*x + d*x + c + \\
& b*c/d))*\text{tan}(1/2*a + 1/2*c)*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)^2*\text{ta} \\
& n(1/2*(b*c - c*d)/d)^2 - 2*\text{imag\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d))* \\
& \text{tan}(1/2*a + 1/2*c)*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)^2*\text{tan}(1/2*(b \\
& *c - c*d)/d)^2 + 4*\text{sin\_integral}((b*d*x + d^2*x + b*c + c*d)/d)*\text{tan}(1/2*a + \\
& 1/2*c)*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)^2*\text{tan}(1/2*(b*c - c*d)/d) \\
& ^2 + \text{real\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{ta} \\
& n(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)^2 + \text{real\_part}(\text{cos\_integral}(b*x - \\
& d*x - c + b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + \\
& c*d)/d)^2 + \text{real\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\text{tan}(1/2*a + 1/2 \\
& *c)^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)^2 + \text{real\_part}(\text{cos\_integra} \\
& l(-b*x - d*x - c - b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/ \\
& 2*(b*c + c*d)/d)^2 - 4*\text{real\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\text{tan}(1 \\
& /2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)*\text{tan}(1/2*(b*c + c*d)/d)^2*\text{tan}(1/2*(b*c - \\
& c*d)/d) - 4*\text{real\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\text{tan}(1/2*a + 1/2 \\
& *c)^2*\text{tan}(1/2*a - 1/2*c)*\text{tan}(1/2*(b*c + c*d)/d)^2*\text{tan}(1/2*(b*c - c*d)/d) - \\
& \text{real\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2 \\
& *a - 1/2*c)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 - \text{real\_part}(\text{cos\_integral}(b*x - d*x - \\
& c + b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c - c*d)/ \\
& d)^2 - \text{real\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\text{tan}(1/2*a + 1/2*c)^2 \\
& *\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 - \text{real\_part}(\text{cos\_integral}(-b* \\
& x - d*x - c - b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b* \\
& c - c*d)/d)^2 + 4*\text{real\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\text{tan}(1/2*a \\
& + 1/2*c)*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)*\text{tan}(1/2*(b*c - c*d)/d) \\
& ^2 + 4*\text{real\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d))*\text{tan}(1/2*a + 1/2*c)*\text{t} \\
& \text{an}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)*\text{tan}(1/2*(b*c - c*d)/d)^2 + \text{real\_} \\
& \text{part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*(b*c \\
& + c*d)/d)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 + \text{real\_part}(\text{cos\_integral}(b*x - d*x - \\
& c + b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)^2*\text{tan}(1/2*(b*c - c* \\
& d)/d)^2 + \text{real\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\text{tan}(1/2*a + 1/2*c) \\
& )^2*\text{tan}(1/2*(b*c + c*d)/d)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 + \text{real\_part}(\text{cos\_integ} \\
& \text{ral}(-b*x - d*x - c - b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)^2* \\
& \text{tan}(1/2*(b*c - c*d)/d)^2 - \text{real\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\text{t} \\
& \text{an}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 - \text{rea} \\
& \text{l\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b \\
& *c + c*d)/d)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 - \text{real\_part}(\text{cos\_integral}(-b*x + d*x
\end{aligned}$$

$$\begin{aligned}
& + c - b*c/d)) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d)^2 * \tan(1/2*(b*c - \\
& c*d)/d)^2 - \text{real\_part}(\cos\_integral(-b*x - d*x - c - b*c/d)) * \tan(1/2*a - 1/ \\
& 2*c)^2 * \tan(1/2*(b*c + c*d)/d)^2 * \tan(1/2*(b*c - c*d)/d)^2 - 2 * \text{imag\_part}(\cos\_ \\
& integral(b*x + d*x + c + b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*a - 1/2*c)^2 * \\
& \tan(1/2*(b*c + c*d)/d) + 2 * \text{imag\_part}(\cos\_integral(-b*x - d*x - c - b*c/d)) * \\
& \tan(1/2*a + 1/2*c)^2 * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d) - 4 * \text{sin\_in} \\
& tegral((b*d*x + d^2*x + b*c + c*d)/d) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*a - 1/2* \\
& c)^2 * \tan(1/2*(b*c + c*d)/d) + 2 * \text{imag\_part}(\cos\_integral(b*x - d*x - c + b*c/ \\
& d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*a - 1/2*c) * \tan(1/2*(b*c + c*d)/d)^2 - 2 * \text{im} \\
& ag\_part(\cos\_integral(-b*x + d*x + c - b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2* \\
& a - 1/2*c) * \tan(1/2*(b*c + c*d)/d)^2 + 4 * \text{sin\_integral}((b*d*x - d^2*x + b*c - \\
& c*d)/d) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*a - 1/2*c) * \tan(1/2*(b*c + c*d)/d)^2 + \\
& 2 * \text{imag\_part}(\cos\_integral(b*x + d*x + c + b*c/d)) * \tan(1/2*a + 1/2*c) * \tan(1/ \\
& 2*a - 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d)^2 - 2 * \text{imag\_part}(\cos\_integral(-b*x - d \\
& *x - c - b*c/d)) * \tan(1/2*a + 1/2*c) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c + c*d \\
& )/d)^2 + 4 * \text{sin\_integral}((b*d*x + d^2*x + b*c + c*d)/d) * \tan(1/2*a + 1/2*c) * \text{t} \\
& an(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d)^2 + 2 * \text{imag\_part}(\cos\_integral(b*x \\
& - d*x - c + b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c \\
& - c*d)/d) - 2 * \text{imag\_part}(\cos\_integral(-b*x + d*x + c - b*c/d)) * \tan(1/2*a + \\
& 1/2*c)^2 * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d) + 4 * \text{sin\_integral}((b*d* \\
& x - d^2*x + b*c - c*d)/d) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*a - 1/2*c)^2 * \tan(1/2 \\
& *(b*c - c*d)/d) - 2 * \text{imag\_part}(\cos\_integral(b*x - d*x - c + b*c/d)) * \tan(1/2* \\
& a + 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d)^2 * \tan(1/2*(b*c - c*d)/d) + 2 * \text{imag\_part} \\
& (\cos\_integral(-b*x + d*x + c - b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c + c \\
& *d)/d)^2 * \tan(1/2*(b*c - c*d)/d) - 4 * \text{sin\_integral}((b*d*x - d^2*x + b*c - c*d \\
& )/d) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d)^2 * \tan(1/2*(b*c - c*d)/d) + \\
& 2 * \text{imag\_part}(\cos\_integral(b*x - d*x - c + b*c/d)) * \tan(1/2*a - 1/2*c)^2 * \tan \\
& (1/2*(b*c + c*d)/d)^2 * \tan(1/2*(b*c - c*d)/d) - 2 * \text{imag\_part}(\cos\_integral(-b*x \\
& + d*x + c - b*c/d)) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d)^2 * \tan(1/2* \\
& (b*c - c*d)/d) + 4 * \text{sin\_integral}((b*d*x - d^2*x + b*c - c*d)/d) * \tan(1/2*a - \\
& 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d)^2 * \tan(1/2*(b*c - c*d)/d) - 2 * \text{imag\_part}(\cos\_ \\
& integral(b*x - d*x - c + b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*a - 1/2*c) * \text{t} \\
& an(1/2*(b*c - c*d)/d)^2 + 2 * \text{imag\_part}(\cos\_integral(-b*x + d*x + c - b*c/d)) * \\
& \tan(1/2*a + 1/2*c)^2 * \tan(1/2*a - 1/2*c) * \tan(1/2*(b*c - c*d)/d)^2 - 4 * \text{sin\_in} \\
& tegral((b*d*x - d^2*x + b*c - c*d)/d) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*a - 1/2* \\
& c) * \tan(1/2*(b*c - c*d)/d)^2 - 2 * \text{imag\_part}(\cos\_integral(b*x + d*x + c + b*c/ \\
& d)) * \tan(1/2*a + 1/2*c) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d)^2 + 2 * \text{im} \\
& ag\_part(\cos\_integral(-b*x - d*x - c - b*c/d)) * \tan(1/2*a + 1/2*c) * \tan(1/2*a \\
& - 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d)^2 - 4 * \text{sin\_integral}((b*d*x + d^2*x + b*c + \\
& c*d)/d) * \tan(1/2*a + 1/2*c) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d)^2 - \\
& 2 * \text{imag\_part}(\cos\_integral(b*x + d*x + c + b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan \\
& (1/2*(b*c + c*d)/d) * \tan(1/2*(b*c - c*d)/d)^2 + 2 * \text{imag\_part}(\cos\_integral(-b*x \\
& - d*x - c - b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d) * \tan(1/2*(b \\
& *c - c*d)/d)^2 - 4 * \text{sin\_integral}((b*d*x + d^2*x + b*c + c*d)/d) * \tan(1/2*a + \\
& 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d) * \tan(1/2*(b*c - c*d)/d)^2 + 2 * \text{imag\_part}(\cos\_
\end{aligned}$$

```

integral(b*x + d*x + c + b*c/d))*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d
)*tan(1/2*(b*c - c*d)/d)^2 - 2*imag_part(cos_integral(-b*x - d*x - c - b*c/
d))*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)*tan(1/2*(b*c - c*d)/d)^2 +
4*sin_integral((b*d*x + d^2*x + b*c + c*d)/d)*tan(1/2*a - 1/2*c)^2*tan(1/2*
(b*c + c*d)/d)*tan(1/2*(b*c - c*d)/d)^2 + 2*imag_part(cos_integral(b*x + d*
x + c + b*c/d))*tan(1/2*a + 1/2*c)*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c -
c*d)/d)^2 - 2*imag_part(cos_integral(-b*x - d*x - c - b*c/d))*tan(1/2*a + 1
/2*c)*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d)^2 + 4*sin_integral((b
*d*x + d^2*x + b*c + c*d)/d)*tan(1/2*a + 1/2*c)*tan(1/2*(b*c + c*d)/d)^2*ta
n(1/2*(b*c - c*d)/d)^2 - 2*imag_part(cos_integral(b*x - d*x - c + b*c/d))*t
an(1/2*a - 1/2*c)*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d)^2 + 2*ima
g_part(cos_integral(-b*x + d*x + c - b*c/d))*tan(1/2*a - 1/2*c)*tan(1/2*(b*
c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d)^2 - 4*sin_integral((b*d*x - d^2*x + b*
c - c*d)/d)*tan(1/2*a - 1/2*c)*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)
/d)^2 - real_part(cos_integral(b*x + d*x + c + b*c/d))*tan(1/2*a + 1/2*c)^2
*tan(1/2*a - 1/2*c)^2 + real_part(cos_integral(b*x - d*x - c + b*c/d))*tan(
1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2 + real_part(cos_integral(-b*x + d*x +
c - b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2 - real_part(cos_inte
gral(-b*x - d*x - c - b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2 + 4
*real_part(cos_integral(b*x + d*x + c + b*c/d))*tan(1/2*a + 1/2*c)*tan(1/2*
a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d) + 4*real_part(cos_integral(-b*x - d*x -
c - b*c/d))*tan(1/2*a + 1/2*c)*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)
+ real_part(cos_integral(b*x + d*x + c + b*c/d))*tan(1/2*a + 1/2*c)^2*tan(
1/2*(b*c + c*d)/d)^2 - real_part(cos_integral(b*x - d*x - c + b*c/d))*tan(1
/2*a + 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2 - real_part(cos_integral(-b*x + d*
x + c - b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2 + real_part(c
os_integral(-b*x - d*x - c - b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*(b*c + c*
d)/d)^2 - real_part(cos_integral(b*x + d*x + c + b*c/d))*tan(1/2*a - 1/2*c)
^2*tan(1/2*(b*c + c*d)/d)^2 + real_part(cos_integral(b*x - d*x - c + b*c/d)
)*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2 + real_part(cos_integral(-b
*x + d*x + c - b*c/d))*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2 - real
_part(cos_integral(-b*x - d*x - c - b*c/d))*tan(1/2*a - 1/2*c)^2*tan(1/2*(b
*c + c*d)/d)^2 - 4*real_part(cos_integral(b*x - d*x - c + b*c/d))*tan(1/2*a
+ 1/2*c)^2*tan(1/2*a - 1/2*c)*tan(1/2*(b*c - c*d)/d) - 4*real_part(cos_int
egral(-b*x + d*x + c - b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)*tan(
1/2*(b*c - c*d)/d) - 4*real_part(cos_integral(b*x - d*x - c + b*c/d))*tan(1
/2*a - 1/2*c)*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d) - 4*real_part
(cos_integral(-b*x + d*x + c - b*c/d))*tan(1/2*a - 1/2*c)*tan(1/2*(b*c + c*
d)/d)^2*tan(1/2*(b*c - c*d)/d) - real_part(cos_integral(b*x + d*x + c + b*c
/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*(b*c - c*d)/d)^2 + real_part(cos_integral
(b*x - d*x - c + b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*(b*c - c*d)/d)^2 + re
al_part(cos_integral(-b*x + d*x + c - b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*
(b*c - c*d)/d)^2 - real_part(cos_integral(-b*x - d*x - c - b*c/d))*tan(1/2*
a + 1/2*c)^2*tan(1/2*(b*c - c*d)/d)^2 + real_part(cos_integral(b*x + d*x +
c + b*c/d))*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c - c*d)/d)^2 - real_part(cos_i

```

$$\begin{aligned}
& \text{ntegral}(b*x - d*x - c + b*c/d) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d) \\
& ^2 - \text{real\_part}(\cos\_integral(-b*x + d*x + c - b*c/d)) * \tan(1/2*a - 1/2*c)^2 * \\
& \tan(1/2*(b*c - c*d)/d)^2 + \text{real\_part}(\cos\_integral(-b*x - d*x - c - b*c/d)) * \\
& \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d)^2 + 4 * \text{real\_part}(\cos\_integral(b*x \\
& + d*x + c + b*c/d)) * \tan(1/2*a + 1/2*c) * \tan(1/2*(b*c + c*d)/d) * \tan(1/2*(b*c \\
& - c*d)/d)^2 + 4 * \text{real\_part}(\cos\_integral(-b*x - d*x - c - b*c/d)) * \tan(1/2*a \\
& + 1/2*c) * \tan(1/2*(b*c + c*d)/d) * \tan(1/2*(b*c - c*d)/d)^2 - \text{real\_part}(\cos\_in \\
& tegral(b*x + d*x + c + b*c/d)) * \tan(1/2*(b*c + c*d)/d)^2 * \tan(1/2*(b*c - c*d) \\
& /d)^2 + \text{real\_part}(\cos\_integral(b*x - d*x - c + b*c/d)) * \tan(1/2*(b*c + c*d)/ \\
& d)^2 * \tan(1/2*(b*c - c*d)/d)^2 + \text{real\_part}(\cos\_integral(-b*x + d*x + c - b*c \\
& /d)) * \tan(1/2*(b*c + c*d)/d)^2 * \tan(1/2*(b*c - c*d)/d)^2 - \text{real\_part}(\cos\_inte \\
& gral(-b*x - d*x - c - b*c/d)) * \tan(1/2*(b*c + c*d)/d)^2 * \tan(1/2*(b*c - c*d)/ \\
& d)^2 + 2 * \text{imag\_part}(\cos\_integral(b*x - d*x - c + b*c/d)) * \tan(1/2*a + 1/2*c)^ \\
& 2 * \tan(1/2*a - 1/2*c) - 2 * \text{imag\_part}(\cos\_integral(-b*x + d*x + c - b*c/d)) * \\
& \tan(1/2*a + 1/2*c)^2 * \tan(1/2*a - 1/2*c) + 4 * \sin\_integral((b*d*x - d^2*x + b*c \\
& - c*d)/d) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*a - 1/2*c) - 2 * \text{imag\_part}(\cos\_integr \\
& al(b*x + d*x + c + b*c/d)) * \tan(1/2*a + 1/2*c) * \tan(1/2*a - 1/2*c)^2 + 2 * \text{imag} \\
& \_part(\cos\_integral(-b*x - d*x - c - b*c/d)) * \tan(1/2*a + 1/2*c) * \tan(1/2*a - \\
& 1/2*c)^2 - 4 * \sin\_integral((b*d*x + d^2*x + b*c + c*d)/d) * \tan(1/2*a + 1/2*c) \\
& * \tan(1/2*a - 1/2*c)^2 - 2 * \text{imag\_part}(\cos\_integral(b*x + d*x + c + b*c/d)) * \\
& \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d) + 2 * \text{imag\_part}(\cos\_integral(-b*x - \\
& d*x - c - b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d) - 4 * \sin\_inte \\
& gral((b*d*x + d^2*x + b*c + c*d)/d) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c + c*d) \\
& )/d) + 2 * \text{imag\_part}(\cos\_integral(b*x + d*x + c + b*c/d)) * \tan(1/2*a - 1/2*c)^ \\
& 2 * \tan(1/2*(b*c + c*d)/d) - 2 * \text{imag\_part}(\cos\_integral(-b*x - d*x - c - b*c/d) \\
& ) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d) + 4 * \sin\_integral((b*d*x + d^2 \\
& *x + b*c + c*d)/d) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d) + 2 * \text{imag\_par} \\
& t(\cos\_integral(b*x + d*x + c + b*c/d)) * \tan(1/2*a + 1/2*c) * \tan(1/2*(b*c + c* \\
& d)/d)^2 - 2 * \text{imag\_part}(\cos\_integral(-b*x - d*x - c - b*c/d)) * \tan(1/2*a + 1/2 \\
& *c) * \tan(1/2*(b*c + c*d)/d)^2 + 4 * \sin\_integral((b*d*x + d^2*x + b*c + c*d)/d \\
& ) * \tan(1/2*a + 1/2*c) * \tan(1/2*(b*c + c*d)/d)^2 + 2 * \text{imag\_part}(\cos\_integral(b* \\
& x - d*x - c + b*c/d)) * \tan(1/2*a - 1/2*c) * \tan(1/2*(b*c + c*d)/d)^2 - 2 * \text{imag} \\
& \_part(\cos\_integral(-b*x + d*x + c - b*c/d)) * \tan(1/2*a - 1/2*c) * \tan(1/2*(b*c \\
& + c*d)/d)^2 + 4 * \sin\_integral((b*d*x - d^2*x + b*c - c*d)/d) * \tan(1/2*a - 1/2 \\
& *c) * \tan(1/2*(b*c + c*d)/d)^2 - 2 * \text{imag\_part}(\cos\_integral(b*x - d*x - c + b*c \\
& /d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d) + 2 * \text{imag\_part}(\cos\_integral \\
& (-b*x + d*x + c - b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d) - 4 * \\
& \sin\_integral((b*d*x - d^2*x + b*c - c*d)/d) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b* \\
& c - c*d)/d) + 2 * \text{imag\_part}(\cos\_integral(b*x - d*x - c + b*c/d)) * \tan(1/2*a - \\
& 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d) - 2 * \text{imag\_part}(\cos\_integral(-b*x + d*x + c - \\
& b*c/d)) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d) + 4 * \sin\_integral((b*d* \\
& x - d^2*x + b*c - c*d)/d) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d) - 2 * \\
& \text{imag\_part}(\cos\_integral(b*x - d*x - c + b*c/d)) * \tan(1/2*(b*c + c*d)/d)^2 * \tan( \\
& 1/2*(b*c - c*d)/d) + 2 * \text{imag\_part}(\cos\_integral(-b*x + d*x + c - b*c/d)) * \tan( \\
& 1/2*(b*c + c*d)/d)^2 * \tan(1/2*(b*c - c*d)/d) - 4 * \sin\_integral((b*d*x - d^2*x
\end{aligned}$$

$$\begin{aligned}
& + b*c - c*d)/d)*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d) - 2*\operatorname{imag\_part}(\cos\_integral(b*x + d*x + c + b*c/d))*\tan(1/2*a + 1/2*c)*\tan(1/2*(b*c - c*d)/d)^2 + 2*\operatorname{imag\_part}(\cos\_integral(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)*\tan(1/2*(b*c - c*d)/d)^2 - 4*\sin\_integral((b*d*x + d^2*x + b*c + c*d)/d)*\tan(1/2*a + 1/2*c)*\tan(1/2*(b*c - c*d)/d)^2 - 2*\operatorname{imag\_part}(\cos\_integral(b*x - d*x - c + b*c/d))*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c - c*d)/d)^2 + 2*\operatorname{imag\_part}(\cos\_integral(-b*x + d*x + c - b*c/d))*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c - c*d)/d)^2 - 4*\sin\_integral((b*d*x - d^2*x + b*c - c*d)/d)*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c - c*d)/d)^2 + 2*\operatorname{imag\_part}(\cos\_integral(b*x + d*x + c + b*c/d))*\tan(1/2*(b*c + c*d)/d)*\tan(1/2*(b*c - c*d)/d)^2 - 2*\operatorname{imag\_part}(\cos\_integral(-b*x - d*x - c - b*c/d))*\tan(1/2*(b*c + c*d)/d)*\tan(1/2*(b*c - c*d)/d)^2 + 4*\sin\_integral((b*d*x + d^2*x + b*c + c*d)/d)*\tan(1/2*(b*c + c*d)/d)*\tan(1/2*(b*c - c*d)/d)^2 - \operatorname{real\_part}(\cos\_integral(b*x + d*x + c + b*c/d))*\tan(1/2*a + 1/2*c)^2 - \operatorname{real\_part}(\cos\_integral(b*x - d*x - c + b*c/d))*\tan(1/2*a + 1/2*c)^2 - \operatorname{real\_part}(\cos\_integral(-b*x + d*x + c - b*c/d))*\tan(1/2*a + 1/2*c)^2 - \operatorname{real\_part}(\cos\_integral(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)^2 + \operatorname{real\_part}(\cos\_integral(b*x + d*x + c + b*c/d))*\tan(1/2*a - 1/2*c)^2 + \operatorname{real\_part}(\cos\_integral(b*x - d*x - c + b*c/d))*\tan(1/2*a - 1/2*c)^2 + \operatorname{real\_part}(\cos\_integral(-b*x + d*x + c - b*c/d))*\tan(1/2*a - 1/2*c)^2 + \operatorname{real\_part}(\cos\_integral(-b*x - d*x - c - b*c/d))*\tan(1/2*a - 1/2*c)^2 + 4*\operatorname{real\_part}(\cos\_integral(b*x + d*x + c + b*c/d))*\tan(1/2*a + 1/2*c)*\tan(1/2*(b*c + c*d)/d) + 4*\operatorname{real\_part}(\cos\_integral(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)*\tan(1/2*(b*c + c*d)/d) - \operatorname{real\_part}(\cos\_integral(b*x + d*x + c + b*c/d))*\tan(1/2*(b*c + c*d)/d)^2 - \operatorname{real\_part}(\cos\_integral(b*x - d*x - c + b*c/d))*\tan(1/2*(b*c + c*d)/d)^2 - \operatorname{real\_part}(\cos\_integral(-b*x + d*x + c - b*c/d))*\tan(1/2*(b*c + c*d)/d)^2 - \operatorname{real\_part}(\cos\_integral(-b*x - d*x - c - b*c/d))*\tan(1/2*(b*c + c*d)/d)^2 - 4*\operatorname{real\_part}(\cos\_integral(b*x - d*x - c + b*c/d))*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c - c*d)/d) - 4*\operatorname{real\_part}(\cos\_integral(-b*x + d*x + c - b*c/d))*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c - c*d)/d) + \operatorname{real\_part}(\cos\_integral(b*x + d*x + c + b*c/d))*\tan(1/2*(b*c - c*d)/d)^2 + \operatorname{real\_part}(\cos\_integral(b*x - d*x - c + b*c/d))*\tan(1/2*(b*c - c*d)/d)^2 + \operatorname{real\_part}(\cos\_integral(-b*x + d*x + c - b*c/d))*\tan(1/2*(b*c - c*d)/d)^2 + \operatorname{real\_part}(\cos\_integral(-b*x - d*x - c - b*c/d))*\tan(1/2*(b*c - c*d)/d)^2 - 2*\operatorname{imag\_part}(\cos\_integral(b*x + d*x + c + b*c/d))*\tan(1/2*a + 1/2*c) + 2*\operatorname{imag\_part}(\cos\_integral(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c) - 4*\sin\_integral((b*d*x + d^2*x + b*c + c*d)/d)*\tan(1/2*a + 1/2*c) + 2*\operatorname{imag\_part}(\cos\_integral(b*x - d*x - c + b*c/d))*\tan(1/2*a - 1/2*c) - 2*\operatorname{imag\_part}(\cos\_integral(-b*x + d*x + c - b*c/d))*\tan(1/2*a - 1/2*c) + 4*\sin\_integral((b*d*x - d^2*x + b*c - c*d)/d)*\tan(1/2*a - 1/2*c) + 2*\operatorname{imag\_part}(\cos\_integral(b*x + d*x + c + b*c/d))*\tan(1/2*(b*c + c*d)/d) - 2*\operatorname{imag\_part}(\cos\_integral(-b*x - d*x - c - b*c/d))*\tan(1/2*(b*c + c*d)/d) + 4*\sin\_integral((b*d*x + d^2*x + b*c + c*d)/d)*\tan(1/2*(b*c + c*d)/d) - 2*\operatorname{imag\_part}(\cos\_integral(b*x - d*x - c + b*c/d))*\tan(1/2*(b*c - c*d)/d) + 2*\operatorname{imag\_part}(\cos\_integral(-b*x + d*x + c - b*c/d))*\tan(1/2*(b*c - c*d)/d) - 4*\sin\_integral((b*d*x - d^2*x + b*c - c*d)/d)*\tan(1/2*(b*c - c*d)/d) + \operatorname{real\_part}(\cos\_integral(b*x + d*x + c + b*c/d)) - \operatorname{real\_part}
\end{aligned}$$

$$\begin{aligned}
& t(\cos\_integral(b*x - d*x - c + b*c/d)) - \text{real\_part}(\cos\_integral(-b*x + d*x \\
& + c - b*c/d)) + \text{real\_part}(\cos\_integral(-b*x - d*x - c - b*c/d))*d/(b*d*\tan \\
& (1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b* \\
& c - c*d)/d)^2 + b*d*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c \\
& + c*d)/d)^2 + b*d*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c - \\
& c*d)/d)^2 + b*d*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c \\
& - c*d)/d)^2 + b*d*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c \\
& c - c*d)/d)^2 + b*d*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2 + b*d*\tan(1/2 \\
& *a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 + b*d*\tan(1/2*a - 1/2*c)^2*\tan(1/2*( \\
& b*c + c*d)/d)^2 + b*d*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c - c*d)/d)^2 + b*d*t \\
& an(1/2*a - 1/2*c)^2*\tan(1/2*(b*c - c*d)/d)^2 + b*d*\tan(1/2*(b*c + c*d)/d)^2 \\
& *\tan(1/2*(b*c - c*d)/d)^2 + b*d*\tan(1/2*a + 1/2*c)^2 + b*d*\tan(1/2*a - 1/2* \\
& c)^2 + b*d*\tan(1/2*(b*c + c*d)/d)^2 + b*d*\tan(1/2*(b*c - c*d)/d)^2 + b*d) + \\
& \sin(b*x + a)*\sin\_integral(d*x + c)/b
\end{aligned}$$



$$3.68 \quad \int \frac{\cos(ax)\text{Si}(c+dx)}{x} dx$$

**Optimal.** Leaf size=18

$$\text{CannotIntegrate}\left(\frac{\cos(a+bx)\text{Si}(c+dx)}{x}, x\right)$$

[Out] CannotIntegrate[(Cos[a + b\*x]\*SinIntegral[c + d\*x])/x, x]

**Rubi [A]** time = 0.106662, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\cos(a+bx)\text{Si}(c+dx)}{x} dx$$

Verification is Not applicable to the result.

[In] Int[(Cos[a + b\*x]\*SinIntegral[c + d\*x])/x, x]

[Out] Defer[Int] [(Cos[a + b\*x]\*SinIntegral[c + d\*x])/x, x]

Rubi steps

$$\int \frac{\cos(a+bx)\text{Si}(c+dx)}{x} dx = \int \frac{\cos(a+bx)\text{Si}(c+dx)}{x} dx$$

**Mathematica [A]** time = 13.115, size = 0, normalized size = 0.

$$\int \frac{\cos(a+bx)\text{Si}(c+dx)}{x} dx$$

Verification is Not applicable to the result.

[In] Integrate[(Cos[a + b\*x]\*SinIntegral[c + d\*x])/x, x]

[Out] Integrate[(Cos[a + b\*x]\*SinIntegral[c + d\*x])/x, x]

**Maple [A]** time = 0.093, size = 0, normalized size = 0.

$$\int \frac{\cos(bx + a) \operatorname{Si}(dx + c)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(cos(b\*x+a)\*Si(d\*x+c)/x,x)

[Out] int(cos(b\*x+a)\*Si(d\*x+c)/x,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\operatorname{Si}(dx + c) \cos(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(cos(b\*x+a)\*Si(d\*x+c)/x,x, algorithm="maxima")

[Out] integrate(Si(d\*x + c)\*cos(b\*x + a)/x, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}\left(\frac{\cos(bx + a) \operatorname{Si}(dx + c)}{x}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(cos(b\*x+a)\*Si(d\*x+c)/x,x, algorithm="fricas")

[Out] integral(cos(b\*x + a)\*sin\_integral(d\*x + c)/x, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\cos(a + bx) \operatorname{Si}(c + dx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(cos(b*x+a)*Si(d*x+c)/x,x)`

[Out] `Integral(cos(a + b*x)*Si(c + d*x)/x, x)`

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Si}(dx + c) \cos(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(cos(b*x+a)*Si(d*x+c)/x,x, algorithm="giac")`

[Out] `integrate(Si(d*x + c)*cos(b*x + a)/x, x)`

### 3.69 $\int x^m \text{CosIntegral}(bx) dx$

**Optimal.** Leaf size=90

$$\frac{ix^m(-ibx)^{-m}\Gamma(m+1,-ibx)}{2b(m+1)} - \frac{ix^m(ibx)^{-m}\Gamma(m+1,ibx)}{2b(m+1)} + \frac{x^{m+1}\text{CosIntegral}(bx)}{m+1}$$

[Out]  $(x^{(1+m)}\text{CosIntegral}[b*x])/(1+m) + ((I/2)*x^m*\Gamma[1+m, (-I)*b*x])/(b*(1+m)*((-I)*b*x)^m) - ((I/2)*x^m*\Gamma[1+m, I*b*x])/(b*(1+m)*(I*b*x)^m)$

**Rubi [A]** time = 0.0823221, antiderivative size = 90, normalized size of antiderivative = 1., number of steps used = 5, number of rules used = 4, integrand size = 8,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.5$ , Rules used = {6504, 12, 3307, 2181}

$$\frac{ix^m(-ibx)^{-m}\Gamma(m+1,-ibx)}{2b(m+1)} - \frac{ix^m(ibx)^{-m}\Gamma(m+1,ibx)}{2b(m+1)} + \frac{x^{m+1}\text{CosIntegral}(bx)}{m+1}$$

Antiderivative was successfully verified.

[In] Int[x^m\*CosIntegral[b\*x],x]

[Out]  $(x^{(1+m)}\text{CosIntegral}[b*x])/(1+m) + ((I/2)*x^m*\Gamma[1+m, (-I)*b*x])/(b*(1+m)*((-I)*b*x)^m) - ((I/2)*x^m*\Gamma[1+m, I*b*x])/(b*(1+m)*(I*b*x)^m)$

#### Rule 6504

Int[CosIntegral[(a\_.) + (b\_.)\*(x\_)]\*((c\_.) + (d\_.)\*(x\_))^(m\_.), x\_Symbol] :> Simp[((c + d\*x)^(m + 1)\*CosIntegral[a + b\*x])/(d\*(m + 1)), x] - Dist[b/(d\*(m + 1)), Int[((c + d\*x)^(m + 1)\*Cos[a + b\*x])/(a + b\*x), x], x] /; FreeQ[{a, b, c, d, m}, x] && NeQ[m, -1]

#### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] :> Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b\_)\*(v\_)] /; FreeQ[b, x]

#### Rule 3307

Int[((c\_.) + (d\_.)\*(x\_))^(m\_.)\*sin[(e\_.) + Pi\*(k\_.) + (f\_.)\*(x\_)], x\_Symbol] :> Dist[I/2, Int[(c + d\*x)^m/(E^(I\*k\*Pi)\*E^(I\*(e + f\*x))), x], x] - Dist[

$I/2, \text{Int}[(c + d*x)^m * E^{(I*k*Pi)*E^{(I*(e + f*x))}}, x], x] /;$  FreeQ[{c, d, e, f, m}, x] && IntegerQ[2\*k]

### Rule 2181

$\text{Int}[(F_)^((g_.) * ((e_.) + (f_.) * (x_))) * ((c_.) + (d_.) * (x_))^{(m_)}, x\_Symbol]$   
 $\rightarrow -\text{Simp}[(F^{(g*(e - (c*f)/d)}) * (c + d*x)^{\text{FracPart}[m]} * \text{Gamma}[m + 1, (-(f*g*\text{Log}[F])/d)] * (c + d*x))] / (d * (-(f*g*\text{Log}[F])/d))^{(\text{IntPart}[m] + 1)} * (-(f*g*\text{Log}[F]) * (c + d*x)/d)^{\text{FracPart}[m]}, x] /;$  FreeQ[{F, c, d, e, f, g, m}, x] && !IntegerQ[m]

### Rubi steps

$$\begin{aligned} \int x^m \text{Ci}(bx) dx &= \frac{x^{1+m} \text{Ci}(bx)}{1+m} - \frac{b \int \frac{x^m \cos(bx)}{b} dx}{1+m} \\ &= \frac{x^{1+m} \text{Ci}(bx)}{1+m} - \frac{\int x^m \cos(bx) dx}{1+m} \\ &= \frac{x^{1+m} \text{Ci}(bx)}{1+m} - \frac{\int e^{-ibx} x^m dx}{2(1+m)} - \frac{\int e^{ibx} x^m dx}{2(1+m)} \\ &= \frac{x^{1+m} \text{Ci}(bx)}{1+m} + \frac{ix^m (-ibx)^{-m} \Gamma(1+m, -ibx)}{2b(1+m)} - \frac{ix^m (ibx)^{-m} \Gamma(1+m, ibx)}{2b(1+m)} \end{aligned}$$

**Mathematica [A]** time = 0.0762758, size = 78, normalized size = 0.87

$$\frac{x^m \left( 2x \text{CosIntegral}(bx) + \frac{i(b^2 x^2)^{-m} ((ibx)^m \text{Gamma}(m+1, -ibx) - (-ibx)^m \text{Gamma}(m+1, ibx))}{b} \right)}{2(m+1)}$$

Antiderivative was successfully verified.

[In] Integrate[x^m \* CosIntegral[b\*x], x]

[Out]  $(x^m * (2*x*\text{CosIntegral}[b*x] + (I*((I*b*x)^m*\text{Gamma}[1+m, (-I)*b*x] - ((-I)*b*x)^m*\text{Gamma}[1+m, I*b*x])) / (b*(b^2*x^2)^m)) / (2*(1+m))$

**Maple [C]** time = 0.099, size = 124, normalized size = 1.4

$$2^{-1+m} b^{-1-m} \sqrt{\pi} \left( 2 \frac{(\Psi(1/2 + m/2) + 2\gamma - \Psi(3/2 + m/2) + 2 \ln(x) + 2 \ln(b)) x^{1+m} 2^{-1-m} b^{1+m}}{\sqrt{\pi} (1+m)} - \frac{2^{-1-m} x^{3+m} b^{3+m}}{\sqrt{\pi} (3+m)} {}_3F_4(1, \dots) \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(x^m*Ci(b*x),x)`

[Out]  $2^{(-1+m)}b^{(-1-m)}\pi^{(1/2)}*(2*(\Psi(1/2+1/2*m))+2*\gamma-\Psi(3/2+1/2*m)+2*\ln(x)+2*\ln(b))/\pi^{(1/2)}*x^{(1+m)}*2^{(-1-m)}b^{(1+m)}/(1+m)-2^{(-1-m)}/\pi^{(1/2)}/(3+m)*x^{(3+m)}b^{(3+m)}\text{hypergeom}([1,1,3/2+1/2*m],[3/2,2,2,5/2+1/2*m],-1/4*b^2*x^2)$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^m \text{Ci}(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^m*Ci(b*x),x, algorithm="maxima")`

[Out] `integrate(x^m*Ci(b*x), x)`

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^m \text{Ci}(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^m*Ci(b*x),x, algorithm="fricas")`

[Out] `integral(x^m*cos_integral(b*x), x)`

**Sympy [B]** time = 2.17449, size = 654, normalized size = 7.27

result too large to display

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x**m*Ci(b*x),x)`

```
[Out] 4*2**m*b**(-m)*m*x*sqrt(exp(-2*m*log(2))*exp(m*log(b**2*x**2)))*log(b**2*x**2)*gamma(m/2 + 5/2)/(8*m**2*gamma(m/2 + 5/2) + 16*m*gamma(m/2 + 5/2) + 8*gamma(m/2 + 5/2)) + 8*2**m*EulerGamma*b**(-m)*m*x*sqrt(exp(-2*m*log(2))*exp(m*log(b**2*x**2)))*gamma(m/2 + 5/2)/(8*m**2*gamma(m/2 + 5/2) + 16*m*gamma(m/2 + 5/2) + 8*gamma(m/2 + 5/2)) + 4*2**m*b**(-m)*x*sqrt(exp(-2*m*log(2))*exp(m*log(b**2*x**2)))*log(b**2*x**2)*gamma(m/2 + 5/2)/(8*m**2*gamma(m/2 + 5/2) + 16*m*gamma(m/2 + 5/2) + 8*gamma(m/2 + 5/2)) - 8*2**m*b**(-m)*x*sqrt(exp(-2*m*log(2))*exp(m*log(b**2*x**2)))*gamma(m/2 + 5/2)/(8*m**2*gamma(m/2 + 5/2) + 16*m*gamma(m/2 + 5/2) + 8*gamma(m/2 + 5/2)) + 8*2**m*EulerGamma*b**(-m)*x*sqrt(exp(-2*m*log(2))*exp(m*log(b**2*x**2)))*gamma(m/2 + 5/2)/(8*m**2*gamma(m/2 + 5/2) + 16*m*gamma(m/2 + 5/2) + 8*gamma(m/2 + 5/2)) - b**2*m**2*x**3*x**m*gamma(m/2 + 3/2)*hyper((1, 1, m/2 + 3/2), (3/2, 2, 2, m/2 + 5/2), -b**2*x**2/4)/(8*m**2*gamma(m/2 + 5/2) + 16*m*gamma(m/2 + 5/2) + 8*gamma(m/2 + 5/2)) - 2*b**2*m*x**3*x**m*gamma(m/2 + 3/2)*hyper((1, 1, m/2 + 3/2), (3/2, 2, 2, m/2 + 5/2), -b**2*x**2/4)/(8*m**2*gamma(m/2 + 5/2) + 16*m*gamma(m/2 + 5/2) + 8*gamma(m/2 + 5/2)) - b**2*x**3*x**m*gamma(m/2 + 3/2)*hyper((1, 1, m/2 + 3/2), (3/2, 2, 2, m/2 + 5/2), -b**2*x**2/4)/(8*m**2*gamma(m/2 + 5/2) + 16*m*gamma(m/2 + 5/2) + 8*gamma(m/2 + 5/2))
```

**Giac [F]** time = 0., size = 0, normalized size = 0.

$$\int x^m \text{Ci}(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x^m*Ci(b*x),x, algorithm="giac")
```

```
[Out] integrate(x^m*Ci(b*x), x)
```

## 3.70 $\int x^3 \text{CosIntegral}(bx) dx$

**Optimal.** Leaf size=63

$$-\frac{3x^2 \cos(bx)}{4b^2} + \frac{3x \sin(bx)}{2b^3} + \frac{3 \cos(bx)}{2b^4} + \frac{1}{4}x^4 \text{CosIntegral}(bx) - \frac{x^3 \sin(bx)}{4b}$$

[Out] (3\*Cos[b\*x])/(2\*b^4) - (3\*x^2\*Cos[b\*x])/(4\*b^2) + (x^4\*CosIntegral[b\*x])/4 + (3\*x\*Sin[b\*x])/(2\*b^3) - (x^3\*Sin[b\*x])/(4\*b)

**Rubi [A]** time = 0.0713873, antiderivative size = 63, normalized size of antiderivative = 1., number of steps used = 6, number of rules used = 4, integrand size = 8,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.5$ , Rules used = {6504, 12, 3296, 2638}

$$-\frac{3x^2 \cos(bx)}{4b^2} + \frac{3x \sin(bx)}{2b^3} + \frac{3 \cos(bx)}{2b^4} + \frac{1}{4}x^4 \text{CosIntegral}(bx) - \frac{x^3 \sin(bx)}{4b}$$

Antiderivative was successfully verified.

[In] Int[x^3\*CosIntegral[b\*x],x]

[Out] (3\*Cos[b\*x])/(2\*b^4) - (3\*x^2\*Cos[b\*x])/(4\*b^2) + (x^4\*CosIntegral[b\*x])/4 + (3\*x\*Sin[b\*x])/(2\*b^3) - (x^3\*Sin[b\*x])/(4\*b)

### Rule 6504

```
Int[CosIntegral[(a_.) + (b_.)*(x_)]*((c_.) + (d_.)*(x_))^(m_.), x_Symbol] :
> Simp[((c + d*x)^(m + 1)*CosIntegral[a + b*x])/(d*(m + 1)), x] - Dist[b/(d
*(m + 1)), Int[((c + d*x)^(m + 1)*Cos[a + b*x])/(a + b*x), x], x] /; FreeQ[
{a, b, c, d, m}, x] && NeQ[m, -1]
```

### Rule 12

```
Int[(a_)*(u_), x_Symbol] :> Dist[a, Int[u, x], x] /; FreeQ[a, x] && !Match
Q[u, (b_.)*(v_)] /; FreeQ[b, x]
```

### Rule 3296

```
Int[((c_.) + (d_.)*(x_))^(m_.)*sin[(e_.) + (f_.)*(x_)], x_Symbol] :> -Simp[
((c + d*x)^m*Cos[e + f*x])/f, x] + Dist[(d*m)/f, Int[(c + d*x)^(m - 1)*Cos[
e + f*x], x], x] /; FreeQ[{c, d, e, f}, x] && GtQ[m, 0]
```



Rule 2638

```
Int[sin[(c_.) + (d_.)*(x_.)], x_Symbol] := -Simp[Cos[c + d*x]/d, x] /; FreeQ
[{c, d}, x]
```

Rubi steps

$$\begin{aligned}
\int x^3 \text{Ci}(bx) dx &= \frac{1}{4} x^4 \text{Ci}(bx) - \frac{1}{4} b \int \frac{x^3 \cos(bx)}{b} dx \\
&= \frac{1}{4} x^4 \text{Ci}(bx) - \frac{1}{4} \int x^3 \cos(bx) dx \\
&= \frac{1}{4} x^4 \text{Ci}(bx) - \frac{x^3 \sin(bx)}{4b} + \frac{3 \int x^2 \sin(bx) dx}{4b} \\
&= -\frac{3x^2 \cos(bx)}{4b^2} + \frac{1}{4} x^4 \text{Ci}(bx) - \frac{x^3 \sin(bx)}{4b} + \frac{3 \int x \cos(bx) dx}{2b^2} \\
&= -\frac{3x^2 \cos(bx)}{4b^2} + \frac{1}{4} x^4 \text{Ci}(bx) + \frac{3x \sin(bx)}{2b^3} - \frac{x^3 \sin(bx)}{4b} - \frac{3 \int \sin(bx) dx}{2b^3} \\
&= \frac{3 \cos(bx)}{2b^4} - \frac{3x^2 \cos(bx)}{4b^2} + \frac{1}{4} x^4 \text{Ci}(bx) + \frac{3x \sin(bx)}{2b^3} - \frac{x^3 \sin(bx)}{4b}
\end{aligned}$$

**Mathematica [A]** time = 0.0398461, size = 53, normalized size = 0.84

$$-\frac{x(b^2x^2 - 6)\sin(bx)}{4b^3} - \frac{3(b^2x^2 - 2)\cos(bx)}{4b^4} + \frac{1}{4}x^4\text{CosIntegral}(bx)$$

Antiderivative was successfully verified.

```
[In] Integrate[x^3*CosIntegral[b*x], x]
```

```
[Out] (-3*(-2 + b^2*x^2)*Cos[b*x])/(4*b^4) + (x^4*CosIntegral[b*x])/4 - (x*(-6 +
b^2*x^2)*Sin[b*x])/(4*b^3)
```

**Maple [A]** time = 0.048, size = 56, normalized size = 0.9

$$\frac{1}{b^4} \left( \frac{b^4 x^4 \text{Ci}(bx)}{4} - \frac{\sin(bx) b^3 x^3}{4} - \frac{3 b^2 x^2 \cos(bx)}{4} + \frac{3 \cos(bx)}{2} + \frac{3 \sin(bx) bx}{2} \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(x^3*Ci(b*x),x)`

[Out]  $1/b^4*(1/4*b^4*x^4*Ci(b*x)-1/4*\sin(b*x)*b^3*x^3-3/4*b^2*x^2*\cos(b*x)+3/2*\cos(b*x)+3/2*\sin(b*x)*b*x)$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^3 Ci(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^3*Ci(b*x),x, algorithm="maxima")`

[Out] `integrate(x^3*Ci(b*x), x)`

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^3 Ci(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^3*Ci(b*x),x, algorithm="fricas")`

[Out] `integral(x^3*cos_integral(b*x), x)`

**Sympy [A]** time = 2.9055, size = 85, normalized size = 1.35

$$-\frac{x^4 \log(bx)}{4} + \frac{x^4 \log(b^2 x^2)}{8} + \frac{x^4 Ci(bx)}{4} - \frac{x^3 \sin(bx)}{4b} - \frac{3x^2 \cos(bx)}{4b^2} + \frac{3x \sin(bx)}{2b^3} + \frac{3 \cos(bx)}{2b^4}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x**3*Ci(b*x),x)`

[Out]  $-x^{**4}*\log(b*x)/4 + x^{**4}*\log(b^{**2}*x^{**2})/8 + x^{**4}*Ci(b*x)/4 - x^{**3}*\sin(b*x)/(4*b) - 3*x^{**2}*\cos(b*x)/(4*b^{**2}) + 3*x*\sin(b*x)/(2*b^{**3}) + 3*\cos(b*x)/(2*b^{**4})$

4)

---

**Giac [A]** time = 1.19487, size = 66, normalized size = 1.05

$$\frac{1}{4} x^4 \operatorname{Ci}(bx) - \frac{3(b^2 x^2 - 2) \cos(bx)}{4 b^4} - \frac{(b^3 x^3 - 6bx) \sin(bx)}{4 b^4}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^3\*Ci(b\*x),x, algorithm="giac")

[Out] 1/4\*x^4\*cos\_integral(b\*x) - 3/4\*(b^2\*x^2 - 2)\*cos(b\*x)/b^4 - 1/4\*(b^3\*x^3 - 6\*b\*x)\*sin(b\*x)/b^4

### 3.71 $\int x^2 \text{CosIntegral}(bx) dx$

**Optimal.** Leaf size=49

$$\frac{2 \sin(bx)}{3b^3} - \frac{2x \cos(bx)}{3b^2} + \frac{1}{3}x^3 \text{CosIntegral}(bx) - \frac{x^2 \sin(bx)}{3b}$$

[Out]  $(-2*x*\text{Cos}[b*x])/(3*b^2) + (x^3*\text{CosIntegral}[b*x])/3 + (2*\text{Sin}[b*x])/(3*b^3) - (x^2*\text{Sin}[b*x])/(3*b)$

**Rubi [A]** time = 0.0478551, antiderivative size = 49, normalized size of antiderivative = 1., number of steps used = 5, number of rules used = 4, integrand size = 8,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.5$ , Rules used = {6504, 12, 3296, 2637}

$$\frac{2 \sin(bx)}{3b^3} - \frac{2x \cos(bx)}{3b^2} + \frac{1}{3}x^3 \text{CosIntegral}(bx) - \frac{x^2 \sin(bx)}{3b}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[x^2*\text{CosIntegral}[b*x], x]$

[Out]  $(-2*x*\text{Cos}[b*x])/(3*b^2) + (x^3*\text{CosIntegral}[b*x])/3 + (2*\text{Sin}[b*x])/(3*b^3) - (x^2*\text{Sin}[b*x])/(3*b)$

#### Rule 6504

$\text{Int}[\text{CosIntegral}[(a_.) + (b_.)*(x_.)]*((c_.) + (d_.)*(x_.))^{(m_.)}, x\_Symbol] :$   
 $> \text{Simp}[(c + d*x)^{(m + 1)}*\text{CosIntegral}[a + b*x]/(d*(m + 1)), x] - \text{Dist}[b/(d$   
 $*(m + 1)), \text{Int}[(c + d*x)^{(m + 1)}*\text{Cos}[a + b*x]/(a + b*x), x], x] /;$  FreeQ[  
 $\{a, b, c, d, m\}, x] \&\& \text{NeQ}[m, -1]$

#### Rule 12

$\text{Int}[(a_.)*(u_), x\_Symbol] :> \text{Dist}[a, \text{Int}[u, x], x] /;$  FreeQ[a, x] && !Match  
 $Q[u, (b_.)*(v_)] /;$  FreeQ[b, x]

#### Rule 3296

$\text{Int}[(c_.) + (d_.)*(x_.))^{(m_.)}*\sin[(e_.) + (f_.)*(x_.)], x\_Symbol] :> -\text{Simp}[(c + d*x)^m*\text{Cos}[e + f*x]/f, x] + \text{Dist}[(d*m)/f, \text{Int}[(c + d*x)^{(m - 1)}*\text{Cos}[e + f*x], x], x] /;$  FreeQ[{c, d, e, f}, x] && GtQ[m, 0]

Rule 2637

```
Int[sin[Pi/2 + (c_.) + (d_.)*(x_)], x_Symbol] := Simp[Sin[c + d*x]/d, x] /;
FreeQ[{c, d}, x]
```

Rubi steps

$$\begin{aligned}
 \int x^2 \text{Ci}(bx) dx &= \frac{1}{3} x^3 \text{Ci}(bx) - \frac{1}{3} b \int \frac{x^2 \cos(bx)}{b} dx \\
 &= \frac{1}{3} x^3 \text{Ci}(bx) - \frac{1}{3} \int x^2 \cos(bx) dx \\
 &= \frac{1}{3} x^3 \text{Ci}(bx) - \frac{x^2 \sin(bx)}{3b} + \frac{2 \int x \sin(bx) dx}{3b} \\
 &= -\frac{2x \cos(bx)}{3b^2} + \frac{1}{3} x^3 \text{Ci}(bx) - \frac{x^2 \sin(bx)}{3b} + \frac{2 \int \cos(bx) dx}{3b^2} \\
 &= -\frac{2x \cos(bx)}{3b^2} + \frac{1}{3} x^3 \text{Ci}(bx) + \frac{2 \sin(bx)}{3b^3} - \frac{x^2 \sin(bx)}{3b}
 \end{aligned}$$

**Mathematica [A]** time = 0.0287376, size = 44, normalized size = 0.9

$$-\frac{(b^2 x^2 - 2) \sin(bx)}{3b^3} - \frac{2x \cos(bx)}{3b^2} + \frac{1}{3} x^3 \text{CosIntegral}(bx)$$

Antiderivative was successfully verified.

```
[In] Integrate[x^2*CosIntegral[b*x], x]
```

```
[Out] (-2*x*Cos[b*x])/(3*b^2) + (x^3*CosIntegral[b*x])/3 - ((-2 + b^2*x^2)*Sin[b*x])/(3*b^3)
```

**Maple [A]** time = 0.05, size = 44, normalized size = 0.9

$$\frac{1}{b^3} \left( \frac{b^3 x^3 \text{Ci}(bx)}{3} - \frac{b^2 x^2 \sin(bx)}{3} + \frac{2 \sin(bx)}{3} - \frac{2bx \cos(bx)}{3} \right)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(x^2*Ci(b*x), x)
```

[Out]  $1/b^3*(1/3*b^3*x^3*Ci(b*x)-1/3*b^2*x^2*\sin(b*x)+2/3*\sin(b*x)-2/3*b*x*\cos(b*x))$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 Ci(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Ci(b*x),x, algorithm="maxima")`

[Out] `integrate(x^2*Ci(b*x), x)`

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^2 Ci(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Ci(b*x),x, algorithm="fricas")`

[Out] `integral(x^2*cos_integral(b*x), x)`

**Sympy [A]** time = 2.43547, size = 70, normalized size = 1.43

$$-\frac{x^3 \log(bx)}{3} + \frac{x^3 \log(b^2 x^2)}{6} + \frac{x^3 Ci(bx)}{3} - \frac{x^2 \sin(bx)}{3b} - \frac{2x \cos(bx)}{3b^2} + \frac{2 \sin(bx)}{3b^3}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x**2*Ci(b*x),x)`

[Out] `-x**3*log(b*x)/3 + x**3*log(b**2*x**2)/6 + x**3*Ci(b*x)/3 - x**2*sin(b*x)/(3*b) - 2*x*cos(b*x)/(3*b**2) + 2*sin(b*x)/(3*b**3)`

**Giac [A]** time = 1.17142, size = 51, normalized size = 1.04

$$\frac{1}{3}x^3 \operatorname{Ci}(bx) - \frac{2x \cos(bx)}{3b^2} - \frac{(b^2x^2 - 2) \sin(bx)}{3b^3}$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x^2*cos(b*x),x, algorithm="giac")
```

```
[Out] 1/3*x^3*cos_integral(b*x) - 2/3*x*cos(b*x)/b^2 - 1/3*(b^2*x^2 - 2)*sin(b*x)/b^3
```

## 3.72 $\int x \text{CosIntegral}(bx) dx$

**Optimal.** Leaf size=35

$$-\frac{\cos(bx)}{2b^2} + \frac{1}{2}x^2 \text{CosIntegral}(bx) - \frac{x \sin(bx)}{2b}$$

[Out]  $-\text{Cos}[b*x]/(2*b^2) + (x^2*\text{CosIntegral}[b*x])/2 - (x*\text{Sin}[b*x])/(2*b)$

**Rubi [A]** time = 0.0235583, antiderivative size = 35, normalized size of antiderivative = 1., number of steps used = 4, number of rules used = 4, integrand size = 6,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.667$ , Rules used = {6504, 12, 3296, 2638}

$$-\frac{\cos(bx)}{2b^2} + \frac{1}{2}x^2 \text{CosIntegral}(bx) - \frac{x \sin(bx)}{2b}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[x*\text{CosIntegral}[b*x], x]$

[Out]  $-\text{Cos}[b*x]/(2*b^2) + (x^2*\text{CosIntegral}[b*x])/2 - (x*\text{Sin}[b*x])/(2*b)$

### Rule 6504

$\text{Int}[\text{CosIntegral}[(a_.) + (b_.)*(x_.)]*((c_.) + (d_.)*(x_.))^{(m_.)}, x\_Symbol] :$   
 $> \text{Simp}[\frac{(c + d*x)^{(m + 1)}*\text{CosIntegral}[a + b*x]}{(d*(m + 1))}, x] - \text{Dist}[b/(d$   
 $*(m + 1)), \text{Int}[\frac{(c + d*x)^{(m + 1)}*\text{Cos}[a + b*x]}{(a + b*x)}, x], x] /;$  FreeQ[  
 $\{a, b, c, d, m\}, x] \ \&\& \ \text{NeQ}[m, -1]$

### Rule 12

$\text{Int}[(a_)*(u_), x\_Symbol] := \text{Dist}[a, \text{Int}[u, x], x] /;$  FreeQ[a, x] && !Match  
 $Q[u, (b_)*(v_)] /;$  FreeQ[b, x]

### Rule 3296

$\text{Int}[\frac{(c_.) + (d_.)*(x_.))^{(m_.)}*\sin[(e_.) + (f_.)*(x_.)], x\_Symbol] := -\text{Simp}[\frac{(c + d*x)^m*\text{Cos}[e + f*x]}{f}, x] + \text{Dist}[\frac{(d*m)}{f}, \text{Int}[\frac{(c + d*x)^{(m - 1)}*\text{Cos}[e + f*x]}{f}, x], x] /;$  FreeQ[{c, d, e, f}, x] && GtQ[m, 0]

### Rule 2638



```
Int[sin[(c_.) + (d_.)*(x_.)], x_Symbol] := -Simp[Cos[c + d*x]/d, x] /; FreeQ
[{c, d}, x]
```

### Rubi steps

$$\begin{aligned}
 \int x \operatorname{Ci}(bx) dx &= \frac{1}{2} x^2 \operatorname{Ci}(bx) - \frac{1}{2} b \int \frac{x \cos(bx)}{b} dx \\
 &= \frac{1}{2} x^2 \operatorname{Ci}(bx) - \frac{1}{2} \int x \cos(bx) dx \\
 &= \frac{1}{2} x^2 \operatorname{Ci}(bx) - \frac{x \sin(bx)}{2b} + \frac{\int \sin(bx) dx}{2b} \\
 &= -\frac{\cos(bx)}{2b^2} + \frac{1}{2} x^2 \operatorname{Ci}(bx) - \frac{x \sin(bx)}{2b}
 \end{aligned}$$

**Mathematica [A]** time = 0.0079792, size = 35, normalized size = 1.

$$-\frac{\cos(bx)}{2b^2} + \frac{1}{2} x^2 \operatorname{CosIntegral}(bx) - \frac{x \sin(bx)}{2b}$$

Antiderivative was successfully verified.

```
[In] Integrate[x*CosIntegral[b*x], x]
```

```
[Out] -Cos[b*x]/(2*b^2) + (x^2*CosIntegral[b*x])/2 - (x*Sin[b*x])/(2*b)
```

**Maple [A]** time = 0.05, size = 32, normalized size = 0.9

$$\frac{1}{b^2} \left( \frac{b^2 x^2 \operatorname{Ci}(bx)}{2} - \frac{\sin(bx) bx}{2} - \frac{\cos(bx)}{2} \right)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(x*Ci(b*x), x)
```

```
[Out] 1/b^2*(1/2*b^2*x^2*Ci(b*x)-1/2*sin(b*x)*b*x-1/2*cos(b*x))
```

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x \operatorname{Ci}(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Ci(b\*x),x, algorithm="maxima")

[Out] integrate(x\*Ci(b\*x), x)

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(x \operatorname{Ci}(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Ci(b\*x),x, algorithm="fricas")

[Out] integral(x\*cos\_integral(b\*x), x)

---

**Sympy [A]** time = 1.74918, size = 53, normalized size = 1.51

$$-\frac{x^2 \log(bx)}{2} + \frac{x^2 \log(b^2 x^2)}{4} + \frac{x^2 \operatorname{Ci}(bx)}{2} - \frac{x \sin(bx)}{2b} - \frac{\cos(bx)}{2b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Ci(b\*x),x)

[Out] -x\*\*2\*log(b\*x)/2 + x\*\*2\*log(b\*\*2\*x\*\*2)/4 + x\*\*2\*Ci(b\*x)/2 - x\*sin(b\*x)/(2\*b) - cos(b\*x)/(2\*b\*\*2)

---

**Giac [A]** time = 1.16488, size = 39, normalized size = 1.11

$$\frac{1}{2} x^2 \operatorname{Ci}(bx) - \frac{x \sin(bx)}{2b} - \frac{\cos(bx)}{2b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x*Ci(b*x),x, algorithm="giac")
```

```
[Out] 1/2*x^2*cos_integral(b*x) - 1/2*x*sin(b*x)/b - 1/2*cos(b*x)/b^2
```

### 3.73 $\int \text{CosIntegral}(bx) dx$

Optimal. Leaf size=16

$$x\text{CosIntegral}(bx) - \frac{\sin(bx)}{b}$$

[Out] x\*CosIntegral[b\*x] - Sin[b\*x]/b

**Rubi [A]** time = 0.0044011, antiderivative size = 16, normalized size of antiderivative = 1., number of steps used = 1, number of rules used = 1, integrand size = 4,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.25$ , Rules used = {6500}

$$x\text{CosIntegral}(bx) - \frac{\sin(bx)}{b}$$

Antiderivative was successfully verified.

[In] Int[CosIntegral[b\*x],x]

[Out] x\*CosIntegral[b\*x] - Sin[b\*x]/b

#### Rule 6500

Int[CosIntegral[(a\_.) + (b\_.)\*(x\_)], x\_Symbol] := Simp[((a + b\*x)\*CosIntegral[a + b\*x])/b, x] - Simp[Sin[a + b\*x]/b, x] /; FreeQ[{a, b}, x]

#### Rubi steps

$$\int \text{Ci}(bx) dx = x\text{Ci}(bx) - \frac{\sin(bx)}{b}$$

**Mathematica [A]** time = 0.0014589, size = 16, normalized size = 1.

$$x\text{CosIntegral}(bx) - \frac{\sin(bx)}{b}$$

Antiderivative was successfully verified.

[In] Integrate[CosIntegral[b\*x],x]

[Out]  $x \cdot \text{CosIntegral}[b \cdot x] - \text{Sin}[b \cdot x] / b$

---

**Maple [A]** time = 0.045, size = 19, normalized size = 1.2

$$\frac{bx \text{Ci}(bx) - \sin(bx)}{b}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(Ci(b*x), x)`

[Out] `1/b*(b*x*Ci(b*x)-sin(b*x))`

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \text{Ci}(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Ci(b*x), x, algorithm="maxima")`

[Out] `integrate(Ci(b*x), x)`

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(\text{Ci}(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Ci(b*x), x, algorithm="fricas")`

[Out] `integral(cos_integral(b*x), x)`

---

**Sympy [B]** time = 1.68395, size = 31, normalized size = 1.94

$$-x \log(bx) + \frac{x \log(b^2 x^2)}{2} + x \operatorname{Ci}(bx) - \frac{\sin(bx)}{b}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x),x)

[Out] -x\*log(b\*x) + x\*log(b\*\*2\*x\*\*2)/2 + x\*Ci(b\*x) - sin(b\*x)/b

**Giac [A]** time = 1.19137, size = 22, normalized size = 1.38

$$x \operatorname{Ci}(bx) - \frac{\sin(bx)}{b}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x),x, algorithm="giac")

[Out] x\*cos\_integral(b\*x) - sin(b\*x)/b

$$3.74 \quad \int \frac{\text{CosIntegral}(bx)}{x} dx$$

**Optimal.** Leaf size=61

$$-\frac{1}{2}ibx\text{HypergeometricPFQ}(\{1,1,1\},\{2,2,2\},-ibx) + \frac{1}{2}ibx\text{HypergeometricPFQ}(\{1,1,1\},\{2,2,2\},ibx) + \frac{1}{2}\log^2(bx)$$

[Out]  $(-I/2)*b*x*\text{HypergeometricPFQ}[\{1, 1, 1\}, \{2, 2, 2\}, (-I)*b*x] + (I/2)*b*x*\text{HypergeometricPFQ}[\{1, 1, 1\}, \{2, 2, 2\}, I*b*x] + \text{EulerGamma}*\text{Log}[x] + \text{Log}[b*x]^2/2$

**Rubi [A]** time = 0.02331, antiderivative size = 61, normalized size of antiderivative = 1., number of steps used = 1, number of rules used = 1, integrand size = 8,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.125$ , Rules used = {6502}

$$-\frac{1}{2}ibx {}_3F_3(1,1,1;2,2,2;-ibx) + \frac{1}{2}ibx {}_3F_3(1,1,1;2,2,2;ibx) + \frac{1}{2}\log^2(bx) + \gamma \log(x)$$

Antiderivative was successfully verified.

[In] Int[CosIntegral[b\*x]/x,x]

[Out]  $(-I/2)*b*x*\text{HypergeometricPFQ}[\{1, 1, 1\}, \{2, 2, 2\}, (-I)*b*x] + (I/2)*b*x*\text{HypergeometricPFQ}[\{1, 1, 1\}, \{2, 2, 2\}, I*b*x] + \text{EulerGamma}*\text{Log}[x] + \text{Log}[b*x]^2/2$

**Rule 6502**

Int[CosIntegral[(b\_.)\*(x\_)]/(x\_), x\_Symbol] := -Simp[(I\*b\*x\*HypergeometricPFQ[{1, 1, 1}, {2, 2, 2}, -(I\*b\*x)])/2, x] + (Simp[(1\*I\*b\*x\*HypergeometricPFQ[{1, 1, 1}, {2, 2, 2}, I\*b\*x])/2, x] + Simp[EulerGamma\*Log[x], x] + Simp[(1\*Log[b\*x]^2)/2, x]) /; FreeQ[b, x]

**Rubi steps**

$$\int \frac{\text{Ci}(bx)}{x} dx = -\frac{1}{2}ibx {}_3F_3(1,1,1;2,2,2;-ibx) + \frac{1}{2}ibx {}_3F_3(1,1,1;2,2,2;ibx) + \gamma \log(x) + \frac{1}{2}\log^2(bx)$$

**Mathematica [A]** time = 0.039013, size = 94, normalized size = 1.54

$$\frac{1}{2}(-ibx\text{HypergeometricPFQ}(\{1,1,1\},\{2,2,2\},-ibx) + ibx\text{HypergeometricPFQ}(\{1,1,1\},\{2,2,2\},ibx) + \log(x)(\text{Gamma}[\gamma]))$$

Antiderivative was successfully verified.

[In] Integrate[CosIntegral[b\*x]/x,x]

[Out]  $((-I)*b*x*HypergeometricPFQ[\{1, 1, 1\}, \{2, 2, 2\}, (-I)*b*x] + I*b*x*HypergeometricPFQ[\{1, 1, 1\}, \{2, 2, 2\}, I*b*x] + \text{Log}[x]*(2*EulerGamma + 2*\text{CosIntegral}[b*x] + \text{Gamma}[0, (-I)*b*x] + \text{Gamma}[0, I*b*x] - \text{Log}[x] + \text{Log}[(-I)*b*x] + \text{Log}[I*b*x]))/2$

**Maple [B]** time = 0.091, size = 158, normalized size = 2.6

$$\frac{\sqrt{\pi}}{4} \left( \frac{1}{2\sqrt{\pi}} \left( -\frac{\pi^2}{3} + 4 \ln(x)\gamma - 4 \ln(2)\gamma + 4 \ln(b)\gamma + (-\gamma - 2 \ln(2))^2 + 4 (\ln(2))^2 + 4 (\ln(b))^2 + 4 (\ln(x))^2 - 2\gamma \right) \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(b\*x)/x,x)

[Out]  $1/4*\text{Pi}^{(1/2)}*(1/2*(-1/3*\text{Pi}^2+4*\ln(x)*\text{gamma}-4*\ln(2)*\text{gamma}+4*\ln(b)*\text{gamma}+(-\text{gamma}-2*\ln(2))^2+4*\ln(2)^2+4*\ln(b)^2+4*(\ln(x))^2-2*\ln(2))*\text{gamma}+(-\text{gamma}-2*\ln(2))-4*\ln(b)*(-\text{gamma}-2*\ln(2))+4*\ln(2)*(-\text{gamma}-2*\ln(2))-4*\ln(x)*(-\text{gamma}-2*\ln(2))+\text{gamma}^2-8*\ln(x)*\ln(2)+8*\ln(x)*\ln(b)-8*\ln(2)*\ln(b))/\text{Pi}^{(1/2)}-1/2/\text{Pi}^{(1/2)}*b^2*x^2*\text{hypergeom}([1,1,1],[3/2,2,2,2],-1/4*b^2*x^2)$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)/x,x, algorithm="maxima")

[Out] integrate(Ci(b\*x)/x, x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Ci}(bx)}{x}, x\right)$$



Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x)/x,x, algorithm="fricas")
```

```
[Out] integral(cos_integral(b*x)/x, x)
```

---

**Sympy [F(-2)]** time = 0., size = 0, normalized size = 0.

Exception raised: AttributeError

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x)/x,x)
```

```
[Out] Exception raised: AttributeError
```

---

**Giac [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x)/x,x, algorithm="giac")
```

```
[Out] integrate(Ci(b*x)/x, x)
```

$$3.75 \quad \int \frac{\text{CosIntegral}(bx)}{x^2} dx$$

**Optimal.** Leaf size=26

$$-\frac{\text{CosIntegral}(bx)}{x} - b\text{Si}(bx) - \frac{\cos(bx)}{x}$$

[Out] -(Cos[b\*x]/x) - CosIntegral[b\*x]/x - b\*SinIntegral[b\*x]

**Rubi [A]** time = 0.0478876, antiderivative size = 26, normalized size of antiderivative = 1., number of steps used = 4, number of rules used = 4, integrand size = 8,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.5$ , Rules used = {6504, 12, 3297, 3299}

$$-\frac{\text{CosIntegral}(bx)}{x} - b\text{Si}(bx) - \frac{\cos(bx)}{x}$$

Antiderivative was successfully verified.

[In] Int[CosIntegral[b\*x]/x^2,x]

[Out] -(Cos[b\*x]/x) - CosIntegral[b\*x]/x - b\*SinIntegral[b\*x]

#### Rule 6504

```
Int[CosIntegral[(a_.) + (b_.)*(x_)]*((c_.) + (d_.)*(x_)^(m_.), x_Symbol] :
> Simp[((c + d*x)^(m + 1)*CosIntegral[a + b*x])/(d*(m + 1)), x] - Dist[b/(d
*(m + 1)), Int[((c + d*x)^(m + 1)*Cos[a + b*x])/(a + b*x), x], x] /; FreeQ[
{a, b, c, d, m}, x] && NeQ[m, -1]
```

#### Rule 12

```
Int[(a_)*(u_), x_Symbol] :> Dist[a, Int[u, x], x] /; FreeQ[a, x] && !Match
Q[u, (b_)*(v_)] /; FreeQ[b, x]
```

#### Rule 3297

```
Int[((c_.) + (d_.)*(x_)^(m_))*sin[(e_.) + (f_.)*(x_)], x_Symbol] :> Simp[((
c + d*x)^(m + 1)*Sin[e + f*x])/(d*(m + 1)), x] - Dist[f/(d*(m + 1)), Int[(c
+ d*x)^(m + 1)*Cos[e + f*x], x], x] /; FreeQ[{c, d, e, f}, x] && LtQ[m, -1
]
```

#### Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[SinInte
gral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

### Rubi steps

$$\begin{aligned} \int \frac{\text{Ci}(bx)}{x^2} dx &= -\frac{\text{Ci}(bx)}{x} + b \int \frac{\cos(bx)}{bx^2} dx \\ &= -\frac{\text{Ci}(bx)}{x} + \int \frac{\cos(bx)}{x^2} dx \\ &= -\frac{\cos(bx)}{x} - \frac{\text{Ci}(bx)}{x} - b \int \frac{\sin(bx)}{x} dx \\ &= -\frac{\cos(bx)}{x} - \frac{\text{Ci}(bx)}{x} - b\text{Si}(bx) \end{aligned}$$

**Mathematica [A]** time = 0.0108275, size = 26, normalized size = 1.

$$-\frac{\text{CosIntegral}(bx)}{x} - b\text{Si}(bx) - \frac{\cos(bx)}{x}$$

Antiderivative was successfully verified.

```
[In] Integrate[CosIntegral[b*x]/x^2,x]
```

```
[Out] -(Cos[b*x]/x) - CosIntegral[b*x]/x - b*SinIntegral[b*x]
```

**Maple [A]** time = 0.047, size = 34, normalized size = 1.3

$$b \left( -\frac{\text{Ci}(bx)}{bx} - \frac{\cos(bx)}{bx} - \text{Si}(bx) \right)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(Ci(b*x)/x^2,x)
```

```
[Out] b*(-Ci(b*x)/b/x-cos(b*x)/b/x-Si(b*x))
```

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)/x^2,x, algorithm="maxima")

[Out] integrate(Ci(b\*x)/x^2, x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Ci}(bx)}{x^2}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)/x^2,x, algorithm="fricas")

[Out] integral(cos\_integral(b\*x)/x^2, x)

**Sympy [B]** time = 1.38407, size = 42, normalized size = 1.62

$$\frac{b^2 x {}_3F_4\left(\frac{1}{2}, 1, 1 \mid \frac{b^2 x^2}{4}\right)}{4} - \frac{\log(b^2 x^2)}{2x} - \frac{1}{x} - \frac{\gamma}{x}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)/x\*\*2,x)

[Out] -b\*\*2\*x\*hyper((1/2, 1, 1), (3/2, 3/2, 2, 2), -b\*\*2\*x\*\*2/4)/4 - log(b\*\*2\*x\*\*2)/(2\*x) - 1/x - EulerGamma/x

**Giac [C]** time = 1.20492, size = 147, normalized size = 5.65

$$\frac{bx\Im(\operatorname{Ci}(bx))\tan\left(\frac{1}{2}bx\right)^2 - bx\Im(\operatorname{Ci}(-bx))\tan\left(\frac{1}{2}bx\right)^2 + 2bx\operatorname{Si}(bx)\tan\left(\frac{1}{2}bx\right)^2 + bx\Im(\operatorname{Ci}(bx)) - bx\Im(\operatorname{Ci}(-bx)) + 2}{2\left(x\tan\left(\frac{1}{2}bx\right)^2 + x\right)}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)/x^2,x, algorithm="giac")

[Out] -1/2\*(b\*x\*imag\_part(cos\_integral(b\*x))\*tan(1/2\*b\*x)^2 - b\*x\*imag\_part(cos\_integral(-b\*x))\*tan(1/2\*b\*x)^2 + 2\*b\*x\*sin\_integral(b\*x)\*tan(1/2\*b\*x)^2 + b\*x\*imag\_part(cos\_integral(b\*x)) - b\*x\*imag\_part(cos\_integral(-b\*x)) + 2\*b\*x\*sin\_integral(b\*x) - 2\*tan(1/2\*b\*x)^2 + 2)/(x\*tan(1/2\*b\*x)^2 + x) - cos\_integral(b\*x)/x

### 3.76 $\int \frac{\text{CosIntegral}(bx)}{x^3} dx$

**Optimal.** Leaf size=46

$$-\frac{1}{4}b^2\text{CosIntegral}(bx) - \frac{\text{CosIntegral}(bx)}{2x^2} - \frac{\cos(bx)}{4x^2} + \frac{b \sin(bx)}{4x}$$

[Out]  $-\text{Cos}[b*x]/(4*x^2) - (b^2*\text{CosIntegral}[b*x])/4 - \text{CosIntegral}[b*x]/(2*x^2) + (b*\text{Sin}[b*x])/(4*x)$

**Rubi [A]** time = 0.0675109, antiderivative size = 46, normalized size of antiderivative = 1., number of steps used = 5, number of rules used = 4, integrand size = 8,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.5$ , Rules used = {6504, 12, 3297, 3302}

$$-\frac{1}{4}b^2\text{CosIntegral}(bx) - \frac{\text{CosIntegral}(bx)}{2x^2} - \frac{\cos(bx)}{4x^2} + \frac{b \sin(bx)}{4x}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[\text{CosIntegral}[b*x]/x^3, x]$

[Out]  $-\text{Cos}[b*x]/(4*x^2) - (b^2*\text{CosIntegral}[b*x])/4 - \text{CosIntegral}[b*x]/(2*x^2) + (b*\text{Sin}[b*x])/(4*x)$

#### Rule 6504

```
Int[CosIntegral[(a_.) + (b_.)*(x_)]*((c_.) + (d_.)*(x_))^(m_.), x_Symbol] :
> Simp[((c + d*x)^(m + 1)*CosIntegral[a + b*x])/(d*(m + 1)), x] - Dist[b/(d
*(m + 1)), Int[((c + d*x)^(m + 1)*Cos[a + b*x])/(a + b*x), x], x] /; FreeQ[
{a, b, c, d, m}, x] && NeQ[m, -1]
```

#### Rule 12

```
Int[(a_)*(u_), x_Symbol] :> Dist[a, Int[u, x], x] /; FreeQ[a, x] && !Match
Q[u, (b_)*(v_)] /; FreeQ[b, x]
```

#### Rule 3297

```
Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)], x_Symbol] :> Simp[((
c + d*x)^(m + 1)*Sin[e + f*x])/(d*(m + 1)), x] - Dist[f/(d*(m + 1)), Int[(c
+ d*x)^(m + 1)*Cos[e + f*x], x], x] /; FreeQ[{c, d, e, f}, x] && LtQ[m, -1]
```

]

Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] :> Simp[CosIntegral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) - c*f, 0]
```

Rubi steps

$$\begin{aligned}
 \int \frac{\text{Ci}(bx)}{x^3} dx &= -\frac{\text{Ci}(bx)}{2x^2} + \frac{1}{2}b \int \frac{\cos(bx)}{bx^3} dx \\
 &= -\frac{\text{Ci}(bx)}{2x^2} + \frac{1}{2} \int \frac{\cos(bx)}{x^3} dx \\
 &= -\frac{\cos(bx)}{4x^2} - \frac{\text{Ci}(bx)}{2x^2} - \frac{1}{4}b \int \frac{\sin(bx)}{x^2} dx \\
 &= -\frac{\cos(bx)}{4x^2} - \frac{\text{Ci}(bx)}{2x^2} + \frac{b \sin(bx)}{4x} - \frac{1}{4}b^2 \int \frac{\cos(bx)}{x} dx \\
 &= -\frac{\cos(bx)}{4x^2} - \frac{1}{4}b^2 \text{Ci}(bx) - \frac{\text{Ci}(bx)}{2x^2} + \frac{b \sin(bx)}{4x}
 \end{aligned}$$

**Mathematica [A]** time = 0.0138352, size = 46, normalized size = 1.

$$-\frac{1}{4}b^2 \text{CosIntegral}(bx) - \frac{\text{CosIntegral}(bx)}{2x^2} - \frac{\cos(bx)}{4x^2} + \frac{b \sin(bx)}{4x}$$

Antiderivative was successfully verified.

[In] Integrate[CosIntegral[b\*x]/x^3,x]

[Out] -Cos[b\*x]/(4\*x^2) - (b^2\*CosIntegral[b\*x])/4 - CosIntegral[b\*x]/(2\*x^2) + (b\*Sin[b\*x])/(4\*x)

**Maple [A]** time = 0.053, size = 48, normalized size = 1.

$$b^2 \left( -\frac{\text{Ci}(bx)}{2b^2x^2} - \frac{\cos(bx)}{4b^2x^2} + \frac{\sin(bx)}{4bx} - \frac{\text{Ci}(bx)}{4} \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(Ci(b*x)/x^3,x)`

[Out] `b^2*(-1/2*Ci(b*x)/b^2/x^2-1/4*cos(b*x)/b^2/x^2+1/4*sin(b*x)/b/x-1/4*Ci(b*x))`

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Ci(b*x)/x^3,x, algorithm="maxima")`

[Out] `integrate(Ci(b*x)/x^3, x)`

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Ci}(bx)}{x^3}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Ci(b*x)/x^3,x, algorithm="fricas")`

[Out] `integral(cos_integral(b*x)/x^3, x)`

**Sympy [B]** time = 3.13406, size = 87, normalized size = 1.89

$$\frac{b^2 \log(bx)}{4} - \frac{b^2 \log(b^2 x^2)}{8} - \frac{b^2 \text{Ci}(bx)}{4} + \frac{b \sin(bx)}{4x} + \frac{\log(bx)}{2x^2} - \frac{\log(b^2 x^2)}{4x^2} - \frac{\cos(bx)}{4x^2} - \frac{\text{Ci}(bx)}{2x^2}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Ci(b*x)/x**3,x)`



```
[Out] b**2*log(b*x)/4 - b**2*log(b**2*x**2)/8 - b**2*Ci(b*x)/4 + b*sin(b*x)/(4*x)
+ log(b*x)/(2*x**2) - log(b**2*x**2)/(4*x**2) - cos(b*x)/(4*x**2) - Ci(b*x)
)/(2*x**2)
```

**Giac [A]** time = 1.16096, size = 72, normalized size = 1.57

$$\frac{b^2 x^2 \operatorname{Ci}(bx) + b^2 x^2 \operatorname{Ci}(-bx) - 2bx \sin(bx) + 2 \cos(bx)}{8x^2} - \frac{\operatorname{Ci}(bx)}{2x^2}$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x)/x^3,x, algorithm="giac")
```

```
[Out] -1/8*(b^2*x^2*cos_integral(b*x) + b^2*x^2*cos_integral(-b*x) - 2*b*x*sin(b*
x) + 2*cos(b*x))/x^2 - 1/2*cos_integral(b*x)/x^2
```

### 3.77 $\int x^m \text{CosIntegral}(bx)^2 dx$

Optimal. Leaf size=12

CannotIntegrate( $x^m \text{CosIntegral}(bx)^2, x$ )

[Out] CannotIntegrate[x<sup>m</sup>\*CosIntegral[b\*x]<sup>2</sup>, x]

**Rubi [A]** time = 0.0329213, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int x^m \text{CosIntegral}(bx)^2 dx$$

Verification is Not applicable to the result.

[In] Int[x<sup>m</sup>\*CosIntegral[b\*x]<sup>2</sup>, x]

[Out] Defer[Int][x<sup>m</sup>\*CosIntegral[b\*x]<sup>2</sup>, x]

Rubi steps

$$\int x^m \text{Ci}(bx)^2 dx = \int x^m \text{Ci}(bx)^2 dx$$

**Mathematica [A]** time = 2.70721, size = 0, normalized size = 0.

$$\int x^m \text{CosIntegral}(bx)^2 dx$$

Verification is Not applicable to the result.

[In] Integrate[x<sup>m</sup>\*CosIntegral[b\*x]<sup>2</sup>, x]

[Out] Integrate[x<sup>m</sup>\*CosIntegral[b\*x]<sup>2</sup>, x]

**Maple [A]** time = 0.056, size = 0, normalized size = 0.

$$\int x^m (\text{Ci}(bx))^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(x^m*Ci(b*x)^2,x)`

[Out] `int(x^m*Ci(b*x)^2,x)`

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int x^m \text{Ci}(bx)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^m*Ci(b*x)^2,x, algorithm="maxima")`

[Out] `integrate(x^m*Ci(b*x)^2, x)`

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^m \text{Ci}(bx)^2, x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^m*Ci(b*x)^2,x, algorithm="fricas")`

[Out] `integral(x^m*cos_integral(b*x)^2, x)`

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int x^m \text{Ci}^2(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x**m*Ci(b*x)**2,x)
```

```
[Out] Integral(x**m*Ci(b*x)**2, x)
```

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int x^m \text{Ci}(bx)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x^m*Ci(b*x)^2,x, algorithm="giac")
```

```
[Out] integrate(x^m*Ci(b*x)^2, x)
```

### 3.78 $\int x^3 \text{CosIntegral}(bx)^2 dx$

**Optimal.** Leaf size=163

$$\frac{3x^2 \text{CosIntegral}(bx) \cos(bx)}{2b^2} - \frac{3 \text{CosIntegral}(2bx)}{2b^4} + \frac{3x \text{CosIntegral}(bx) \sin(bx)}{b^3} + \frac{3 \text{CosIntegral}(bx) \cos(bx)}{b^4} + \frac{x}{4}$$

```
[Out] x^2/(4*b^2) + (3*Cos[b*x]^2)/(8*b^4) + (3*Cos[b*x]*CosIntegral[b*x])/b^4 -
(3*x^2*Cos[b*x]*CosIntegral[b*x])/(2*b^2) + (x^4*CosIntegral[b*x]^2)/4 - (3
*CosIntegral[2*b*x])/(2*b^4) - (3*Log[x])/(2*b^4) + (x*Cos[b*x]*Sin[b*x])/b
^3 + (3*x*CosIntegral[b*x]*Sin[b*x])/b^3 - (x^3*CosIntegral[b*x]*Sin[b*x])/
(2*b) - (13*Sin[b*x]^2)/(8*b^4) + (x^2*Sin[b*x]^2)/(4*b^2)
```

**Rubi [A]** time = 0.228525, antiderivative size = 163, normalized size of antiderivative = 1., number of steps used = 19, number of rules used = 11, integrand size = 10,  $\frac{\text{number of rules}}{\text{integrand size}} = 1.1$ , Rules used = {6508, 6514, 12, 3443, 3310, 30, 6520, 2564, 6518, 3312, 3302}

$$\frac{3x^2 \text{CosIntegral}(bx) \cos(bx)}{2b^2} - \frac{3 \text{CosIntegral}(2bx)}{2b^4} + \frac{3x \text{CosIntegral}(bx) \sin(bx)}{b^3} + \frac{3 \text{CosIntegral}(bx) \cos(bx)}{b^4} + \frac{x}{4}$$

Antiderivative was successfully verified.

```
[In] Int[x^3*CosIntegral[b*x]^2,x]
```

```
[Out] x^2/(4*b^2) + (3*Cos[b*x]^2)/(8*b^4) + (3*Cos[b*x]*CosIntegral[b*x])/b^4 -
(3*x^2*Cos[b*x]*CosIntegral[b*x])/(2*b^2) + (x^4*CosIntegral[b*x]^2)/4 - (3
*CosIntegral[2*b*x])/(2*b^4) - (3*Log[x])/(2*b^4) + (x*Cos[b*x]*Sin[b*x])/b
^3 + (3*x*CosIntegral[b*x]*Sin[b*x])/b^3 - (x^3*CosIntegral[b*x]*Sin[b*x])/
(2*b) - (13*Sin[b*x]^2)/(8*b^4) + (x^2*Sin[b*x]^2)/(4*b^2)
```

#### Rule 6508

```
Int[CosIntegral[(b_.)*(x_)]^2*(x_)^(m_.), x_Symbol] :> Simp[(x^(m + 1)*CosI
ntegral[b*x]^2)/(m + 1), x] - Dist[2/(m + 1), Int[x^m*Cos[b*x]*CosIntegral[
b*x], x], x] /; FreeQ[b, x] && IGtQ[m, 0]
```

#### Rule 6514

```
Int[Cos[(a_.) + (b_.)*(x_)]*CosIntegral[(c_.) + (d_.)*(x_)]*((e_.) + (f_.)*
(x_))^(m_.), x_Symbol] :> Simp[((e + f*x)^m*Sin[a + b*x]*CosIntegral[c + d*
x])/b, x] + (-Dist[d/b, Int[((e + f*x)^m*Sin[a + b*x]*Cos[c + d*x])/(c + d*
x), x], x] - Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*Sin[a + b*x]*CosIntegral[c
```

+ d\*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]

### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] := Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b\_)\*(v\_)] /; FreeQ[b, x]

### Rule 3443

Int[Cos[(a\_.) + (b\_.)\*(x\_)^(n\_.)]\*(x\_)^(m\_.)\*Sin[(a\_.) + (b\_.)\*(x\_)^(n\_.)]^(p\_.), x\_Symbol] := Simp[(x^(m - n + 1)\*Sin[a + b\*x^n]^(p + 1))/(b\*n\*(p + 1)), x] - Dist[(m - n + 1)/(b\*n\*(p + 1)), Int[x^(m - n)\*Sin[a + b\*x^n]^(p + 1), x], x] /; FreeQ[{a, b, p}, x] && LtQ[0, n, m + 1] && NeQ[p, -1]

### Rule 3310

Int[((c\_.) + (d\_.)\*(x\_))\*((b\_.)\*sin[(e\_.) + (f\_.)\*(x\_)])^(n\_), x\_Symbol] := Simp[(d\*(b\*Sine[e + f\*x])^n)/(f^2\*n^2), x] + (Dist[(b^2\*(n - 1))/n, Int[(c + d\*x)\*(b\*Sine[e + f\*x])^(n - 2), x], x] - Simp[(b\*(c + d\*x)\*Cos[e + f\*x]\*(b\*Sine[e + f\*x])^(n - 1))/(f\*n), x]) /; FreeQ[{b, c, d, e, f}, x] && GtQ[n, 1]

### Rule 30

Int[(x\_)^(m\_.), x\_Symbol] := Simp[x^(m + 1)/(m + 1), x] /; FreeQ[m, x] && NeQ[m, -1]

### Rule 6520

Int[CosIntegral[(c\_.) + (d\_.)\*(x\_)]\*((e\_.) + (f\_.)\*(x\_))^(m\_.)\*Sin[(a\_.) + (b\_.)\*(x\_)], x\_Symbol] := -Simp[((e + f\*x)^m \* Cos[a + b\*x] \* CosIntegral[c + d\*x])/b, x] + (Dist[d/b, Int[((e + f\*x)^m \* Cos[a + b\*x] \* Cos[c + d\*x])/(c + d\*x), x], x] + Dist[(f\*m)/b, Int[(e + f\*x)^(m - 1) \* Cos[a + b\*x] \* CosIntegral[c + d\*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]

### Rule 2564

Int[cos[(e\_.) + (f\_.)\*(x\_)]^(n\_.)\*((a\_.)\*sin[(e\_.) + (f\_.)\*(x\_)])^(m\_.), x\_Symbol] := Dist[1/(a\*f), Subst[Int[x^m\*(1 - x^2/a^2)^((n - 1)/2), x], x, a\*Sine[e + f\*x], x] /; FreeQ[{a, e, f, m}, x] && IntegerQ[(n - 1)/2] && !(IntegerQ[(m - 1)/2] && LtQ[0, m, n])

### Rule 6518

```
Int[CosIntegral[(c_.) + (d_.)*(x_)]*Sin[(a_.) + (b_.)*(x_)], x_Symbol] := -
Simp[(Cos[a + b*x]*CosIntegral[c + d*x])/b, x] + Dist[d/b, Int[(Cos[a + b*x]
]*Cos[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

### Rule 3312

```
Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)]^(n_), x_Symbol] := In
t[ExpandTrigReduce[(c + d*x)^m, Sin[e + f*x]^n, x], x] /; FreeQ[{c, d, e, f
, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))
```

### Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[CosInte
gral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) -
c*f, 0]
```

### Rubi steps

$$\begin{aligned}
\int x^3 \text{Ci}(bx)^2 dx &= \frac{1}{4} x^4 \text{Ci}(bx)^2 - \frac{1}{2} \int x^3 \cos(bx) \text{Ci}(bx) dx \\
&= \frac{1}{4} x^4 \text{Ci}(bx)^2 - \frac{x^3 \text{Ci}(bx) \sin(bx)}{2b} + \frac{1}{2} \int \frac{x^2 \cos(bx) \sin(bx)}{b} dx + \frac{3 \int x^2 \text{Ci}(bx) \sin(bx) dx}{2b} \\
&= -\frac{3x^2 \cos(bx) \text{Ci}(bx)}{2b^2} + \frac{1}{4} x^4 \text{Ci}(bx)^2 - \frac{x^3 \text{Ci}(bx) \sin(bx)}{2b} + \frac{3 \int x \cos(bx) \text{Ci}(bx) dx}{b^2} + \frac{\int x^2 \cos(bx) \sin(bx) dx}{2b} \\
&= -\frac{3x^2 \cos(bx) \text{Ci}(bx)}{2b^2} + \frac{1}{4} x^4 \text{Ci}(bx)^2 + \frac{3x \text{Ci}(bx) \sin(bx)}{b^3} - \frac{x^3 \text{Ci}(bx) \sin(bx)}{2b} + \frac{x^2 \sin^2(bx)}{4b^2} - \frac{3 \int \text{Ci}(bx) \sin(bx) dx}{b^3} \\
&= \frac{3 \cos^2(bx)}{8b^4} + \frac{3 \cos(bx) \text{Ci}(bx)}{b^4} - \frac{3x^2 \cos(bx) \text{Ci}(bx)}{2b^2} + \frac{1}{4} x^4 \text{Ci}(bx)^2 + \frac{x \cos(bx) \sin(bx)}{b^3} + \frac{3x \text{Ci}(bx) \sin(bx)}{b^3} \\
&= \frac{x^2}{4b^2} + \frac{3 \cos^2(bx)}{8b^4} + \frac{3 \cos(bx) \text{Ci}(bx)}{b^4} - \frac{3x^2 \cos(bx) \text{Ci}(bx)}{2b^2} + \frac{1}{4} x^4 \text{Ci}(bx)^2 + \frac{x \cos(bx) \sin(bx)}{b^3} + \frac{3x \text{Ci}(bx) \sin(bx)}{b^3} \\
&= \frac{x^2}{4b^2} + \frac{3 \cos^2(bx)}{8b^4} + \frac{3 \cos(bx) \text{Ci}(bx)}{b^4} - \frac{3x^2 \cos(bx) \text{Ci}(bx)}{2b^2} + \frac{1}{4} x^4 \text{Ci}(bx)^2 + \frac{x \cos(bx) \sin(bx)}{b^3} + \frac{3x \text{Ci}(bx) \sin(bx)}{b^3} \\
&= \frac{x^2}{4b^2} + \frac{3 \cos^2(bx)}{8b^4} + \frac{3 \cos(bx) \text{Ci}(bx)}{b^4} - \frac{3x^2 \cos(bx) \text{Ci}(bx)}{2b^2} + \frac{1}{4} x^4 \text{Ci}(bx)^2 - \frac{3 \log(x)}{2b^4} + \frac{x \cos(bx) \sin(bx)}{b^3} \\
&= \frac{x^2}{4b^2} + \frac{3 \cos^2(bx)}{8b^4} + \frac{3 \cos(bx) \text{Ci}(bx)}{b^4} - \frac{3x^2 \cos(bx) \text{Ci}(bx)}{2b^2} + \frac{1}{4} x^4 \text{Ci}(bx)^2 - \frac{3 \text{Ci}(2bx)}{2b^4} - \frac{3 \log(x)}{2b^4} + \frac{x \cos(bx) \sin(bx)}{b^3}
\end{aligned}$$

**Mathematica [A]** time = 0.115799, size = 108, normalized size = 0.66

$$\frac{2b^4x^4\text{CosIntegral}(bx)^2 - 4\text{CosIntegral}(bx)\left(bx(b^2x^2 - 6)\sin(bx) + 3(b^2x^2 - 2)\cos(bx)\right) + 3b^2x^2 - b^2x^2\cos(2bx) - 12}{8b^4}$$

Antiderivative was successfully verified.

[In] Integrate[x^3\*CosIntegral[b\*x]^2,x]

[Out] (3\*b^2\*x^2 + 8\*Cos[2\*b\*x] - b^2\*x^2\*Cos[2\*b\*x] + 2\*b^4\*x^4\*CosIntegral[b\*x]^2 - 12\*CosIntegral[2\*b\*x] - 12\*Log[x] - 4\*CosIntegral[b\*x]\*(3\*(-2 + b^2\*x^2)\*Cos[b\*x] + b\*x\*(-6 + b^2\*x^2)\*Sin[b\*x]) + 4\*b\*x\*Sin[2\*b\*x])/(8\*b^4)

**Maple [A]** time = 0.069, size = 148, normalized size = 0.9

$$\frac{x^4(\text{Ci}(bx))^2}{4} - \frac{x^3\text{Ci}(bx)\sin(bx)}{2b} - \frac{3x^2\text{Ci}(bx)\cos(bx)}{2b^2} + 3\frac{\text{Ci}(bx)\cos(bx)}{b^4} + 3\frac{x\text{Ci}(bx)\sin(bx)}{b^3} - \frac{x^2(\cos(bx))^2}{4b^2} + \frac{x\cos(bx)}{b^4}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x^3\*Ci(b\*x)^2,x)

[Out] 1/4\*x^4\*Ci(b\*x)^2-1/2\*x^3\*Ci(b\*x)\*sin(b\*x)/b-3/2\*x^2\*Ci(b\*x)\*cos(b\*x)/b^2+3\*Ci(b\*x)\*cos(b\*x)/b^4+3\*x\*Ci(b\*x)\*sin(b\*x)/b^3-1/4/b^2\*x^2\*cos(b\*x)^2+x\*cos(b\*x)\*sin(b\*x)/b^3+1/2\*x^2/b^2-1/2\*sin(b\*x)^2/b^4-3/2/b^4\*ln(b\*x)-3/2\*Ci(2\*b\*x)/b^4+3/2\*cos(b\*x)^2/b^4

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^3\text{Ci}(bx)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^3\*Ci(b\*x)^2,x, algorithm="maxima")

[Out] integrate(x^3\*Ci(b\*x)^2, x)



**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^3 \text{Ci}(bx)^2, x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^3\*Ci(b\*x)^2,x, algorithm="fricas")

[Out] integral(x^3\*cos\_integral(b\*x)^2, x)

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x^3 \text{Ci}^2(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*\*3\*Ci(b\*x)\*\*2,x)

[Out] Integral(x\*\*3\*Ci(b\*x)\*\*2, x)

**Giac [A]** time = 1.18327, size = 119, normalized size = 0.73

$$\frac{1}{4} x^4 \text{Ci}(bx)^2 - \frac{1}{2} \left( \frac{3(b^2 x^2 - 2) \cos(bx)}{b^4} + \frac{(b^3 x^3 - 6bx) \sin(bx)}{b^4} \right) \text{Ci}(bx) + \frac{3(b^2 x^2 - 2) \text{Ci}(2bx) - 2 \text{Ci}(-2bx) - 4 \log(x)}{8b^4}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^3\*Ci(b\*x)^2,x, algorithm="giac")

[Out] 1/4\*x^4\*cos\_integral(b\*x)^2 - 1/2\*(3\*(b^2\*x^2 - 2)\*cos(b\*x)/b^4 + (b^3\*x^3 - 6\*b\*x)\*sin(b\*x)/b^4)\*cos\_integral(b\*x) + 3/8\*(b^2\*x^2 - 2\*cos\_integral(2\*b\*x) - 2\*cos\_integral(-2\*b\*x) - 4\*log(x))/b^4

### 3.79 $\int x^2 \text{CosIntegral}(bx)^2 dx$

**Optimal.** Leaf size=112

$$\frac{4\text{CosIntegral}(bx) \sin(bx)}{3b^3} - \frac{4x\text{CosIntegral}(bx) \cos(bx)}{3b^2} - \frac{2\text{Si}(2bx)}{3b^3} + \frac{x}{2b^2} + \frac{x \sin^2(bx)}{3b^2} + \frac{5 \sin(bx) \cos(bx)}{6b^3} + \frac{1}{3}x^3 \text{Cos}$$

[Out]  $x/(2*b^2) - (4*x*\text{Cos}[b*x]*\text{CosIntegral}[b*x])/(3*b^2) + (x^3*\text{CosIntegral}[b*x]^2)/3 + (5*\text{Cos}[b*x]*\text{Sin}[b*x])/(6*b^3) + (4*\text{CosIntegral}[b*x]*\text{Sin}[b*x])/(3*b^3) - (2*x^2*\text{CosIntegral}[b*x]*\text{Sin}[b*x])/(3*b) + (x*\text{Sin}[b*x]^2)/(3*b^2) - (2*\text{SinIntegral}[2*b*x])/(3*b^3)$

**Rubi [A]** time = 0.138129, antiderivative size = 112, normalized size of antiderivative = 1., number of steps used = 15, number of rules used = 10, integrand size = 10,  $\frac{\text{number of rules}}{\text{integrand size}} = 1.$ , Rules used = {6508, 6514, 12, 3443, 2635, 8, 6520, 6512, 4406, 3299}

$$\frac{4\text{CosIntegral}(bx) \sin(bx)}{3b^3} - \frac{4x\text{CosIntegral}(bx) \cos(bx)}{3b^2} - \frac{2\text{Si}(2bx)}{3b^3} + \frac{x}{2b^2} + \frac{x \sin^2(bx)}{3b^2} + \frac{5 \sin(bx) \cos(bx)}{6b^3} + \frac{1}{3}x^3 \text{Cos}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[x^2*\text{CosIntegral}[b*x]^2, x]$

[Out]  $x/(2*b^2) - (4*x*\text{Cos}[b*x]*\text{CosIntegral}[b*x])/(3*b^2) + (x^3*\text{CosIntegral}[b*x]^2)/3 + (5*\text{Cos}[b*x]*\text{Sin}[b*x])/(6*b^3) + (4*\text{CosIntegral}[b*x]*\text{Sin}[b*x])/(3*b^3) - (2*x^2*\text{CosIntegral}[b*x]*\text{Sin}[b*x])/(3*b) + (x*\text{Sin}[b*x]^2)/(3*b^2) - (2*\text{SinIntegral}[2*b*x])/(3*b^3)$

#### Rule 6508

$\text{Int}[\text{CosIntegral}[(b_.)*(x_)]^2*(x_)^(m_.), x\_Symbol] \rightarrow \text{Simp}[(x^(m+1)*\text{CosIntegral}[b*x]^2)/(m+1), x] - \text{Dist}[2/(m+1), \text{Int}[x^m*\text{Cos}[b*x]*\text{CosIntegral}[b*x], x], x] /; \text{FreeQ}[b, x] \ \&\& \ \text{IGtQ}[m, 0]$

#### Rule 6514

$\text{Int}[\text{Cos}[(a_.) + (b_.)*(x_)]*\text{CosIntegral}[(c_.) + (d_.)*(x_)]*((e_.) + (f_.)*(x_))^(m_.), x\_Symbol] \rightarrow \text{Simp}[((e + f*x)^m*\text{Sin}[a + b*x]*\text{CosIntegral}[c + d*x])/b, x] + (-\text{Dist}[d/b, \text{Int}[(e + f*x)^m*\text{Sin}[a + b*x]*\text{Cos}[c + d*x]/(c + d*x), x], x] - \text{Dist}[(f*m)/b, \text{Int}[(e + f*x)^(m-1)*\text{Sin}[a + b*x]*\text{CosIntegral}[c + d*x], x], x]) /; \text{FreeQ}\{a, b, c, d, e, f\}, x \ \&\& \ \text{IGtQ}[m, 0]$

Rule 12

$\text{Int}[(a_*)(u_), x\_Symbol] \rightarrow \text{Dist}[a, \text{Int}[u, x], x] /; \text{FreeQ}[a, x] \ \&\& \ !\text{MatchQ}[u, (b_*)(v_)] /; \text{FreeQ}[b, x]$

Rule 3443

$\text{Int}[\text{Cos}[(a_.) + (b_.)*(x_)^(n_.)]*(x_)^(m_.)*\text{Sin}[(a_.) + (b_.)*(x_)^(n_.)]^(p_.), x\_Symbol] \rightarrow \text{Simp}[(x^{(m-n+1)}*\text{Sin}[a + b*x^n]^{(p+1)})/(b*n*(p+1)), x] - \text{Dist}[(m-n+1)/(b*n*(p+1)), \text{Int}[x^{(m-n)}*\text{Sin}[a + b*x^n]^{(p+1)}, x], x] /; \text{FreeQ}\{a, b, p\}, x \ \&\& \ \text{LtQ}[0, n, m+1] \ \&\& \ \text{NeQ}[p, -1]$

Rule 2635

$\text{Int}[(b_*)*\text{sin}[(c_.) + (d_.)*(x_)]^(n_), x\_Symbol] \rightarrow -\text{Simp}[(b*\text{Cos}[c + d*x]*\text{Sin}[c + d*x]^{(n-1)})/(d*n), x] + \text{Dist}[(b^2*(n-1))/n, \text{Int}[(b*\text{Sin}[c + d*x]^{(n-2)})], x], x] /; \text{FreeQ}\{b, c, d\}, x \ \&\& \ \text{GtQ}[n, 1] \ \&\& \ \text{IntegerQ}[2*n]$

Rule 8

$\text{Int}[a_*, x\_Symbol] \rightarrow \text{Simp}[a*x, x] /; \text{FreeQ}[a, x]$

Rule 6520

$\text{Int}[\text{CosIntegral}[(c_.) + (d_.)*(x_)]*((e_.) + (f_.)*(x_))^(m_.)*\text{Sin}[(a_.) + (b_.)*(x_)], x\_Symbol] \rightarrow -\text{Simp}[(e + f*x)^m*\text{Cos}[a + b*x]*\text{CosIntegral}[c + d*x]/b, x] + (\text{Dist}[d/b, \text{Int}[(e + f*x)^m*\text{Cos}[a + b*x]*\text{Cos}[c + d*x]]/(c + d*x), x], x] + \text{Dist}[(f*m)/b, \text{Int}[(e + f*x)^{(m-1)}*\text{Cos}[a + b*x]*\text{CosIntegral}[c + d*x]], x], x] /; \text{FreeQ}\{a, b, c, d, e, f\}, x \ \&\& \ \text{IGtQ}[m, 0]$

Rule 6512

$\text{Int}[\text{Cos}[(a_.) + (b_.)*(x_)]*\text{CosIntegral}[(c_.) + (d_.)*(x_)], x\_Symbol] \rightarrow \text{Simp}[(\text{Sin}[a + b*x]*\text{CosIntegral}[c + d*x])/b, x] - \text{Dist}[d/b, \text{Int}[(\text{Sin}[a + b*x]*\text{Cos}[c + d*x])/(c + d*x)], x], x] /; \text{FreeQ}\{a, b, c, d\}, x]$

Rule 4406

$\text{Int}[\text{Cos}[(a_.) + (b_.)*(x_)]^(p_.)*((c_.) + (d_.)*(x_))^(m_.)*\text{Sin}[(a_.) + (b_.)*(x_)]^(n_.), x\_Symbol] \rightarrow \text{Int}[\text{ExpandTrigReduce}[(c + d*x)^m, \text{Sin}[a + b*x]^{n*}\text{Cos}[a + b*x]^p], x], x] /; \text{FreeQ}\{a, b, c, d, m\}, x \ \&\& \ \text{IGtQ}[n, 0] \ \&\& \ \text{IGtQ}[p, 0]$

Rule 3299

Int[sin[(e\_.) + (f\_.)\*(x\_.)]/((c\_.) + (d\_.)\*(x\_.)), x\_Symbol] :> Simp[SinIntegral[e + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*e - c\*f, 0]

### Rubi steps

$$\begin{aligned}
 \int x^2 \text{Ci}(bx)^2 dx &= \frac{1}{3} x^3 \text{Ci}(bx)^2 - \frac{2}{3} \int x^2 \cos(bx) \text{Ci}(bx) dx \\
 &= \frac{1}{3} x^3 \text{Ci}(bx)^2 - \frac{2x^2 \text{Ci}(bx) \sin(bx)}{3b} + \frac{2}{3} \int \frac{x \cos(bx) \sin(bx)}{b} dx + \frac{4 \int x \text{Ci}(bx) \sin(bx) dx}{3b} \\
 &= -\frac{4x \cos(bx) \text{Ci}(bx)}{3b^2} + \frac{1}{3} x^3 \text{Ci}(bx)^2 - \frac{2x^2 \text{Ci}(bx) \sin(bx)}{3b} + \frac{4 \int \cos(bx) \text{Ci}(bx) dx}{3b^2} + \frac{2 \int x \cos(bx) \sin(bx) dx}{3b} \\
 &= -\frac{4x \cos(bx) \text{Ci}(bx)}{3b^2} + \frac{1}{3} x^3 \text{Ci}(bx)^2 + \frac{4 \text{Ci}(bx) \sin(bx)}{3b^3} - \frac{2x^2 \text{Ci}(bx) \sin(bx)}{3b} + \frac{x \sin^2(bx)}{3b^2} - \frac{\int \sin^2(bx) dx}{3b^2} \\
 &= -\frac{4x \cos(bx) \text{Ci}(bx)}{3b^2} + \frac{1}{3} x^3 \text{Ci}(bx)^2 + \frac{5 \cos(bx) \sin(bx)}{6b^3} + \frac{4 \text{Ci}(bx) \sin(bx)}{3b^3} - \frac{2x^2 \text{Ci}(bx) \sin(bx)}{3b} + \frac{x \sin^2(bx)}{3b^2} \\
 &= \frac{x}{2b^2} - \frac{4x \cos(bx) \text{Ci}(bx)}{3b^2} + \frac{1}{3} x^3 \text{Ci}(bx)^2 + \frac{5 \cos(bx) \sin(bx)}{6b^3} + \frac{4 \text{Ci}(bx) \sin(bx)}{3b^3} - \frac{2x^2 \text{Ci}(bx) \sin(bx)}{3b} + \frac{x \sin^2(bx)}{3b^2} \\
 &= \frac{x}{2b^2} - \frac{4x \cos(bx) \text{Ci}(bx)}{3b^2} + \frac{1}{3} x^3 \text{Ci}(bx)^2 + \frac{5 \cos(bx) \sin(bx)}{6b^3} + \frac{4 \text{Ci}(bx) \sin(bx)}{3b^3} - \frac{2x^2 \text{Ci}(bx) \sin(bx)}{3b} + \frac{x \sin^2(bx)}{3b^2} \\
 &= \frac{x}{2b^2} - \frac{4x \cos(bx) \text{Ci}(bx)}{3b^2} + \frac{1}{3} x^3 \text{Ci}(bx)^2 + \frac{5 \cos(bx) \sin(bx)}{6b^3} + \frac{4 \text{Ci}(bx) \sin(bx)}{3b^3} - \frac{2x^2 \text{Ci}(bx) \sin(bx)}{3b} + \frac{x \sin^2(bx)}{3b^2}
 \end{aligned}$$

**Mathematica [A]** time = 0.0805696, size = 78, normalized size = 0.7

$$\frac{4b^3 x^3 \text{CosIntegral}(bx)^2 - 8 \text{CosIntegral}(bx) \left( (b^2 x^2 - 2) \sin(bx) + 2bx \cos(bx) \right) - 8 \text{Si}(2bx) + 8bx + 5 \sin(2bx) - 2bx \cos(2bx)}{12b^3}$$

Antiderivative was successfully verified.

[In] Integrate[x^2\*CosIntegral[b\*x]^2,x]

[Out] (8\*b\*x - 2\*b\*x\*Cos[2\*b\*x] + 4\*b^3\*x^3\*CosIntegral[b\*x]^2 - 8\*CosIntegral[b\*x]\*(2\*b\*x\*Cos[b\*x] + (-2 + b^2\*x^2)\*Sin[b\*x]) + 5\*Sin[2\*b\*x] - 8\*SinIntegral[2\*b\*x])/(12\*b^3)

**Maple [A]** time = 0.073, size = 84, normalized size = 0.8

$$\frac{1}{b^3} \left( \frac{b^3 x^3 (\text{Ci}(bx))^2}{3} - 2 \text{Ci}(bx) \left( \frac{1}{3} b^2 x^2 \sin(bx) - \frac{2}{3} \sin(bx) + \frac{2}{3} bx \cos(bx) \right) - \frac{bx (\cos(bx))^2}{3} + \frac{5 \sin(bx) \cos(bx)}{6} + \dots \right)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(x^2*Ci(b*x)^2,x)
```

```
[Out] 1/b^3*(1/3*b^3*x^3*Ci(b*x)^2-2*Ci(b*x)*(1/3*b^2*x^2*sin(b*x)-2/3*sin(b*x)+2/3*b*x*cos(b*x))-1/3*b*x*cos(b*x)^2+5/6*sin(b*x)*cos(b*x)+5/6*b*x-2/3*Si(2*b*x))
```

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \text{Ci}(bx)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x^2*Ci(b*x)^2,x, algorithm="maxima")
```

```
[Out] integrate(x^2*Ci(b*x)^2, x)
```

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^2 \text{Ci}(bx)^2, x)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x^2*Ci(b*x)^2,x, algorithm="fricas")
```

```
[Out] integral(x^2*cos_integral(b*x)^2, x)
```

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \text{Ci}^2(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x**2*Ci(b*x)**2,x)
```

[Out] Integral(x\*\*2\*Ci(b\*x)\*\*2, x)

---

**Giac [C]** time = 1.22111, size = 104, normalized size = 0.93

$$\frac{1}{3} x^3 \operatorname{Ci}(bx)^2 - \frac{2}{3} \left( \frac{2x \cos(bx)}{b^2} + \frac{(b^2 x^2 - 2) \sin(bx)}{b^3} \right) \operatorname{Ci}(bx) + \frac{2bx - \Im(\operatorname{Ci}(2bx)) + \Im(\operatorname{Ci}(-2bx)) - 2 \operatorname{Si}(2bx)}{3b^3}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^2\*Ci(b\*x)^2,x, algorithm="giac")

[Out] 1/3\*x^3\*cos\_integral(b\*x)^2 - 2/3\*(2\*x\*cos(b\*x)/b^2 + (b^2\*x^2 - 2)\*sin(b\*x)/b^3)\*cos\_integral(b\*x) + 1/3\*(2\*b\*x - imag\_part(cos\_integral(2\*b\*x)) + imag\_part(cos\_integral(-2\*b\*x)) - 2\*sin\_integral(2\*b\*x))/b^3

### 3.80 $\int x \text{CosIntegral}(bx)^2 dx$

**Optimal.** Leaf size=75

$$\frac{\text{CosIntegral}(2bx)}{2b^2} - \frac{\text{CosIntegral}(bx) \cos(bx)}{b^2} + \frac{\log(x)}{2b^2} + \frac{\sin^2(bx)}{2b^2} + \frac{1}{2}x^2 \text{CosIntegral}(bx)^2 - \frac{x \text{CosIntegral}(bx) \sin(bx)}{b}$$

```
[Out] -((Cos[b*x]*CosIntegral[b*x])/b^2) + (x^2*CosIntegral[b*x]^2)/2 + CosIntegral[2*b*x]/(2*b^2) + Log[x]/(2*b^2) - (x*CosIntegral[b*x]*Sin[b*x])/b + Sin[b*x]^2/(2*b^2)
```

**Rubi [A]** time = 0.0906658, antiderivative size = 75, normalized size of antiderivative = 1., number of steps used = 10, number of rules used = 8, integrand size = 8,  $\frac{\text{number of rules}}{\text{integrand size}} = 1.$ , Rules used = {6508, 6514, 12, 2564, 30, 6518, 3312, 3302}

$$\frac{\text{CosIntegral}(2bx)}{2b^2} - \frac{\text{CosIntegral}(bx) \cos(bx)}{b^2} + \frac{\log(x)}{2b^2} + \frac{\sin^2(bx)}{2b^2} + \frac{1}{2}x^2 \text{CosIntegral}(bx)^2 - \frac{x \text{CosIntegral}(bx) \sin(bx)}{b}$$

Antiderivative was successfully verified.

```
[In] Int[x*CosIntegral[b*x]^2,x]
```

```
[Out] -((Cos[b*x]*CosIntegral[b*x])/b^2) + (x^2*CosIntegral[b*x]^2)/2 + CosIntegral[2*b*x]/(2*b^2) + Log[x]/(2*b^2) - (x*CosIntegral[b*x]*Sin[b*x])/b + Sin[b*x]^2/(2*b^2)
```

#### Rule 6508

```
Int[CosIntegral[(b_.)*(x_)]^2*(x_)^(m_.), x_Symbol] :> Simp[(x^(m + 1)*CosIntegral[b*x]^2)/(m + 1), x] - Dist[2/(m + 1), Int[x^m*Cos[b*x]*CosIntegral[b*x], x], x] /; FreeQ[b, x] && IGtQ[m, 0]
```

#### Rule 6514

```
Int[Cos[(a_.) + (b_.)*(x_)]*CosIntegral[(c_.) + (d_.)*(x_)]*((e_.) + (f_.)*(x_))^(m_.), x_Symbol] :> Simp[((e + f*x)^m*Sin[a + b*x]*CosIntegral[c + d*x])/b, x] + (-Dist[d/b, Int[((e + f*x)^m*Sin[a + b*x]*Cos[c + d*x])/(c + d*x), x], x] - Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*Sin[a + b*x]*CosIntegral[c + d*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]
```

#### Rule 12

```
Int[(a_)*(u_), x_Symbol] := Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b_)*(v_)] /; FreeQ[b, x]
```

### Rule 2564

```
Int[cos[(e_.) + (f_.)*(x_)]^(n_.)*((a_.)*sin[(e_.) + (f_.)*(x_)]^(m_.), x_Symbol] := Dist[1/(a*f), Subst[Int[x^m*(1 - x^2/a^2)^((n - 1)/2), x], x, a*Sin[e + f*x]], x] /; FreeQ[{a, e, f, m}, x] && IntegerQ[(n - 1)/2] && !(IntegerQ[(m - 1)/2] && LtQ[0, m, n])
```

### Rule 30

```
Int[(x_)^(m_.), x_Symbol] := Simp[x^(m + 1)/(m + 1), x] /; FreeQ[m, x] && NeQ[m, -1]
```

### Rule 6518

```
Int[CosIntegral[(c_.) + (d_.)*(x_)]*Sin[(a_.) + (b_.)*(x_)], x_Symbol] := -Simp[(Cos[a + b*x]*CosIntegral[c + d*x])/b, x] + Dist[d/b, Int[(Cos[a + b*x]*Cos[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

### Rule 3312

```
Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)]^(n_), x_Symbol] := Int[ExpandTrigReduce[(c + d*x)^m, Sin[e + f*x]^n, x], x] /; FreeQ[{c, d, e, f, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))
```

### Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[CosIntegral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) - c*f, 0]
```

### Rubi steps



$$\begin{aligned}
\int x \operatorname{Ci}(bx)^2 dx &= \frac{1}{2} x^2 \operatorname{Ci}(bx)^2 - \int x \cos(bx) \operatorname{Ci}(bx) dx \\
&= \frac{1}{2} x^2 \operatorname{Ci}(bx)^2 - \frac{x \operatorname{Ci}(bx) \sin(bx)}{b} + \frac{\int \operatorname{Ci}(bx) \sin(bx) dx}{b} + \int \frac{\cos(bx) \sin(bx)}{b} dx \\
&= -\frac{\cos(bx) \operatorname{Ci}(bx)}{b^2} + \frac{1}{2} x^2 \operatorname{Ci}(bx)^2 - \frac{x \operatorname{Ci}(bx) \sin(bx)}{b} + \frac{\int \frac{\cos^2(bx)}{bx} dx}{b} + \frac{\int \cos(bx) \sin(bx) dx}{b} \\
&= -\frac{\cos(bx) \operatorname{Ci}(bx)}{b^2} + \frac{1}{2} x^2 \operatorname{Ci}(bx)^2 - \frac{x \operatorname{Ci}(bx) \sin(bx)}{b} + \frac{\int \frac{\cos^2(bx)}{x} dx}{b^2} + \frac{\operatorname{Subst}(\int x dx, x, \sin(bx))}{b^2} \\
&= -\frac{\cos(bx) \operatorname{Ci}(bx)}{b^2} + \frac{1}{2} x^2 \operatorname{Ci}(bx)^2 - \frac{x \operatorname{Ci}(bx) \sin(bx)}{b} + \frac{\sin^2(bx)}{2b^2} + \frac{\int \left( \frac{1}{2x} + \frac{\cos(2bx)}{2x} \right) dx}{b^2} \\
&= -\frac{\cos(bx) \operatorname{Ci}(bx)}{b^2} + \frac{1}{2} x^2 \operatorname{Ci}(bx)^2 + \frac{\log(x)}{2b^2} - \frac{x \operatorname{Ci}(bx) \sin(bx)}{b} + \frac{\sin^2(bx)}{2b^2} + \frac{\int \frac{\cos(2bx)}{x} dx}{2b^2} \\
&= -\frac{\cos(bx) \operatorname{Ci}(bx)}{b^2} + \frac{1}{2} x^2 \operatorname{Ci}(bx)^2 + \frac{\operatorname{Ci}(2bx)}{2b^2} + \frac{\log(x)}{2b^2} - \frac{x \operatorname{Ci}(bx) \sin(bx)}{b} + \frac{\sin^2(bx)}{2b^2}
\end{aligned}$$

**Mathematica [A]** time = 0.0489505, size = 58, normalized size = 0.77

$$\frac{2b^2 x^2 \operatorname{CosIntegral}(bx)^2 + 2 \operatorname{CosIntegral}(2bx) - 4 \operatorname{CosIntegral}(bx)(bx \sin(bx) + \cos(bx)) - \cos(2bx) + 2 \log(x)}{4b^2}$$

Antiderivative was successfully verified.

[In] Integrate[x\*CosIntegral[b\*x]^2, x]

[Out]  $(-\operatorname{Cos}[2*b*x] + 2*b^2*x^2*\operatorname{CosIntegral}[b*x]^2 + 2*\operatorname{CosIntegral}[2*b*x] + 2*\operatorname{Log}[x] - 4*\operatorname{CosIntegral}[b*x]*(\operatorname{Cos}[b*x] + b*x*\operatorname{Sin}[b*x]))/(4*b^2)$

**Maple [A]** time = 0.059, size = 70, normalized size = 0.9

$$\frac{x^2 (\operatorname{Ci}(bx))^2}{2} - \frac{x \operatorname{Ci}(bx) \sin(bx)}{b} - \frac{\operatorname{Ci}(bx) \cos(bx)}{b^2} - \frac{(\cos(bx))^2}{2b^2} + \frac{\ln(bx)}{2b^2} + \frac{\operatorname{Ci}(2bx)}{2b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x\*Ci(b\*x)^2, x)

[Out]  $\frac{1}{2}x^2\text{Ci}(bx)^2 - x\text{Ci}(bx)\sin(bx)/b - \text{Ci}(bx)\cos(bx)/b^2 - \frac{1}{2}b^{-2}\cos(bx)^2 + \frac{1}{2}b^{-2}\ln(bx) + \frac{1}{2}\text{Ci}(2bx)/b^2$

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x\text{Ci}(bx)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*Ci(b*x)^2,x, algorithm="maxima")`

[Out] `integrate(x*Ci(b*x)^2, x)`

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x\text{Ci}(bx)^2, x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*Ci(b*x)^2,x, algorithm="fricas")`

[Out] `integral(x*cos_integral(b*x)^2, x)`

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x\text{Ci}^2(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*Ci(b*x)**2,x)`

[Out] `Integral(x*Ci(b*x)**2, x)`

---

**Giac [A]** time = 1.29807, size = 76, normalized size = 1.01

$$\frac{1}{2}x^2 \operatorname{Ci}(bx)^2 - \left( \frac{x \sin(bx)}{b} + \frac{\cos(bx)}{b^2} \right) \operatorname{Ci}(bx) + \frac{\operatorname{Ci}(2bx) + \operatorname{Ci}(-2bx) + 2 \log(x)}{4b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*cos\_integral(b\*x)^2,x, algorithm="giac")

[Out] 1/2\*x^2\*cos\_integral(b\*x)^2 - (x\*sin(b\*x)/b + cos(b\*x)/b^2)\*cos\_integral(b\*x) + 1/4\*(cos\_integral(2\*b\*x) + cos\_integral(-2\*b\*x) + 2\*log(x))/b^2

### 3.81 $\int \text{CosIntegral}(bx)^2 dx$

**Optimal.** Leaf size=31

$$x\text{CosIntegral}(bx)^2 - \frac{2\text{CosIntegral}(bx)\sin(bx)}{b} + \frac{\text{Si}(2bx)}{b}$$

[Out] x\*CosIntegral[b\*x]^2 - (2\*CosIntegral[b\*x]\*Sin[b\*x])/b + SinIntegral[2\*b\*x]/b

**Rubi [A]** time = 0.0537311, antiderivative size = 31, normalized size of antiderivative = 1., number of steps used = 6, number of rules used = 5, integrand size = 6,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.833$ , Rules used = {6506, 6512, 12, 4406, 3299}

$$x\text{CosIntegral}(bx)^2 - \frac{2\text{CosIntegral}(bx)\sin(bx)}{b} + \frac{\text{Si}(2bx)}{b}$$

Antiderivative was successfully verified.

[In] Int[CosIntegral[b\*x]^2,x]

[Out] x\*CosIntegral[b\*x]^2 - (2\*CosIntegral[b\*x]\*Sin[b\*x])/b + SinIntegral[2\*b\*x]/b

#### Rule 6506

Int[CosIntegral[(a\_.) + (b\_.)\*(x\_)]^2, x\_Symbol] := Simp[((a + b\*x)\*CosIntegral[a + b\*x]^2)/b, x] - Dist[2, Int[Cos[a + b\*x]\*CosIntegral[a + b\*x], x], x] /; FreeQ[{a, b}, x]

#### Rule 6512

Int[Cos[(a\_.) + (b\_.)\*(x\_)]\*CosIntegral[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] := Simp[(Sin[a + b\*x]\*CosIntegral[c + d\*x])/b, x] - Dist[d/b, Int[(Sin[a + b\*x]\*Cos[c + d\*x])/(c + d\*x), x], x] /; FreeQ[{a, b, c, d}, x]

#### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] := Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b\_)\*(v\_)] /; FreeQ[b, x]

#### Rule 4406

```
Int[Cos[(a_.) + (b_.)*(x_)]^(p_.)*((c_.) + (d_.)*(x_))^(m_.)*Sin[(a_.) + (b_.)*(x_)]^(n_.), x_Symbol] :> Int[ExpandTrigReduce[(c + d*x)^m, Sin[a + b*x]^n*Cos[a + b*x]^p, x], x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IGtQ[p, 0]
```

### Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] :> Simp[SinIntegral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

### Rubi steps

$$\begin{aligned}
 \int \text{Ci}(bx)^2 dx &= x\text{Ci}(bx)^2 - 2 \int \cos(bx)\text{Ci}(bx) dx \\
 &= x\text{Ci}(bx)^2 - \frac{2\text{Ci}(bx)\sin(bx)}{b} + 2 \int \frac{\cos(bx)\sin(bx)}{bx} dx \\
 &= x\text{Ci}(bx)^2 - \frac{2\text{Ci}(bx)\sin(bx)}{b} + \frac{2 \int \frac{\cos(bx)\sin(bx)}{x} dx}{b} \\
 &= x\text{Ci}(bx)^2 - \frac{2\text{Ci}(bx)\sin(bx)}{b} + \frac{2 \int \frac{\sin(2bx)}{2x} dx}{b} \\
 &= x\text{Ci}(bx)^2 - \frac{2\text{Ci}(bx)\sin(bx)}{b} + \frac{\int \frac{\sin(2bx)}{x} dx}{b} \\
 &= x\text{Ci}(bx)^2 - \frac{2\text{Ci}(bx)\sin(bx)}{b} + \frac{\text{Si}(2bx)}{b}
 \end{aligned}$$

**Mathematica [A]** time = 0.0076127, size = 31, normalized size = 1.

$$x\text{CosIntegral}(bx)^2 - \frac{2\text{CosIntegral}(bx)\sin(bx)}{b} + \frac{\text{Si}(2bx)}{b}$$

Antiderivative was successfully verified.

```
[In] Integrate[CosIntegral[b*x]^2, x]
```

```
[Out] x*CosIntegral[b*x]^2 - (2*CosIntegral[b*x]*Sin[b*x])/b + SinIntegral[2*b*x]/b
```

---

**Maple [A]** time = 0.047, size = 30, normalized size = 1.

$$\frac{bx (Ci(bx))^2 - 2 Ci(bx) \sin(bx) + Si(2bx)}{b}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(b\*x)^2,x)

[Out] 1/b\*(b\*x\*Ci(b\*x)^2-2\*Ci(b\*x)\*sin(b\*x)+Si(2\*b\*x))

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int Ci(bx)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)^2,x, algorithm="maxima")

[Out] integrate(Ci(b\*x)^2, x)

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(Ci(bx)^2, x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)^2,x, algorithm="fricas")

[Out] integral(cos\_integral(b\*x)^2, x)

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int Ci^2(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x)**2,x)
```

```
[Out] Integral(Ci(b*x)**2, x)
```

**Giac [C]** time = 1.28276, size = 66, normalized size = 2.13

$$x \operatorname{Ci}(bx)^2 - \frac{2 \operatorname{Ci}(bx) \sin(bx)}{b} + \frac{\Im(\operatorname{Ci}(2bx)) - \Im(\operatorname{Ci}(-2bx)) + 2 \operatorname{Si}(2bx)}{2b}$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x)^2,x, algorithm="giac")
```

```
[Out] x*cos_integral(b*x)^2 - 2*cos_integral(b*x)*sin(b*x)/b + 1/2*(imag_part(cos
_integral(2*b*x)) - imag_part(cos_integral(-2*b*x)) + 2*sin_integral(2*b*x)
)/b
```

$$3.82 \quad \int \frac{\text{CosIntegral}(bx)^2}{x} dx$$

**Optimal.** Leaf size=12

$$\text{CannotIntegrate}\left(\frac{\text{CosIntegral}(bx)^2}{x}, x\right)$$

[Out] CannotIntegrate[CosIntegral[b\*x]^2/x, x]

**Rubi [A]** time = 0.0217906, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\text{CosIntegral}(bx)^2}{x} dx$$

Verification is Not applicable to the result.

[In] Int[CosIntegral[b\*x]^2/x,x]

[Out] Defer[Int][CosIntegral[b\*x]^2/x, x]

Rubi steps

$$\int \frac{\text{Ci}(bx)^2}{x} dx = \int \frac{\text{Ci}(bx)^2}{x} dx$$

**Mathematica [A]** time = 0.400944, size = 0, normalized size = 0.

$$\int \frac{\text{CosIntegral}(bx)^2}{x} dx$$

Verification is Not applicable to the result.

[In] Integrate[CosIntegral[b\*x]^2/x,x]

[Out] Integrate[CosIntegral[b\*x]^2/x, x]



---

**Maple [A]** time = 0.047, size = 0, normalized size = 0.

$$\int \frac{(\text{Ci}(bx))^2}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(b\*x)^2/x,x)

[Out] int(Ci(b\*x)^2/x,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx)^2}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)^2/x,x, algorithm="maxima")

[Out] integrate(Ci(b\*x)^2/x, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Ci}(bx)^2}{x}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)^2/x,x, algorithm="fricas")

[Out] integral(cos\_integral(b\*x)^2/x, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}^2(bx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x)**2/x,x)
```

```
[Out] Integral(Ci(b*x)**2/x, x)
```

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx)^2}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x)^2/x,x, algorithm="giac")
```

```
[Out] integrate(Ci(b*x)^2/x, x)
```

$$3.83 \quad \int \frac{\text{CosIntegral}(bx)^2}{x^2} dx$$

**Optimal.** Leaf size=12

$$\text{CannotIntegrate}\left(\frac{\text{CosIntegral}(bx)^2}{x^2}, x\right)$$

[Out] CannotIntegrate[CosIntegral[b\*x]^2/x^2, x]

**Rubi [A]** time = 0.0251882, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\text{CosIntegral}(bx)^2}{x^2} dx$$

Verification is Not applicable to the result.

[In] Int[CosIntegral[b\*x]^2/x^2, x]

[Out] Defer[Int][CosIntegral[b\*x]^2/x^2, x]

Rubi steps

$$\int \frac{\text{Ci}(bx)^2}{x^2} dx = \int \frac{\text{Ci}(bx)^2}{x^2} dx$$

**Mathematica [A]** time = 0.484829, size = 0, normalized size = 0.

$$\int \frac{\text{CosIntegral}(bx)^2}{x^2} dx$$

Verification is Not applicable to the result.

[In] Integrate[CosIntegral[b\*x]^2/x^2, x]

[Out] Integrate[CosIntegral[b\*x]^2/x^2, x]

---

**Maple [A]** time = 0.055, size = 0, normalized size = 0.

$$\int \frac{(\text{Ci}(bx))^2}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(b\*x)^2/x^2,x)

[Out] int(Ci(b\*x)^2/x^2,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx)^2}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)^2/x^2,x, algorithm="maxima")

[Out] integrate(Ci(b\*x)^2/x^2, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Ci}(bx)^2}{x^2}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)^2/x^2,x, algorithm="fricas")

[Out] integral(cos\_integral(b\*x)^2/x^2, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}^2(bx)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x)**2/x**2,x)
```

```
[Out] Integral(Ci(b*x)**2/x**2, x)
```

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx)^2}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x)^2/x^2,x, algorithm="giac")
```

```
[Out] integrate(Ci(b*x)^2/x^2, x)
```

$$3.84 \quad \int \frac{\text{CosIntegral}(bx)^2}{x^3} dx$$

**Optimal.** Leaf size=12

$$\text{CannotIntegrate}\left(\frac{\text{CosIntegral}(bx)^2}{x^3}, x\right)$$

[Out] CannotIntegrate[CosIntegral[b\*x]^2/x^3, x]

**Rubi [A]** time = 0.0256739, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\text{CosIntegral}(bx)^2}{x^3} dx$$

Verification is Not applicable to the result.

[In] Int[CosIntegral[b\*x]^2/x^3, x]

[Out] Defer[Int][CosIntegral[b\*x]^2/x^3, x]

Rubi steps

$$\int \frac{\text{Ci}(bx)^2}{x^3} dx = \int \frac{\text{Ci}(bx)^2}{x^3} dx$$

**Mathematica [A]** time = 0.499957, size = 0, normalized size = 0.

$$\int \frac{\text{CosIntegral}(bx)^2}{x^3} dx$$

Verification is Not applicable to the result.

[In] Integrate[CosIntegral[b\*x]^2/x^3, x]

[Out] Integrate[CosIntegral[b\*x]^2/x^3, x]

---

**Maple [A]** time = 0.052, size = 0, normalized size = 0.

$$\int \frac{(\text{Ci}(bx))^2}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(b\*x)^2/x^3,x)

[Out] int(Ci(b\*x)^2/x^3,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx)^2}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)^2/x^3,x, algorithm="maxima")

[Out] integrate(Ci(b\*x)^2/x^3, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Ci}(bx)^2}{x^3}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)^2/x^3,x, algorithm="fricas")

[Out] integral(cos\_integral(b\*x)^2/x^3, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}^2(bx)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x)**2/x**3,x)
```

```
[Out] Integral(Ci(b*x)**2/x**3, x)
```

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx)^2}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x)^2/x^3,x, algorithm="giac")
```

```
[Out] integrate(Ci(b*x)^2/x^3, x)
```



### 3.85 $\int x^m \text{CosIntegral}(a + bx) dx$

Optimal. Leaf size=47

$$\frac{x^{m+1} \text{CosIntegral}(a + bx)}{m + 1} - \frac{b \text{CannotIntegrate}\left(\frac{x^{m+1} \cos(a+bx)}{a+bx}, x\right)}{m + 1}$$

[Out]  $-\left(\frac{b \text{CannotIntegrate}[(x^{1+m}) \cos[a + b*x]]}{(a + b*x)}, x\right) / (1 + m) + (x^{1+m}) \text{CosIntegral}[a + b*x] / (1 + m)$

**Rubi [A]** time = 0.315771, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int x^m \text{CosIntegral}(a + bx) dx$$

Verification is Not applicable to the result.

[In] Int[x<sup>m</sup>\*CosIntegral[a + b\*x], x]

[Out]  $(x^{1+m}) \text{CosIntegral}[a + b*x] / (1 + m) - (b \text{Defer[Int]}[(x^{1+m}) \cos[a + b*x]] / (a + b*x), x) / (1 + m)$

Rubi steps

$$\int x^m \text{Ci}(a + bx) dx = \frac{x^{1+m} \text{Ci}(a + bx)}{1 + m} - \frac{b \int \frac{x^{1+m} \cos(a+bx)}{a+bx} dx}{1 + m}$$

**Mathematica [A]** time = 3.60651, size = 0, normalized size = 0.

$$\int x^m \text{CosIntegral}(a + bx) dx$$

Verification is Not applicable to the result.

[In] Integrate[x<sup>m</sup>\*CosIntegral[a + b\*x], x]

[Out] Integrate[x<sup>m</sup>\*CosIntegral[a + b\*x], x]

---

**Maple [A]** time = 0.155, size = 0, normalized size = 0.

$$\int x^m \text{Ci}(bx + a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x<sup>m</sup>\*Ci(b\*x+a),x)

[Out] int(x<sup>m</sup>\*Ci(b\*x+a),x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int x^m \text{Ci}(bx + a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x<sup>m</sup>\*Ci(b\*x+a),x, algorithm="maxima")

[Out] integrate(x<sup>m</sup>\*Ci(b\*x + a), x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^m \text{Ci}(bx + a), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x<sup>m</sup>\*Ci(b\*x+a),x, algorithm="fricas")

[Out] integral(x<sup>m</sup>\*cos\_integral(b\*x + a), x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int x^m \text{Ci}(a + bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x**m*Ci(b*x+a),x)
```

```
[Out] Integral(x**m*Ci(a + b*x), x)
```

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int x^m \text{Ci}(bx + a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x^m*Ci(b*x+a),x, algorithm="giac")
```

```
[Out] integrate(x^m*Ci(b*x + a), x)
```

### 3.86 $\int x^3 \text{CosIntegral}(a + bx) dx$

**Optimal.** Leaf size=184

$$-\frac{a^4 \text{CosIntegral}(a + bx)}{4b^4} + \frac{a^3 \sin(a + bx)}{4b^4} - \frac{a^2 x \sin(a + bx)}{4b^3} - \frac{a^2 \cos(a + bx)}{4b^4} + \frac{ax^2 \sin(a + bx)}{4b^2} - \frac{3x^2 \cos(a + bx)}{4b^2} - \frac{ax^3 \sin(a + bx)}{4b}$$

```
[Out] (3*Cos[a + b*x])/(2*b^4) - (a^2*Cos[a + b*x])/(4*b^4) + (a*x*Cos[a + b*x])/(2*b^3) - (3*x^2*Cos[a + b*x])/(4*b^2) - (a^4*CosIntegral[a + b*x])/(4*b^4) + (x^4*CosIntegral[a + b*x])/4 - (a*Sin[a + b*x])/(2*b^4) + (a^3*Sin[a + b*x])/(4*b^4) + (3*x*Sin[a + b*x])/(2*b^3) - (a^2*x*Sin[a + b*x])/(4*b^3) + (a*x^2*Sin[a + b*x])/(4*b^2) - (x^3*Sin[a + b*x])/(4*b)
```

---

**Rubi [A]** time = 0.374411, antiderivative size = 184, normalized size of antiderivative = 1., number of steps used = 14, number of rules used = 6, integrand size = 10,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.6$ , Rules used = {6504, 6742, 2637, 3296, 2638, 3302}

$$-\frac{a^4 \text{CosIntegral}(a + bx)}{4b^4} + \frac{a^3 \sin(a + bx)}{4b^4} - \frac{a^2 x \sin(a + bx)}{4b^3} - \frac{a^2 \cos(a + bx)}{4b^4} + \frac{ax^2 \sin(a + bx)}{4b^2} - \frac{3x^2 \cos(a + bx)}{4b^2} - \frac{ax^3 \sin(a + bx)}{4b}$$

Antiderivative was successfully verified.

```
[In] Int[x^3*CosIntegral[a + b*x],x]
```

```
[Out] (3*Cos[a + b*x])/(2*b^4) - (a^2*Cos[a + b*x])/(4*b^4) + (a*x*Cos[a + b*x])/(2*b^3) - (3*x^2*Cos[a + b*x])/(4*b^2) - (a^4*CosIntegral[a + b*x])/(4*b^4) + (x^4*CosIntegral[a + b*x])/4 - (a*Sin[a + b*x])/(2*b^4) + (a^3*Sin[a + b*x])/(4*b^4) + (3*x*Sin[a + b*x])/(2*b^3) - (a^2*x*Sin[a + b*x])/(4*b^3) + (a*x^2*Sin[a + b*x])/(4*b^2) - (x^3*Sin[a + b*x])/(4*b)
```

#### Rule 6504

```
Int[CosIntegral[(a_.) + (b_.)*(x_)]*((c_.) + (d_.)*(x_))^(m_.), x_Symbol] :
> Simp[((c + d*x)^(m + 1)*CosIntegral[a + b*x])/(d*(m + 1)), x] - Dist[b/(d*(m + 1)), Int[((c + d*x)^(m + 1)*Cos[a + b*x])/(a + b*x), x], x] /; FreeQ[{a, b, c, d, m}, x] && NeQ[m, -1]
```

#### Rule 6742

```
Int[u_, x_Symbol] :=> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]]
```

Rule 2637

Int[sin[Pi/2 + (c\_.) + (d\_.)\*(x\_)], x\_Symbol] :> Simp[Sin[c + d\*x]/d, x] /;  
FreeQ[{c, d}, x]

Rule 3296

Int[((c\_.) + (d\_.)\*(x\_))^(m\_.)\*sin[(e\_.) + (f\_.)\*(x\_)], x\_Symbol] :> -Simp[  
((c + d\*x)^m\*Cos[e + f\*x])/f, x] + Dist[(d\*m)/f, Int[(c + d\*x)^(m - 1)\*Cos[  
e + f\*x], x], x] /; FreeQ[{c, d, e, f}, x] && GtQ[m, 0]

Rule 2638

Int[sin[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] :> -Simp[Cos[c + d\*x]/d, x] /; FreeQ  
[{c, d}, x]

Rule 3302

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] :> Simp[CosInte  
gral[e - Pi/2 + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*(e - Pi/2) -  
c\*f, 0]

Rubi steps

$$\begin{aligned}
 \int x^3 \text{Ci}(a + bx) dx &= \frac{1}{4} x^4 \text{Ci}(a + bx) - \frac{1}{4} b \int \frac{x^4 \cos(a + bx)}{a + bx} dx \\
 &= \frac{1}{4} x^4 \text{Ci}(a + bx) - \frac{1}{4} b \int \left( -\frac{a^3 \cos(a + bx)}{b^4} + \frac{a^2 x \cos(a + bx)}{b^3} - \frac{a x^2 \cos(a + bx)}{b^2} + \frac{x^3 \cos(a + bx)}{b} \right) dx \\
 &= \frac{1}{4} x^4 \text{Ci}(a + bx) - \frac{1}{4} \int x^3 \cos(a + bx) dx + \frac{a^3 \int \cos(a + bx) dx}{4b^3} - \frac{a^4 \int \frac{\cos(a + bx)}{a + bx} dx}{4b^3} - \frac{a^2 \int x \cos(a + bx) dx}{4b^2} \\
 &= -\frac{a^4 \text{Ci}(a + bx)}{4b^4} + \frac{1}{4} x^4 \text{Ci}(a + bx) + \frac{a^3 \sin(a + bx)}{4b^4} - \frac{a^2 x \sin(a + bx)}{4b^3} + \frac{a x^2 \sin(a + bx)}{4b^2} - \frac{x^3 \sin(a + bx)}{4b} \\
 &= -\frac{a^2 \cos(a + bx)}{4b^4} + \frac{a x \cos(a + bx)}{2b^3} - \frac{3x^2 \cos(a + bx)}{4b^2} - \frac{a^4 \text{Ci}(a + bx)}{4b^4} + \frac{1}{4} x^4 \text{Ci}(a + bx) + \frac{a^3 \sin(a + bx)}{4b^4} \\
 &= -\frac{a^2 \cos(a + bx)}{4b^4} + \frac{a x \cos(a + bx)}{2b^3} - \frac{3x^2 \cos(a + bx)}{4b^2} - \frac{a^4 \text{Ci}(a + bx)}{4b^4} + \frac{1}{4} x^4 \text{Ci}(a + bx) - \frac{a \sin(a + bx)}{2b^4} \\
 &= \frac{3 \cos(a + bx)}{2b^4} - \frac{a^2 \cos(a + bx)}{4b^4} + \frac{a x \cos(a + bx)}{2b^3} - \frac{3x^2 \cos(a + bx)}{4b^2} - \frac{a^4 \text{Ci}(a + bx)}{4b^4} + \frac{1}{4} x^4 \text{Ci}(a + bx)
 \end{aligned}$$



**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^3 \text{Ci}(bx + a), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^3\*Ci(b\*x+a),x, algorithm="fricas")

[Out] integral(x^3\*cos\_integral(b\*x + a), x)

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x^3 \text{Ci}(a + bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*\*3\*Ci(b\*x+a),x)

[Out] Integral(x\*\*3\*Ci(a + b\*x), x)

**Giac [A]** time = 1.20939, size = 108, normalized size = 0.59

$$\frac{1}{4} x^4 \text{Ci}(bx + a) - \frac{a^4 \cos(a)^2 \text{Ci}(bx + a) + a^4 \cos(a)^2 \text{Ci}(-bx - a) + a^4 \text{Ci}(bx + a) \sin(a)^2 + a^4 \text{Ci}(-bx - a) \sin(a)^2}{8b^4}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^3\*Ci(b\*x+a),x, algorithm="giac")

[Out] 1/4\*x^4\*cos\_integral(b\*x + a) - 1/8\*(a^4\*cos(a)^2\*cos\_integral(b\*x + a) + a^4\*cos(a)^2\*cos\_integral(-b\*x - a) + a^4\*cos\_integral(b\*x + a)\*sin(a)^2 + a^4\*cos\_integral(-b\*x - a)\*sin(a)^2)/b^4

### 3.87 $\int x^2 \text{CosIntegral}(a + bx) dx$

**Optimal.** Leaf size=118

$$\frac{a^3 \text{CosIntegral}(a + bx)}{3b^3} - \frac{a^2 \sin(a + bx)}{3b^3} + \frac{ax \sin(a + bx)}{3b^2} + \frac{2 \sin(a + bx)}{3b^3} + \frac{a \cos(a + bx)}{3b^3} - \frac{2x \cos(a + bx)}{3b^2} + \frac{1}{3} x^3 \text{CosIntegral}(a + bx)$$

[Out] (a\*cos[a + b\*x])/(3\*b^3) - (2\*x\*cos[a + b\*x])/(3\*b^2) + (a^3\*cosIntegral[a + b\*x])/(3\*b^3) + (x^3\*cosIntegral[a + b\*x])/3 + (2\*sin[a + b\*x])/(3\*b^3) - (a^2\*sin[a + b\*x])/(3\*b^3) + (a\*x\*sin[a + b\*x])/(3\*b^2) - (x^2\*sin[a + b\*x])/(3\*b)

**Rubi [A]** time = 0.272134, antiderivative size = 118, normalized size of antiderivative = 1., number of steps used = 10, number of rules used = 6, integrand size = 10,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.6$ , Rules used = {6504, 6742, 2637, 3296, 2638, 3302}

$$\frac{a^3 \text{CosIntegral}(a + bx)}{3b^3} - \frac{a^2 \sin(a + bx)}{3b^3} + \frac{ax \sin(a + bx)}{3b^2} + \frac{2 \sin(a + bx)}{3b^3} + \frac{a \cos(a + bx)}{3b^3} - \frac{2x \cos(a + bx)}{3b^2} + \frac{1}{3} x^3 \text{CosIntegral}(a + bx)$$

Antiderivative was successfully verified.

[In] Int[x^2\*CosIntegral[a + b\*x],x]

[Out] (a\*cos[a + b\*x])/(3\*b^3) - (2\*x\*cos[a + b\*x])/(3\*b^2) + (a^3\*cosIntegral[a + b\*x])/(3\*b^3) + (x^3\*cosIntegral[a + b\*x])/3 + (2\*sin[a + b\*x])/(3\*b^3) - (a^2\*sin[a + b\*x])/(3\*b^3) + (a\*x\*sin[a + b\*x])/(3\*b^2) - (x^2\*sin[a + b\*x])/(3\*b)

#### Rule 6504

Int[CosIntegral[(a\_.) + (b\_.)\*(x\_)]\*((c\_.) + (d\_.)\*(x\_))^(m\_.), x\_Symbol] :> Simp[((c + d\*x)^(m + 1)\*CosIntegral[a + b\*x])/(d\*(m + 1)), x] - Dist[b/(d\*(m + 1)), Int[((c + d\*x)^(m + 1)\*Cos[a + b\*x])/(a + b\*x), x], x] /; FreeQ[{a, b, c, d, m}, x] && NeQ[m, -1]

#### Rule 6742

Int[u\_, x\_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]]

#### Rule 2637



```
Int[sin[Pi/2 + (c_.) + (d_.)*(x_)], x_Symbol] := Simp[Sin[c + d*x]/d, x] /;
FreeQ[{c, d}, x]
```

### Rule 3296

```
Int[((c_.) + (d_.)*(x_))^(m_.)*sin[(e_.) + (f_.)*(x_)], x_Symbol] := -Simp[
((c + d*x)^m*Cos[e + f*x])/f, x] + Dist[(d*m)/f, Int[(c + d*x)^(m - 1)*Cos[
e + f*x], x], x] /; FreeQ[{c, d, e, f}, x] && GtQ[m, 0]
```

### Rule 2638

```
Int[sin[(c_.) + (d_.)*(x_)], x_Symbol] := -Simp[Cos[c + d*x]/d, x] /; FreeQ
[{c, d}, x]
```

### Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[CosInte
gral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) -
c*f, 0]
```

### Rubi steps

$$\begin{aligned}
\int x^2 \operatorname{Ci}(a + bx) dx &= \frac{1}{3} x^3 \operatorname{Ci}(a + bx) - \frac{1}{3} b \int \frac{x^3 \cos(a + bx)}{a + bx} dx \\
&= \frac{1}{3} x^3 \operatorname{Ci}(a + bx) - \frac{1}{3} b \int \left( \frac{a^2 \cos(a + bx)}{b^3} - \frac{ax \cos(a + bx)}{b^2} + \frac{x^2 \cos(a + bx)}{b} - \frac{a^3 \cos(a + bx)}{b^3(a + bx)} \right) dx \\
&= \frac{1}{3} x^3 \operatorname{Ci}(a + bx) - \frac{1}{3} \int x^2 \cos(a + bx) dx - \frac{a^2 \int \cos(a + bx) dx}{3b^2} + \frac{a^3 \int \frac{\cos(a + bx)}{a + bx} dx}{3b^2} + \frac{a \int x \cos(a + bx) dx}{3b} \\
&= \frac{a^3 \operatorname{Ci}(a + bx)}{3b^3} + \frac{1}{3} x^3 \operatorname{Ci}(a + bx) - \frac{a^2 \sin(a + bx)}{3b^3} + \frac{ax \sin(a + bx)}{3b^2} - \frac{x^2 \sin(a + bx)}{3b} - \frac{a \int \sin(a + bx) dx}{3b^2} \\
&= \frac{a \cos(a + bx)}{3b^3} - \frac{2x \cos(a + bx)}{3b^2} + \frac{a^3 \operatorname{Ci}(a + bx)}{3b^3} + \frac{1}{3} x^3 \operatorname{Ci}(a + bx) - \frac{a^2 \sin(a + bx)}{3b^3} + \frac{ax \sin(a + bx)}{3b^2} \\
&= \frac{a \cos(a + bx)}{3b^3} - \frac{2x \cos(a + bx)}{3b^2} + \frac{a^3 \operatorname{Ci}(a + bx)}{3b^3} + \frac{1}{3} x^3 \operatorname{Ci}(a + bx) + \frac{2 \sin(a + bx)}{3b^3} - \frac{a^2 \sin(a + bx)}{3b^3}
\end{aligned}$$

**Mathematica [A]** time = 0.149831, size = 64, normalized size = 0.54

$$\frac{(a^3 + b^3 x^3) \operatorname{CosIntegral}(a + bx) - (a^2 - abx + b^2 x^2 - 2) \sin(a + bx) + (a - 2bx) \cos(a + bx)}{3b^3}$$

Antiderivative was successfully verified.

[In] Integrate[x^2\*CosIntegral[a + b\*x],x]

[Out] ((a - 2\*b\*x)\*Cos[a + b\*x] + (a^3 + b^3\*x^3)\*CosIntegral[a + b\*x] - (-2 + a^2 - a\*b\*x + b^2\*x^2)\*Sin[a + b\*x])/(3\*b^3)

**Maple [A]** time = 0.049, size = 99, normalized size = 0.8

$$\frac{1}{b^3} \left( \frac{b^3 x^3 \text{Ci}(bx + a)}{3} - \frac{(bx + a)^2 \sin(bx + a)}{3} + \frac{2 \sin(bx + a)}{3} - \frac{(2bx + 2a) \cos(bx + a)}{3} + a(\sin(bx + a)(bx + a) + \cos(bx + a)) \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x^2\*Ci(b\*x+a),x)

[Out] 1/b^3\*(1/3\*b^3\*x^3\*Ci(b\*x+a)-1/3\*(b\*x+a)^2\*sin(b\*x+a)+2/3\*sin(b\*x+a)-2/3\*(b\*x+a)\*cos(b\*x+a)+a\*(sin(b\*x+a)\*(b\*x+a)+cos(b\*x+a))-a^2\*sin(b\*x+a)+1/3\*a^3\*Ci(b\*x+a))

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \text{Ci}(bx + a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^2\*Ci(b\*x+a),x, algorithm="maxima")

[Out] integrate(x^2\*Ci(b\*x + a), x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^2 \text{Ci}(bx + a), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^2\*Ci(b\*x+a),x, algorithm="fricas")

[Out] `integral(x^2*cos_integral(b*x + a), x)`

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \operatorname{Ci}(a + bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x**2*Ci(b*x+a),x)`

[Out] `Integral(x**2*Ci(a + b*x), x)`

**Giac [A]** time = 1.17672, size = 108, normalized size = 0.92

$$\frac{1}{3} x^3 \operatorname{Ci}(bx + a) + \frac{a^3 \cos(a)^2 \operatorname{Ci}(bx + a) + a^3 \cos(a)^2 \operatorname{Ci}(-bx - a) + a^3 \operatorname{Ci}(bx + a) \sin(a)^2 + a^3 \operatorname{Ci}(-bx - a) \sin(a)^2}{6 b^3}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Ci(b*x+a),x, algorithm="giac")`

[Out] `1/3*x^3*cos_integral(b*x + a) + 1/6*(a^3*cos(a)^2*cos_integral(b*x + a) + a^3*cos(a)^2*cos_integral(-b*x - a) + a^3*cos_integral(b*x + a)*sin(a)^2 + a^3*cos_integral(-b*x - a)*sin(a)^2)/b^3`

### 3.88 $\int x \text{CosIntegral}(a + bx) dx$

**Optimal.** Leaf size=71

$$-\frac{a^2 \text{CosIntegral}(a + bx)}{2b^2} + \frac{a \sin(a + bx)}{2b^2} - \frac{\cos(a + bx)}{2b^2} + \frac{1}{2} x^2 \text{CosIntegral}(a + bx) - \frac{x \sin(a + bx)}{2b}$$

[Out]  $-\text{Cos}[a + b*x]/(2*b^2) - (a^2*\text{CosIntegral}[a + b*x])/(2*b^2) + (x^2*\text{CosIntegral}[a + b*x])/2 + (a*\text{Sin}[a + b*x])/(2*b^2) - (x*\text{Sin}[a + b*x])/(2*b)$

**Rubi [A]** time = 0.20677, antiderivative size = 71, normalized size of antiderivative = 1., number of steps used = 7, number of rules used = 6, integrand size = 8,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.75$ , Rules used = {6504, 6742, 2637, 3296, 2638, 3302}

$$-\frac{a^2 \text{CosIntegral}(a + bx)}{2b^2} + \frac{a \sin(a + bx)}{2b^2} - \frac{\cos(a + bx)}{2b^2} + \frac{1}{2} x^2 \text{CosIntegral}(a + bx) - \frac{x \sin(a + bx)}{2b}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[x*\text{CosIntegral}[a + b*x], x]$

[Out]  $-\text{Cos}[a + b*x]/(2*b^2) - (a^2*\text{CosIntegral}[a + b*x])/(2*b^2) + (x^2*\text{CosIntegral}[a + b*x])/2 + (a*\text{Sin}[a + b*x])/(2*b^2) - (x*\text{Sin}[a + b*x])/(2*b)$

#### Rule 6504

$\text{Int}[\text{CosIntegral}[(a_.) + (b_.)*(x_.)]*((c_.) + (d_.)*(x_.))^{(m_.)}, x\_Symbol] :$   
 $> \text{Simp}[(c + d*x)^{(m + 1)}*\text{CosIntegral}[a + b*x]/(d*(m + 1)), x] - \text{Dist}[b/(d*(m + 1)), \text{Int}[(c + d*x)^{(m + 1)}*\text{Cos}[a + b*x]/(a + b*x), x], x] /;$   $\text{FreeQ}[\{a, b, c, d, m\}, x] \ \&\& \ \text{NeQ}[m, -1]$

#### Rule 6742

$\text{Int}[u_, x\_Symbol] := \text{With}[\{v = \text{ExpandIntegrand}[u, x]\}, \text{Int}[v, x] /; \text{SumQ}[v]]$

#### Rule 2637

$\text{Int}[\sin[\text{Pi}/2 + (c_.) + (d_.)*(x_.)], x\_Symbol] := \text{Simp}[\text{Sin}[c + d*x]/d, x] /;$   
 $\text{FreeQ}[\{c, d\}, x]$

#### Rule 3296

```
Int[((c_.) + (d_.)*(x_))^(m_.)*sin[(e_.) + (f_.)*(x_)], x_Symbol] := -Simp[
((c + d*x)^m*Cos[e + f*x])/f, x] + Dist[(d*m)/f, Int[(c + d*x)^(m - 1)*Cos[
e + f*x], x], x] /; FreeQ[{c, d, e, f}, x] && GtQ[m, 0]
```

### Rule 2638

```
Int[sin[(c_.) + (d_.)*(x_)], x_Symbol] := -Simp[Cos[c + d*x]/d, x] /; FreeQ
[{c, d}, x]
```

### Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[CosInte
gral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) -
c*f, 0]
```

### Rubi steps

$$\begin{aligned}
\int x \operatorname{Ci}(a + bx) dx &= \frac{1}{2} x^2 \operatorname{Ci}(a + bx) - \frac{1}{2} b \int \frac{x^2 \cos(a + bx)}{a + bx} dx \\
&= \frac{1}{2} x^2 \operatorname{Ci}(a + bx) - \frac{1}{2} b \int \left( -\frac{a \cos(a + bx)}{b^2} + \frac{x \cos(a + bx)}{b} + \frac{a^2 \cos(a + bx)}{b^2(a + bx)} \right) dx \\
&= \frac{1}{2} x^2 \operatorname{Ci}(a + bx) - \frac{1}{2} \int x \cos(a + bx) dx + \frac{a \int \cos(a + bx) dx}{2b} - \frac{a^2 \int \frac{\cos(a + bx)}{a + bx} dx}{2b} \\
&= -\frac{a^2 \operatorname{Ci}(a + bx)}{2b^2} + \frac{1}{2} x^2 \operatorname{Ci}(a + bx) + \frac{a \sin(a + bx)}{2b^2} - \frac{x \sin(a + bx)}{2b} + \frac{\int \sin(a + bx) dx}{2b} \\
&= -\frac{\cos(a + bx)}{2b^2} - \frac{a^2 \operatorname{Ci}(a + bx)}{2b^2} + \frac{1}{2} x^2 \operatorname{Ci}(a + bx) + \frac{a \sin(a + bx)}{2b^2} - \frac{x \sin(a + bx)}{2b}
\end{aligned}$$

**Mathematica [A]** time = 0.105331, size = 49, normalized size = 0.69

$$\frac{(b^2 x^2 - a^2) \operatorname{CosIntegral}(a + bx) + (a - bx) \sin(a + bx) - \cos(a + bx)}{2b^2}$$

Antiderivative was successfully verified.

```
[In] Integrate[x*CosIntegral[a + b*x], x]
```

```
[Out] (-Cos[a + b*x] + (-a^2 + b^2*x^2)*CosIntegral[a + b*x] + (a - b*x)*Sin[a +
b*x])/(2*b^2)
```

---

**Maple [A]** time = 0.049, size = 60, normalized size = 0.9

$$\frac{1}{b^2} \left( \text{Ci}(bx + a) \left( \frac{(bx + a)^2}{2} - a(bx + a) \right) - \frac{\sin(bx + a)(bx + a)}{2} - \frac{\cos(bx + a)}{2} + a \sin(bx + a) \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(x*Ci(b*x+a),x)`

[Out] `1/b^2*(Ci(b*x+a)*(1/2*(b*x+a)^2-a*(b*x+a))-1/2*sin(b*x+a)*(b*x+a)-1/2*cos(b*x+a)+a*sin(b*x+a))`

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x \text{Ci}(bx + a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*Ci(b*x+a),x, algorithm="maxima")`

[Out] `integrate(x*Ci(b*x + a), x)`

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x \text{Ci}(bx + a), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*Ci(b*x+a),x, algorithm="fricas")`

[Out] `integral(x*cos_integral(b*x + a), x)`

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x \text{Ci}(a + bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Ci(b\*x+a),x)

[Out] Integral(x\*Ci(a + b\*x), x)

**Giac [A]** time = 1.14683, size = 108, normalized size = 1.52

$$\frac{1}{2} x^2 \operatorname{Ci}(bx + a) - \frac{a^2 \cos(a)^2 \operatorname{Ci}(bx + a) + a^2 \cos(a)^2 \operatorname{Ci}(-bx - a) + a^2 \operatorname{Ci}(bx + a) \sin(a)^2 + a^2 \operatorname{Ci}(-bx - a) \sin(a)^2}{4b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Ci(b\*x+a),x, algorithm="giac")

[Out] 1/2\*x^2\*cos\_integral(b\*x + a) - 1/4\*(a^2\*cos(a)^2\*cos\_integral(b\*x + a) + a^2\*cos(a)^2\*cos\_integral(-b\*x - a) + a^2\*cos\_integral(b\*x + a)\*sin(a)^2 + a^2\*cos\_integral(-b\*x - a)\*sin(a)^2)/b^2

### 3.89 $\int \text{CosIntegral}(a + bx) dx$

**Optimal.** Leaf size=27

$$\frac{(a + bx)\text{CosIntegral}(a + bx)}{b} - \frac{\sin(a + bx)}{b}$$

[Out] ((a + b\*x)\*CosIntegral[a + b\*x])/b - Sin[a + b\*x]/b

**Rubi [A]** time = 0.0056449, antiderivative size = 27, normalized size of antiderivative = 1., number of steps used = 1, number of rules used = 1, integrand size = 6,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.167$ , Rules used = {6500}

$$\frac{(a + bx)\text{CosIntegral}(a + bx)}{b} - \frac{\sin(a + bx)}{b}$$

Antiderivative was successfully verified.

[In] Int[CosIntegral[a + b\*x],x]

[Out] ((a + b\*x)\*CosIntegral[a + b\*x])/b - Sin[a + b\*x]/b

#### Rule 6500

Int[CosIntegral[(a\_.) + (b\_.)\*(x\_)], x\_Symbol] := Simp[((a + b\*x)\*CosIntegral[a + b\*x])/b, x] - Simp[Sin[a + b\*x]/b, x] /; FreeQ[{a, b}, x]

#### Rubi steps

$$\int \text{Ci}(a + bx) dx = \frac{(a + bx)\text{Ci}(a + bx)}{b} - \frac{\sin(a + bx)}{b}$$

**Mathematica [A]** time = 0.0363525, size = 42, normalized size = 1.56

$$x\text{CosIntegral}(a + bx) + \frac{a\text{CosIntegral}(a + bx)}{b} - \frac{\sin(a) \cos(bx)}{b} - \frac{\cos(a) \sin(bx)}{b}$$

Antiderivative was successfully verified.

[In] Integrate[CosIntegral[a + b\*x],x]



[Out]  $(a \cdot \text{CosIntegral}[a + b \cdot x])/b + x \cdot \text{CosIntegral}[a + b \cdot x] - (\text{Cos}[b \cdot x] \cdot \text{Sin}[a])/b - (\text{Cos}[a] \cdot \text{Sin}[b \cdot x])/b$

---

**Maple [A]** time = 0.043, size = 26, normalized size = 1.

$$\frac{(bx + a) \text{Ci}(bx + a) - \sin(bx + a)}{b}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(Ci(b*x+a),x)`

[Out] `1/b*((b*x+a)*Ci(b*x+a)-sin(b*x+a))`

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \text{Ci}(bx + a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Ci(b*x+a),x, algorithm="maxima")`

[Out] `integrate(Ci(b*x + a), x)`

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(\text{Ci}(bx + a), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Ci(b*x+a),x, algorithm="fricas")`

[Out] `integral(cos_integral(b*x + a), x)`

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \text{Ci}(a + bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a), x)

[Out] Integral(Ci(a + b\*x), x)

**Giac [B]** time = 1.13353, size = 93, normalized size = 3.44

$$x \text{Ci}(bx + a) + \frac{a \cos(a)^2 \text{Ci}(bx + a) + a \cos(a)^2 \text{Ci}(-bx - a) + a \text{Ci}(bx + a) \sin(a)^2 + a \text{Ci}(-bx - a) \sin(a)^2}{2b}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a), x, algorithm="giac")

[Out] x\*cos\_integral(b\*x + a) + 1/2\*(a\*cos(a)^2\*cos\_integral(b\*x + a) + a\*cos(a)^2\*cos\_integral(-b\*x - a) + a\*cos\_integral(b\*x + a)\*sin(a)^2 + a\*cos\_integral(-b\*x - a)\*sin(a)^2)/b

$$3.90 \quad \int \frac{\text{CosIntegral}(a+bx)}{x} dx$$

Optimal. Leaf size=12

$$\text{CannotIntegrate}\left(\frac{\text{CosIntegral}(a+bx)}{x}, x\right)$$

[Out] CannotIntegrate[CosIntegral[a + b\*x]/x, x]

**Rubi [A]** time = 0.0207117, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\text{CosIntegral}(a+bx)}{x} dx$$

Verification is Not applicable to the result.

[In] Int[CosIntegral[a + b\*x]/x,x]

[Out] Defer[Int][CosIntegral[a + b\*x]/x, x]

Rubi steps

$$\int \frac{\text{Ci}(a+bx)}{x} dx = \int \frac{\text{Ci}(a+bx)}{x} dx$$

**Mathematica [A]** time = 0.612036, size = 0, normalized size = 0.

$$\int \frac{\text{CosIntegral}(a+bx)}{x} dx$$

Verification is Not applicable to the result.

[In] Integrate[CosIntegral[a + b\*x]/x,x]

[Out] Integrate[CosIntegral[a + b\*x]/x, x]

---

**Maple [A]** time = 0.056, size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(b\*x+a)/x,x)

[Out] int(Ci(b\*x+a)/x,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)/x,x, algorithm="maxima")

[Out] integrate(Ci(b\*x + a)/x, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Ci}(bx + a)}{x}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)/x,x, algorithm="fricas")

[Out] integral(cos\_integral(b\*x + a)/x, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(a + bx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x+a)/x,x)
```

```
[Out] Integral(Ci(a + b*x)/x, x)
```

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x+a)/x,x, algorithm="giac")
```

```
[Out] integrate(Ci(b*x + a)/x, x)
```

### 3.91 $\int \frac{\text{CosIntegral}(a+bx)}{x^2} dx$

**Optimal.** Leaf size=47

$$-\frac{b\text{CosIntegral}(a+bx)}{a} - \frac{\text{CosIntegral}(a+bx)}{x} + \frac{b\cos(a)\text{CosIntegral}(bx)}{a} - \frac{b\sin(a)\text{Si}(bx)}{a}$$

[Out] (b\*Cos[a]\*CosIntegral[b\*x])/a - (b\*CosIntegral[a + b\*x])/a - CosIntegral[a + b\*x]/x - (b\*Sin[a]\*SinIntegral[b\*x])/a

**Rubi [A]** time = 0.221595, antiderivative size = 47, normalized size of antiderivative = 1., number of steps used = 7, number of rules used = 5, integrand size = 10,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.5$ , Rules used = {6504, 6742, 3303, 3299, 3302}

$$-\frac{b\text{CosIntegral}(a+bx)}{a} - \frac{\text{CosIntegral}(a+bx)}{x} + \frac{b\cos(a)\text{CosIntegral}(bx)}{a} - \frac{b\sin(a)\text{Si}(bx)}{a}$$

Antiderivative was successfully verified.

[In] Int[CosIntegral[a + b\*x]/x^2,x]

[Out] (b\*Cos[a]\*CosIntegral[b\*x])/a - (b\*CosIntegral[a + b\*x])/a - CosIntegral[a + b\*x]/x - (b\*Sin[a]\*SinIntegral[b\*x])/a

#### Rule 6504

```
Int[CosIntegral[(a_.) + (b_.)*(x_)]*((c_.) + (d_.)*(x_))^(m_.), x_Symbol] :
> Simp[((c + d*x)^(m + 1)*CosIntegral[a + b*x])/(d*(m + 1)), x] - Dist[b/(d
*(m + 1)), Int[((c + d*x)^(m + 1)*Cos[a + b*x])/(a + b*x), x], x] /; FreeQ[
{a, b, c, d, m}, x] && NeQ[m, -1]
```

#### Rule 6742

```
Int[u_, x_Symbol] :=> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

#### Rule 3303

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] :=> Dist[Cos[(d*
e - c*f)/d], Int[Sin[(c*f)/d + f*x]/(c + d*x), x], x] + Dist[Sin[(d*e - c*f
)/d], Int[Cos[(c*f)/d + f*x]/(c + d*x), x], x] /; FreeQ[{c, d, e, f}, x] &&
```

NeQ[d\*e - c\*f, 0]

### Rule 3299

Int[sin[(e\_.) + (f\_.)\*(x\_.)]/((c\_.) + (d\_.)\*(x\_.)), x\_Symbol] :> Simp[SinIntegral[e + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*e - c\*f, 0]

### Rule 3302

Int[sin[(e\_.) + (f\_.)\*(x\_.)]/((c\_.) + (d\_.)\*(x\_.)), x\_Symbol] :> Simp[CosIntegral[e - Pi/2 + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*(e - Pi/2) - c\*f, 0]

### Rubi steps

$$\begin{aligned}
 \int \frac{\text{Ci}(a+bx)}{x^2} dx &= -\frac{\text{Ci}(a+bx)}{x} + b \int \frac{\cos(a+bx)}{x(a+bx)} dx \\
 &= -\frac{\text{Ci}(a+bx)}{x} + b \int \left( \frac{\cos(a+bx)}{ax} - \frac{b \cos(a+bx)}{a(a+bx)} \right) dx \\
 &= -\frac{\text{Ci}(a+bx)}{x} + \frac{b \int \frac{\cos(a+bx)}{x} dx}{a} - \frac{b^2 \int \frac{\cos(a+bx)}{a+bx} dx}{a} \\
 &= -\frac{b \text{Ci}(a+bx)}{a} - \frac{\text{Ci}(a+bx)}{x} + \frac{(b \cos(a)) \int \frac{\cos(bx)}{x} dx}{a} - \frac{(b \sin(a)) \int \frac{\sin(bx)}{x} dx}{a} \\
 &= \frac{b \cos(a) \text{Ci}(bx)}{a} - \frac{b \text{Ci}(a+bx)}{a} - \frac{\text{Ci}(a+bx)}{x} - \frac{b \sin(a) \text{Si}(bx)}{a}
 \end{aligned}$$

**Mathematica [A]** time = 0.0796085, size = 40, normalized size = 0.85

$$\frac{-(a+bx)\text{CosIntegral}(a+bx) + bx \cos(a)\text{CosIntegral}(bx) - bx \sin(a)\text{Si}(bx)}{ax}$$

Antiderivative was successfully verified.

[In] Integrate[CosIntegral[a + b\*x]/x^2, x]

[Out] (b\*x\*Cos[a]\*CosIntegral[b\*x] - (a + b\*x)\*CosIntegral[a + b\*x] - b\*x\*Sin[a]\*SinIntegral[b\*x])/(a\*x)

**Maple [A]** time = 0.057, size = 49, normalized size = 1.

$$b \left( -\frac{\text{Ci}(bx+a)}{bx} - \frac{\text{Ci}(bx+a)}{a} + \frac{-\text{Si}(bx)\sin(a) + \text{Ci}(bx)\cos(a)}{a} \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(b\*x+a)/x^2,x)

[Out] b\*(-Ci(b\*x+a)/b/x-1/a\*Ci(b\*x+a)+1/a\*(-Si(b\*x)\*sin(a)+Ci(b\*x)\*cos(a)))

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx+a)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)/x^2,x, algorithm="maxima")

[Out] integrate(Ci(b\*x + a)/x^2, x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Ci}(bx+a)}{x^2}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)/x^2,x, algorithm="fricas")

[Out] integral(cos\_integral(b\*x + a)/x^2, x)

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(a+bx)}{x^2} dx$$



Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)/x\*\*2,x)

[Out] Integral(Ci(a + b\*x)/x\*\*2, x)

**Giac [C]** time = 1.22721, size = 201, normalized size = 4.28

$$\frac{\left(\Re(\text{Ci}(bx+a))\tan\left(\frac{1}{2}a\right)^2 + \Re(\text{Ci}(bx))\tan\left(\frac{1}{2}a\right)^2 + \Re(\text{Ci}(-bx-a))\tan\left(\frac{1}{2}a\right)^2 + \Re(\text{Ci}(-bx))\tan\left(\frac{1}{2}a\right)^2 + 2\Im(\text{Ci}(bx+a))\tan\left(\frac{1}{2}a\right)\right)}{2\left(a^2 + \cos^2\left(\frac{1}{2}a\right)\right)}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)/x^2,x, algorithm="giac")

[Out] 
$$\begin{aligned} & -1/2*(\text{real\_part}(\text{cos\_integral}(b*x + a))*\tan(1/2*a)^2 + \text{real\_part}(\text{cos\_integral}(b*x))*\tan(1/2*a)^2 \\ & + \text{real\_part}(\text{cos\_integral}(-b*x - a))*\tan(1/2*a)^2 + \text{real\_part}(\text{cos\_integral}(-b*x))*\tan(1/2*a)^2 \\ & + 2*\text{imag\_part}(\text{cos\_integral}(b*x))*\tan(1/2*a) - 2*\text{imag\_part}(\text{cos\_integral}(-b*x))*\tan(1/2*a) \\ & + 4*\text{sin\_integral}(b*x)*\tan(1/2*a) + \text{real\_part}(\text{cos\_integral}(b*x + a)) - \text{real\_part}(\text{cos\_integral}(b*x)) \\ & + \text{real\_part}(\text{cos\_integral}(-b*x - a)) - \text{real\_part}(\text{cos\_integral}(-b*x)))*b/( \\ & a*\tan(1/2*a)^2 + a) - \text{cos\_integral}(b*x + a)/x \end{aligned}$$

### 3.92 $\int \frac{\text{CosIntegral}(a+bx)}{x^3} dx$

**Optimal.** Leaf size=111

$$\frac{b^2 \text{CosIntegral}(a+bx)}{2a^2} - \frac{b^2 \cos(a) \text{CosIntegral}(bx)}{2a^2} + \frac{b^2 \sin(a) \text{Si}(bx)}{2a^2} - \frac{b^2 \sin(a) \text{CosIntegral}(bx)}{2a} - \frac{b^2 \cos(a) \text{Si}(bx)}{2a}$$

[Out]  $-(b \cdot \text{Cos}[a + b \cdot x]) / (2 \cdot a \cdot x) - (b^2 \cdot \text{Cos}[a] \cdot \text{CosIntegral}[b \cdot x]) / (2 \cdot a^2) + (b^2 \cdot \text{CosIntegral}[a + b \cdot x]) / (2 \cdot a^2) - \text{CosIntegral}[a + b \cdot x] / (2 \cdot x^2) - (b^2 \cdot \text{CosIntegral}[b \cdot x] \cdot \text{Sin}[a]) / (2 \cdot a) - (b^2 \cdot \text{Cos}[a] \cdot \text{SinIntegral}[b \cdot x]) / (2 \cdot a) + (b^2 \cdot \text{Sin}[a] \cdot \text{SinIntegral}[b \cdot x]) / (2 \cdot a^2)$

**Rubi [A]** time = 0.326721, antiderivative size = 111, normalized size of antiderivative = 1., number of steps used = 11, number of rules used = 6, integrand size = 10,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.6$ , Rules used = {6504, 6742, 3297, 3303, 3299, 3302}

$$\frac{b^2 \text{CosIntegral}(a+bx)}{2a^2} - \frac{b^2 \cos(a) \text{CosIntegral}(bx)}{2a^2} + \frac{b^2 \sin(a) \text{Si}(bx)}{2a^2} - \frac{b^2 \sin(a) \text{CosIntegral}(bx)}{2a} - \frac{b^2 \cos(a) \text{Si}(bx)}{2a}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[\text{CosIntegral}[a + b \cdot x] / x^3, x]$

[Out]  $-(b \cdot \text{Cos}[a + b \cdot x]) / (2 \cdot a \cdot x) - (b^2 \cdot \text{Cos}[a] \cdot \text{CosIntegral}[b \cdot x]) / (2 \cdot a^2) + (b^2 \cdot \text{CosIntegral}[a + b \cdot x]) / (2 \cdot a^2) - \text{CosIntegral}[a + b \cdot x] / (2 \cdot x^2) - (b^2 \cdot \text{CosIntegral}[b \cdot x] \cdot \text{Sin}[a]) / (2 \cdot a) - (b^2 \cdot \text{Cos}[a] \cdot \text{SinIntegral}[b \cdot x]) / (2 \cdot a) + (b^2 \cdot \text{Sin}[a] \cdot \text{SinIntegral}[b \cdot x]) / (2 \cdot a^2)$

#### Rule 6504

$\text{Int}[\text{CosIntegral}[(a_.) + (b_.)(x_.)] * ((c_.) + (d_.)(x_.))^{(m_.)}, x\_Symbol] :$   
 $> \text{Simp}[\frac{(c + d \cdot x)^{(m + 1)} \cdot \text{CosIntegral}[a + b \cdot x]}{(d \cdot (m + 1))}, x] - \text{Dist}[b / (d \cdot (m + 1)), \text{Int}[\frac{(c + d \cdot x)^{(m + 1)} \cdot \text{Cos}[a + b \cdot x]}{(a + b \cdot x)}, x], x] /;$  FreeQ[{a, b, c, d, m}, x] && NeQ[m, -1]

#### Rule 6742

$\text{Int}[u_, x\_Symbol] := \text{With}[\{v = \text{ExpandIntegrand}[u, x]\}, \text{Int}[v, x] /; \text{SumQ}[v]]$

#### Rule 3297

```
Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)], x_Symbol] := Simp[((c + d*x)^(m + 1)*Sin[e + f*x])/(d*(m + 1)), x] - Dist[f/(d*(m + 1)), Int[(c + d*x)^(m + 1)*Cos[e + f*x], x], x] /; FreeQ[{c, d, e, f}, x] && LtQ[m, -1]
```

### Rule 3303

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Dist[Cos[(d*e - c*f)/d], Int[Sin[(c*f)/d + f*x]/(c + d*x), x], x] + Dist[Sin[(d*e - c*f)/d], Int[Cos[(c*f)/d + f*x]/(c + d*x), x], x] /; FreeQ[{c, d, e, f}, x] && NeQ[d*e - c*f, 0]
```

### Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[SinIntegral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

### Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[CosIntegral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) - c*f, 0]
```

### Rubi steps

$$\begin{aligned}
\int \frac{\text{Ci}(a + bx)}{x^3} dx &= -\frac{\text{Ci}(a + bx)}{2x^2} + \frac{1}{2}b \int \frac{\cos(a + bx)}{x^2(a + bx)} dx \\
&= -\frac{\text{Ci}(a + bx)}{2x^2} + \frac{1}{2}b \int \left( \frac{\cos(a + bx)}{ax^2} - \frac{b \cos(a + bx)}{a^2x} + \frac{b^2 \cos(a + bx)}{a^2(a + bx)} \right) dx \\
&= -\frac{\text{Ci}(a + bx)}{2x^2} + \frac{b \int \frac{\cos(a + bx)}{x^2} dx}{2a} - \frac{b^2 \int \frac{\cos(a + bx)}{x} dx}{2a^2} + \frac{b^3 \int \frac{\cos(a + bx)}{a + bx} dx}{2a^2} \\
&= -\frac{b \cos(a + bx)}{2ax} + \frac{b^2 \text{Ci}(a + bx)}{2a^2} - \frac{\text{Ci}(a + bx)}{2x^2} - \frac{b^2 \int \frac{\sin(a + bx)}{x} dx}{2a} - \frac{(b^2 \cos(a)) \int \frac{\cos(bx)}{x} dx}{2a^2} + \frac{(b^2 \sin(a)) \int \frac{\sin(bx)}{x} dx}{2a^2} \\
&= -\frac{b \cos(a + bx)}{2ax} - \frac{b^2 \cos(a) \text{Ci}(bx)}{2a^2} + \frac{b^2 \text{Ci}(a + bx)}{2a^2} - \frac{\text{Ci}(a + bx)}{2x^2} + \frac{b^2 \sin(a) \text{Si}(bx)}{2a^2} - \frac{(b^2 \cos(a)) \int \frac{\cos(bx)}{x} dx}{2a} \\
&= -\frac{b \cos(a + bx)}{2ax} - \frac{b^2 \cos(a) \text{Ci}(bx)}{2a^2} + \frac{b^2 \text{Ci}(a + bx)}{2a^2} - \frac{\text{Ci}(a + bx)}{2x^2} - \frac{b^2 \text{Ci}(bx) \sin(a)}{2a} - \frac{b^2 \cos(a) \text{Si}(bx)}{2a}
\end{aligned}$$

**Mathematica [A]** time = 0.398744, size = 76, normalized size = 0.68

$$\frac{(a^2 - b^2x^2) \operatorname{CosIntegral}(a + bx) + b^2x^2(a \sin(a) + \cos(a)) \operatorname{CosIntegral}(bx) + bx(bx(a \cos(a) - \sin(a)) \operatorname{Si}(bx) + a \cos(a))}{2a^2x^2}$$

Antiderivative was successfully verified.

[In] Integrate[CosIntegral[a + b\*x]/x^3,x]

[Out]  $-\left(\left(a^2 - b^2x^2\right) \operatorname{CosIntegral}[a + b*x] + b^2x^2 \operatorname{CosIntegral}[b*x] * (\operatorname{Cos}[a] + a \operatorname{Sin}[a]) + b*x * (a \operatorname{Cos}[a + b*x] + b*x * (a \operatorname{Cos}[a] - \operatorname{Sin}[a]) * \operatorname{SinIntegral}[b*x])\right) / (2*a^2*x^2)$

**Maple [A]** time = 0.056, size = 88, normalized size = 0.8

$$b^2 \left( -\frac{\operatorname{Ci}(bx+a)}{2b^2x^2} + \frac{\operatorname{Ci}(bx+a)}{2a^2} + \frac{1}{2a} \left( -\frac{\cos(bx+a)}{bx} - \operatorname{Si}(bx) \cos(a) - \operatorname{Ci}(bx) \sin(a) \right) - \frac{-\operatorname{Si}(bx) \sin(a) + \operatorname{Ci}(bx) \cos(a)}{2a^2} \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(b\*x+a)/x^3,x)

[Out]  $b^2 * (-1/2 * \operatorname{Ci}(b*x+a) / b^2 / x^2 + 1/2 / a^2 * \operatorname{Ci}(b*x+a) + 1/2 / a * (-\cos(b*x+a) / b / x - \operatorname{Si}(b*x) * \cos(a) - \operatorname{Ci}(b*x) * \sin(a)) - 1/2 / a^2 * (-\operatorname{Si}(b*x) * \sin(a) + \operatorname{Ci}(b*x) * \cos(a)))$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\operatorname{Ci}(bx+a)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)/x^3,x, algorithm="maxima")

[Out] integrate(Ci(b\*x + a)/x^3, x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Ci}(bx+a)}{x^3}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)/x^3,x, algorithm="fricas")

[Out] integral(cos\_integral(b\*x + a)/x^3, x)

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(a+bx)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)/x\*\*3,x)

[Out] Integral(Ci(a + b\*x)/x\*\*3, x)

**Giac [C]** time = 1.23233, size = 1010, normalized size = 9.1

result too large to display

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)/x^3,x, algorithm="giac")

[Out]  $\frac{1}{4}*(a*b*x*\text{imag\_part}(\text{cos\_integral}(b*x))*\tan(1/2*b*x)^2*\tan(1/2*a)^2 - a*b*x*\text{imag\_part}(\text{cos\_integral}(-b*x))*\tan(1/2*b*x)^2*\tan(1/2*a)^2 + 2*a*b*x*\text{sin\_integral}(b*x)*\tan(1/2*b*x)^2*\tan(1/2*a)^2 - 2*a*b*x*\text{real\_part}(\text{cos\_integral}(b*x))*\tan(1/2*b*x)^2*\tan(1/2*a) - 2*a*b*x*\text{real\_part}(\text{cos\_integral}(-b*x))*\tan(1/2*b*x)^2*\tan(1/2*a) + b*x*\text{real\_part}(\text{cos\_integral}(b*x + a))*\tan(1/2*b*x)^2*\tan(1/2*a)^2 + b*x*\text{real\_part}(\text{cos\_integral}(b*x))*\tan(1/2*b*x)^2*\tan(1/2*a)^2 + b*x*\text{real\_part}(\text{cos\_integral}(-b*x - a))*\tan(1/2*b*x)^2*\tan(1/2*a)^2 + b*x*\text{real\_part}(\text{cos\_integral}(-b*x))*\tan(1/2*b*x)^2*\tan(1/2*a)^2 - a*b*x*\text{imag\_part}(\text{cos\_integral}(b*x))*\tan(1/2*b*x)^2 + a*b*x*\text{imag\_part}(\text{cos\_integral}(-b*x))*\tan(1/2*b*x)^2$

$$\begin{aligned}
& n(1/2*b*x)^2 - 2*a*b*x*\sin\_integral(b*x)*\tan(1/2*b*x)^2 + 2*b*x*\text{imag\_part}(\cos\_integral(b*x))*\tan(1/2*b*x)^2*\tan(1/2*a) - 2*b*x*\text{imag\_part}(\cos\_integral(-b*x))*\tan(1/2*b*x)^2*\tan(1/2*a) + 4*b*x*\sin\_integral(b*x)*\tan(1/2*b*x)^2*\tan(1/2*a) + a*b*x*\text{imag\_part}(\cos\_integral(b*x))*\tan(1/2*a)^2 - a*b*x*\text{imag\_part}(\cos\_integral(-b*x))*\tan(1/2*a)^2 + 2*a*b*x*\sin\_integral(b*x)*\tan(1/2*a)^2 + b*x*\text{real\_part}(\cos\_integral(b*x + a))*\tan(1/2*b*x)^2 - b*x*\text{real\_part}(\cos\_integral(b*x))*\tan(1/2*b*x)^2 + b*x*\text{real\_part}(\cos\_integral(-b*x - a))*\tan(1/2*b*x)^2 - b*x*\text{real\_part}(\cos\_integral(-b*x))*\tan(1/2*b*x)^2 - 2*a*b*x*\text{real\_part}(\cos\_integral(b*x))*\tan(1/2*a) - 2*a*b*x*\text{real\_part}(\cos\_integral(-b*x))*\tan(1/2*a) + b*x*\text{real\_part}(\cos\_integral(b*x + a))*\tan(1/2*a)^2 + b*x*\text{real\_part}(\cos\_integral(b*x))*\tan(1/2*a)^2 + b*x*\text{real\_part}(\cos\_integral(-b*x - a))*\tan(1/2*a)^2 + b*x*\text{real\_part}(\cos\_integral(-b*x))*\tan(1/2*a)^2 - 2*a*\tan(1/2*b*x)^2*\tan(1/2*a)^2 - a*b*x*\text{imag\_part}(\cos\_integral(b*x)) + a*b*x*\text{imag\_part}(\cos\_integral(-b*x)) - 2*a*b*x*\sin\_integral(b*x) + 2*b*x*\text{imag\_part}(\cos\_integral(b*x))*\tan(1/2*a) - 2*b*x*\text{imag\_part}(\cos\_integral(-b*x))*\tan(1/2*a) + 4*b*x*\sin\_integral(b*x)*\tan(1/2*a) + b*x*\text{real\_part}(\cos\_integral(b*x + a)) - b*x*\text{real\_part}(\cos\_integral(b*x)) + b*x*\text{real\_part}(\cos\_integral(-b*x - a)) - b*x*\text{real\_part}(\cos\_integral(-b*x)) + 2*a*\tan(1/2*b*x)^2 + 8*a*\tan(1/2*b*x)*\tan(1/2*a) + 2*a*\tan(1/2*a)^2 - 2*a)*b/(a^2*x*\tan(1/2*b*x)^2*\tan(1/2*a)^2 + a^2*x*\tan(1/2*b*x)^2 + a^2*x*\tan(1/2*a)^2 + a^2*x) - 1/2*\cos\_integral(b*x + a)/x^2
\end{aligned}$$

### 3.93 $\int x^m \text{CosIntegral}(a + bx)^2 dx$

Optimal. Leaf size=14

CannotIntegrate( $x^m \text{CosIntegral}(a + bx)^2, x$ )

[Out] CannotIntegrate[x<sup>m</sup>\*CosIntegral[a + b\*x]<sup>2</sup>, x]

**Rubi [A]** time = 0.0424156, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int x^m \text{CosIntegral}(a + bx)^2 dx$$

Verification is Not applicable to the result.

[In] Int[x<sup>m</sup>\*CosIntegral[a + b\*x]<sup>2</sup>,x]

[Out] Defer[Int][x<sup>m</sup>\*CosIntegral[a + b\*x]<sup>2</sup>, x]

Rubi steps

$$\int x^m \text{Ci}(a + bx)^2 dx = \int x^m \text{Ci}(a + bx)^2 dx$$

**Mathematica [A]** time = 5.27344, size = 0, normalized size = 0.

$$\int x^m \text{CosIntegral}(a + bx)^2 dx$$

Verification is Not applicable to the result.

[In] Integrate[x<sup>m</sup>\*CosIntegral[a + b\*x]<sup>2</sup>,x]

[Out] Integrate[x<sup>m</sup>\*CosIntegral[a + b\*x]<sup>2</sup>, x]

**Maple [A]** time = 0.142, size = 0, normalized size = 0.

$$\int x^m (\text{Ci}(bx + a))^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x^m\*Ci(b\*x+a)^2,x)

[Out] int(x^m\*Ci(b\*x+a)^2,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int x^m \text{Ci}(bx + a)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^m\*Ci(b\*x+a)^2,x, algorithm="maxima")

[Out] integrate(x^m\*Ci(b\*x + a)^2, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^m \text{Ci}(bx + a)^2, x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^m\*Ci(b\*x+a)^2,x, algorithm="fricas")

[Out] integral(x^m\*cos\_integral(b\*x + a)^2, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int x^m \text{Ci}^2(a + bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.



```
[In] integrate(x**m*Ci(b*x+a)**2,x)
```

```
[Out] Integral(x**m*Ci(a + b*x)**2, x)
```

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int x^m \operatorname{Ci}(bx + a)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x^m*Ci(b*x+a)^2,x, algorithm="giac")
```

```
[Out] integrate(x^m*Ci(b*x + a)^2, x)
```

### 3.94 $\int x^2 \text{CosIntegral}(a + bx)^2 dx$

**Optimal.** Leaf size=329

$$\frac{a^2(a + bx)\text{CosIntegral}(a + bx)^2}{3b^3} - \frac{2a^2\text{CosIntegral}(a + bx)\sin(a + bx)}{3b^3} + \frac{a^2\text{Si}(2a + 2bx)}{b^3} - \frac{ax(a + bx)\text{CosIntegral}(a + bx)}{3b^2}$$

```
[Out] (2*x)/(3*b^2) + (a*cos[2*a + 2*b*x])/(3*b^3) - (x*cos[2*a + 2*b*x])/(6*b^2)
+ (2*a*cos[a + b*x]*CosIntegral[a + b*x])/(3*b^3) - (4*x*cos[a + b*x]*CosIntegral[a + b*x])/(3*b^2)
+ (a^2*(a + b*x)*CosIntegral[a + b*x]^2)/(3*b^3)
- (a*x*(a + b*x)*CosIntegral[a + b*x]^2)/(3*b^2) + (x^2*(a + b*x)*CosIntegral[a + b*x]^2)/(3*b)
- (a*cosIntegral[2*a + 2*b*x])/b^3 - (a*Log[a + b*x])/b^3
+ (2*cos[a + b*x]*Sin[a + b*x])/(3*b^3) + (4*cosIntegral[a + b*x]*Sin[a + b*x])/(3*b^3)
- (2*a^2*cosIntegral[a + b*x]*Sin[a + b*x])/(3*b^3) + (2*a*x*cosIntegral[a + b*x]*Sin[a + b*x])/(3*b^2)
- (2*x^2*cosIntegral[a + b*x]*Sin[a + b*x])/(3*b) + Sin[2*a + 2*b*x]/(12*b^3)
- (2*SinIntegral[2*a + 2*b*x])/(3*b^3) + (a^2*SinIntegral[2*a + 2*b*x])/b^3
```

---

**Rubi [A]** time = 1.32241, antiderivative size = 329, normalized size of antiderivative = 1., number of steps used = 39, number of rules used = 19, integrand size = 12,  $\frac{\text{number of rules}}{\text{integrand size}} = 1.583$ , Rules used = {6510, 6514, 4573, 6741, 6742, 2638, 3296, 2637, 3299, 6520, 2635, 8, 3312, 3302, 6512, 4406, 12, 6518, 6506}

$$\frac{a^2(a + bx)\text{CosIntegral}(a + bx)^2}{3b^3} - \frac{2a^2\text{CosIntegral}(a + bx)\sin(a + bx)}{3b^3} + \frac{a^2\text{Si}(2a + 2bx)}{b^3} - \frac{ax(a + bx)\text{CosIntegral}(a + bx)}{3b^2}$$

Antiderivative was successfully verified.

```
[In] Int[x^2*CosIntegral[a + b*x]^2,x]
```

```
[Out] (2*x)/(3*b^2) + (a*cos[2*a + 2*b*x])/(3*b^3) - (x*cos[2*a + 2*b*x])/(6*b^2)
+ (2*a*cos[a + b*x]*CosIntegral[a + b*x])/(3*b^3) - (4*x*cos[a + b*x]*CosIntegral[a + b*x])/(3*b^2)
+ (a^2*(a + b*x)*CosIntegral[a + b*x]^2)/(3*b^3)
- (a*x*(a + b*x)*CosIntegral[a + b*x]^2)/(3*b^2) + (x^2*(a + b*x)*CosIntegral[a + b*x]^2)/(3*b)
- (a*cosIntegral[2*a + 2*b*x])/b^3 - (a*Log[a + b*x])/b^3
+ (2*cos[a + b*x]*Sin[a + b*x])/(3*b^3) + (4*cosIntegral[a + b*x]*Sin[a + b*x])/(3*b^3)
- (2*a^2*cosIntegral[a + b*x]*Sin[a + b*x])/(3*b^3) + (2*a*x*cosIntegral[a + b*x]*Sin[a + b*x])/(3*b^2)
- (2*x^2*cosIntegral[a + b*x]*Sin[a + b*x])/(3*b) + Sin[2*a + 2*b*x]/(12*b^3)
- (2*SinIntegral[2*a + 2*b*x])/(3*b^3) + (a^2*SinIntegral[2*a + 2*b*x])/b^3
```

Rule 6510

```
Int[CosIntegral[(a_) + (b_.)*(x_)]^2*((c_.) + (d_.)*(x_))^(m_.), x_Symbol]
:> Simp[((a + b*x)*(c + d*x)^m*CosIntegral[a + b*x]^2)/(b*(m + 1)), x] + (-
Dist[2/(m + 1), Int[(c + d*x)^m*Cos[a + b*x]*CosIntegral[a + b*x], x], x] +
Dist[((b*c - a*d)*m)/(b*(m + 1)), Int[(c + d*x)^(m - 1)*CosIntegral[a + b*
x]^2, x], x]) /; FreeQ[{a, b, c, d}, x] && IGtQ[m, 0]
```

#### Rule 6514

```
Int[Cos[(a_.) + (b_.)*(x_)]*CosIntegral[(c_.) + (d_.)*(x_)]*((e_.) + (f_.)*
(x_))^(m_.), x_Symbol] :> Simp[((e + f*x)^m*Sin[a + b*x]*CosIntegral[c + d*
x])/b, x] + (-Dist[d/b, Int[((e + f*x)^m*Sin[a + b*x]*Cos[c + d*x])/(c + d*
x), x], x] - Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*Sin[a + b*x]*CosIntegral[c
+ d*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]
```

#### Rule 4573

```
Int[Cos[w_]^(p_.)*(u_.)*Sin[v_]^(p_.), x_Symbol] :> Dist[1/2^p, Int[u*Sin[2
*v]^p, x], x] /; EqQ[w, v] && IntegerQ[p]
```

#### Rule 6741

```
Int[u_, x_Symbol] :> With[{v = NormalizeIntegrand[u, x]}, Int[v, x] /; v !=
= u]
```

#### Rule 6742

```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

#### Rule 2638

```
Int[sin[(c_.) + (d_.)*(x_)], x_Symbol] :> -Simp[Cos[c + d*x]/d, x] /; FreeQ
[{c, d}, x]
```

#### Rule 3296

```
Int[((c_.) + (d_.)*(x_))^(m_.)*sin[(e_.) + (f_.)*(x_)], x_Symbol] :> -Simp[
((c + d*x)^m*Cos[e + f*x])/f, x] + Dist[(d*m)/f, Int[(c + d*x)^(m - 1)*Cos[
e + f*x], x], x] /; FreeQ[{c, d, e, f}, x] && GtQ[m, 0]
```

#### Rule 2637

```
Int[sin[Pi/2 + (c_.) + (d_.)*(x_)], x_Symbol] :> Simp[Sin[c + d*x]/d, x] /;
FreeQ[{c, d}, x]
```

Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[SinIntegral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

Rule 6520

```
Int[CosIntegral[(c_.) + (d_.)*(x_)]*((e_.) + (f_.)*(x_))^(m_.)*Sin[(a_.) + (b_.)*(x_)], x_Symbol] := -Simp[((e + f*x)^m*Cos[a + b*x]*CosIntegral[c + d*x])/b, x] + (Dist[d/b, Int[((e + f*x)^m*Cos[a + b*x]*Cos[c + d*x])/(c + d*x), x], x] + Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*Cos[a + b*x]*CosIntegral[c + d*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]
```

Rule 2635

```
Int[((b_.)*sin[(c_.) + (d_.)*(x_)])^(n_), x_Symbol] := -Simp[(b*Cos[c + d*x]*(b*SIN[c + d*x])^(n - 1))/(d*n), x] + Dist[(b^2*(n - 1))/n, Int[(b*SIN[c + d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1] && IntegerQ[2*n]
```

Rule 8

```
Int[a_, x_Symbol] := Simp[a*x, x] /; FreeQ[a, x]
```

Rule 3312

```
Int[((c_.) + (d_.)*(x_))^(m_.)*sin[(e_.) + (f_.)*(x_)]^(n_), x_Symbol] := Int[ExpandTrigReduce[(c + d*x)^m, Sin[e + f*x]^n, x], x] /; FreeQ[{c, d, e, f, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))
```

Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[CosIntegral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) - c*f, 0]
```

Rule 6512

```
Int[Cos[(a_.) + (b_.)*(x_)]*CosIntegral[(c_.) + (d_.)*(x_)], x_Symbol] := Simp[(Sin[a + b*x]*CosIntegral[c + d*x])/b, x] - Dist[d/b, Int[(Sin[a + b*x]*Cos[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

Rule 4406

```
Int[Cos[(a_.) + (b_.)*(x_)]^(p_.)*((c_.) + (d_.)*(x_))^(m_.)*Sin[(a_.) + (b_.)*(x_)]^(n_.), x_Symbol] :> Int[ExpandTrigReduce[(c + d*x)^m, Sin[a + b*x]^n*Cos[a + b*x]^p, x], x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IGtQ[p, 0]
```

### Rule 12

```
Int[(a_)*(u_), x_Symbol] :> Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b_)*(v_) /; FreeQ[b, x]]
```

### Rule 6518

```
Int[CosIntegral[(c_.) + (d_.)*(x_)]*Sin[(a_.) + (b_.)*(x_)], x_Symbol] :> -Simp[(Cos[a + b*x]*CosIntegral[c + d*x])/b, x] + Dist[d/b, Int[(Cos[a + b*x]*Cos[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

### Rule 6506

```
Int[CosIntegral[(a_.) + (b_.)*(x_)]^2, x_Symbol] :> Simp[((a + b*x)*CosIntegral[a + b*x]^2)/b, x] - Dist[2, Int[Cos[a + b*x]*CosIntegral[a + b*x], x], x] /; FreeQ[{a, b}, x]
```

### Rubi steps

$$\begin{aligned}
\int x^2 \text{Ci}(a+bx)^2 dx &= \frac{x^2(a+bx)\text{Ci}(a+bx)^2}{3b} - \frac{2}{3} \int x^2 \cos(a+bx)\text{Ci}(a+bx) dx - \frac{(2a) \int x \text{Ci}(a+bx)^2 dx}{3b} \\
&= -\frac{ax(a+bx)\text{Ci}(a+bx)^2}{3b^2} + \frac{x^2(a+bx)\text{Ci}(a+bx)^2}{3b} - \frac{2x^2\text{Ci}(a+bx) \sin(a+bx)}{3b} + \frac{2}{3} \int \frac{x^2 \cos(a+bx)}{a} dx \\
&= -\frac{4x \cos(a+bx)\text{Ci}(a+bx)}{3b^2} + \frac{a^2(a+bx)\text{Ci}(a+bx)^2}{3b^3} - \frac{ax(a+bx)\text{Ci}(a+bx)^2}{3b^2} + \frac{x^2(a+bx)\text{Ci}(a+bx)}{3b} \\
&= \frac{2a \cos(a+bx)\text{Ci}(a+bx)}{3b^3} - \frac{4x \cos(a+bx)\text{Ci}(a+bx)}{3b^2} + \frac{a^2(a+bx)\text{Ci}(a+bx)^2}{3b^3} - \frac{ax(a+bx)\text{Ci}(a+bx)}{3b^2} \\
&= \frac{2a \cos(a+bx)\text{Ci}(a+bx)}{3b^3} - \frac{4x \cos(a+bx)\text{Ci}(a+bx)}{3b^2} + \frac{a^2(a+bx)\text{Ci}(a+bx)^2}{3b^3} - \frac{ax(a+bx)\text{Ci}(a+bx)}{3b^2} \\
&= \frac{2a \cos(a+bx)\text{Ci}(a+bx)}{3b^3} - \frac{4x \cos(a+bx)\text{Ci}(a+bx)}{3b^2} + \frac{a^2(a+bx)\text{Ci}(a+bx)^2}{3b^3} - \frac{ax(a+bx)\text{Ci}(a+bx)}{3b^2} \\
&= \frac{2x}{3b^2} + \frac{a \cos(2a+2bx)}{6b^3} - \frac{x \cos(2a+2bx)}{6b^2} + \frac{2a \cos(a+bx)\text{Ci}(a+bx)}{3b^3} - \frac{4x \cos(a+bx)\text{Ci}(a+bx)}{3b^2} \\
&= \frac{2x}{3b^2} + \frac{a \cos(2a+2bx)}{3b^3} - \frac{x \cos(2a+2bx)}{6b^2} + \frac{2a \cos(a+bx)\text{Ci}(a+bx)}{3b^3} - \frac{4x \cos(a+bx)\text{Ci}(a+bx)}{3b^2}
\end{aligned}$$

**Mathematica [A]** time = 1.21594, size = 159, normalized size = 0.48

$$4(a^3 + b^3x^3) \text{CosIntegral}(a+bx)^2 - 8\text{CosIntegral}(a+bx) \left( (a^2 - abx + b^2x^2 - 2) \sin(a+bx) - (a - 2bx) \cos(a+bx) \right)$$

Antiderivative was successfully verified.

[In] Integrate[x^2\*CosIntegral[a + b\*x]^2,x]

[Out] (8\*a + 8\*b\*x + 4\*a\*Cos[2\*(a + b\*x)] - 2\*b\*x\*Cos[2\*(a + b\*x)] + 4\*(a^3 + b^3\*x^3)\*CosIntegral[a + b\*x]^2 - 12\*a\*CosIntegral[2\*(a + b\*x)] - 12\*a\*Log[a + b\*x] - 8\*CosIntegral[a + b\*x]\*(-(a - 2\*b\*x)\*Cos[a + b\*x]) + (-2 + a^2 - a\*b\*x + b^2\*x^2)\*Sin[a + b\*x]) + 5\*Sin[2\*(a + b\*x)] - 8\*SinIntegral[2\*(a + b\*x)] + 12\*a^2\*SinIntegral[2\*(a + b\*x)]/(12\*b^3)

**Maple [F]** time = 0.053, size = 0, normalized size = 0.

$$\int x^2 (\text{Ci}(bx+a))^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(x^2*Ci(b*x+a)^2,x)`

[Out] `int(x^2*Ci(b*x+a)^2,x)`

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \operatorname{Ci}(bx + a)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Ci(b*x+a)^2,x, algorithm="maxima")`

[Out] `integrate(x^2*Ci(b*x + a)^2, x)`

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(x^2 \operatorname{Ci}(bx + a)^2, x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Ci(b*x+a)^2,x, algorithm="fricas")`

[Out] `integral(x^2*cos_integral(b*x + a)^2, x)`

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \operatorname{Ci}^2(a + bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x**2*Ci(b*x+a)**2,x)`

[Out] `Integral(x**2*Ci(a + b*x)**2, x)`

---

**Giac [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \text{Ci}(bx + a)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Ci(b*x+a)^2,x, algorithm="giac")`

[Out] `integrate(x^2*Ci(b*x + a)^2, x)`



### 3.95 $\int x \text{CosIntegral}(a + bx)^2 dx$

**Optimal.** Leaf size=155

$$-\frac{a(a+bx)\text{CosIntegral}(a+bx)^2}{2b^2} + \frac{\text{CosIntegral}(2a+2bx)}{2b^2} + \frac{a\text{CosIntegral}(a+bx)\sin(a+bx)}{b^2} - \frac{\text{CosIntegral}(a+bx)^2}{b^2}$$

```
[Out] -Cos[2*a + 2*b*x]/(4*b^2) - (Cos[a + b*x]*CosIntegral[a + b*x])/b^2 - (a*(a
+ b*x)*CosIntegral[a + b*x]^2)/(2*b^2) + (x*(a + b*x)*CosIntegral[a + b*x]
^2)/(2*b) + CosIntegral[2*a + 2*b*x]/(2*b^2) + Log[a + b*x]/(2*b^2) + (a*Co
sIntegral[a + b*x]*Sin[a + b*x])/b^2 - (x*CosIntegral[a + b*x]*Sin[a + b*x]
)/b - (a*SinIntegral[2*a + 2*b*x])/b^2
```

**Rubi [A]** time = 0.337556, antiderivative size = 155, normalized size of antiderivative = 1., number of steps used = 17, number of rules used = 14, integrand size = 10,  $\frac{\text{number of rules}}{\text{integrand size}} = 1.4$ , Rules used = {6510, 6514, 4573, 6741, 6742, 2638, 3299, 6518, 3312, 3302, 6506, 6512, 4406, 12}

$$-\frac{a(a+bx)\text{CosIntegral}(a+bx)^2}{2b^2} + \frac{\text{CosIntegral}(2a+2bx)}{2b^2} + \frac{a\text{CosIntegral}(a+bx)\sin(a+bx)}{b^2} - \frac{\text{CosIntegral}(a+bx)^2}{b^2}$$

Antiderivative was successfully verified.

```
[In] Int[x*CosIntegral[a + b*x]^2, x]
```

```
[Out] -Cos[2*a + 2*b*x]/(4*b^2) - (Cos[a + b*x]*CosIntegral[a + b*x])/b^2 - (a*(a
+ b*x)*CosIntegral[a + b*x]^2)/(2*b^2) + (x*(a + b*x)*CosIntegral[a + b*x]
^2)/(2*b) + CosIntegral[2*a + 2*b*x]/(2*b^2) + Log[a + b*x]/(2*b^2) + (a*Co
sIntegral[a + b*x]*Sin[a + b*x])/b^2 - (x*CosIntegral[a + b*x]*Sin[a + b*x]
)/b - (a*SinIntegral[2*a + 2*b*x])/b^2
```

#### Rule 6510

```
Int[CosIntegral[(a_) + (b_.)*(x_)]^2*((c_.) + (d_.)*(x_))^(m_.), x_Symbol]
:> Simp[((a + b*x)*(c + d*x)^m*CosIntegral[a + b*x]^2)/(b*(m + 1)), x] + (-
Dist[2/(m + 1), Int[(c + d*x)^m*Cos[a + b*x]*CosIntegral[a + b*x], x], x] +
Dist[((b*c - a*d)*m)/(b*(m + 1)), Int[(c + d*x)^(m - 1)*CosIntegral[a + b*
x]^2, x], x]) /; FreeQ[{a, b, c, d}, x] && IGtQ[m, 0]
```

#### Rule 6514

```
Int[Cos[(a_.) + (b_.)*(x_)]*CosIntegral[(c_.) + (d_.)*(x_)]*((e_.) + (f_.)*
(x_))^(m_.), x_Symbol] :> Simp[(e + f*x)^m*Sin[a + b*x]*CosIntegral[c + d*
```

$x])/b, x] + (-\text{Dist}[d/b, \text{Int}[(e + f*x)^m * \text{Sin}[a + b*x] * \text{Cos}[c + d*x]]/(c + d*x), x], x] - \text{Dist}[(f*m)/b, \text{Int}[(e + f*x)^{m-1} * \text{Sin}[a + b*x] * \text{CosIntegral}[c + d*x], x], x]) /;$  FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]

### Rule 4573

$\text{Int}[\text{Cos}[w_]^{(p_.)} * (u_.) * \text{Sin}[v_]^{(p_.)}, x\_Symbol] \rightarrow \text{Dist}[1/2^p, \text{Int}[u * \text{Sin}[2*v]^{p, x}], x] /;$  EqQ[w, v] && IntegerQ[p]

### Rule 6741

$\text{Int}[u_, x\_Symbol] \rightarrow \text{With}\{v = \text{NormalizeIntegrand}[u, x]\}, \text{Int}[v, x] /;$  v != u]

### Rule 6742

$\text{Int}[u_, x\_Symbol] \rightarrow \text{With}\{v = \text{ExpandIntegrand}[u, x]\}, \text{Int}[v, x] /;$  SumQ[v]

### Rule 2638

$\text{Int}[\text{sin}[(c_.) + (d_.)*(x_)], x\_Symbol] \rightarrow -\text{Simp}[\text{Cos}[c + d*x]/d, x] /;$  FreeQ[{c, d}, x]

### Rule 3299

$\text{Int}[\text{sin}[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x\_Symbol] \rightarrow \text{Simp}[\text{SinIntegral}[e + f*x]/d, x] /;$  FreeQ[{c, d, e, f}, x] && EqQ[d\*e - c\*f, 0]

### Rule 6518

$\text{Int}[\text{CosIntegral}[(c_.) + (d_.)*(x_)] * \text{Sin}[(a_.) + (b_.)*(x_)], x\_Symbol] \rightarrow -\text{Simp}[(\text{Cos}[a + b*x] * \text{CosIntegral}[c + d*x])/b, x] + \text{Dist}[d/b, \text{Int}[(\text{Cos}[a + b*x] * \text{Cos}[c + d*x])/(c + d*x), x], x] /;$  FreeQ[{a, b, c, d}, x]

### Rule 3312

$\text{Int}[(c_.) + (d_.)*(x_)]^{(m_.)} * \text{sin}[(e_.) + (f_.)*(x_)]^{(n_.)}, x\_Symbol] \rightarrow \text{Int}[\text{ExpandTrigReduce}[(c + d*x)^m, \text{Sin}[e + f*x]^n, x], x] /;$  FreeQ[{c, d, e, f, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))

### Rule 3302

$\text{Int}[\text{sin}[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x\_Symbol] \rightarrow \text{Simp}[\text{CosIntegral}[e - \text{Pi}/2 + f*x]/d, x] /;$  FreeQ[{c, d, e, f}, x] && EqQ[d\*(e - Pi/2) -

c\*f, 0]

### Rule 6506

```
Int[CosIntegral[(a_.) + (b_.)*(x_)]^2, x_Symbol] := Simp[((a + b*x)*CosIntegral[a + b*x]^2)/b, x] - Dist[2, Int[Cos[a + b*x]*CosIntegral[a + b*x], x], x] /; FreeQ[{a, b}, x]
```

### Rule 6512

```
Int[Cos[(a_.) + (b_.)*(x_)]*CosIntegral[(c_.) + (d_.)*(x_)], x_Symbol] := Simp[(Sin[a + b*x]*CosIntegral[c + d*x])/b, x] - Dist[d/b, Int[(Sin[a + b*x]*Cos[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

### Rule 4406

```
Int[Cos[(a_.) + (b_.)*(x_)]^(p_.)*((c_.) + (d_.)*(x_))^(m_.)*Sin[(a_.) + (b_.)*(x_)]^(n_.), x_Symbol] := Int[ExpandTrigReduce[(c + d*x)^m, Sin[a + b*x]^n*Cos[a + b*x]^p, x], x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IGtQ[p, 0]
```

### Rule 12

```
Int[(a_)*(u_), x_Symbol] := Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b_)*(v_)] /; FreeQ[b, x]
```

### Rubi steps

$$\begin{aligned}
\int x \operatorname{Ci}(a+bx)^2 dx &= \frac{x(a+bx)\operatorname{Ci}(a+bx)^2}{2b} - \frac{a \int \operatorname{Ci}(a+bx)^2 dx}{2b} - \int x \cos(a+bx)\operatorname{Ci}(a+bx) dx \\
&= -\frac{a(a+bx)\operatorname{Ci}(a+bx)^2}{2b^2} + \frac{x(a+bx)\operatorname{Ci}(a+bx)^2}{2b} - \frac{x\operatorname{Ci}(a+bx)\sin(a+bx)}{b} + \frac{\int \operatorname{Ci}(a+bx)\sin(a+bx)}{b} \\
&= -\frac{\cos(a+bx)\operatorname{Ci}(a+bx)}{b^2} - \frac{a(a+bx)\operatorname{Ci}(a+bx)^2}{2b^2} + \frac{x(a+bx)\operatorname{Ci}(a+bx)^2}{2b} + \frac{a\operatorname{Ci}(a+bx)\sin(a+bx)}{b^2} \\
&= -\frac{\cos(a+bx)\operatorname{Ci}(a+bx)}{b^2} - \frac{a(a+bx)\operatorname{Ci}(a+bx)^2}{2b^2} + \frac{x(a+bx)\operatorname{Ci}(a+bx)^2}{2b} + \frac{a\operatorname{Ci}(a+bx)\sin(a+bx)}{b^2} \\
&= -\frac{\cos(a+bx)\operatorname{Ci}(a+bx)}{b^2} - \frac{a(a+bx)\operatorname{Ci}(a+bx)^2}{2b^2} + \frac{x(a+bx)\operatorname{Ci}(a+bx)^2}{2b} + \frac{\log(a+bx)}{2b^2} + \frac{a\operatorname{Ci}(a+bx)}{2b^2} \\
&= -\frac{\cos(a+bx)\operatorname{Ci}(a+bx)}{b^2} - \frac{a(a+bx)\operatorname{Ci}(a+bx)^2}{2b^2} + \frac{x(a+bx)\operatorname{Ci}(a+bx)^2}{2b} + \frac{\operatorname{Ci}(2a+2bx)}{2b^2} + \frac{\log(a+bx)}{2b^2} \\
&= -\frac{\cos(2a+2bx)}{4b^2} - \frac{\cos(a+bx)\operatorname{Ci}(a+bx)}{b^2} - \frac{a(a+bx)\operatorname{Ci}(a+bx)^2}{2b^2} + \frac{x(a+bx)\operatorname{Ci}(a+bx)^2}{2b} + \frac{\operatorname{Ci}(2a+2bx)}{2b^2}
\end{aligned}$$

**Mathematica [A]** time = 0.327434, size = 96, normalized size = 0.62

$$\frac{2(a^2 - b^2x^2)\operatorname{CosIntegral}(a+bx)^2 - 2\operatorname{CosIntegral}(2(a+bx)) + 4\operatorname{CosIntegral}(a+bx)((bx-a)\sin(a+bx) + \cos(a+bx))}{4b^2}$$

Antiderivative was successfully verified.

[In] Integrate[x\*CosIntegral[a + b\*x]^2,x]

[Out]  $-(\operatorname{Cos}[2*(a + b*x)] + 2*(a^2 - b^2*x^2)*\operatorname{CosIntegral}[a + b*x]^2 - 2*\operatorname{CosIntegral}[2*(a + b*x)] - 2*\operatorname{Log}[a + b*x] + 4*\operatorname{CosIntegral}[a + b*x]*(\operatorname{Cos}[a + b*x] + (-a + b*x)*\operatorname{Sin}[a + b*x])) + 4*a*\operatorname{SinIntegral}[2*(a + b*x)]/(4*b^2)$

**Maple [A]** time = 0.061, size = 136, normalized size = 0.9

$$\frac{x^2(\operatorname{Ci}(bx+a))^2}{2} - \frac{(\operatorname{Ci}(bx+a))^2 a^2}{2b^2} - \frac{x\operatorname{Ci}(bx+a)\sin(bx+a)}{b} + \frac{\operatorname{Ci}(bx+a)a\sin(bx+a)}{b^2} - \frac{\operatorname{Ci}(bx+a)\cos(bx+a)}{b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x\*Ci(b\*x+a)^2,x)

[Out]  $\frac{1}{2}x^2\text{Ci}(bx+a)^2 - \frac{1}{2}x\text{Ci}(bx+a)\sin(bx+a) - \frac{1}{2}x\text{Ci}(bx+a)\cos(bx+a) - \frac{1}{2}\ln(bx+a)\text{Ci}(bx+a) - \frac{1}{2}\text{Si}(2bx+2a)$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x\text{Ci}(bx+a)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Ci(b\*x+a)^2,x, algorithm="maxima")

[Out] integrate(x\*Ci(b\*x + a)^2, x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x\text{Ci}(bx+a)^2, x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Ci(b\*x+a)^2,x, algorithm="fricas")

[Out] integral(x\*cos\_integral(b\*x + a)^2, x)

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x\text{Ci}^2(a+bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Ci(b\*x+a)\*\*2,x)

[Out] Integral(x\*Ci(a + b\*x)\*\*2, x)

**Giac [F]** time = 0., size = 0, normalized size = 0.

$$\int x \operatorname{Ci}(bx + a)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x*Ci(b*x+a)^2,x, algorithm="giac")
```

```
[Out] integrate(x*Ci(b*x + a)^2, x)
```

### 3.96 $\int \text{CosIntegral}(a + bx)^2 dx$

**Optimal.** Leaf size=48

$$\frac{(a + bx)\text{CosIntegral}(a + bx)^2}{b} - \frac{2\text{CosIntegral}(a + bx)\sin(a + bx)}{b} + \frac{\text{Si}(2a + 2bx)}{b}$$

[Out] ((a + b\*x)\*CosIntegral[a + b\*x]^2)/b - (2\*CosIntegral[a + b\*x]\*Sin[a + b\*x])/b + SinIntegral[2\*a + 2\*b\*x]/b

**Rubi [A]** time = 0.0652635, antiderivative size = 48, normalized size of antiderivative = 1., number of steps used = 5, number of rules used = 5, integrand size = 8,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.625$ , Rules used = {6506, 6512, 4406, 12, 3299}

$$\frac{(a + bx)\text{CosIntegral}(a + bx)^2}{b} - \frac{2\text{CosIntegral}(a + bx)\sin(a + bx)}{b} + \frac{\text{Si}(2a + 2bx)}{b}$$

Antiderivative was successfully verified.

[In] Int[CosIntegral[a + b\*x]^2,x]

[Out] ((a + b\*x)\*CosIntegral[a + b\*x]^2)/b - (2\*CosIntegral[a + b\*x]\*Sin[a + b\*x])/b + SinIntegral[2\*a + 2\*b\*x]/b

#### Rule 6506

Int[CosIntegral[(a\_.) + (b\_.)\*(x\_)]^2, x\_Symbol] :> Simp[((a + b\*x)\*CosIntegral[a + b\*x]^2)/b, x] - Dist[2, Int[Cos[a + b\*x]\*CosIntegral[a + b\*x], x], x] /; FreeQ[{a, b}, x]

#### Rule 6512

Int[Cos[(a\_.) + (b\_.)\*(x\_)]\*CosIntegral[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] :> Simp[(Sin[a + b\*x]\*CosIntegral[c + d\*x])/b, x] - Dist[d/b, Int[(Sin[a + b\*x]\*Cos[c + d\*x])/(c + d\*x), x], x] /; FreeQ[{a, b, c, d}, x]

#### Rule 4406

Int[Cos[(a\_.) + (b\_.)\*(x\_)]^(p\_.)\*((c\_.) + (d\_.)\*(x\_))^(m\_.)\*Sin[(a\_.) + (b\_.)\*(x\_)]^(n\_.), x\_Symbol] :> Int[ExpandTrigReduce[(c + d\*x)^m, Sin[a + b\*x]^n\*Cos[a + b\*x]^p, x], x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IGtQ[p, 0]

Rule 12

`Int[(a_)*(u_), x_Symbol] := Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b_)*(v_)] /; FreeQ[b, x]`

Rule 3299

`Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[SinIntegral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]`

Rubi steps

$$\begin{aligned}
 \int \text{Ci}(a+bx)^2 dx &= \frac{(a+bx)\text{Ci}(a+bx)^2}{b} - 2 \int \cos(a+bx)\text{Ci}(a+bx) dx \\
 &= \frac{(a+bx)\text{Ci}(a+bx)^2}{b} - \frac{2\text{Ci}(a+bx)\sin(a+bx)}{b} + 2 \int \frac{\cos(a+bx)\sin(a+bx)}{a+bx} dx \\
 &= \frac{(a+bx)\text{Ci}(a+bx)^2}{b} - \frac{2\text{Ci}(a+bx)\sin(a+bx)}{b} + 2 \int \frac{\sin(2a+2bx)}{2(a+bx)} dx \\
 &= \frac{(a+bx)\text{Ci}(a+bx)^2}{b} - \frac{2\text{Ci}(a+bx)\sin(a+bx)}{b} + \int \frac{\sin(2a+2bx)}{a+bx} dx \\
 &= \frac{(a+bx)\text{Ci}(a+bx)^2}{b} - \frac{2\text{Ci}(a+bx)\sin(a+bx)}{b} + \frac{\text{Si}(2a+2bx)}{b}
 \end{aligned}$$

**Mathematica [A]** time = 0.0107419, size = 41, normalized size = 0.85

$$\frac{(a+bx)\text{CosIntegral}(a+bx)^2 - 2\text{CosIntegral}(a+bx)\sin(a+bx) + \text{Si}(2(a+bx))}{b}$$

Antiderivative was successfully verified.

[In] Integrate[CosIntegral[a + b\*x]^2, x]

[Out] ((a + b\*x)\*CosIntegral[a + b\*x]^2 - 2\*CosIntegral[a + b\*x]\*Sin[a + b\*x] + SinIntegral[2\*(a + b\*x)])/b

**Maple [A]** time = 0.046, size = 43, normalized size = 0.9

$$\frac{(bx+a)(\text{Ci}(bx+a))^2 - 2\text{Ci}(bx+a)\sin(bx+a) + \text{Si}(2bx+2a)}{b}$$



Verification of antiderivative is not currently implemented for this CAS.

[In] `int(Ci(b*x+a)^2,x)`

[Out] `1/b*((b*x+a)*Ci(b*x+a)^2-2*Ci(b*x+a)*sin(b*x+a)+Si(2*b*x+2*a))`

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \operatorname{Ci}(bx + a)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Ci(b*x+a)^2,x, algorithm="maxima")`

[Out] `integrate(Ci(b*x + a)^2, x)`

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}\left(\operatorname{Ci}(bx + a)^2, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Ci(b*x+a)^2,x, algorithm="fricas")`

[Out] `integral(cos_integral(b*x + a)^2, x)`

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \operatorname{Ci}^2(a + bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Ci(b*x+a)**2,x)`

[Out] `Integral(Ci(a + b*x)**2, x)`

---

**Giac [F]** time = 0., size = 0, normalized size = 0.

$$\int \operatorname{Ci}(bx + a)^2 dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)^2,x, algorithm="giac")

[Out] integrate(Ci(b\*x + a)^2, x)

$$3.97 \quad \int \frac{\text{CosIntegral}(a+bx)^2}{x} dx$$

**Optimal.** Leaf size=14

$$\text{CannotIntegrate}\left(\frac{\text{CosIntegral}(a+bx)^2}{x}, x\right)$$

[Out] CannotIntegrate[CosIntegral[a + b\*x]^2/x, x]

**Rubi [A]** time = 0.0299319, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\text{CosIntegral}(a+bx)^2}{x} dx$$

Verification is Not applicable to the result.

[In] Int[CosIntegral[a + b\*x]^2/x, x]

[Out] Defer[Int][CosIntegral[a + b\*x]^2/x, x]

Rubi steps

$$\int \frac{\text{Ci}(a+bx)^2}{x} dx = \int \frac{\text{Ci}(a+bx)^2}{x} dx$$

**Mathematica [A]** time = 1.31549, size = 0, normalized size = 0.

$$\int \frac{\text{CosIntegral}(a+bx)^2}{x} dx$$

Verification is Not applicable to the result.

[In] Integrate[CosIntegral[a + b\*x]^2/x, x]

[Out] Integrate[CosIntegral[a + b\*x]^2/x, x]

---

**Maple [A]** time = 0.049, size = 0, normalized size = 0.

$$\int \frac{(\operatorname{Ci}(bx + a))^2}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(b\*x+a)^2/x,x)

[Out] int(Ci(b\*x+a)^2/x,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\operatorname{Ci}(bx + a)^2}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)^2/x,x, algorithm="maxima")

[Out] integrate(Ci(b\*x + a)^2/x, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}\left(\frac{\operatorname{Ci}(bx + a)^2}{x}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)^2/x,x, algorithm="fricas")

[Out] integral(cos\_integral(b\*x + a)^2/x, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\operatorname{Ci}^2(a + bx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x+a)**2/x,x)
```

```
[Out] Integral(Ci(a + b*x)**2/x, x)
```

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx + a)^2}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x+a)^2/x,x, algorithm="giac")
```

```
[Out] integrate(Ci(b*x + a)^2/x, x)
```

$$3.98 \quad \int \frac{\text{CosIntegral}(a+bx)^2}{x^2} dx$$

**Optimal.** Leaf size=14

$$\text{CannotIntegrate}\left(\frac{\text{CosIntegral}(a+bx)^2}{x^2}, x\right)$$

[Out] CannotIntegrate[CosIntegral[a + b\*x]^2/x^2, x]

**Rubi [A]** time = 0.0359025, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\text{CosIntegral}(a+bx)^2}{x^2} dx$$

Verification is Not applicable to the result.

[In] Int[CosIntegral[a + b\*x]^2/x^2, x]

[Out] Defer[Int][CosIntegral[a + b\*x]^2/x^2, x]

Rubi steps

$$\int \frac{\text{Ci}(a+bx)^2}{x^2} dx = \int \frac{\text{Ci}(a+bx)^2}{x^2} dx$$

**Mathematica [A]** time = 2.17928, size = 0, normalized size = 0.

$$\int \frac{\text{CosIntegral}(a+bx)^2}{x^2} dx$$

Verification is Not applicable to the result.

[In] Integrate[CosIntegral[a + b\*x]^2/x^2, x]

[Out] Integrate[CosIntegral[a + b\*x]^2/x^2, x]

---

**Maple [A]** time = 0.059, size = 0, normalized size = 0.

$$\int \frac{(\operatorname{Ci}(bx + a))^2}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(b\*x+a)^2/x^2,x)

[Out] int(Ci(b\*x+a)^2/x^2,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\operatorname{Ci}(bx + a)^2}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)^2/x^2,x, algorithm="maxima")

[Out] integrate(Ci(b\*x + a)^2/x^2, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}\left(\frac{\operatorname{Ci}(bx + a)^2}{x^2}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)^2/x^2,x, algorithm="fricas")

[Out] integral(cos\_integral(b\*x + a)^2/x^2, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\operatorname{Ci}^2(a + bx)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x+a)**2/x**2,x)
```

```
[Out] Integral(Ci(a + b*x)**2/x**2, x)
```

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx + a)^2}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x+a)^2/x^2,x, algorithm="giac")
```

```
[Out] integrate(Ci(b*x + a)^2/x^2, x)
```



$$3.99 \quad \int \frac{\text{CosIntegral}(a+bx)^2}{x^3} dx$$

Optimal. Leaf size=14

$$\text{CannotIntegrate}\left(\frac{\text{CosIntegral}(a+bx)^2}{x^3}, x\right)$$

[Out] CannotIntegrate[CosIntegral[a + b\*x]^2/x^3, x]

Rubi [A] time = 0.0347127, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\text{CosIntegral}(a+bx)^2}{x^3} dx$$

Verification is Not applicable to the result.

[In] Int[CosIntegral[a + b\*x]^2/x^3,x]

[Out] Defer[Int][CosIntegral[a + b\*x]^2/x^3, x]

Rubi steps

$$\int \frac{\text{Ci}(a+bx)^2}{x^3} dx = \int \frac{\text{Ci}(a+bx)^2}{x^3} dx$$

Mathematica [A] time = 2.52033, size = 0, normalized size = 0.

$$\int \frac{\text{CosIntegral}(a+bx)^2}{x^3} dx$$

Verification is Not applicable to the result.

[In] Integrate[CosIntegral[a + b\*x]^2/x^3,x]

[Out] Integrate[CosIntegral[a + b\*x]^2/x^3, x]

---

**Maple [A]** time = 0.066, size = 0, normalized size = 0.

$$\int \frac{(\text{Ci}(bx + a))^2}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(b\*x+a)^2/x^3,x)

[Out] int(Ci(b\*x+a)^2/x^3,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx + a)^2}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)^2/x^3,x, algorithm="maxima")

[Out] integrate(Ci(b\*x + a)^2/x^3, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Ci}(bx + a)^2}{x^3}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)^2/x^3,x, algorithm="fricas")

[Out] integral(cos\_integral(b\*x + a)^2/x^3, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}^2(a + bx)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x+a)**2/x**3,x)
```

```
[Out] Integral(Ci(a + b*x)**2/x**3, x)
```

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\operatorname{Ci}(bx+a)^2}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x+a)^2/x^3,x, algorithm="giac")
```

```
[Out] integrate(Ci(b*x + a)^2/x^3, x)
```

### 3.100 $\int x^2 \text{CosIntegral}(d(a + b \log(cx^n))) dx$

**Optimal.** Leaf size=133

$$\frac{1}{3}x^3 \text{CosIntegral}(d(a + b \log(cx^n))) - \frac{1}{6}x^3 e^{-\frac{3a}{bn}} (cx^n)^{-3/n} \text{ExpIntegralEi}\left(\frac{(3 - ibdn)(a + b \log(cx^n))}{bn}\right) - \frac{1}{6}x^3 e^{-\frac{3a}{bn}} (cx^n)^{-3/n}$$

[Out] (x^3\*CosIntegral[d\*(a + b\*Log[c\*x^n])])/3 - (x^3\*ExpIntegralEi[((3 - I\*b\*d\*n)\*(a + b\*Log[c\*x^n])/(b\*n))]/(6\*E^((3\*a)/(b\*n))\*(c\*x^n)^(3/n)) - (x^3\*ExpIntegralEi[((3 + I\*b\*d\*n)\*(a + b\*Log[c\*x^n])/(b\*n))]/(6\*E^((3\*a)/(b\*n))\*(c\*x^n)^(3/n))

**Rubi [A]** time = 0.251172, antiderivative size = 133, normalized size of antiderivative = 1., number of steps used = 7, number of rules used = 5, integrand size = 17,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.294$ , Rules used = {6527, 12, 4498, 2310, 2178}

$$\frac{1}{3}x^3 \text{CosIntegral}(d(a + b \log(cx^n))) - \frac{1}{6}x^3 e^{-\frac{3a}{bn}} (cx^n)^{-3/n} \text{Ei}\left(\frac{(3 - ibdn)(a + b \log(cx^n))}{bn}\right) - \frac{1}{6}x^3 e^{-\frac{3a}{bn}} (cx^n)^{-3/n} \text{Ei}\left(\frac{(ibdn + 3)(a + b \log(cx^n))}{bn}\right)$$

Antiderivative was successfully verified.

[In] Int[x^2\*CosIntegral[d\*(a + b\*Log[c\*x^n])],x]

[Out] (x^3\*CosIntegral[d\*(a + b\*Log[c\*x^n])])/3 - (x^3\*ExpIntegralEi[((3 - I\*b\*d\*n)\*(a + b\*Log[c\*x^n])/(b\*n))]/(6\*E^((3\*a)/(b\*n))\*(c\*x^n)^(3/n)) - (x^3\*ExpIntegralEi[((3 + I\*b\*d\*n)\*(a + b\*Log[c\*x^n])/(b\*n))]/(6\*E^((3\*a)/(b\*n))\*(c\*x^n)^(3/n))

#### Rule 6527

Int[CosIntegral[((a\_.) + Log[(c\_.)\*(x\_)^(n\_.)]\*(b\_.))\*(d\_.)]\*((e\_.)\*(x\_)^(m\_.), x\_Symbol] := Simp[((e\*x)^(m + 1)\*CosIntegral[d\*(a + b\*Log[c\*x^n])]/(e\*(m + 1)), x] - Dist[(b\*d\*n)/(m + 1), Int[((e\*x)^m\*Cos[d\*(a + b\*Log[c\*x^n])])]/(d\*(a + b\*Log[c\*x^n])), x], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && NeQ[m, -1]

#### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] := Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b\_)\*(v\_) /; FreeQ[b, x]]

#### Rule 4498

```
Int[Cos[(a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.)]*(d_.)]*(((e_.) + Log[(g_.)*(x_)^(m_.)]*(f_.))*(h_.))^(q_.)*((i_.)*(x_)^(r_.), x_Symbol] := Dist[(i*x)^r/(E^(I*a*d)*(c*x^n)^(I*b*d)*(2*x^(r - I*b*d*n))), Int[x^(r - I*b*d*n)*(h*(e + f*Log[g*x^m]))^q, x], x] + Dist[(E^(I*a*d)*(i*x)^r*(c*x^n)^(I*b*d))/(2*x^(r + I*b*d*n)), Int[x^(r + I*b*d*n)*(h*(e + f*Log[g*x^m]))^q, x], x] /; FreeQ[{a, b, c, d, e, f, g, h, i, m, n, q, r}, x]
```

### Rule 2310

```
Int[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))^(p_)*((d_.)*(x_)^(m_.), x_Symbol] := Dist[(d*x)^(m + 1)/(d*n*(c*x^n)^(m + 1)/n), Subst[Int[E^((m + 1)*x/n)*(a + b*x)^p, x], x, Log[c*x^n]], x] /; FreeQ[{a, b, c, d, m, n, p}, x]
```

### Rule 2178

```
Int[(F_)^((g_.)*((e_.) + (f_.)*(x_)))/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[(F^(g*(e - (c*f)/d))*ExpIntegralEi[(f*g*(c + d*x)*Log[F])/d])/d, x] /; FreeQ[{F, c, d, e, f, g}, x] && !$UseGamma === True
```

### Rubi steps

$$\begin{aligned}
 \int x^2 \operatorname{Ci}(d(a + b \log(cx^n))) dx &= \frac{1}{3} x^3 \operatorname{Ci}(d(a + b \log(cx^n))) - \frac{1}{3} (bdn) \int \frac{x^2 \cos(d(a + b \log(cx^n)))}{d(a + b \log(cx^n))} dx \\
 &= \frac{1}{3} x^3 \operatorname{Ci}(d(a + b \log(cx^n))) - \frac{1}{3} (bn) \int \frac{x^2 \cos(d(a + b \log(cx^n)))}{a + b \log(cx^n)} dx \\
 &= \frac{1}{3} x^3 \operatorname{Ci}(d(a + b \log(cx^n))) - \frac{1}{6} (be^{-iad} n x^{ibdn} (cx^n)^{-ibd}) \int \frac{x^{2-ibdn}}{a + b \log(cx^n)} dx - \frac{1}{6} (be^{iad} n x^{ibdn} (cx^n)^{-ibd}) \int \frac{x^{2-ibdn}}{a + b \log(cx^n)} dx \\
 &= \frac{1}{3} x^3 \operatorname{Ci}(d(a + b \log(cx^n))) - \frac{1}{6} (be^{-iad} x^3 (cx^n)^{-ibd-\frac{3-ibdn}{n}}) \operatorname{Subst} \left( \int \frac{e^{\frac{(3-ibdn)x}{n}}}{a + bx} dx, x, \log(cx^n) \right) \\
 &= \frac{1}{3} x^3 \operatorname{Ci}(d(a + b \log(cx^n))) - \frac{1}{6} e^{-\frac{3a}{bn}} x^3 (cx^n)^{-3/n} \operatorname{Ei} \left( \frac{(3 - ibdn)(a + b \log(cx^n))}{bn} \right) - \frac{1}{6} e^{-\frac{3a}{bn}} x^3 (cx^n)^{-3/n} \operatorname{Ei} \left( \frac{(3 - ibdn)(a + b \log(cx^n))}{bn} \right)
 \end{aligned}$$

**Mathematica [A]** time = 1.74331, size = 102, normalized size = 0.77

$$\frac{1}{6} x^3 \left( 2 \operatorname{CosIntegral}(d(a + b \log(cx^n))) - e^{-\frac{3a}{bn}} (cx^n)^{-3/n} \left( \operatorname{ExpIntegralEi} \left( \frac{(3 - ibdn)(a + b \log(cx^n))}{bn} \right) \right) + \operatorname{ExpIntegralEi} \left( \frac{(3 - ibdn)(a + b \log(cx^n))}{bn} \right) \right)$$

Antiderivative was successfully verified.

```
[In] Integrate[x^2*CosIntegral[d*(a + b*Log[c*x^n])], x]
```

```
[Out] (x^3*(2*CosIntegral[d*(a + b*Log[c*x^n])] - (ExpIntegralEi[((3 - I*b*d*n)*(a + b*Log[c*x^n]))/(b*n)] + ExpIntegralEi[((3 + I*b*d*n)*(a + b*Log[c*x^n]))/(b*n)]))/(E^((3*a)/(b*n))*(c*x^n)^(3/n)))/6
```

**Maple [F]** time = 0.096, size = 0, normalized size = 0.

$$\int x^2 \text{Ci}(d(a + b \ln(cx^n))) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(x^2*Ci(d*(a+b*ln(c*x^n))),x)
```

```
[Out] int(x^2*Ci(d*(a+b*ln(c*x^n))),x)
```

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \text{Ci}((b \log(cx^n) + a)d) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x^2*Ci(d*(a+b*log(c*x^n))),x, algorithm="maxima")
```

```
[Out] integrate(x^2*Ci((b*log(c*x^n) + a)*d), x)
```

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^2 \text{Ci}(bd \log(cx^n) + ad), x)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x^2*Ci(d*(a+b*log(c*x^n))),x, algorithm="fricas")
```

```
[Out] integral(x^2*cos_integral(b*d*log(c*x^n) + a*d), x)
```

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \operatorname{Ci}(ad + bd \log(cx^n)) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x**2*Ci(d*(a+b*ln(c*x**n))),x)`

[Out] `Integral(x**2*Ci(a*d + b*d*log(c*x**n)), x)`

**Giac [F(-1)]** time = 0., size = 0, normalized size = 0.

Timed out

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Ci(d*(a+b*log(c*x^n))),x, algorithm="giac")`

[Out] Timed out

### 3.101 $\int x \text{CosIntegral}(d(a + b \log(cx^n))) dx$

**Optimal.** Leaf size=133

$$\frac{1}{2}x^2 \text{CosIntegral}(d(a + b \log(cx^n))) - \frac{1}{4}x^2 e^{-\frac{2a}{bn}} (cx^n)^{-2/n} \text{ExpIntegralEi}\left(\frac{(2 - ibdn)(a + b \log(cx^n))}{bn}\right) - \frac{1}{4}x^2 e^{-\frac{2a}{bn}} (cx^n)^{-2/n}$$

[Out] (x^2\*CosIntegral[d\*(a + b\*Log[c\*x^n])])/2 - (x^2\*ExpIntegralEi[((2 - I\*b\*d\*n)\*(a + b\*Log[c\*x^n])/(b\*n))]/(4\*E^((2\*a)/(b\*n))\*(c\*x^n)^(2/n)) - (x^2\*ExpIntegralEi[((2 + I\*b\*d\*n)\*(a + b\*Log[c\*x^n])/(b\*n))]/(4\*E^((2\*a)/(b\*n))\*(c\*x^n)^(2/n))

**Rubi [A]** time = 0.247479, antiderivative size = 133, normalized size of antiderivative = 1., number of steps used = 7, number of rules used = 5, integrand size = 15,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.333$ , Rules used = {6527, 12, 4498, 2310, 2178}

$$\frac{1}{2}x^2 \text{CosIntegral}(d(a + b \log(cx^n))) - \frac{1}{4}x^2 e^{-\frac{2a}{bn}} (cx^n)^{-2/n} \text{Ei}\left(\frac{(2 - ibdn)(a + b \log(cx^n))}{bn}\right) - \frac{1}{4}x^2 e^{-\frac{2a}{bn}} (cx^n)^{-2/n} \text{Ei}\left(\frac{(ibdn + 2)(a + b \log(cx^n))}{bn}\right)$$

Antiderivative was successfully verified.

[In] Int[x\*CosIntegral[d\*(a + b\*Log[c\*x^n])], x]

[Out] (x^2\*CosIntegral[d\*(a + b\*Log[c\*x^n])])/2 - (x^2\*ExpIntegralEi[((2 - I\*b\*d\*n)\*(a + b\*Log[c\*x^n])/(b\*n))]/(4\*E^((2\*a)/(b\*n))\*(c\*x^n)^(2/n)) - (x^2\*ExpIntegralEi[((2 + I\*b\*d\*n)\*(a + b\*Log[c\*x^n])/(b\*n))]/(4\*E^((2\*a)/(b\*n))\*(c\*x^n)^(2/n))

#### Rule 6527

Int[CosIntegral[((a\_.) + Log[(c\_.)\*(x\_)^(n\_.)]\*(b\_.))\*(d\_.)]\*((e\_.)\*(x\_)^(m\_.), x\_Symbol] := Simp[((e\*x)^(m + 1)\*CosIntegral[d\*(a + b\*Log[c\*x^n])]/(e\*(m + 1)), x] - Dist[(b\*d\*n)/(m + 1), Int[((e\*x)^m\*Cos[d\*(a + b\*Log[c\*x^n])])]/(d\*(a + b\*Log[c\*x^n])), x], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && NeQ[m, -1]

#### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] := Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b\_)\*(v\_) /; FreeQ[b, x]]

#### Rule 4498



```
Int[Cos[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]*(((e_.) + Log[(g_.)*(x_)^(m_.)]*(f_.))*(h_.))^(q_.)*((i_.)*(x_)^(r_.), x_Symbol] :> Dist[(i*x)^r/(E^(I*a*d)*(c*x^n)^(I*b*d)*(2*x^(r - I*b*d*n))), Int[x^(r - I*b*d*n)*(h*(e + f*Log[g*x^m]))^q, x], x] + Dist[(E^(I*a*d)*(i*x)^r*(c*x^n)^(I*b*d))/(2*x^(r + I*b*d*n)), Int[x^(r + I*b*d*n)*(h*(e + f*Log[g*x^m]))^q, x], x] /; FreeQ[{a, b, c, d, e, f, g, h, i, m, n, q, r}, x]
```

### Rule 2310

```
Int[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))^(p_)*((d_.)*(x_)^(m_.), x_Symbol] :> Dist[(d*x)^(m + 1)/(d*n*(c*x^n)^(m + 1)/n), Subst[Int[E^((m + 1)*x/n)*(a + b*x)^p, x], x, Log[c*x^n]], x] /; FreeQ[{a, b, c, d, m, n, p}, x]
```

### Rule 2178

```
Int[(F_)^((g_.)*((e_.) + (f_.)*(x_)))/((c_.) + (d_.)*(x_)), x_Symbol] :> Simp[(F^(g*(e - (c*f)/d))*ExpIntegralEi[(f*g*(c + d*x)*Log[F])/d])/d, x] /; FreeQ[{F, c, d, e, f, g}, x] && !$UseGamma === True
```

### Rubi steps

$$\begin{aligned}
 \int x \operatorname{Ci}(d(a + b \log(cx^n))) dx &= \frac{1}{2} x^2 \operatorname{Ci}(d(a + b \log(cx^n))) - \frac{1}{2} (bdn) \int \frac{x \cos(d(a + b \log(cx^n)))}{d(a + b \log(cx^n))} dx \\
 &= \frac{1}{2} x^2 \operatorname{Ci}(d(a + b \log(cx^n))) - \frac{1}{2} (bn) \int \frac{x \cos(d(a + b \log(cx^n)))}{a + b \log(cx^n)} dx \\
 &= \frac{1}{2} x^2 \operatorname{Ci}(d(a + b \log(cx^n))) - \frac{1}{4} \left( be^{-iad} n x^{ibdn} (cx^n)^{-ibd} \right) \int \frac{x^{1-ibdn}}{a + b \log(cx^n)} dx - \frac{1}{4} \left( be^{iad} n \right) \int \frac{x^{1+ibdn}}{a + b \log(cx^n)} dx \\
 &= \frac{1}{2} x^2 \operatorname{Ci}(d(a + b \log(cx^n))) - \frac{1}{4} \left( be^{-iad} x^2 (cx^n)^{-ibd - \frac{2-ibdn}{n}} \right) \operatorname{Subst} \left( \int \frac{e^{\frac{(2-ibdn)x}{a+bx}}}{a+bx} dx, x, \log(cx^n) \right) \\
 &= \frac{1}{2} x^2 \operatorname{Ci}(d(a + b \log(cx^n))) - \frac{1}{4} e^{-\frac{2a}{bn}} x^2 (cx^n)^{-2/n} \operatorname{Ei} \left( \frac{(2-ibdn)(a + b \log(cx^n))}{bn} \right) - \frac{1}{4} e^{-\frac{2a}{bn}} x^2 (cx^n)^{-2/n} \operatorname{Ei} \left( \frac{(2+ibdn)(a + b \log(cx^n))}{bn} \right)
 \end{aligned}$$

**Mathematica [A]** time = 1.71581, size = 102, normalized size = 0.77

$$\frac{1}{4} x^2 \left( 2 \operatorname{CosIntegral}(d(a + b \log(cx^n))) - e^{-\frac{2a}{bn}} (cx^n)^{-2/n} \left( \operatorname{ExpIntegralEi} \left( \frac{(2-ibdn)(a + b \log(cx^n))}{bn} \right) + \operatorname{ExpIntegralEi} \left( \frac{(2+ibdn)(a + b \log(cx^n))}{bn} \right) \right) \right)$$

Antiderivative was successfully verified.

```
[In] Integrate[x*CosIntegral[d*(a + b*Log[c*x^n]), x]
```

```
[Out] (x^2*(2*CosIntegral[d*(a + b*Log[c*x^n])] - (ExpIntegralEi[((2 - I*b*d*n)*(a + b*Log[c*x^n]))/(b*n)] + ExpIntegralEi[((2 + I*b*d*n)*(a + b*Log[c*x^n]))/(b*n)]))/(E^((2*a)/(b*n))*(c*x^n)^(2/n)))/4
```

**Maple [F]** time = 0.092, size = 0, normalized size = 0.

$$\int x \operatorname{Ci}(d(a + b \ln(cx^n))) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(x*Ci(d*(a+b*ln(c*x^n))),x)
```

```
[Out] int(x*Ci(d*(a+b*ln(c*x^n))),x)
```

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x \operatorname{Ci}((b \log(cx^n) + a)d) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x*Ci(d*(a+b*log(c*x^n))),x, algorithm="maxima")
```

```
[Out] integrate(x*Ci((b*log(c*x^n) + a)*d), x)
```

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(x \operatorname{Ci}(bd \log(cx^n) + ad), x)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x*Ci(d*(a+b*log(c*x^n))),x, algorithm="fricas")
```

```
[Out] integral(x*cos_integral(b*d*log(c*x^n) + a*d), x)
```

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x \operatorname{Ci}(ad + bd \log(cx^n)) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Ci(d\*(a+b\*ln(c\*x\*\*n))),x)

[Out] Integral(x\*Ci(a\*d + b\*d\*log(c\*x\*\*n)), x)

**Giac [F(-1)]** time = 0., size = 0, normalized size = 0.

Timed out

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Ci(d\*(a+b\*log(c\*x^n))),x, algorithm="giac")

[Out] Timed out

### 3.102 $\int \text{CosIntegral}(d(a + b \log(cx^n))) dx$

**Optimal.** Leaf size=124

$$x \text{CosIntegral}(d(a + b \log(cx^n))) - \frac{1}{2} x e^{-\frac{a}{bn}} (cx^n)^{-1/n} \text{ExpIntegralEi}\left(\frac{(1 - ibdn)(a + b \log(cx^n))}{bn}\right) - \frac{1}{2} x e^{-\frac{a}{bn}} (cx^n)^{-1/n} \text{ExpIntegralEi}\left(\frac{(1 + ibdn)(a + b \log(cx^n))}{bn}\right)$$

[Out] x\*CosIntegral[d\*(a + b\*Log[c\*x^n])] - (x\*ExpIntegralEi[((1 - I\*b\*d\*n)\*(a + b\*Log[c\*x^n]))/(b\*n)])/(2\*E^(a/(b\*n))\*(c\*x^n)^n^(-1)) - (x\*ExpIntegralEi[((1 + I\*b\*d\*n)\*(a + b\*Log[c\*x^n]))/(b\*n)])/(2\*E^(a/(b\*n))\*(c\*x^n)^n^(-1))

**Rubi [A]** time = 0.228058, antiderivative size = 124, normalized size of antiderivative = 1., number of steps used = 7, number of rules used = 5, integrand size = 13,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.385$ , Rules used = {6524, 12, 4496, 2310, 2178}

$$x \text{CosIntegral}(d(a + b \log(cx^n))) - \frac{1}{2} x e^{-\frac{a}{bn}} (cx^n)^{-1/n} \text{Ei}\left(\frac{(1 - ibdn)(a + b \log(cx^n))}{bn}\right) - \frac{1}{2} x e^{-\frac{a}{bn}} (cx^n)^{-1/n} \text{Ei}\left(\frac{(1 + ibdn)(a + b \log(cx^n))}{bn}\right)$$

Antiderivative was successfully verified.

[In] Int[CosIntegral[d\*(a + b\*Log[c\*x^n])], x]

[Out] x\*CosIntegral[d\*(a + b\*Log[c\*x^n])] - (x\*ExpIntegralEi[((1 - I\*b\*d\*n)\*(a + b\*Log[c\*x^n]))/(b\*n)])/(2\*E^(a/(b\*n))\*(c\*x^n)^n^(-1)) - (x\*ExpIntegralEi[((1 + I\*b\*d\*n)\*(a + b\*Log[c\*x^n]))/(b\*n)])/(2\*E^(a/(b\*n))\*(c\*x^n)^n^(-1))

#### Rule 6524

Int[CosIntegral[((a\_.) + Log[(c\_.)\*(x\_)^(n\_.)]\*(b\_.))\*(d\_.)], x\_Symbol] := Simp[x\*CosIntegral[d\*(a + b\*Log[c\*x^n])], x] - Dist[b\*d\*n, Int[Cos[d\*(a + b\*Log[c\*x^n])]/(d\*(a + b\*Log[c\*x^n])], x], x] /; FreeQ[{a, b, c, d, n}, x]

#### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] := Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b\_)\*(v\_) /; FreeQ[b, x]]

#### Rule 4496

Int[Cos[((a\_.) + Log[(c\_.)\*(x\_)^(n\_.)]\*(b\_.))\*(d\_.)]\*(((e\_.) + Log[(g\_.)\*(x\_)^(m\_.)]\*(f\_.))\*(h\_.))^(q\_.), x\_Symbol] := Dist[1/(E^(I\*a\*d)\*(c\*x^n)^(I\*b\*d)\*(2/x^(I\*b\*d\*n))), Int[(h\*(e + f\*Log[g\*x^m]))^q/x^(I\*b\*d\*n), x], x] + Dis

`t[(E^(I*a*d)*(c*x^n)^(I*b*d))/(2*x^(I*b*d*n)), Int[x^(I*b*d*n)*(h*(e + f*Log[g*x^m]))^q, x], x] /; FreeQ[{a, b, c, d, e, f, g, h, m, n, q}, x]`

### Rule 2310

`Int[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))^(p_.)*((d_.)*(x_)^(m_.), x_Symbol] :> Dist[(d*x)^(m + 1)/(d*n*(c*x^n)^((m + 1)/n)), Subst[Int[E^(((m + 1)*x)/n)*(a + b*x)^p, x], x, Log[c*x^n]], x] /; FreeQ[{a, b, c, d, m, n, p}, x]`

### Rule 2178

`Int[(F_)^((g_.)*((e_.) + (f_.)*(x_)))/((c_.) + (d_.)*(x_)), x_Symbol] :> Simp[(F^(g*(e - (c*f)/d))*ExpIntegralEi[(f*g*(c + d*x)*Log[F])/d])/d, x] /; FreeQ[{F, c, d, e, f, g}, x] && !$UseGamma === True`

### Rubi steps

$$\begin{aligned}
 \int \text{Ci}(d(a + b \log(cx^n))) dx &= x \text{Ci}(d(a + b \log(cx^n))) - (bdn) \int \frac{\cos(d(a + b \log(cx^n)))}{d(a + b \log(cx^n))} dx \\
 &= x \text{Ci}(d(a + b \log(cx^n))) - (bn) \int \frac{\cos(d(a + b \log(cx^n)))}{a + b \log(cx^n)} dx \\
 &= x \text{Ci}(d(a + b \log(cx^n))) - \frac{1}{2} (be^{-iad} n x^{ibd} (cx^n)^{-ibd}) \int \frac{x^{-ibd}}{a + b \log(cx^n)} dx - \frac{1}{2} (be^{iad} n x^{-ibd}) \int \frac{x^{-ibd}}{a + b \log(cx^n)} dx \\
 &= x \text{Ci}(d(a + b \log(cx^n))) - \frac{1}{2} (be^{-iad} x (cx^n)^{-ibd - \frac{1-ibd}{n}}) \text{Subst} \left( \int \frac{e^{\frac{(1-ibd)x}{n}}}{a + bx} dx, x, \log(cx^n) \right) \\
 &= x \text{Ci}(d(a + b \log(cx^n))) - \frac{1}{2} e^{-\frac{a}{bn} x} (cx^n)^{-1/n} \text{Ei} \left( \frac{(1-ibd)(a + b \log(cx^n))}{bn} \right) - \frac{1}{2} e^{-\frac{a}{bn} x} (cx^n)^{-1/n} \text{Ei} \left( \frac{(1+ibd)(a + b \log(cx^n))}{bn} \right)
 \end{aligned}$$

**Mathematica [A]** time = 1.65783, size = 98, normalized size = 0.79

$$x \text{CosIntegral}(d(a + b \log(cx^n))) - \frac{1}{2} x e^{-\frac{a}{bn}} (cx^n)^{-1/n} \left( \text{ExpIntegralEi} \left( \frac{(1-ibd)(a + b \log(cx^n))}{bn} \right) + \text{ExpIntegralEi} \left( \frac{(1+ibd)(a + b \log(cx^n))}{bn} \right) \right)$$

Antiderivative was successfully verified.

[In] Integrate[CosIntegral[d\*(a + b\*Log[c\*x^n]), x]

[Out] x\*CosIntegral[d\*(a + b\*Log[c\*x^n])] - (x\*(ExpIntegralEi[((1 - I\*b\*d\*n)\*(a + b\*Log[c\*x^n]))/(b\*n)] + ExpIntegralEi[((1 + I\*b\*d\*n)\*(a + b\*Log[c\*x^n]))/(b\*n)]))

$b \cdot n] ] ) / ( 2 \cdot E^{(a/(b \cdot n))} \cdot (c \cdot x^n)^n \cdot (-1) )$

---

**Maple [F]** time = 0.073, size = 0, normalized size = 0.

$$\int \text{Ci}(d(a + b \ln(cx^n))) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(d\*(a+b\*ln(c\*x^n))),x)

[Out] int(Ci(d\*(a+b\*ln(c\*x^n))),x)

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \text{Ci}((b \log(cx^n) + a)d) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(d\*(a+b\*log(c\*x^n))),x, algorithm="maxima")

[Out] integrate(Ci((b\*log(c\*x^n) + a)\*d), x)

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(\text{Ci}(bd \log(cx^n) + ad), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(d\*(a+b\*log(c\*x^n))),x, algorithm="fricas")

[Out] integral(cos\_integral(b\*d\*log(c\*x^n) + a\*d), x)

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \text{Ci}(d(a + b \log(cx^n))) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(d*(a+b*ln(c*x**n))),x)
```

```
[Out] Integral(Ci(d*(a + b*log(c*x**n))), x)
```

---

**Giac [F(-1)]** time = 0., size = 0, normalized size = 0.

Timed out

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(d*(a+b*log(c*x^n))),x, algorithm="giac")
```

```
[Out] Timed out
```

$$3.103 \quad \int \frac{\text{CosIntegral}(d(a+b \log(cx^n)))}{x} dx$$

**Optimal.** Leaf size=55

$$\frac{(a + b \log(cx^n)) \text{CosIntegral}(d(a + b \log(cx^n)))}{bn} - \frac{\sin(d(a + b \log(cx^n)))}{bdn}$$

[Out] (CosIntegral[d\*(a + b\*Log[c\*x^n])]\*(a + b\*Log[c\*x^n]))/(b\*n) - Sin[d\*(a + b\*Log[c\*x^n])]/(b\*d\*n)

**Rubi [A]** time = 0.0352144, antiderivative size = 55, normalized size of antiderivative = 1., number of steps used = 3, number of rules used = 1, integrand size = 17,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.059$ , Rules used = {6500}

$$\frac{(a + b \log(cx^n)) \text{CosIntegral}(d(a + b \log(cx^n)))}{bn} - \frac{\sin(d(a + b \log(cx^n)))}{bdn}$$

Antiderivative was successfully verified.

[In] Int[CosIntegral[d\*(a + b\*Log[c\*x^n])]/x,x]

[Out] (CosIntegral[d\*(a + b\*Log[c\*x^n])]\*(a + b\*Log[c\*x^n]))/(b\*n) - Sin[d\*(a + b\*Log[c\*x^n])]/(b\*d\*n)

### Rule 6500

Int[CosIntegral[(a\_.) + (b\_.)\*(x\_)], x\_Symbol] :> Simp[((a + b\*x)\*CosIntegral[a + b\*x])/b, x] - Simp[Sin[a + b\*x]/b, x] /; FreeQ[{a, b}, x]

### Rubi steps

$$\begin{aligned} \int \frac{\text{Ci}(d(a + b \log(cx^n)))}{x} dx &= \frac{\text{Subst}\left(\int \text{Ci}(d(a + bx)) dx, x, \log(cx^n)\right)}{n} \\ &= \frac{\text{Subst}\left(\int \text{Ci}(x) dx, x, ad + bd \log(cx^n)\right)}{bdn} \\ &= \frac{\text{Ci}(ad + bd \log(cx^n))(a + b \log(cx^n))}{bn} - \frac{\sin(ad + bd \log(cx^n))}{bdn} \end{aligned}$$



**Mathematica [A]** time = 0.0786387, size = 96, normalized size = 1.75

$$\frac{a \operatorname{CosIntegral}(ad + bd \log(cx^n))}{bn} + \frac{\log(cx^n) \operatorname{CosIntegral}(d(a + b \log(cx^n)))}{n} - \frac{\sin(ad) \cos(bd \log(cx^n))}{bdn} - \frac{\cos(ad) \sin(bd \log(cx^n))}{bdn}$$

Antiderivative was successfully verified.

[In] Integrate[CosIntegral[d\*(a + b\*Log[c\*x^n])]/x,x]

[Out] (a\*CosIntegral[a\*d + b\*d\*Log[c\*x^n])/(b\*n) + (CosIntegral[d\*(a + b\*Log[c\*x^n])]\*Log[c\*x^n])/n - (Cos[b\*d\*Log[c\*x^n])\*Sin[a\*d]/(b\*d\*n) - (Cos[a\*d]\*Sin[b\*d\*Log[c\*x^n])/(b\*d\*n)

**Maple [A]** time = 0.07, size = 73, normalized size = 1.3

$$\frac{\ln(cx^n) \operatorname{Ci}(ad + bd \ln(cx^n))}{n} + \frac{\operatorname{Ci}(ad + bd \ln(cx^n)) a}{bn} - \frac{\sin(ad + bd \ln(cx^n))}{bdn}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(d\*(a+b\*ln(c\*x^n)))/x,x)

[Out] 1/n\*ln(c\*x^n)\*Ci(a\*d+b\*d\*ln(c\*x^n))+1/n/b\*Ci(a\*d+b\*d\*ln(c\*x^n))\*a-1/n/b/d\*sin(a\*d+b\*d\*ln(c\*x^n))

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\operatorname{Ci}((b \log(cx^n) + a)d)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(d\*(a+b\*log(c\*x^n)))/x,x, algorithm="maxima")

[Out] integrate(Ci((b\*log(c\*x^n) + a)\*d)/x, x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}\left(\frac{\operatorname{Ci}(bd \log(cx^n) + ad)}{x}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(d\*(a+b\*log(c\*x^n)))/x,x, algorithm="fricas")

[Out] integral(cos\_integral(b\*d\*log(c\*x^n) + a\*d)/x, x)

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(ad + bd \log(cx^n))}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(d\*(a+b\*ln(c\*x\*\*n)))/x,x)

[Out] Integral(Ci(a\*d + b\*d\*log(c\*x\*\*n))/x, x)

**Giac [A]** time = 1.33635, size = 82, normalized size = 1.49

$$\frac{(bdn \log(x) + bd \log(c) + ad) \text{Ci}(bdn \log(x) + bd \log(c) + ad) - \sin(bdn \log(x) + bd \log(c) + ad)}{bdn}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(d\*(a+b\*log(c\*x^n)))/x,x, algorithm="giac")

[Out] ((b\*d\*n\*log(x) + b\*d\*log(c) + a\*d)\*cos\_integral(b\*d\*n\*log(x) + b\*d\*log(c) + a\*d) - sin(b\*d\*n\*log(x) + b\*d\*log(c) + a\*d))/(b\*d\*n)

### 3.104 $\int \frac{\text{CosIntegral}(d(a+b \log(cx^n)))}{x^2} dx$

**Optimal.** Leaf size=127

$$-\frac{\text{CosIntegral}(d(a+b \log(cx^n)))}{x} + \frac{e^{\frac{a}{bn}} (cx^n)^{\frac{1}{n}} \text{ExpIntegralEi}\left(-\frac{(1-ibdn)(a+b \log(cx^n))}{bn}\right)}{2x} + \frac{e^{\frac{a}{bn}} (cx^n)^{\frac{1}{n}} \text{ExpIntegralEi}\left(-\frac{(1+ibdn)(a+b \log(cx^n))}{bn}\right)}{2x}$$

```
[Out] -(CosIntegral[d*(a + b*Log[c*x^n]])/x) + (E^(a/(b*n))*(c*x^n)^n^(-1)*ExpIntegralEi[-(((1 - I*b*d*n)*(a + b*Log[c*x^n]))/(b*n))]/(2*x) + (E^(a/(b*n))*(c*x^n)^n^(-1)*ExpIntegralEi[-(((1 + I*b*d*n)*(a + b*Log[c*x^n]))/(b*n))]/(2*x))
```

**Rubi [A]** time = 0.247361, antiderivative size = 127, normalized size of antiderivative = 1., number of steps used = 7, number of rules used = 5, integrand size = 17,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.294$ , Rules used = {6527, 12, 4498, 2310, 2178}

$$-\frac{\text{CosIntegral}(d(a+b \log(cx^n)))}{x} + \frac{e^{\frac{a}{bn}} (cx^n)^{\frac{1}{n}} \text{Ei}\left(-\frac{(1-ibdn)(a+b \log(cx^n))}{bn}\right)}{2x} + \frac{e^{\frac{a}{bn}} (cx^n)^{\frac{1}{n}} \text{Ei}\left(-\frac{(1+ibdn)(a+b \log(cx^n))}{bn}\right)}{2x}$$

Antiderivative was successfully verified.

```
[In] Int[CosIntegral[d*(a + b*Log[c*x^n])/x^2,x]
```

```
[Out] -(CosIntegral[d*(a + b*Log[c*x^n]])/x) + (E^(a/(b*n))*(c*x^n)^n^(-1)*ExpIntegralEi[-(((1 - I*b*d*n)*(a + b*Log[c*x^n]))/(b*n))]/(2*x) + (E^(a/(b*n))*(c*x^n)^n^(-1)*ExpIntegralEi[-(((1 + I*b*d*n)*(a + b*Log[c*x^n]))/(b*n))]/(2*x))
```

#### Rule 6527

```
Int[CosIntegral[(a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.)]*(d_.)]*((e_.)*(x_)^(m_.), x_Symbol] :> Simp[((e*x)^(m + 1)*CosIntegral[d*(a + b*Log[c*x^n])]/(e*(m + 1)), x] - Dist[(b*d*n)/(m + 1), Int[((e*x)^m*Cos[d*(a + b*Log[c*x^n])])]/(d*(a + b*Log[c*x^n])), x], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && NeQ[m, -1]
```

#### Rule 12

```
Int[(a_)*(u_), x_Symbol] :> Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b_)*(v_) /; FreeQ[b, x]]
```

Rule 4498

```
Int[Cos[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]*(((e_.) + Log[(g_.)*(x_)^(m_.)]*(f_.))*(h_.))^(q_.)*((i_.)*(x_)^(r_.), x_Symbol] := Dist[(i*x)^(r)/(E^(I*a*d)*(c*x^n)^(I*b*d)*(2*x^(r - I*b*d*n))), Int[x^(r - I*b*d*n)*(h*(e + f*Log[g*x^m]))^q, x], x] + Dist[(E^(I*a*d)*(i*x)^(r)*(c*x^n)^(I*b*d))/(2*x^(r + I*b*d*n)), Int[x^(r + I*b*d*n)*(h*(e + f*Log[g*x^m]))^q, x], x] /; FreeQ[{a, b, c, d, e, f, g, h, i, m, n, q, r}, x]
```

Rule 2310

```
Int[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))^(p_.)*((d_.)*(x_)^(m_.), x_Symbol] := Dist[(d*x)^(m + 1)/(d*n*(c*x^n)^((m + 1)/n)), Subst[Int[E^(((m + 1)*x)/n)*(a + b*x)^p, x], x, Log[c*x^n]], x] /; FreeQ[{a, b, c, d, m, n, p}, x]
```

Rule 2178

```
Int[(F_)^((g_.)*((e_.) + (f_.)*(x_)))/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[(F^(g*(e - (c*f)/d))*ExpIntegralEi[(f*g*(c + d*x)*Log[F])/d])/d, x] /; FreeQ[{F, c, d, e, f, g}, x] && !$UseGamma == True
```

Rubi steps

$$\begin{aligned}
\int \frac{\text{Ci}(d(a + b \log(cx^n)))}{x^2} dx &= -\frac{\text{Ci}(d(a + b \log(cx^n)))}{x} + (bdn) \int \frac{\cos(d(a + b \log(cx^n)))}{dx^2(a + b \log(cx^n))} dx \\
&= -\frac{\text{Ci}(d(a + b \log(cx^n)))}{x} + (bn) \int \frac{\cos(d(a + b \log(cx^n)))}{x^2(a + b \log(cx^n))} dx \\
&= -\frac{\text{Ci}(d(a + b \log(cx^n)))}{x} + \frac{1}{2} \left( be^{-iad} n x^{ibdn} (cx^n)^{-ibd} \int \frac{x^{-2-ibdn}}{a + b \log(cx^n)} dx + \frac{1}{2} \left( be^{iad} n x^{-ibd} \right. \right. \\
&\quad \left. \left. \frac{\left( be^{-iad} (cx^n)^{-ibd - \frac{-1-ibdn}{n}} \right) \text{Subst} \left( \int \frac{e^{\frac{(-1-ibdn)x}{a+bx}}}{a+bx} dx, x, \log(cx^n) \right)}{2x} \right) \right) \\
&= -\frac{\text{Ci}(d(a + b \log(cx^n)))}{x} + \frac{e^{\frac{a}{bn}} (cx^n)^{\frac{1}{n}} \text{Ei} \left( -\frac{(1-ibdn)(a+b \log(cx^n))}{bn} \right)}{2x} + \frac{e^{\frac{a}{bn}} (cx^n)^{\frac{1}{n}} \text{Ei} \left( -\frac{(1+ibdn)(a+b \log(cx^n))}{bn} \right)}{2x}
\end{aligned}$$

**Mathematica [A]** time = 1.701, size = 102, normalized size = 0.8

$$\frac{-2\text{CosIntegral}(d(a + b \log(cx^n))) + e^{\frac{a}{bn}} (cx^n)^{\frac{1}{n}} \left( \text{ExpIntegralEi} \left( -\frac{i(bdn-i)(a+b \log(cx^n))}{bn} \right) + \text{ExpIntegralEi} \left( \frac{i(bdn+i)(a+b \log(cx^n))}{bn} \right) \right)}{2x}$$

Antiderivative was successfully verified.

[In] Integrate[CosIntegral[d\*(a + b\*Log[c\*x^n])/x^2,x]

[Out]  $(-2*\text{CosIntegral}[d*(a + b*\text{Log}[c*x^n])] + E^{(a/(b*n))}*(c*x^n)^n^{(-1)}*(\text{ExpIntegralEi}[((-I)*(-I + b*d*n)*(a + b*\text{Log}[c*x^n]))/(b*n)] + \text{ExpIntegralEi}[(I*(I + b*d*n)*(a + b*\text{Log}[c*x^n]))/(b*n)]))/(2*x)$

**Maple [F]** time = 0.096, size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(d(a + b \ln(cx^n)))}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(d\*(a+b\*ln(c\*x^n)))/x^2,x)

[Out] int(Ci(d\*(a+b\*ln(c\*x^n)))/x^2,x)

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}((b \log(cx^n) + a)d)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(d\*(a+b\*log(c\*x^n)))/x^2,x, algorithm="maxima")

[Out] integrate(Ci((b\*log(c\*x^n) + a)\*d)/x^2, x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Ci}(bd \log(cx^n) + ad)}{x^2}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(d\*(a+b\*log(c\*x^n)))/x^2,x, algorithm="fricas")

[Out] `integral(cos_integral(b*d*log(c*x^n) + a*d)/x^2, x)`

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(ad + bd \log(cx^n))}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Ci(d*(a+b*ln(c*x**n)))/x**2,x)`

[Out] `Integral(Ci(a*d + b*d*log(c*x**n))/x**2, x)`

---

**Giac [F(-1)]** time = 0., size = 0, normalized size = 0.

Timed out

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Ci(d*(a+b*log(c*x^n)))/x^2,x, algorithm="giac")`

[Out] Timed out

### 3.105 $\int \frac{\text{CosIntegral}(d(a+b \log(cx^n)))}{x^3} dx$

**Optimal.** Leaf size=135

$$-\frac{\text{CosIntegral}(d(a+b \log(cx^n)))}{2x^2} + \frac{e^{\frac{2a}{bn}}(cx^n)^{2/n} \text{ExpIntegralEi}\left(-\frac{(2-ibdn)(a+b \log(cx^n))}{bn}\right)}{4x^2} + \frac{e^{\frac{2a}{bn}}(cx^n)^{2/n} \text{ExpIntegralEi}\left(-\frac{(2+ibdn)(a+b \log(cx^n))}{bn}\right)}{4x^2}$$

```
[Out] -CosIntegral[d*(a + b*Log[c*x^n])]/(2*x^2) + (E^((2*a)/(b*n))*(c*x^n)^(2/n)
*ExpIntegralEi[-(((2 - I*b*d*n)*(a + b*Log[c*x^n]))/(b*n))])/ (4*x^2) + (E^
(2*a)/(b*n))*(c*x^n)^(2/n)*ExpIntegralEi[-(((2 + I*b*d*n)*(a + b*Log[c*x^n]
)))/(b*n))]/(4*x^2)
```

**Rubi [A]** time = 0.238982, antiderivative size = 135, normalized size of antiderivative = 1., number of steps used = 7, number of rules used = 5, integrand size = 17,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.294$ , Rules used = {6527, 12, 4498, 2310, 2178}

$$-\frac{\text{CosIntegral}(d(a+b \log(cx^n)))}{2x^2} + \frac{e^{\frac{2a}{bn}}(cx^n)^{2/n} \text{Ei}\left(-\frac{(2-ibdn)(a+b \log(cx^n))}{bn}\right)}{4x^2} + \frac{e^{\frac{2a}{bn}}(cx^n)^{2/n} \text{Ei}\left(-\frac{(ibdn+2)(a+b \log(cx^n))}{bn}\right)}{4x^2}$$

Antiderivative was successfully verified.

```
[In] Int[CosIntegral[d*(a + b*Log[c*x^n])]/x^3,x]
```

```
[Out] -CosIntegral[d*(a + b*Log[c*x^n])]/(2*x^2) + (E^((2*a)/(b*n))*(c*x^n)^(2/n)
*ExpIntegralEi[-(((2 - I*b*d*n)*(a + b*Log[c*x^n]))/(b*n))])/ (4*x^2) + (E^
(2*a)/(b*n))*(c*x^n)^(2/n)*ExpIntegralEi[-(((2 + I*b*d*n)*(a + b*Log[c*x^n]
)))/(b*n))]/(4*x^2)
```

#### Rule 6527

```
Int[CosIntegral[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]*(e_.)*(x_)^(
m_.), x_Symbol] := Simp[((e*x)^(m + 1)*CosIntegral[d*(a + b*Log[c*x^n])])/
(e*(m + 1)), x] - Dist[(b*d*n)/(m + 1), Int[((e*x)^m*Cos[d*(a + b*Log[c*x^n]
))]/(d*(a + b*Log[c*x^n])), x], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && Ne
Q[m, -1]
```

#### Rule 12

```
Int[(a_)*(u_), x_Symbol] := Dist[a, Int[u, x], x] /; FreeQ[a, x] && !Match
Q[u, (b_)*(v_) /; FreeQ[b, x]]
```

Rule 4498

```
Int[Cos[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))*(d_.)]*(((e_.) + Log[(g_.)*(x_)^(m_.)]*(f_.))*(h_.))^(q_.)*((i_.)*(x_)^(r_.), x_Symbol] := Dist[(i*x)^(r)/(E^(I*a*d)*(c*x^n)^(I*b*d)*(2*x^(r - I*b*d*n))), Int[x^(r - I*b*d*n)*(h*(e + f*Log[g*x^m]))^q, x], x] + Dist[(E^(I*a*d)*(i*x)^(r)*(c*x^n)^(I*b*d))/(2*x^(r + I*b*d*n)), Int[x^(r + I*b*d*n)*(h*(e + f*Log[g*x^m]))^q, x], x] /; FreeQ[{a, b, c, d, e, f, g, h, i, m, n, q, r}, x]
```

Rule 2310

```
Int[((a_.) + Log[(c_.)*(x_)^(n_.)]*(b_.))^(p_.)*((d_.)*(x_)^(m_.), x_Symbol] := Dist[(d*x)^(m + 1)/(d*n*(c*x^n)^((m + 1)/n)), Subst[Int[E^(((m + 1)*x)/n)*(a + b*x)^p, x], x, Log[c*x^n]], x] /; FreeQ[{a, b, c, d, m, n, p}, x]
```

Rule 2178

```
Int[(F_)^((g_.)*((e_.) + (f_.)*(x_)))/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[(F^(g*(e - (c*f)/d))*ExpIntegralEi[(f*g*(c + d*x)*Log[F])/d])/d, x] /; FreeQ[{F, c, d, e, f, g}, x] && !$UseGamma == True
```

Rubi steps

$$\begin{aligned}
 \int \frac{\text{Ci}(d(a + b \log(cx^n)))}{x^3} dx &= -\frac{\text{Ci}(d(a + b \log(cx^n)))}{2x^2} + \frac{1}{2}(bdn) \int \frac{\cos(d(a + b \log(cx^n)))}{dx^3(a + b \log(cx^n))} dx \\
 &= -\frac{\text{Ci}(d(a + b \log(cx^n)))}{2x^2} + \frac{1}{2}(bn) \int \frac{\cos(d(a + b \log(cx^n)))}{x^3(a + b \log(cx^n))} dx \\
 &= -\frac{\text{Ci}(d(a + b \log(cx^n)))}{2x^2} + \frac{1}{4} \left( be^{-iad} n x^{ibdn} (cx^n)^{-ibd} \right) \int \frac{x^{-3-ibdn}}{a + b \log(cx^n)} dx + \frac{1}{4} \left( be^{iad} n x^{-ibdn} \right) \int \frac{x^{-3-ibdn}}{a + b \log(cx^n)} dx \\
 &= -\frac{\text{Ci}(d(a + b \log(cx^n)))}{2x^2} + \frac{\left( be^{-iad} (cx^n)^{-ibd - \frac{-2-ibdn}{n}} \right) \text{Subst} \left( \int \frac{e^{\frac{(-2-ibdn)x}{a+bx}}}{a+bx} dx, x, \log(cx^n) \right)}{4x^2} + \frac{\left( be^{iad} (cx^n)^{-ibd - \frac{-2-ibdn}{n}} \right) \text{Subst} \left( \int \frac{e^{\frac{(-2-ibdn)x}{a+bx}}}{a+bx} dx, x, \log(cx^n) \right)}{4x^2} \\
 &= -\frac{\text{Ci}(d(a + b \log(cx^n)))}{2x^2} + \frac{e^{\frac{2a}{bn}} (cx^n)^{2/n} \text{Ei} \left( -\frac{(2-ibdn)(a+b \log(cx^n))}{bn} \right)}{4x^2} + \frac{e^{\frac{2a}{bn}} (cx^n)^{2/n} \text{Ei} \left( -\frac{(2+ibdn)(a+b \log(cx^n))}{bn} \right)}{4x^2}
 \end{aligned}$$

**Mathematica [A]** time = 1.71334, size = 105, normalized size = 0.78

$$\frac{-2\text{CosIntegral}(d(a + b \log(cx^n))) + e^{\frac{2a}{bn}} (cx^n)^{2/n} \left( \text{ExpIntegralEi} \left( -\frac{i(bdn-2i)(a+b \log(cx^n))}{bn} \right) + \text{ExpIntegralEi} \left( \frac{i(bdn+2i)(a+b \log(cx^n))}{bn} \right) \right)}{4x^2}$$

Antiderivative was successfully verified.



[In] Integrate[CosIntegral[d\*(a + b\*Log[c\*x^n])/x^3,x]

[Out]  $(-2*\text{CosIntegral}[d*(a + b*\text{Log}[c*x^n])] + E^{((2*a)/(b*n))*(c*x^n)^{(2/n)}}*(\text{ExpIntegralEi}[((-I)*(-2*I + b*d*n)*(a + b*\text{Log}[c*x^n]))/(b*n)] + \text{ExpIntegralEi}[ (I*(2*I + b*d*n)*(a + b*\text{Log}[c*x^n]))/(b*n)]))/ (4*x^2)$

**Maple [F]** time = 0.097, size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(d(a + b \ln(cx^n)))}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(d\*(a+b\*ln(c\*x^n)))/x^3,x)

[Out] int(Ci(d\*(a+b\*ln(c\*x^n)))/x^3,x)

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}((b \log(cx^n) + a)d)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(d\*(a+b\*log(c\*x^n)))/x^3,x, algorithm="maxima")

[Out] integrate(Ci((b\*log(c\*x^n) + a)\*d)/x^3, x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Ci}(bd \log(cx^n) + ad)}{x^3}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(d\*(a+b\*log(c\*x^n)))/x^3,x, algorithm="fricas")

[Out] `integral(cos_integral(b*d*log(c*x^n) + a*d)/x^3, x)`

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(ad + bd \log(cx^n))}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Ci(d*(a+b*ln(c*x**n)))/x**3,x)`

[Out] `Integral(Ci(a*d + b*d*log(c*x**n))/x**3, x)`

---

**Giac [F(-1)]** time = 0., size = 0, normalized size = 0.

Timed out

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Ci(d*(a+b*log(c*x^n)))/x^3,x, algorithm="giac")`

[Out] Timed out

### 3.106 $\int (ex)^m \text{CosIntegral}(d(a + b \log(cx^n))) dx$

**Optimal.** Leaf size=172

$$\frac{(ex)^{m+1} \text{CosIntegral}(d(a + b \log(cx^n)))}{e(m+1)} - \frac{x(ex)^m e^{-\frac{a(m+1)}{bn}} (cx^n)^{-\frac{m+1}{n}} \text{ExpIntegralEi}\left(\frac{(-ibdn+m+1)(a+b \log(cx^n))}{bn}\right)}{2(m+1)} - \frac{x(ex)^m e^{-\frac{a(m+1)}{bn}} (cx^n)^{-\frac{m+1}{n}} \text{ExpIntegralEi}\left(\frac{(-ibdn+m+1)(a+b \log(cx^n))}{bn}\right)}{2(m+1)}$$

[Out]  $((e*x)^{(1+m)}*\text{CosIntegral}[d*(a + b*\text{Log}[c*x^n])])/(e*(1+m)) - (x*(e*x)^m*\text{ExpIntegralEi}[((1+m - I*b*d*n)*(a + b*\text{Log}[c*x^n]))/(b*n)])/ (2*E^{((a*(1+m))/(b*n))* (1+m)*(c*x^n)^{((1+m)/n)}} - (x*(e*x)^m*\text{ExpIntegralEi}[((1+m + I*b*d*n)*(a + b*\text{Log}[c*x^n]))/(b*n)])/ (2*E^{((a*(1+m))/(b*n))* (1+m)*(c*x^n)^{((1+m)/n)}})$

**Rubi [A]** time = 0.294702, antiderivative size = 172, normalized size of antiderivative = 1., number of steps used = 7, number of rules used = 5, integrand size = 19,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.263$ , Rules used = {6527, 12, 4498, 2310, 2178}

$$\frac{(ex)^{m+1} \text{CosIntegral}(d(a + b \log(cx^n)))}{e(m+1)} - \frac{x(ex)^m e^{-\frac{a(m+1)}{bn}} (cx^n)^{-\frac{m+1}{n}} \text{Ei}\left(\frac{(m-ibdn+1)(a+b \log(cx^n))}{bn}\right)}{2(m+1)} - \frac{x(ex)^m e^{-\frac{a(m+1)}{bn}} (cx^n)^{-\frac{m+1}{n}} \text{Ei}\left(\frac{(m-ibdn+1)(a+b \log(cx^n))}{bn}\right)}{2(m+1)}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[(e*x)^m*\text{CosIntegral}[d*(a + b*\text{Log}[c*x^n])], x]$

[Out]  $((e*x)^{(1+m)}*\text{CosIntegral}[d*(a + b*\text{Log}[c*x^n])])/(e*(1+m)) - (x*(e*x)^m*\text{ExpIntegralEi}[((1+m - I*b*d*n)*(a + b*\text{Log}[c*x^n]))/(b*n)])/ (2*E^{((a*(1+m))/(b*n))* (1+m)*(c*x^n)^{((1+m)/n)}} - (x*(e*x)^m*\text{ExpIntegralEi}[((1+m + I*b*d*n)*(a + b*\text{Log}[c*x^n]))/(b*n)])/ (2*E^{((a*(1+m))/(b*n))* (1+m)*(c*x^n)^{((1+m)/n)}})$

#### Rule 6527

$\text{Int}[\text{CosIntegral}[(a_.) + \text{Log}[(c_.)*(x_.)^{(n_.)}]*(b_.)]*(d_.)]*(e_.)*(x_.)^{(m_.)}, x\_Symbol] :> \text{Simp}[(e*x)^{(m+1)}*\text{CosIntegral}[d*(a + b*\text{Log}[c*x^n])]/(e*(m+1)), x] - \text{Dist}[(b*d*n)/(m+1), \text{Int}[(e*x)^m*\text{Cos}[d*(a + b*\text{Log}[c*x^n])]]/(d*(a + b*\text{Log}[c*x^n])), x], x] /; \text{FreeQ}\{a, b, c, d, e, m, n\}, x \&\& \text{Ne}\{m, -1\}$

#### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] := Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b\_)\*(v\_)] /; FreeQ[b, x]

### Rule 4498

Int[Cos[((a\_.) + Log[(c\_.)\*(x\_)^(n\_.)]\*(b\_.))\*(d\_.)]\*(((e\_.) + Log[(g\_.)\*(x\_)^(m\_.)]\*(f\_.))\*(h\_.))^(q\_.)\*((i\_.)\*(x\_)^(r\_.), x\_Symbol] := Dist[(i\*x)^r/(E^(I\*a\*d)\*(c\*x^n)^(I\*b\*d)\*(2\*x^(r - I\*b\*d\*n))), Int[x^(r - I\*b\*d\*n)\*(h\*(e + f\*Log[g\*x^m]))^q, x], x] + Dist[(E^(I\*a\*d)\*(i\*x)^r\*(c\*x^n)^(I\*b\*d))/(2\*x^(r + I\*b\*d\*n)), Int[x^(r + I\*b\*d\*n)\*(h\*(e + f\*Log[g\*x^m]))^q, x], x] /; FreeQ[{a, b, c, d, e, f, g, h, i, m, n, q, r}, x]

### Rule 2310

Int[((a\_.) + Log[(c\_.)\*(x\_)^(n\_.)]\*(b\_.))^(p\_)\*((d\_.)\*(x\_)^(m\_.), x\_Symbol] := Dist[(d\*x)^(m + 1)/(d\*n\*(c\*x^n)^(m + 1)/n), Subst[Int[E^((m + 1)\*x/n)\*(a + b\*x)^p, x], x, Log[c\*x^n]], x] /; FreeQ[{a, b, c, d, m, n, p}, x]

### Rule 2178

Int[(F\_)^((g\_.)\*((e\_.) + (f\_.)\*(x\_)))/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] := Simp[(F^(g\*(e - (c\*f)/d))\*ExpIntegralEi[(f\*g\*(c + d\*x)\*Log[F])/d])/d, x] /; FreeQ[{F, c, d, e, f, g}, x] && !\$UseGamma == True

### Rubi steps

$$\begin{aligned}
 \int (ex)^m \operatorname{Ci}(d(a + b \log(cx^n))) dx &= \frac{(ex)^{1+m} \operatorname{Ci}(d(a + b \log(cx^n)))}{e(1+m)} - \frac{(bdn) \int \frac{(ex)^m \cos(d(a+b \log(cx^n)))}{d(a+b \log(cx^n))} dx}{1+m} \\
 &= \frac{(ex)^{1+m} \operatorname{Ci}(d(a + b \log(cx^n)))}{e(1+m)} - \frac{(bn) \int \frac{(ex)^m \cos(d(a+b \log(cx^n)))}{a+b \log(cx^n)} dx}{1+m} \\
 &= \frac{(ex)^{1+m} \operatorname{Ci}(d(a + b \log(cx^n)))}{e(1+m)} - \frac{(be^{-iad} n x^{-m+ibdn} (ex)^m (cx^n)^{-ibdn}) \int \frac{x^{m-ibdn}}{a+b \log(cx^n)} dx}{2(1+m)} \\
 &= \frac{(ex)^{1+m} \operatorname{Ci}(d(a + b \log(cx^n)))}{e(1+m)} - \frac{(be^{-iad} x (ex)^m (cx^n)^{-ibdn - \frac{1+m-ibdn}{n}}) \operatorname{Subst}\left(\int \frac{e^{\frac{(1+m-ibdn)x}{a+bx}}}{a+bx} dx\right)}{2(1+m)} \\
 &= \frac{(ex)^{1+m} \operatorname{Ci}(d(a + b \log(cx^n)))}{e(1+m)} - \frac{e^{-\frac{a(1+m)}{bn}} x (ex)^m (cx^n)^{-\frac{1+m}{n}} \operatorname{Ei}\left(\frac{(1+m-ibdn)(a+b \log(cx^n))}{bn}\right)}{2(1+m)}
 \end{aligned}$$

**Mathematica [A]** time = 3.04162, size = 124, normalized size = 0.72

$$\frac{(ex)^m \left( 2x \operatorname{CosIntegral}(d(a + b \log(cx^n))) - x^{-m} \exp\left(-\frac{(m+1)(a+b \log(cx^n)) - bn \log(x)}{bn}\right) \right) \left( \operatorname{ExpIntegralEi}\left(\frac{(-ibdn+m+1)(a+b \log(cx^n))}{bn}\right) \right)}{2(m+1)}$$

Antiderivative was successfully verified.

[In] Integrate[(e\*x)^m\*CosIntegral[d\*(a + b\*Log[c\*x^n])],x]

[Out] ((e\*x)^m\*(2\*x\*CosIntegral[d\*(a + b\*Log[c\*x^n])]) - (ExpIntegralEi[((1 + m - I\*b\*d\*n)\*(a + b\*Log[c\*x^n])]/(b\*n)] + ExpIntegralEi[((1 + m + I\*b\*d\*n)\*(a + b\*Log[c\*x^n])]/(b\*n))]/(E^(((1 + m)\*(a - b\*n\*Log[x] + b\*Log[c\*x^n]))/(b\*n))\*x^m)))/(2\*(1 + m))

**Maple [F]** time = 0.082, size = 0, normalized size = 0.

$$\int (ex)^m \operatorname{Ci}(d(a + b \ln(cx^n))) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int((e\*x)^m\*Ci(d\*(a+b\*ln(c\*x^n))),x)

[Out] int((e\*x)^m\*Ci(d\*(a+b\*ln(c\*x^n))),x)

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int (ex)^m \operatorname{Ci}((b \log(cx^n) + a)d) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate((e\*x)^m\*Ci(d\*(a+b\*log(c\*x^n))),x, algorithm="maxima")

[Out] integrate((e\*x)^m\*Ci((b\*log(c\*x^n) + a)\*d), x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left((ex)^m \text{Ci}(bd \log(cx^n) + ad), x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate((e\*x)^m\*cos\_integral(b\*d\*log(c\*x^n) + a\*d), x, algorithm="fricas")

[Out] integral((e\*x)^m\*cos\_integral(b\*d\*log(c\*x^n) + a\*d), x)

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int (ex)^m \text{Ci}(ad + bd \log(cx^n)) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate((e\*x)\*\*m\*cos\_integral(b\*d\*log(c\*x\*\*n) + a\*d), x)

[Out] Integral((e\*x)\*\*m\*cos\_integral(b\*d\*log(c\*x\*\*n) + a\*d), x)

**Giac [F(-1)]** time = 0., size = 0, normalized size = 0.

Timed out

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate((e\*x)^m\*cos\_integral(b\*d\*log(c\*x^n) + a\*d), x, algorithm="giac")

[Out] Timed out

$$3.107 \quad \int \frac{\text{CosIntegral}(bx) \sin(bx)}{x^3} dx$$

**Optimal.** Leaf size=102

$$-\frac{1}{2}b^2 \text{CannotIntegrate}\left(\frac{\text{CosIntegral}(bx) \sin(bx)}{x}, x\right) - b^2 \text{Si}(2bx) - \frac{\text{CosIntegral}(bx) \sin(bx)}{2x^2} - \frac{b \text{CosIntegral}(bx) \cos(bx)}{2x}$$

[Out]  $-(b^2 \text{CannotIntegrate}[(\text{CosIntegral}[b*x]*\text{Sin}[b*x])/x, x])/2 - (b*\text{Cos}[b*x]^2)/(2*x) - (b*\text{Cos}[2*b*x])/(4*x) - (b*\text{Cos}[b*x]*\text{CosIntegral}[b*x])/(2*x) - (\text{CosIntegral}[b*x]*\text{Sin}[b*x])/(2*x^2) - \text{Sin}[2*b*x]/(8*x^2) - b^2*\text{SinIntegral}[2*b*x]$

**Rubi [A]** time = 0.250831, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\text{CosIntegral}(bx) \sin(bx)}{x^3} dx$$

Verification is Not applicable to the result.

[In] Int[(CosIntegral[b\*x]\*Sin[b\*x])/x^3, x]

[Out]  $-(b*\text{Cos}[b*x]^2)/(2*x) - (b*\text{Cos}[2*b*x])/(4*x) - (b*\text{Cos}[b*x]*\text{CosIntegral}[b*x])/(2*x) - (\text{CosIntegral}[b*x]*\text{Sin}[b*x])/(2*x^2) - \text{Sin}[2*b*x]/(8*x^2) - b^2*\text{SinIntegral}[2*b*x] - (b^2*\text{Defer[Int]}[(\text{CosIntegral}[b*x]*\text{Sin}[b*x])/x, x])/2$

Rubi steps

$$\begin{aligned}
\int \frac{\text{Ci}(bx) \sin(bx)}{x^3} dx &= -\frac{\text{Ci}(bx) \sin(bx)}{2x^2} + \frac{1}{2}b \int \frac{\cos(bx)\text{Ci}(bx)}{x^2} dx + \frac{1}{2}b \int \frac{\cos(bx) \sin(bx)}{bx^3} dx \\
&= -\frac{b \cos(bx)\text{Ci}(bx)}{2x} - \frac{\text{Ci}(bx) \sin(bx)}{2x^2} + \frac{1}{2} \int \frac{\cos(bx) \sin(bx)}{x^3} dx + \frac{1}{2}b^2 \int \frac{\cos^2(bx)}{bx^2} dx - \frac{1}{2}b^2 \int \frac{\text{Ci}(bx) \sin(bx)}{x} dx \\
&= -\frac{b \cos(bx)\text{Ci}(bx)}{2x} - \frac{\text{Ci}(bx) \sin(bx)}{2x^2} + \frac{1}{2} \int \frac{\sin(2bx)}{2x^3} dx + \frac{1}{2}b \int \frac{\cos^2(bx)}{x^2} dx - \frac{1}{2}b^2 \int \frac{\text{Ci}(bx) \sin(bx)}{x} dx \\
&= -\frac{b \cos^2(bx)}{2x} - \frac{b \cos(bx)\text{Ci}(bx)}{2x} - \frac{\text{Ci}(bx) \sin(bx)}{2x^2} + \frac{1}{4} \int \frac{\sin(2bx)}{x^3} dx - \frac{1}{2}b^2 \int \frac{\text{Ci}(bx) \sin(bx)}{x} dx \\
&= -\frac{b \cos^2(bx)}{2x} - \frac{b \cos(bx)\text{Ci}(bx)}{2x} - \frac{\text{Ci}(bx) \sin(bx)}{2x^2} - \frac{\sin(2bx)}{8x^2} + \frac{1}{4}b \int \frac{\cos(2bx)}{x^2} dx - \frac{1}{2}b^2 \int \frac{\text{Ci}(bx) \sin(bx)}{x} dx \\
&= -\frac{b \cos^2(bx)}{2x} - \frac{b \cos(2bx)}{4x} - \frac{b \cos(bx)\text{Ci}(bx)}{2x} - \frac{\text{Ci}(bx) \sin(bx)}{2x^2} - \frac{\sin(2bx)}{8x^2} - \frac{1}{2}b^2 \text{Si}(2bx) - \frac{1}{2}b^2 \int \frac{\text{Ci}(bx) \sin(bx)}{x} dx \\
&= -\frac{b \cos^2(bx)}{2x} - \frac{b \cos(2bx)}{4x} - \frac{b \cos(bx)\text{Ci}(bx)}{2x} - \frac{\text{Ci}(bx) \sin(bx)}{2x^2} - \frac{\sin(2bx)}{8x^2} - b^2 \text{Si}(2bx) - \frac{1}{2}b^2 \int \frac{\text{Ci}(bx) \sin(bx)}{x} dx
\end{aligned}$$

**Mathematica [A]** time = 1.46596, size = 0, normalized size = 0.

$$\int \frac{\text{CosIntegral}(bx) \sin(bx)}{x^3} dx$$

Verification is Not applicable to the result.

[In] Integrate[(CosIntegral[b\*x]\*Sin[b\*x])/x^3,x]

[Out] Integrate[(CosIntegral[b\*x]\*Sin[b\*x])/x^3, x]

**Maple [A]** time = 0.056, size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx) \sin(bx)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(b\*x)\*sin(b\*x)/x^3,x)

[Out] int(Ci(b\*x)\*sin(b\*x)/x^3,x)



**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx) \sin(bx)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)\*sin(b\*x)/x^3,x, algorithm="maxima")

[Out] integrate(Ci(b\*x)\*sin(b\*x)/x^3, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Ci}(bx) \sin(bx)}{x^3}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)\*sin(b\*x)/x^3,x, algorithm="fricas")

[Out] integral(cos\_integral(b\*x)\*sin(b\*x)/x^3, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\sin(bx) \text{Ci}(bx)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)\*sin(b\*x)/x\*\*3,x)

[Out] Integral(sin(b\*x)\*Ci(b\*x)/x\*\*3, x)

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx) \sin(bx)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x)*sin(b*x)/x^3,x, algorithm="giac")
```

```
[Out] integrate(Ci(b*x)*sin(b*x)/x^3, x)
```

$$3.108 \quad \int \frac{\text{CosIntegral}(bx) \sin(bx)}{x^2} dx$$

**Optimal.** Leaf size=44

$$\frac{1}{2}b\text{CosIntegral}(bx)^2 + b\text{CosIntegral}(2bx) - \frac{\text{CosIntegral}(bx) \sin(bx)}{x} - \frac{\sin(2bx)}{2x}$$

[Out] (b\*CosIntegral[b\*x]^2)/2 + b\*CosIntegral[2\*b\*x] - (CosIntegral[b\*x]\*Sin[b\*x])/x - Sin[2\*b\*x]/(2\*x)

**Rubi [A]** time = 0.102781, antiderivative size = 44, normalized size of antiderivative = 1., number of steps used = 7, number of rules used = 6, integrand size = 12,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.5$ , Rules used = {6522, 6686, 12, 4406, 3297, 3302}

$$\frac{1}{2}b\text{CosIntegral}(bx)^2 + b\text{CosIntegral}(2bx) - \frac{\text{CosIntegral}(bx) \sin(bx)}{x} - \frac{\sin(2bx)}{2x}$$

Antiderivative was successfully verified.

[In] Int[(CosIntegral[b\*x]\*Sin[b\*x])/x^2,x]

[Out] (b\*CosIntegral[b\*x]^2)/2 + b\*CosIntegral[2\*b\*x] - (CosIntegral[b\*x]\*Sin[b\*x])/x - Sin[2\*b\*x]/(2\*x)

### Rule 6522

Int[CosIntegral[(c\_.) + (d\_.)\*(x\_.)]\*((e\_.) + (f\_.)\*(x\_.))^(m\_)\*Sin[(a\_.) + (b\_.)\*(x\_.)], x\_Symbol] := Simp[((e + f\*x)^(m + 1)\*Sin[a + b\*x]\*CosIntegral[c + d\*x])/(f\*(m + 1)), x] + (-Dist[b/(f\*(m + 1)), Int[(e + f\*x)^(m + 1)\*Cos[a + b\*x]\*CosIntegral[c + d\*x], x], x] - Dist[d/(f\*(m + 1)), Int[((e + f\*x)^(m + 1)\*Sin[a + b\*x]\*Cos[c + d\*x])/(c + d\*x), x], x) /; FreeQ[{a, b, c, d, e, f}, x] && ILtQ[m, -1]

### Rule 6686

Int[(u\_)\*(y\_)^(m\_.), x\_Symbol] := With[{q = DerivativeDivides[y, u, x]}, Simp[(q\*y^(m + 1))/(m + 1), x] /; !FalseQ[q]] /; FreeQ[m, x] && NeQ[m, -1]

### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] := Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b\_)\*(v\_)] /; FreeQ[b, x]

Rule 4406

```
Int[Cos[(a_.) + (b_.)*(x_)]^(p_.)*((c_.) + (d_.)*(x_))^(m_.)*Sin[(a_.) + (b_.)*(x_)]^(n_.), x_Symbol] :> Int[ExpandTrigReduce[(c + d*x)^m, Sin[a + b*x]^n*Cos[a + b*x]^p, x], x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IGtQ[p, 0]
```

Rule 3297

```
Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)], x_Symbol] :> Simp[((c + d*x)^(m + 1)*Sin[e + f*x]/(d*(m + 1)), x] - Dist[f/(d*(m + 1)), Int[(c + d*x)^(m + 1)*Cos[e + f*x], x], x] /; FreeQ[{c, d, e, f}, x] && LtQ[m, -1]
```

Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] :> Simp[CosIntegral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) - c*f, 0]
```

Rubi steps

$$\begin{aligned}
\int \frac{\text{Ci}(bx) \sin(bx)}{x^2} dx &= -\frac{\text{Ci}(bx) \sin(bx)}{x} + b \int \frac{\cos(bx) \text{Ci}(bx)}{x} dx + b \int \frac{\cos(bx) \sin(bx)}{bx^2} dx \\
&= \frac{1}{2} b \text{Ci}(bx)^2 - \frac{\text{Ci}(bx) \sin(bx)}{x} + \int \frac{\cos(bx) \sin(bx)}{x^2} dx \\
&= \frac{1}{2} b \text{Ci}(bx)^2 - \frac{\text{Ci}(bx) \sin(bx)}{x} + \int \frac{\sin(2bx)}{2x^2} dx \\
&= \frac{1}{2} b \text{Ci}(bx)^2 - \frac{\text{Ci}(bx) \sin(bx)}{x} + \frac{1}{2} \int \frac{\sin(2bx)}{x^2} dx \\
&= \frac{1}{2} b \text{Ci}(bx)^2 - \frac{\text{Ci}(bx) \sin(bx)}{x} - \frac{\sin(2bx)}{2x} + b \int \frac{\cos(2bx)}{x} dx \\
&= \frac{1}{2} b \text{Ci}(bx)^2 + b \text{Ci}(2bx) - \frac{\text{Ci}(bx) \sin(bx)}{x} - \frac{\sin(2bx)}{2x}
\end{aligned}$$

**Mathematica [A]** time = 0.0095825, size = 44, normalized size = 1.

$$\frac{1}{2} b \text{CosIntegral}(bx)^2 + b \text{CosIntegral}(2bx) - \frac{\text{CosIntegral}(bx) \sin(bx)}{x} - \frac{\sin(2bx)}{2x}$$

Antiderivative was successfully verified.

```
[In] Integrate[(CosIntegral[b*x]*Sin[b*x])/x^2,x]
```

[Out] (b\*CosIntegral[b\*x]^2)/2 + b\*CosIntegral[2\*b\*x] - (CosIntegral[b\*x]\*Sin[b\*x])/x - Sin[2\*b\*x]/(2\*x)

**Maple [F]** time = 0.059, size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx) \sin(bx)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(b\*x)\*sin(b\*x)/x^2,x)

[Out] int(Ci(b\*x)\*sin(b\*x)/x^2,x)

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx) \sin(bx)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)\*sin(b\*x)/x^2,x, algorithm="maxima")

[Out] integrate(Ci(b\*x)\*sin(b\*x)/x^2, x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Ci}(bx) \sin(bx)}{x^2}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)\*sin(b\*x)/x^2,x, algorithm="fricas")

[Out] integral(cos\_integral(b\*x)\*sin(b\*x)/x^2, x)

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\sin(bx) \operatorname{Ci}(bx)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)\*sin(b\*x)/x\*\*2,x)

[Out] Integral(sin(b\*x)\*Ci(b\*x)/x\*\*2, x)

**Giac [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\operatorname{Ci}(bx) \sin(bx)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)\*sin(b\*x)/x^2,x, algorithm="giac")

[Out] integrate(Ci(b\*x)\*sin(b\*x)/x^2, x)

$$3.109 \quad \int \frac{\text{CosIntegral}(bx) \sin(bx)}{x} dx$$

Optimal. Leaf size=14

$$\text{CannotIntegrate}\left(\frac{\text{CosIntegral}(bx) \sin(bx)}{x}, x\right)$$

[Out] CannotIntegrate[(CosIntegral[b\*x]\*Sin[b\*x])/x, x]

**Rubi [A]** time = 0.0265349, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\text{CosIntegral}(bx) \sin(bx)}{x} dx$$

Verification is Not applicable to the result.

[In] Int[(CosIntegral[b\*x]\*Sin[b\*x])/x,x]

[Out] Defer[Int] [(CosIntegral[b\*x]\*Sin[b\*x])/x, x]

Rubi steps

$$\int \frac{\text{Ci}(bx) \sin(bx)}{x} dx = \int \frac{\text{Ci}(bx) \sin(bx)}{x} dx$$

**Mathematica [A]** time = 2.05059, size = 0, normalized size = 0.

$$\int \frac{\text{CosIntegral}(bx) \sin(bx)}{x} dx$$

Verification is Not applicable to the result.

[In] Integrate[(CosIntegral[b\*x]\*Sin[b\*x])/x,x]

[Out] Integrate[(CosIntegral[b\*x]\*Sin[b\*x])/x, x]

---

**Maple [A]** time = 0.057, size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx) \sin(bx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(b\*x)\*sin(b\*x)/x,x)

[Out] int(Ci(b\*x)\*sin(b\*x)/x,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx) \sin(bx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)\*sin(b\*x)/x,x, algorithm="maxima")

[Out] integrate(Ci(b\*x)\*sin(b\*x)/x, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Ci}(bx) \sin(bx)}{x}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)\*sin(b\*x)/x,x, algorithm="fricas")

[Out] integral(cos\_integral(b\*x)\*sin(b\*x)/x, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\sin(bx) \text{Ci}(bx)}{x} dx$$



Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x)*sin(b*x)/x,x)
```

```
[Out] Integral(sin(b*x)*Ci(b*x)/x, x)
```

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx) \sin(bx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x)*sin(b*x)/x,x, algorithm="giac")
```

```
[Out] integrate(Ci(b*x)*sin(b*x)/x, x)
```

### 3.110 $\int \text{CosIntegral}(bx) \sin(bx) dx$

**Optimal.** Leaf size=35

$$\frac{\text{CosIntegral}(2bx)}{2b} - \frac{\text{CosIntegral}(bx) \cos(bx)}{b} + \frac{\log(x)}{2b}$$

[Out] -((Cos[b\*x]\*CosIntegral[b\*x])/b) + CosIntegral[2\*b\*x]/(2\*b) + Log[x]/(2\*b)

**Rubi [A]** time = 0.0612325, antiderivative size = 35, normalized size of antiderivative = 1., number of steps used = 5, number of rules used = 4, integrand size = 9,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.444$ , Rules used = {6518, 12, 3312, 3302}

$$\frac{\text{CosIntegral}(2bx)}{2b} - \frac{\text{CosIntegral}(bx) \cos(bx)}{b} + \frac{\log(x)}{2b}$$

Antiderivative was successfully verified.

[In] Int[CosIntegral[b\*x]\*Sin[b\*x], x]

[Out] -((Cos[b\*x]\*CosIntegral[b\*x])/b) + CosIntegral[2\*b\*x]/(2\*b) + Log[x]/(2\*b)

#### Rule 6518

Int[CosIntegral[(c\_.) + (d\_.)\*(x\_.)]\*Sin[(a\_.) + (b\_.)\*(x\_.)], x\_Symbol] :> -Simp[(Cos[a + b\*x]\*CosIntegral[c + d\*x])/b, x] + Dist[d/b, Int[(Cos[a + b\*x]\*Cos[c + d\*x])/(c + d\*x), x], x] /; FreeQ[{a, b, c, d}, x]

#### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] :> Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b\_)\*(v\_) /; FreeQ[b, x]]

#### Rule 3312

Int[((c\_.) + (d\_.)\*(x\_.))^(m\_)\*sin[(e\_.) + (f\_.)\*(x\_.)]^(n\_), x\_Symbol] :> Int[ExpandTrigReduce[(c + d\*x)^m, Sin[e + f\*x]^n, x], x] /; FreeQ[{c, d, e, f, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))

#### Rule 3302

Int[sin[(e\_.) + (f\_.)\*(x\_.)]/((c\_.) + (d\_.)\*(x\_.)), x\_Symbol] :> Simp[CosIntegral[e - Pi/2 + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*(e - Pi/2) -

c\*f, 0]

### Rubi steps

$$\begin{aligned}
 \int \text{Ci}(bx) \sin(bx) dx &= -\frac{\cos(bx)\text{Ci}(bx)}{b} + \int \frac{\cos^2(bx)}{bx} dx \\
 &= -\frac{\cos(bx)\text{Ci}(bx)}{b} + \frac{\int \frac{\cos^2(bx)}{x} dx}{b} \\
 &= -\frac{\cos(bx)\text{Ci}(bx)}{b} + \frac{\int \left( \frac{1}{2x} + \frac{\cos(2bx)}{2x} \right) dx}{b} \\
 &= -\frac{\cos(bx)\text{Ci}(bx)}{b} + \frac{\log(x)}{2b} + \frac{\int \frac{\cos(2bx)}{x} dx}{2b} \\
 &= -\frac{\cos(bx)\text{Ci}(bx)}{b} + \frac{\text{Ci}(2bx)}{2b} + \frac{\log(x)}{2b}
 \end{aligned}$$

**Mathematica [A]** time = 0.0132629, size = 37, normalized size = 1.06

$$\frac{\text{CosIntegral}(2bx)}{2b} - \frac{\text{CosIntegral}(bx) \cos(bx)}{b} + \frac{\log(bx)}{2b}$$

Antiderivative was successfully verified.

[In] Integrate[CosIntegral[b\*x]\*Sin[b\*x],x]

[Out] -((Cos[b\*x]\*CosIntegral[b\*x])/b) + CosIntegral[2\*b\*x]/(2\*b) + Log[b\*x]/(2\*b)

**Maple [A]** time = 0.052, size = 34, normalized size = 1.

$$-\frac{\text{Ci}(bx) \cos(bx)}{b} + \frac{\ln(bx)}{2b} + \frac{\text{Ci}(2bx)}{2b}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(b\*x)\*sin(b\*x),x)

[Out] -Ci(b\*x)\*cos(b\*x)/b+1/2/b\*ln(b\*x)+1/2\*Ci(2\*b\*x)/b

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \text{Ci}(bx) \sin(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)\*sin(b\*x),x, algorithm="maxima")

[Out] integrate(Ci(b\*x)\*sin(b\*x), x)

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(\text{Ci}(bx) \sin(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)\*sin(b\*x),x, algorithm="fricas")

[Out] integral(cos\_integral(b\*x)\*sin(b\*x), x)

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \sin(bx) \text{Ci}(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)\*sin(b\*x),x)

[Out] Integral(sin(b\*x)\*Ci(b\*x), x)

---

**Giac [A]** time = 1.16776, size = 46, normalized size = 1.31

$$-\frac{\cos(bx) \text{Ci}(bx)}{b} + \frac{\text{Ci}(2bx) + \text{Ci}(-2bx) + 2 \log(x)}{4b}$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x)*sin(b*x),x, algorithm="giac")
```

```
[Out] -cos(b*x)*cos_integral(b*x)/b + 1/4*(cos_integral(2*b*x) + cos_integral(-2*  
b*x) + 2*log(x))/b
```

### 3.111 $\int x \text{CosIntegral}(bx) \sin(bx) dx$

**Optimal.** Leaf size=62

$$\frac{\text{CosIntegral}(bx) \sin(bx)}{b^2} - \frac{\text{Si}(2bx)}{2b^2} + \frac{\sin(bx) \cos(bx)}{2b^2} - \frac{x \text{CosIntegral}(bx) \cos(bx)}{b} + \frac{x}{2b}$$

[Out]  $x/(2*b) - (x*\text{Cos}[b*x]*\text{CosIntegral}[b*x])/b + (\text{Cos}[b*x]*\text{Sin}[b*x])/(2*b^2) + (\text{CosIntegral}[b*x]*\text{Sin}[b*x])/b^2 - \text{SinIntegral}[2*b*x]/(2*b^2)$

**Rubi [A]** time = 0.0691263, antiderivative size = 62, normalized size of antiderivative = 1., number of steps used = 9, number of rules used = 7, integrand size = 10,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.7$ , Rules used = {6520, 12, 2635, 8, 6512, 4406, 3299}

$$\frac{\text{CosIntegral}(bx) \sin(bx)}{b^2} - \frac{\text{Si}(2bx)}{2b^2} + \frac{\sin(bx) \cos(bx)}{2b^2} - \frac{x \text{CosIntegral}(bx) \cos(bx)}{b} + \frac{x}{2b}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[x*\text{CosIntegral}[b*x]*\text{Sin}[b*x], x]$

[Out]  $x/(2*b) - (x*\text{Cos}[b*x]*\text{CosIntegral}[b*x])/b + (\text{Cos}[b*x]*\text{Sin}[b*x])/(2*b^2) + (\text{CosIntegral}[b*x]*\text{Sin}[b*x])/b^2 - \text{SinIntegral}[2*b*x]/(2*b^2)$

#### Rule 6520

$\text{Int}[\text{CosIntegral}[(c_.) + (d_.)*(x_.)]*((e_.) + (f_.)*(x_.))^{(m_.)*\text{Sin}[(a_.) + (b_.)*(x_.)]}, x\_Symbol] \text{ :> } -\text{Simp}[(e + f*x)^m*\text{Cos}[a + b*x]*\text{CosIntegral}[c + d*x])/b, x] + (\text{Dist}[d/b, \text{Int}[(e + f*x)^m*\text{Cos}[a + b*x]*\text{Cos}[c + d*x]]/(c + d*x), x], x] + \text{Dist}[(f*m)/b, \text{Int}[(e + f*x)^{m-1}*\text{Cos}[a + b*x]*\text{CosIntegral}[c + d*x], x], x] /; \text{FreeQ}\{a, b, c, d, e, f\}, x] \&\& \text{IGtQ}[m, 0]$

#### Rule 12

$\text{Int}[(a_.)*(u_.), x\_Symbol] \text{ :> } \text{Dist}[a, \text{Int}[u, x], x] /; \text{FreeQ}[a, x] \&\& \text{!MatchQ}[u, (b_.)*(v_.)] /; \text{FreeQ}[b, x]$

#### Rule 2635

$\text{Int}[(b_.)*\text{sin}[(c_.) + (d_.)*(x_.)]^{(n_.)}, x\_Symbol] \text{ :> } -\text{Simp}[(b*\text{Cos}[c + d*x])*(b*\text{Sin}[c + d*x])^{n-1}]/(d*n), x] + \text{Dist}[(b^2*(n-1))/n, \text{Int}[(b*\text{Sin}[c + d*x])^{n-2}], x], x] /; \text{FreeQ}\{b, c, d\}, x] \&\& \text{GtQ}[n, 1] \&\& \text{IntegerQ}[2*n]$

]

Rule 8

```
Int[a_, x_Symbol] := Simp[a*x, x] /; FreeQ[a, x]
```

Rule 6512

```
Int[Cos[(a_.) + (b_.)*(x_)]*CosIntegral[(c_.) + (d_.)*(x_)], x_Symbol] := S
imp[(Sin[a + b*x]*CosIntegral[c + d*x])/b, x] - Dist[d/b, Int[(Sin[a + b*x]
*Cos[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

Rule 4406

```
Int[Cos[(a_.) + (b_.)*(x_)]^(p_.)*((c_.) + (d_.)*(x_))^(m_.)*Sin[(a_.) + (b
_.)*(x_)]^(n_.), x_Symbol] := Int[ExpandTrigReduce[(c + d*x)^m, Sin[a + b*x
]^(n)*Cos[a + b*x]^p, x], x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IG
tQ[p, 0]
```

Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[SinInte
gral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

Rubi steps

$$\begin{aligned}
\int x \operatorname{Ci}(bx) \sin(bx) dx &= -\frac{x \cos(bx) \operatorname{Ci}(bx)}{b} + \frac{\int \cos(bx) \operatorname{Ci}(bx) dx}{b} + \int \frac{\cos^2(bx)}{b} dx \\
&= -\frac{x \cos(bx) \operatorname{Ci}(bx)}{b} + \frac{\operatorname{Ci}(bx) \sin(bx)}{b^2} + \frac{\int \cos^2(bx) dx}{b} - \frac{\int \frac{\cos(bx) \sin(bx)}{bx} dx}{b} \\
&= -\frac{x \cos(bx) \operatorname{Ci}(bx)}{b} + \frac{\cos(bx) \sin(bx)}{2b^2} + \frac{\operatorname{Ci}(bx) \sin(bx)}{b^2} - \frac{\int \frac{\cos(bx) \sin(bx)}{x} dx}{b^2} + \frac{\int 1 dx}{2b} \\
&= \frac{x}{2b} - \frac{x \cos(bx) \operatorname{Ci}(bx)}{b} + \frac{\cos(bx) \sin(bx)}{2b^2} + \frac{\operatorname{Ci}(bx) \sin(bx)}{b^2} - \frac{\int \frac{\sin(2bx)}{2x} dx}{b^2} \\
&= \frac{x}{2b} - \frac{x \cos(bx) \operatorname{Ci}(bx)}{b} + \frac{\cos(bx) \sin(bx)}{2b^2} + \frac{\operatorname{Ci}(bx) \sin(bx)}{b^2} - \frac{\int \frac{\sin(2bx)}{x} dx}{2b^2} \\
&= \frac{x}{2b} - \frac{x \cos(bx) \operatorname{Ci}(bx)}{b} + \frac{\cos(bx) \sin(bx)}{2b^2} + \frac{\operatorname{Ci}(bx) \sin(bx)}{b^2} - \frac{\operatorname{Si}(2bx)}{2b^2}
\end{aligned}$$

**Mathematica [A]** time = 0.0504018, size = 44, normalized size = 0.71

$$\frac{\text{CosIntegral}(bx)(4 \sin(bx) - 4bx \cos(bx)) - 2\text{Si}(2bx) + 2bx + \sin(2bx)}{4b^2}$$

Antiderivative was successfully verified.

[In] Integrate[x\*CosIntegral[b\*x]\*Sin[b\*x],x]

[Out] (2\*b\*x + CosIntegral[b\*x]\*(-4\*b\*x\*Cos[b\*x] + 4\*Sin[b\*x]) + Sin[2\*b\*x] - 2\*SinIntegral[2\*b\*x])/(4\*b^2)

**Maple [A]** time = 0.057, size = 45, normalized size = 0.7

$$\frac{1}{b^2} \left( \text{Ci}(bx) (-bx \cos(bx) + \sin(bx)) + \frac{\sin(bx) \cos(bx)}{2} + \frac{bx}{2} - \frac{\text{Si}(2bx)}{2} \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x\*Ci(b\*x)\*sin(b\*x),x)

[Out] 1/b^2\*(Ci(b\*x)\*(-b\*x\*cos(b\*x)+sin(b\*x))+1/2\*sin(b\*x)\*cos(b\*x)+1/2\*b\*x-1/2\*Si(2\*b\*x))

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x \text{Ci}(bx) \sin(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Ci(b\*x)\*sin(b\*x),x, algorithm="maxima")

[Out] integrate(x\*Ci(b\*x)\*sin(b\*x), x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

integral(x Ci(bx) sin(bx), x)



Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x*cos_integral(b*x)*sin(b*x),x, algorithm="fricas")
```

```
[Out] integral(x*cos_integral(b*x)*sin(b*x), x)
```

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x \sin(bx) \operatorname{Ci}(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x*cos_integral(b*x)*sin(b*x),x)
```

```
[Out] Integral(x*sin(b*x)*Ci(b*x), x)
```

**Giac [C]** time = 1.17779, size = 77, normalized size = 1.24

$$-\left(\frac{x \cos(bx)}{b} - \frac{\sin(bx)}{b^2}\right) \operatorname{Ci}(bx) + \frac{2bx - \Im(\operatorname{Ci}(2bx)) + \Im(\operatorname{Ci}(-2bx)) - 2 \operatorname{Si}(2bx)}{4b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x*cos_integral(b*x)*sin(b*x),x, algorithm="giac")
```

```
[Out] -(x*cos(b*x)/b - sin(b*x)/b^2)*cos_integral(b*x) + 1/4*(2*b*x - imag_part(cos_integral(2*b*x)) + imag_part(cos_integral(-2*b*x)) - 2*sin_integral(2*b*x))/b^2
```

### 3.112 $\int x^2 \text{CosIntegral}(bx) \sin(bx) dx$

**Optimal.** Leaf size=111

$$-\frac{\text{CosIntegral}(2bx)}{b^3} + \frac{2x\text{CosIntegral}(bx)\sin(bx)}{b^2} + \frac{2\text{CosIntegral}(bx)\cos(bx)}{b^3} - \frac{\log(x)}{b^3} - \frac{\sin^2(bx)}{b^3} + \frac{\cos^2(bx)}{4b^3} + \frac{x \sin(bx)}{b^2}$$

[Out]  $x^2/(4*b) + \text{Cos}[b*x]^2/(4*b^3) + (2*\text{Cos}[b*x]*\text{CosIntegral}[b*x])/b^3 - (x^2*\text{Cos}[b*x]*\text{CosIntegral}[b*x])/b - \text{CosIntegral}[2*b*x]/b^3 - \text{Log}[x]/b^3 + (x*\text{Cos}[b*x]*\text{Sin}[b*x])/(2*b^2) + (2*x*\text{CosIntegral}[b*x]*\text{Sin}[b*x])/b^2 - \text{Sin}[b*x]^2/b^3$

**Rubi [A]** time = 0.12765, antiderivative size = 111, normalized size of antiderivative = 1., number of steps used = 13, number of rules used = 9, integrand size = 12,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.75$ , Rules used = {6520, 12, 3310, 30, 6514, 2564, 6518, 3312, 3302}

$$-\frac{\text{CosIntegral}(2bx)}{b^3} + \frac{2x\text{CosIntegral}(bx)\sin(bx)}{b^2} + \frac{2\text{CosIntegral}(bx)\cos(bx)}{b^3} - \frac{\log(x)}{b^3} - \frac{\sin^2(bx)}{b^3} + \frac{\cos^2(bx)}{4b^3} + \frac{x \sin(bx)}{b^2}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[x^2*\text{CosIntegral}[b*x]*\text{Sin}[b*x], x]$

[Out]  $x^2/(4*b) + \text{Cos}[b*x]^2/(4*b^3) + (2*\text{Cos}[b*x]*\text{CosIntegral}[b*x])/b^3 - (x^2*\text{Cos}[b*x]*\text{CosIntegral}[b*x])/b - \text{CosIntegral}[2*b*x]/b^3 - \text{Log}[x]/b^3 + (x*\text{Cos}[b*x]*\text{Sin}[b*x])/(2*b^2) + (2*x*\text{CosIntegral}[b*x]*\text{Sin}[b*x])/b^2 - \text{Sin}[b*x]^2/b^3$

#### Rule 6520

$\text{Int}[\text{CosIntegral}[(c_.) + (d_.)*(x_.)]*((e_.) + (f_.)*(x_.))^m*\text{Sin}[(a_.) + (b_.)*(x_.)], x\_Symbol] \rightarrow -\text{Simp}[(e + f*x)^m*\text{Cos}[a + b*x]*\text{CosIntegral}[c + d*x])/b, x] + (\text{Dist}[d/b, \text{Int}[(e + f*x)^m*\text{Cos}[a + b*x]*\text{Cos}[c + d*x])/(c + d*x), x], x] + \text{Dist}[(f*m)/b, \text{Int}[(e + f*x)^(m-1)*\text{Cos}[a + b*x]*\text{CosIntegral}[c + d*x], x], x) /; \text{FreeQ}\{a, b, c, d, e, f\}, x] \&\& \text{IGtQ}[m, 0]$

#### Rule 12

$\text{Int}[(a_)*(u_), x\_Symbol] \rightarrow \text{Dist}[a, \text{Int}[u, x], x] /; \text{FreeQ}[a, x] \&\& !\text{MatchQ}[u, (b_)*(v_)] /; \text{FreeQ}[b, x]$

#### Rule 3310

```
Int[((c_.) + (d_.)*(x_))*((b_.)*sin[(e_.) + (f_.)*(x_)])^(n_), x_Symbol] :=
  Simp[(d*(b*SIn[e + f*x])^n)/(f^2*n^2), x] + (Dist[(b^2*(n - 1))/n, Int[(c
+ d*x)*(b*SIn[e + f*x])^(n - 2), x], x] - Simp[(b*(c + d*x)*Cos[e + f*x]*(b
*SIn[e + f*x])^(n - 1))/(f*n), x]) /; FreeQ[{b, c, d, e, f}, x] && GtQ[n, 1
]
```

### Rule 30

```
Int[(x_)^(m_), x_Symbol] := Simp[x^(m + 1)/(m + 1), x] /; FreeQ[m, x] && N
eQ[m, -1]
```

### Rule 6514

```
Int[Cos[(a_.) + (b_.)*(x_)]*CosIntegral[(c_.) + (d_.)*(x_)]*((e_.) + (f_.)*
(x_))^(m_), x_Symbol] := Simp[((e + f*x)^m*SIn[a + b*x]*CosIntegral[c + d*
x])/b, x] + (-Dist[d/b, Int[((e + f*x)^m*SIn[a + b*x]*Cos[c + d*x])/(c + d*
x), x], x] - Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*SIn[a + b*x]*CosIntegral[c
+ d*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]
```

### Rule 2564

```
Int[cos[(e_.) + (f_.)*(x_)]^(n_)*((a_.)*sin[(e_.) + (f_.)*(x_)])^(m_), x_
Symbol] := Dist[1/(a*f), Subst[Int[x^m*(1 - x^2/a^2)^((n - 1)/2), x], x, a*
Sin[e + f*x]], x] /; FreeQ[{a, e, f, m}, x] && IntegerQ[(n - 1)/2] && !(In
tegerQ[(m - 1)/2] && LtQ[0, m, n])
```

### Rule 6518

```
Int[CosIntegral[(c_.) + (d_.)*(x_)]*SIn[(a_.) + (b_.)*(x_)], x_Symbol] := -
Simp[(Cos[a + b*x]*CosIntegral[c + d*x])/b, x] + Dist[d/b, Int[(Cos[a + b*x
]*Cos[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

### Rule 3312

```
Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)]^(n_), x_Symbol] := In
t[ExpandTrigReduce[(c + d*x)^m, Sin[e + f*x]^n, x], x] /; FreeQ[{c, d, e, f
, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))
```

### Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[CosInte
gral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) -
c*f, 0]
```

Rubi steps

$$\begin{aligned}
\int x^2 \text{Ci}(bx) \sin(bx) dx &= -\frac{x^2 \cos(bx) \text{Ci}(bx)}{b} + \frac{2 \int x \cos(bx) \text{Ci}(bx) dx}{b} + \int \frac{x \cos^2(bx)}{b} dx \\
&= -\frac{x^2 \cos(bx) \text{Ci}(bx)}{b} + \frac{2x \text{Ci}(bx) \sin(bx)}{b^2} - \frac{2 \int \text{Ci}(bx) \sin(bx) dx}{b^2} + \frac{\int x \cos^2(bx) dx}{b} - \frac{2 \int \frac{\cos(bx) \sin(bx)}{b} dx}{b} \\
&= \frac{\cos^2(bx)}{4b^3} + \frac{2 \cos(bx) \text{Ci}(bx)}{b^3} - \frac{x^2 \cos(bx) \text{Ci}(bx)}{b} + \frac{x \cos(bx) \sin(bx)}{2b^2} + \frac{2x \text{Ci}(bx) \sin(bx)}{b^2} - \frac{2 \int \frac{\cos(bx) \sin(bx)}{b} dx}{b} \\
&= \frac{x^2}{4b} + \frac{\cos^2(bx)}{4b^3} + \frac{2 \cos(bx) \text{Ci}(bx)}{b^3} - \frac{x^2 \cos(bx) \text{Ci}(bx)}{b} + \frac{x \cos(bx) \sin(bx)}{2b^2} + \frac{2x \text{Ci}(bx) \sin(bx)}{b^2} \\
&= \frac{x^2}{4b} + \frac{\cos^2(bx)}{4b^3} + \frac{2 \cos(bx) \text{Ci}(bx)}{b^3} - \frac{x^2 \cos(bx) \text{Ci}(bx)}{b} + \frac{x \cos(bx) \sin(bx)}{2b^2} + \frac{2x \text{Ci}(bx) \sin(bx)}{b^2} \\
&= \frac{x^2}{4b} + \frac{\cos^2(bx)}{4b^3} + \frac{2 \cos(bx) \text{Ci}(bx)}{b^3} - \frac{x^2 \cos(bx) \text{Ci}(bx)}{b} - \frac{\log(x)}{b^3} + \frac{x \cos(bx) \sin(bx)}{2b^2} + \frac{2x \text{Ci}(bx) \sin(bx)}{b^2} \\
&= \frac{x^2}{4b} + \frac{\cos^2(bx)}{4b^3} + \frac{2 \cos(bx) \text{Ci}(bx)}{b^3} - \frac{x^2 \cos(bx) \text{Ci}(bx)}{b} - \frac{\text{Ci}(2bx)}{b^3} - \frac{\log(x)}{b^3} + \frac{x \cos(bx) \sin(bx)}{2b^2}
\end{aligned}$$

**Mathematica [A]** time = 0.0859148, size = 72, normalized size = 0.65

$$\frac{-8 \text{CosIntegral}(bx) \left( (b^2 x^2 - 2) \cos(bx) - 2bx \sin(bx) \right) + 2b^2 x^2 - 8 \text{CosIntegral}(2bx) + 2bx \sin(2bx) + 5 \cos(2bx) - 8 \log(x)}{8b^3}$$

Antiderivative was successfully verified.

[In] Integrate[x^2 \* CosIntegral[b\*x] \* Sin[b\*x], x]

[Out] (2\*b^2\*x^2 + 5\*Cos[2\*b\*x] - 8\*CosIntegral[2\*b\*x] - 8\*Log[x] - 8\*CosIntegral[b\*x]\*((-2 + b^2\*x^2)\*Cos[b\*x] - 2\*b\*x\*Sin[b\*x]) + 2\*b\*x\*Sin[2\*b\*x]) / (8\*b^3)

**Maple [A]** time = 0.062, size = 107, normalized size = 1.

$$-\frac{x^2 \text{Ci}(bx) \cos(bx)}{b} + 2 \frac{x \text{Ci}(bx) \sin(bx)}{b^2} + 2 \frac{\text{Ci}(bx) \cos(bx)}{b^3} + \frac{x \cos(bx) \sin(bx)}{2b^2} + \frac{x^2}{4b} - \frac{(\sin(bx))^2}{4b^3} + \frac{(\cos(bx))^2}{b^3} - \ln(x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(x^2*Ci(b*x)*sin(b*x),x)`

[Out]  $-x^2 \operatorname{Ci}(bx) \cos(bx) / b + 2x \operatorname{Ci}(bx) \sin(bx) / b^2 + 2 \operatorname{Ci}(bx) \cos(bx) / b^3 + 1/2 x \cos(bx) \sin(bx) / b^2 + 1/4 x^2 / b - 1/4 \sin(bx)^2 / b^3 + \cos(bx)^2 / b^3 - 1/b^3 \ln(bx) - \operatorname{Ci}(2bx) / b^3$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \operatorname{Ci}(bx) \sin(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Ci(b*x)*sin(b*x),x, algorithm="maxima")`

[Out] `integrate(x^2*Ci(b*x)*sin(b*x), x)`

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(x^2 \operatorname{Ci}(bx) \sin(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Ci(b*x)*sin(b*x),x, algorithm="fricas")`

[Out] `integral(x^2*cos_integral(b*x)*sin(b*x), x)`

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \sin(bx) \operatorname{Ci}(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x**2*Ci(b*x)*sin(b*x),x)`

[Out] `Integral(x**2*sin(b*x)*Ci(b*x), x)`

---

**Giac [A]** time = 1.15272, size = 89, normalized size = 0.8

$$\left( \frac{2x \sin(bx)}{b^2} - \frac{(b^2x^2 - 2) \cos(bx)}{b^3} \right) \text{Ci}(bx) + \frac{b^2x^2 - 2 \text{Ci}(2bx) - 2 \text{Ci}(-2bx) - 4 \log(x)}{4b^3}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^2\*Ci(b\*x)\*sin(b\*x),x, algorithm="giac")

[Out] (2\*x\*sin(b\*x)/b^2 - (b^2\*x^2 - 2)\*cos(b\*x)/b^3)\*cos\_integral(b\*x) + 1/4\*(b^2\*x^2 - 2\*cos\_integral(2\*b\*x) - 2\*cos\_integral(-2\*b\*x) - 4\*log(x))/b^3

### 3.113 $\int x^3 \text{CosIntegral}(bx) \sin(bx) dx$

**Optimal.** Leaf size=147

$$\frac{3x^2 \text{CosIntegral}(bx) \sin(bx)}{b^2} - \frac{6 \text{CosIntegral}(bx) \sin(bx)}{b^4} + \frac{6x \text{CosIntegral}(bx) \cos(bx)}{b^3} + \frac{3 \text{Si}(2bx)}{b^4} + \frac{x^2 \sin(bx) \cos(bx)}{2b^2}$$

```
[Out] (-5*x)/(2*b^3) + x^3/(6*b) + (x*cos[b*x]^2)/(2*b^3) + (6*x*cos[b*x]*CosIntegral[b*x])/b^3 - (x^3*cos[b*x]*CosIntegral[b*x])/b - (4*cos[b*x]*Sin[b*x])/b^4 + (x^2*cos[b*x]*Sin[b*x])/(2*b^2) - (6*cosIntegral[b*x]*Sin[b*x])/b^4 + (3*x^2*cosIntegral[b*x]*Sin[b*x])/b^2 - (3*x*sin[b*x]^2)/(2*b^3) + (3*sinIntegral[2*b*x])/b^4
```

**Rubi [A]** time = 0.182771, antiderivative size = 147, normalized size of antiderivative = 1., number of steps used = 20, number of rules used = 11, integrand size = 12,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.917$ , Rules used = {6520, 12, 3311, 30, 2635, 8, 6514, 3443, 6512, 4406, 3299}

$$\frac{3x^2 \text{CosIntegral}(bx) \sin(bx)}{b^2} - \frac{6 \text{CosIntegral}(bx) \sin(bx)}{b^4} + \frac{6x \text{CosIntegral}(bx) \cos(bx)}{b^3} + \frac{3 \text{Si}(2bx)}{b^4} + \frac{x^2 \sin(bx) \cos(bx)}{2b^2}$$

Antiderivative was successfully verified.

```
[In] Int[x^3*CosIntegral[b*x]*Sin[b*x],x]
```

```
[Out] (-5*x)/(2*b^3) + x^3/(6*b) + (x*cos[b*x]^2)/(2*b^3) + (6*x*cos[b*x]*CosIntegral[b*x])/b^3 - (x^3*cos[b*x]*CosIntegral[b*x])/b - (4*cos[b*x]*Sin[b*x])/b^4 + (x^2*cos[b*x]*Sin[b*x])/(2*b^2) - (6*cosIntegral[b*x]*Sin[b*x])/b^4 + (3*x^2*cosIntegral[b*x]*Sin[b*x])/b^2 - (3*x*sin[b*x]^2)/(2*b^3) + (3*sinIntegral[2*b*x])/b^4
```

#### Rule 6520

```
Int[CosIntegral[(c_.) + (d_.)*(x_)]*((e_.) + (f_.)*(x_))^(m_.)*Sin[(a_.) + (b_.)*(x_)], x_Symbol] :> -Simp[((e + f*x)^m*cos[a + b*x]*CosIntegral[c + d*x])/b, x] + (Dist[d/b, Int[((e + f*x)^m*cos[a + b*x]*Cos[c + d*x])/(c + d*x), x], x] + Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*Cos[a + b*x]*CosIntegral[c + d*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]
```

#### Rule 12

```
Int[(a_)*(u_), x_Symbol] :> Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b_)*(v_) /; FreeQ[b, x]]
```

Rule 3311

```
Int[((c_.) + (d_.)*(x_))^(m_)*((b_.)*sin[(e_.) + (f_.)*(x_)])^(n_), x_Symbol]
:> Simp[(d*m*(c + d*x)^(m - 1)*(b*Sine[e + f*x])^n)/(f^2*n^2), x] + (Dist
[(b^2*(n - 1))/n, Int[(c + d*x)^m*(b*Sine[e + f*x])^(n - 2), x], x] - Dist[
(d^2*m*(m - 1))/(f^2*n^2), Int[(c + d*x)^(m - 2)*(b*Sine[e + f*x])^n, x], x]
- Simp[(b*(c + d*x)^m*Cos[e + f*x]*(b*Sine[e + f*x])^(n - 1))/(f*n), x]) /;
FreeQ[{b, c, d, e, f}, x] && GtQ[n, 1] && GtQ[m, 1]
```

Rule 30

```
Int[(x_)^(m_), x_Symbol] :> Simp[x^(m + 1)/(m + 1), x] /; FreeQ[m, x] && NeQ[m, -1]
```

Rule 2635

```
Int[((b_.)*sin[(c_.) + (d_.)*(x_)])^(n_), x_Symbol] :> -Simp[(b*Cos[c + d*x]
*(b*Sine[c + d*x])^(n - 1))/(d*n), x] + Dist[(b^2*(n - 1))/n, Int[(b*Sine[c
+ d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1] && IntegerQ[2*n]
```

Rule 8

```
Int[a_, x_Symbol] :> Simp[a*x, x] /; FreeQ[a, x]
```

Rule 6514

```
Int[Cos[(a_.) + (b_.)*(x_)]*CosIntegral[(c_.) + (d_.)*(x_)]*((e_.) + (f_.)*
(x_))^(m_), x_Symbol] :> Simp[((e + f*x)^m*Sine[a + b*x]*CosIntegral[c + d*
x])/b, x] + (-Dist[d/b, Int[((e + f*x)^m*Sine[a + b*x]*Cos[c + d*x])/(c + d*
x), x], x] - Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*Sine[a + b*x]*CosIntegral[c
+ d*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]
```

Rule 3443

```
Int[Cos[(a_.) + (b_.)*(x_)^(n_.)]*(x_)^(m_.)*Sine[(a_.) + (b_.)*(x_)^(n_.)]^(
p_.), x_Symbol] :> Simp[(x^(m - n + 1)*Sine[a + b*x^n]^(p + 1))/(b*n*(p + 1
)), x] - Dist[(m - n + 1)/(b*n*(p + 1)), Int[x^(m - n)*Sine[a + b*x^n]^(p +
1), x], x] /; FreeQ[{a, b, p}, x] && LtQ[0, n, m + 1] && NeQ[p, -1]
```

Rule 6512

```
Int[Cos[(a_.) + (b_.)*(x_)]*CosIntegral[(c_.) + (d_.)*(x_)], x_Symbol] :> S
imp[(Sine[a + b*x]*CosIntegral[c + d*x])/b, x] - Dist[d/b, Int[(Sine[a + b*x]
```



\*Cos[c + d\*x]/(c + d\*x), x] , x] /; FreeQ[{a, b, c, d}, x]

### Rule 4406

Int[Cos[(a\_.) + (b\_.)\*(x\_)]^(p\_.)\*((c\_.) + (d\_.)\*(x\_))^(m\_.)\*Sin[(a\_.) + (b\_.)\*(x\_)]^(n\_.), x\_Symbol] :> Int[ExpandTrigReduce[(c + d\*x)^m, Sin[a + b\*x]]^n\*Cos[a + b\*x]^p, x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IGtQ[p, 0]

### Rule 3299

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] :> Simp[SinIntegral[e + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*e - c\*f, 0]

### Rubi steps

$$\begin{aligned}
 \int x^3 \text{Ci}(bx) \sin(bx) dx &= -\frac{x^3 \cos(bx) \text{Ci}(bx)}{b} + \frac{3 \int x^2 \cos(bx) \text{Ci}(bx) dx}{b} + \int \frac{x^2 \cos^2(bx)}{b} dx \\
 &= -\frac{x^3 \cos(bx) \text{Ci}(bx)}{b} + \frac{3x^2 \text{Ci}(bx) \sin(bx)}{b^2} - \frac{6 \int x \text{Ci}(bx) \sin(bx) dx}{b^2} + \frac{\int x^2 \cos^2(bx) dx}{b} - \frac{3 \int x \cos^2(bx) dx}{b} \\
 &= \frac{x \cos^2(bx)}{2b^3} + \frac{6x \cos(bx) \text{Ci}(bx)}{b^3} - \frac{x^3 \cos(bx) \text{Ci}(bx)}{b} + \frac{x^2 \cos(bx) \sin(bx)}{2b^2} + \frac{3x^2 \text{Ci}(bx) \sin(bx)}{b^2} \\
 &= \frac{x^3}{6b} + \frac{x \cos^2(bx)}{2b^3} + \frac{6x \cos(bx) \text{Ci}(bx)}{b^3} - \frac{x^3 \cos(bx) \text{Ci}(bx)}{b} - \frac{\cos(bx) \sin(bx)}{4b^4} + \frac{x^2 \cos(bx) \sin(bx)}{2b^2} \\
 &= -\frac{x}{4b^3} + \frac{x^3}{6b} + \frac{x \cos^2(bx)}{2b^3} + \frac{6x \cos(bx) \text{Ci}(bx)}{b^3} - \frac{x^3 \cos(bx) \text{Ci}(bx)}{b} - \frac{4 \cos(bx) \sin(bx)}{b^4} + \frac{x^2 \cos(bx) \sin(bx)}{2b^2} \\
 &= -\frac{5x}{2b^3} + \frac{x^3}{6b} + \frac{x \cos^2(bx)}{2b^3} + \frac{6x \cos(bx) \text{Ci}(bx)}{b^3} - \frac{x^3 \cos(bx) \text{Ci}(bx)}{b} - \frac{4 \cos(bx) \sin(bx)}{b^4} + \frac{x^2 \cos(bx) \sin(bx)}{2b^2} \\
 &= -\frac{5x}{2b^3} + \frac{x^3}{6b} + \frac{x \cos^2(bx)}{2b^3} + \frac{6x \cos(bx) \text{Ci}(bx)}{b^3} - \frac{x^3 \cos(bx) \text{Ci}(bx)}{b} - \frac{4 \cos(bx) \sin(bx)}{b^4} + \frac{x^2 \cos(bx) \sin(bx)}{2b^2} \\
 &= -\frac{5x}{2b^3} + \frac{x^3}{6b} + \frac{x \cos^2(bx)}{2b^3} + \frac{6x \cos(bx) \text{Ci}(bx)}{b^3} - \frac{x^3 \cos(bx) \text{Ci}(bx)}{b} - \frac{4 \cos(bx) \sin(bx)}{b^4} + \frac{x^2 \cos(bx) \sin(bx)}{2b^2}
 \end{aligned}$$

**Mathematica [A]** time = 0.107106, size = 94, normalized size = 0.64

$$\frac{-12 \text{CosIntegral}(bx) (bx (b^2 x^2 - 6) \cos(bx) - 3 (b^2 x^2 - 2) \sin(bx)) + 2b^3 x^3 + 3b^2 x^2 \sin(2bx) + 36 \text{Si}(2bx) - 36bx - 24}{12b^4}$$

Antiderivative was successfully verified.

[In] Integrate[x^3\*CosIntegral[b\*x]\*Sin[b\*x],x]

[Out]  $(-36bx + 2b^3x^3 + 12bx\cos[2bx] - 12\text{CosIntegral}[bx](bx(-6 + b^2x^2)\cos[bx] - 3(-2 + b^2x^2)\sin[bx]) - 24\sin[2bx] + 3b^2x^2\text{SinIntegral}[2bx] + 36\text{SinIntegral}[2bx]) / (12b^4)$

**Maple [A]** time = 0.076, size = 111, normalized size = 0.8

$$\frac{1}{b^4} \left( \text{Ci}(bx) (-b^3x^3 \cos(bx) + 3b^2x^2 \sin(bx) - 6 \sin(bx) + 6bx \cos(bx)) + b^2x^2 \left( \frac{\sin(bx) \cos(bx)}{2} + \frac{bx}{2} \right) + 2bx \cos(bx) \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x^3\*Ci(b\*x)\*sin(b\*x),x)

[Out]  $1/b^4 * (\text{Ci}(bx) * (-b^3x^3 \cos(bx) + 3b^2x^2 \sin(bx) - 6 \sin(bx) + 6bx \cos(bx)) + b^2x^2 * (1/2 \sin(bx) \cos(bx) + 1/2 bx) + 2bx \cos(bx) - 4 \sin(bx) \cos(bx) - 4bx - 1/3 x^3 b^3 + 3 \text{Si}(2bx))$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^3 \text{Ci}(bx) \sin(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^3\*Ci(b\*x)\*sin(b\*x),x, algorithm="maxima")

[Out] integrate(x^3\*Ci(b\*x)\*sin(b\*x), x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^3 \text{Ci}(bx) \sin(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^3\*Ci(b\*x)\*sin(b\*x),x, algorithm="fricas")

[Out] `integral(x^3*cos_integral(b*x)*sin(b*x), x)`

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x^3 \sin(bx) \operatorname{Ci}(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x**3*Ci(b*x)*sin(b*x),x)`

[Out] `Integral(x**3*sin(b*x)*Ci(b*x), x)`

**Giac [C]** time = 1.23702, size = 116, normalized size = 0.79

$$-\left(\frac{(b^3x^3 - 6bx)\cos(bx)}{b^4} - \frac{3(b^2x^2 - 2)\sin(bx)}{b^4}\right)\operatorname{Ci}(bx) + \frac{b^3x^3 - 18bx + 9\Im(\operatorname{Ci}(2bx)) - 9\Im(\operatorname{Ci}(-2bx)) + 18\operatorname{Si}(2bx)}{6b^4}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^3*Ci(b*x)*sin(b*x),x, algorithm="giac")`

[Out] `-((b^3*x^3 - 6*b*x)*cos(b*x)/b^4 - 3*(b^2*x^2 - 2)*sin(b*x)/b^4)*cos_integr  
al(b*x) + 1/6*(b^3*x^3 - 18*b*x + 9*imag_part(cos_integral(2*b*x)) - 9*imag  
_part(cos_integral(-2*b*x)) + 18*sin_integral(2*b*x))/b^4`

$$3.114 \quad \int \frac{\cos(bx)\text{CosIntegral}(bx)}{x^3} dx$$

**Optimal.** Leaf size=97

$$-\frac{1}{4}b^2\text{CosIntegral}(bx)^2 - b^2\text{CosIntegral}(2bx) - \frac{\text{CosIntegral}(bx)\cos(bx)}{2x^2} + \frac{b\text{CosIntegral}(bx)\sin(bx)}{2x} - \frac{\cos^2(bx)}{4x^2} + \frac{b\sin(2bx)}{4x}$$

[Out]  $-\text{Cos}[b*x]^2/(4*x^2) - (\text{Cos}[b*x]*\text{CosIntegral}[b*x])/(2*x^2) - (b^2*\text{CosIntegral}[b*x]^2)/4 - b^2*\text{CosIntegral}[2*b*x] + (b*\text{Cos}[b*x]*\text{Sin}[b*x])/(2*x) + (b*\text{CosIntegral}[b*x]*\text{Sin}[b*x])/(2*x) + (b*\text{Sin}[2*b*x])/(4*x)$

**Rubi [A]** time = 0.198593, antiderivative size = 97, normalized size of antiderivative = 1., number of steps used = 14, number of rules used = 10, integrand size = 12,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.833$ , Rules used = {6516, 6522, 6686, 12, 4406, 3297, 3302, 3314, 29, 3312}

$$-\frac{1}{4}b^2\text{CosIntegral}(bx)^2 - b^2\text{CosIntegral}(2bx) - \frac{\text{CosIntegral}(bx)\cos(bx)}{2x^2} + \frac{b\text{CosIntegral}(bx)\sin(bx)}{2x} - \frac{\cos^2(bx)}{4x^2} + \frac{b\sin(2bx)}{4x}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[(\text{Cos}[b*x]*\text{CosIntegral}[b*x])/x^3, x]$

[Out]  $-\text{Cos}[b*x]^2/(4*x^2) - (\text{Cos}[b*x]*\text{CosIntegral}[b*x])/(2*x^2) - (b^2*\text{CosIntegral}[b*x]^2)/4 - b^2*\text{CosIntegral}[2*b*x] + (b*\text{Cos}[b*x]*\text{Sin}[b*x])/(2*x) + (b*\text{CosIntegral}[b*x]*\text{Sin}[b*x])/(2*x) + (b*\text{Sin}[2*b*x])/(4*x)$

### Rule 6516

$\text{Int}[\text{Cos}[(a_.) + (b_.)*(x_.)]*\text{CosIntegral}[(c_.) + (d_.)*(x_.)]*((e_.) + (f_.)*(x_.))^{(m_.)}, x\_Symbol] \rightarrow \text{Simp}[(e + f*x)^{(m + 1)}*\text{Cos}[a + b*x]*\text{CosIntegral}[c + d*x]/(f*(m + 1)), x] + (\text{Dist}[b/(f*(m + 1)), \text{Int}[(e + f*x)^{(m + 1)}*\text{Sin}[a + b*x]*\text{CosIntegral}[c + d*x], x], x] - \text{Dist}[d/(f*(m + 1)), \text{Int}[(e + f*x)^{(m + 1)}*\text{Cos}[a + b*x]*\text{Cos}[c + d*x]/(c + d*x), x], x]) /; \text{FreeQ}\{a, b, c, d, e, f\}, x] \&\& \text{ILtQ}[m, -1]$

### Rule 6522

$\text{Int}[\text{CosIntegral}[(c_.) + (d_.)*(x_.)]*((e_.) + (f_.)*(x_.))^{(m_.)}*\text{Sin}[(a_.) + (b_.)*(x_.)], x\_Symbol] \rightarrow \text{Simp}[(e + f*x)^{(m + 1)}*\text{Sin}[a + b*x]*\text{CosIntegral}[c + d*x]/(f*(m + 1)), x] + (-\text{Dist}[b/(f*(m + 1)), \text{Int}[(e + f*x)^{(m + 1)}*\text{Cos}[a + b*x]*\text{CosIntegral}[c + d*x], x], x] - \text{Dist}[d/(f*(m + 1)), \text{Int}[(e + f*x)^{(m + 1)}*\text{Sin}[a + b*x]*\text{Cos}[c + d*x]/(c + d*x), x], x]) /; \text{FreeQ}\{a, b, c, d,$

e, f}, x] && ILtQ[m, -1]

### Rule 6686

Int[(u\_)\*(y\_)^(m\_.), x\_Symbol] :=> With[{q = DerivativeDivides[y, u, x]}, Simp[(q\*y^(m + 1))/(m + 1), x] /; !FalseQ[q] /; FreeQ[m, x] && NeQ[m, -1]

### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] :=> Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b\_)\*(v\_) /; FreeQ[b, x]]

### Rule 4406

Int[Cos[(a\_.) + (b\_.)\*(x\_)]^(p\_.)\*((c\_.) + (d\_.)\*(x\_))^(m\_.)\*Sin[(a\_.) + (b\_.)\*(x\_)]^(n\_.), x\_Symbol] :=> Int[ExpandTrigReduce[(c + d\*x)^m, Sin[a + b\*x]^n \* Cos[a + b\*x]^p, x], x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IGtQ[p, 0]

### Rule 3297

Int[((c\_.) + (d\_.)\*(x\_))^(m\_)\*sin[(e\_.) + (f\_.)\*(x\_)], x\_Symbol] :=> Simp[((c + d\*x)^(m + 1)\*Sin[e + f\*x])/(d\*(m + 1)), x] - Dist[f/(d\*(m + 1)), Int[(c + d\*x)^(m + 1)\*Cos[e + f\*x], x], x] /; FreeQ[{c, d, e, f}, x] && LtQ[m, -1]

### Rule 3302

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] :=> Simp[CosIntegral[e - Pi/2 + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*(e - Pi/2) - c\*f, 0]

### Rule 3314

Int[((c\_.) + (d\_.)\*(x\_))^(m\_)\*((b\_.)\*sin[(e\_.) + (f\_.)\*(x\_)])^(n\_), x\_Symbol] :=> Simp[((c + d\*x)^(m + 1)\*(b\*SIN[e + f\*x])^n)/(d\*(m + 1)), x] + (Dist[(b^2\*f^2\*n\*(n - 1))/(d^2\*(m + 1)\*(m + 2)), Int[(c + d\*x)^(m + 2)\*(b\*SIN[e + f\*x])^(n - 2), x], x] - Dist[(f^2\*n^2)/(d^2\*(m + 1)\*(m + 2)), Int[(c + d\*x)^(m + 2)\*(b\*SIN[e + f\*x])^n, x], x] - Simp[(b\*f\*n\*(c + d\*x)^(m + 2)\*Cos[e + f\*x]\*(b\*SIN[e + f\*x])^(n - 1))/(d^2\*(m + 1)\*(m + 2)), x]) /; FreeQ[{b, c, d, e, f}, x] && GtQ[n, 1] && LtQ[m, -2]

### Rule 29

`Int[(x_)^(-1), x_Symbol] := Simp[Log[x], x]`

### Rule 3312

`Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)]^(n_), x_Symbol] := Int[ExpandTrigReduce[(c + d*x)^m, Sin[e + f*x]^n, x], x] /; FreeQ[{c, d, e, f, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))`

### Rubi steps

$$\begin{aligned}
 \int \frac{\cos(bx)\text{Ci}(bx)}{x^3} dx &= -\frac{\cos(bx)\text{Ci}(bx)}{2x^2} + \frac{1}{2}b \int \frac{\cos^2(bx)}{bx^3} dx - \frac{1}{2}b \int \frac{\text{Ci}(bx) \sin(bx)}{x^2} dx \\
 &= -\frac{\cos(bx)\text{Ci}(bx)}{2x^2} + \frac{b\text{Ci}(bx) \sin(bx)}{2x} + \frac{1}{2} \int \frac{\cos^2(bx)}{x^3} dx - \frac{1}{2}b^2 \int \frac{\cos(bx)\text{Ci}(bx)}{x} dx - \frac{1}{2}b^2 \int \frac{\cos(bx)}{x} dx \\
 &= -\frac{\cos^2(bx)}{4x^2} - \frac{\cos(bx)\text{Ci}(bx)}{2x^2} - \frac{1}{4}b^2\text{Ci}(bx)^2 + \frac{b \cos(bx) \sin(bx)}{2x} + \frac{b\text{Ci}(bx) \sin(bx)}{2x} - \frac{1}{2}b \int \frac{\cos(bx)}{x} dx \\
 &= -\frac{\cos^2(bx)}{4x^2} - \frac{\cos(bx)\text{Ci}(bx)}{2x^2} - \frac{1}{4}b^2\text{Ci}(bx)^2 + \frac{1}{2}b^2 \log(x) + \frac{b \cos(bx) \sin(bx)}{2x} + \frac{b\text{Ci}(bx) \sin(bx)}{2x} - \frac{1}{2}b \int \frac{\cos(bx)}{x} dx \\
 &= -\frac{\cos^2(bx)}{4x^2} - \frac{\cos(bx)\text{Ci}(bx)}{2x^2} - \frac{1}{4}b^2\text{Ci}(bx)^2 + \frac{b \cos(bx) \sin(bx)}{2x} + \frac{b\text{Ci}(bx) \sin(bx)}{2x} - \frac{1}{4}b \int \frac{\sin(2bx)}{x^2} dx \\
 &= -\frac{\cos^2(bx)}{4x^2} - \frac{\cos(bx)\text{Ci}(bx)}{2x^2} - \frac{1}{4}b^2\text{Ci}(bx)^2 - \frac{1}{2}b^2\text{Ci}(2bx) + \frac{b \cos(bx) \sin(bx)}{2x} + \frac{b\text{Ci}(bx) \sin(bx)}{2x} - \frac{1}{4}b \int \frac{\sin(2bx)}{x^2} dx \\
 &= -\frac{\cos^2(bx)}{4x^2} - \frac{\cos(bx)\text{Ci}(bx)}{2x^2} - \frac{1}{4}b^2\text{Ci}(bx)^2 - b^2\text{Ci}(2bx) + \frac{b \cos(bx) \sin(bx)}{2x} + \frac{b\text{Ci}(bx) \sin(bx)}{2x} - \frac{1}{4}b \int \frac{\sin(2bx)}{x^2} dx
 \end{aligned}$$

**Mathematica [A]** time = 0.0138336, size = 97, normalized size = 1.

$$-\frac{1}{4}b^2\text{CosIntegral}(bx)^2 - b^2\text{CosIntegral}(2bx) - \frac{\text{CosIntegral}(bx) \cos(bx)}{2x^2} + \frac{b\text{CosIntegral}(bx) \sin(bx)}{2x} - \frac{\cos^2(bx)}{4x^2} + \frac{b \cos(bx) \sin(bx)}{2x} + \frac{b\text{Ci}(bx) \sin(bx)}{2x}$$

Antiderivative was successfully verified.

[In] `Integrate[(Cos[b*x]*CosIntegral[b*x])/x^3,x]`

[Out] `-Cos[b*x]^2/(4*x^2) - (Cos[b*x]*CosIntegral[b*x])/(2*x^2) - (b^2*CosIntegral[b*x]^2)/4 - b^2*CosIntegral[2*b*x] + (b*Cos[b*x]*Sin[b*x])/(2*x) + (b*CosIntegral[b*x]*Sin[b*x])/(2*x) + (b*Sine[2*b*x])/(4*x)`

**Maple [F]** time = 0.082, size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx) \cos(bx)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(b\*x)\*cos(b\*x)/x^3,x)

[Out] int(Ci(b\*x)\*cos(b\*x)/x^3,x)

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx) \cos(bx)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)\*cos(b\*x)/x^3,x, algorithm="maxima")

[Out] integrate(Ci(b\*x)\*cos(b\*x)/x^3, x)

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\cos(bx) \text{Ci}(bx)}{x^3}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)\*cos(b\*x)/x^3,x, algorithm="fricas")

[Out] integral(cos(b\*x)\*cos\_integral(b\*x)/x^3, x)

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\cos(bx) \text{Ci}(bx)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x)*cos(b*x)/x**3,x)
```

```
[Out] Integral(cos(b*x)*Ci(b*x)/x**3, x)
```

---

**Giac [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx) \cos(bx)}{x^3} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x)*cos(b*x)/x^3,x, algorithm="giac")
```

```
[Out] integrate(Ci(b*x)*cos(b*x)/x^3, x)
```



$$3.115 \quad \int \frac{\cos(bx)\text{CosIntegral}(bx)}{x^2} dx$$

**Optimal.** Leaf size=50

$$-b\text{CannotIntegrate}\left(\frac{\text{CosIntegral}(bx)\sin(bx)}{x}, x\right) - \frac{\text{CosIntegral}(bx)\cos(bx)}{x} - b\text{Si}(2bx) - \frac{\cos^2(bx)}{x}$$

[Out]  $-(b*\text{CannotIntegrate}[(\text{CosIntegral}[b*x]*\text{Sin}[b*x])/x, x]) - \text{Cos}[b*x]^2/x - (\text{Cos}[b*x]*\text{CosIntegral}[b*x])/x - b*\text{SinIntegral}[2*b*x]$

**Rubi [A]** time = 0.0930662, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\cos(bx)\text{CosIntegral}(bx)}{x^2} dx$$

Verification is Not applicable to the result.

[In]  $\text{Int}[(\text{Cos}[b*x]*\text{CosIntegral}[b*x])/x^2, x]$

[Out]  $-(\text{Cos}[b*x]^2/x) - (\text{Cos}[b*x]*\text{CosIntegral}[b*x])/x - b*\text{SinIntegral}[2*b*x] - b*\text{Defer}[\text{Int}[(\text{CosIntegral}[b*x]*\text{Sin}[b*x])/x, x]]$

Rubi steps

$$\begin{aligned} \int \frac{\cos(bx)\text{Ci}(bx)}{x^2} dx &= -\frac{\cos(bx)\text{Ci}(bx)}{x} + b \int \frac{\cos^2(bx)}{bx^2} dx - b \int \frac{\text{Ci}(bx)\sin(bx)}{x} dx \\ &= -\frac{\cos(bx)\text{Ci}(bx)}{x} - b \int \frac{\text{Ci}(bx)\sin(bx)}{x} dx + \int \frac{\cos^2(bx)}{x^2} dx \\ &= -\frac{\cos^2(bx)}{x} - \frac{\cos(bx)\text{Ci}(bx)}{x} - b \int \frac{\text{Ci}(bx)\sin(bx)}{x} dx + (2b) \int -\frac{\sin(2bx)}{2x} dx \\ &= -\frac{\cos^2(bx)}{x} - \frac{\cos(bx)\text{Ci}(bx)}{x} - b \int \frac{\text{Ci}(bx)\sin(bx)}{x} dx - b \int \frac{\sin(2bx)}{x} dx \\ &= -\frac{\cos^2(bx)}{x} - \frac{\cos(bx)\text{Ci}(bx)}{x} - b\text{Si}(2bx) - b \int \frac{\text{Ci}(bx)\sin(bx)}{x} dx \end{aligned}$$

**Mathematica [A]** time = 0.444453, size = 0, normalized size = 0.

$$\int \frac{\cos(bx)\text{CosIntegral}(bx)}{x^2} dx$$

Verification is Not applicable to the result.

[In] Integrate[(Cos[b\*x]\*CosIntegral[b\*x])/x^2,x]

[Out] Integrate[(Cos[b\*x]\*CosIntegral[b\*x])/x^2, x]

**Maple [A]** time = 0.057, size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx) \cos(bx)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(b\*x)\*cos(b\*x)/x^2,x)

[Out] int(Ci(b\*x)\*cos(b\*x)/x^2,x)

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx) \cos(bx)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)\*cos(b\*x)/x^2,x, algorithm="maxima")

[Out] integrate(Ci(b\*x)\*cos(b\*x)/x^2, x)

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\cos(bx) \text{Ci}(bx)}{x^2}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)\*cos(b\*x)/x^2,x, algorithm="fricas")

[Out] `integral(cos(b*x)*cos_integral(b*x)/x^2, x)`

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\cos(bx) \operatorname{Ci}(bx)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Ci(b*x)*cos(b*x)/x**2,x)`

[Out] `Integral(cos(b*x)*Ci(b*x)/x**2, x)`

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\operatorname{Ci}(bx) \cos(bx)}{x^2} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Ci(b*x)*cos(b*x)/x^2,x, algorithm="giac")`

[Out] `integrate(Ci(b*x)*cos(b*x)/x^2, x)`

$$3.116 \quad \int \frac{\cos(bx)\text{CosIntegral}(bx)}{x} dx$$

**Optimal.** Leaf size=10

$$\frac{1}{2}\text{CosIntegral}(bx)^2$$

[Out] CosIntegral[b\*x]^2/2

**Rubi [A]** time = 0.0197507, antiderivative size = 10, normalized size of antiderivative = 1., number of steps used = 1, number of rules used = 1, integrand size = 12,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.083$ , Rules used = {6686}

$$\frac{1}{2}\text{CosIntegral}(bx)^2$$

Antiderivative was successfully verified.

[In] Int[(Cos[b\*x]\*CosIntegral[b\*x])/x,x]

[Out] CosIntegral[b\*x]^2/2

**Rule 6686**

Int[(u\_)\*(y\_)^(m\_.), x\_Symbol] := With[{q = DerivativeDivides[y, u, x]}, Si mp[(q\*y^(m + 1))/(m + 1), x] /; !FalseQ[q] /; FreeQ[m, x] && NeQ[m, -1]

**Rubi steps**

$$\int \frac{\cos(bx)\text{Ci}(bx)}{x} dx = \frac{\text{Ci}(bx)^2}{2}$$

**Mathematica [A]** time = 0.0031494, size = 10, normalized size = 1.

$$\frac{1}{2}\text{CosIntegral}(bx)^2$$

Antiderivative was successfully verified.

[In] Integrate[(Cos[b\*x]\*CosIntegral[b\*x])/x,x]

[Out] CosIntegral[b\*x]^2/2

---

**Maple [A]** time = 0.046, size = 9, normalized size = 0.9

$$\frac{(\text{Ci}(bx))^2}{2}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(b\*x)\*cos(b\*x)/x,x)

[Out] 1/2\*Ci(b\*x)^2

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx) \cos(bx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)\*cos(b\*x)/x,x, algorithm="maxima")

[Out] integrate(Ci(b\*x)\*cos(b\*x)/x, x)

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\cos(bx) \text{Ci}(bx)}{x}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)\*cos(b\*x)/x,x, algorithm="fricas")

[Out] integral(cos(b\*x)\*cos\_integral(b\*x)/x, x)

---

**Sympy [A]** time = 1.06805, size = 7, normalized size = 0.7

$$\frac{\text{Ci}^2(bx)}{2}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)\*cos(b\*x)/x,x)

[Out] Ci(b\*x)\*\*2/2

---

**Giac [A]** time = 1.24342, size = 11, normalized size = 1.1

$$\frac{1}{2} \text{Ci}(bx)^2$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)\*cos(b\*x)/x,x, algorithm="giac")

[Out] 1/2\*cos\_integral(b\*x)^2

### 3.117 $\int \cos(bx) \text{CosIntegral}(bx) dx$

Optimal. Leaf size=25

$$\frac{\text{CosIntegral}(bx) \sin(bx)}{b} - \frac{\text{Si}(2bx)}{2b}$$

[Out] (CosIntegral[b\*x]\*Sin[b\*x])/b - SinIntegral[2\*b\*x]/(2\*b)

**Rubi [A]** time = 0.043309, antiderivative size = 25, normalized size of antiderivative = 1., number of steps used = 5, number of rules used = 4, integrand size = 9,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.444$ , Rules used = {6512, 12, 4406, 3299}

$$\frac{\text{CosIntegral}(bx) \sin(bx)}{b} - \frac{\text{Si}(2bx)}{2b}$$

Antiderivative was successfully verified.

[In] Int[Cos[b\*x]\*CosIntegral[b\*x],x]

[Out] (CosIntegral[b\*x]\*Sin[b\*x])/b - SinIntegral[2\*b\*x]/(2\*b)

#### Rule 6512

Int[Cos[(a\_.) + (b\_.)\*(x\_)]\*CosIntegral[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] :> Simp[(Sin[a + b\*x]\*CosIntegral[c + d\*x])/b, x] - Dist[d/b, Int[(Sin[a + b\*x]\*Cos[c + d\*x])/(c + d\*x), x], x] /; FreeQ[{a, b, c, d}, x]

#### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] :> Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b\_.)\*(v\_) /; FreeQ[b, x]]

#### Rule 4406

Int[Cos[(a\_.) + (b\_.)\*(x\_)]^(p\_.)\*((c\_.) + (d\_.)\*(x\_))^(m\_.)\*Sin[(a\_.) + (b\_.)\*(x\_)]^(n\_.), x\_Symbol] :> Int[ExpandTrigReduce[(c + d\*x)^m, Sin[a + b\*x]]^n\*Cos[a + b\*x]^p, x], x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IGtQ[p, 0]

#### Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[SinInte
gral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

### Rubi steps

$$\begin{aligned}
 \int \cos(bx) \operatorname{Ci}(bx) dx &= \frac{\operatorname{Ci}(bx) \sin(bx)}{b} - \int \frac{\cos(bx) \sin(bx)}{bx} dx \\
 &= \frac{\operatorname{Ci}(bx) \sin(bx)}{b} - \frac{\int \frac{\cos(bx) \sin(bx)}{x} dx}{b} \\
 &= \frac{\operatorname{Ci}(bx) \sin(bx)}{b} - \frac{\int \frac{\sin(2bx)}{2x} dx}{b} \\
 &= \frac{\operatorname{Ci}(bx) \sin(bx)}{b} - \frac{\int \frac{\sin(2bx)}{x} dx}{2b} \\
 &= \frac{\operatorname{Ci}(bx) \sin(bx)}{b} - \frac{\operatorname{Si}(2bx)}{2b}
 \end{aligned}$$

**Mathematica [A]** time = 0.0115221, size = 25, normalized size = 1.

$$\frac{\operatorname{CosIntegral}(bx) \sin(bx)}{b} - \frac{\operatorname{Si}(2bx)}{2b}$$

Antiderivative was successfully verified.

```
[In] Integrate[Cos[b*x]*CosIntegral[b*x], x]
```

```
[Out] (CosIntegral[b*x]*Sin[b*x])/b - SinIntegral[2*b*x]/(2*b)
```

**Maple [A]** time = 0.049, size = 22, normalized size = 0.9

$$\frac{1}{b} \left( \operatorname{Ci}(bx) \sin(bx) - \frac{\operatorname{Si}(2bx)}{2} \right)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(Ci(b*x)*cos(b*x), x)
```

```
[Out] 1/b*(Ci(b*x)*sin(b*x)-1/2*Si(2*b*x))
```



---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \text{Ci}(bx) \cos(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)\*cos(b\*x),x, algorithm="maxima")

[Out] integrate(Ci(b\*x)\*cos(b\*x), x)

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(\cos(bx) \text{Ci}(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)\*cos(b\*x),x, algorithm="fricas")

[Out] integral(cos(b\*x)\*cos\_integral(b\*x), x)

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \cos(bx) \text{Ci}(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x)\*cos(b\*x),x)

[Out] Integral(cos(b\*x)\*Ci(b\*x), x)

---

**Giac [C]** time = 1.25457, size = 54, normalized size = 2.16

$$\frac{\text{Ci}(bx) \sin(bx)}{b} - \frac{\Im(\text{Ci}(2bx)) - \Im(\text{Ci}(-2bx)) + 2 \text{Si}(2bx)}{4b}$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x)*cos(b*x),x, algorithm="giac")
```

```
[Out] cos_integral(b*x)*sin(b*x)/b - 1/4*(imag_part(cos_integral(2*b*x)) - imag_p  
art(cos_integral(-2*b*x)) + 2*sin_integral(2*b*x))/b
```

### 3.118 $\int x \cos(bx) \text{CosIntegral}(bx) dx$

**Optimal.** Leaf size=60

$$-\frac{\text{CosIntegral}(2bx)}{2b^2} + \frac{\text{CosIntegral}(bx) \cos(bx)}{b^2} - \frac{\log(x)}{2b^2} - \frac{\sin^2(bx)}{2b^2} + \frac{x \text{CosIntegral}(bx) \sin(bx)}{b}$$

[Out] (Cos[b\*x]\*CosIntegral[b\*x])/b^2 - CosIntegral[2\*b\*x]/(2\*b^2) - Log[x]/(2\*b^2) + (x\*CosIntegral[b\*x]\*Sin[b\*x])/b - Sin[b\*x]^2/(2\*b^2)

**Rubi [A]** time = 0.0802722, antiderivative size = 60, normalized size of antiderivative = 1., number of steps used = 9, number of rules used = 7, integrand size = 10,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.7$ , Rules used = {6514, 12, 2564, 30, 6518, 3312, 3302}

$$-\frac{\text{CosIntegral}(2bx)}{2b^2} + \frac{\text{CosIntegral}(bx) \cos(bx)}{b^2} - \frac{\log(x)}{2b^2} - \frac{\sin^2(bx)}{2b^2} + \frac{x \text{CosIntegral}(bx) \sin(bx)}{b}$$

Antiderivative was successfully verified.

[In] Int[x\*Cos[b\*x]\*CosIntegral[b\*x],x]

[Out] (Cos[b\*x]\*CosIntegral[b\*x])/b^2 - CosIntegral[2\*b\*x]/(2\*b^2) - Log[x]/(2\*b^2) + (x\*CosIntegral[b\*x]\*Sin[b\*x])/b - Sin[b\*x]^2/(2\*b^2)

#### Rule 6514

Int[Cos[(a\_.) + (b\_.)\*(x\_)]\*CosIntegral[(c\_.) + (d\_.)\*(x\_)]\*((e\_.) + (f\_.)\*(x\_))^(m\_.), x\_Symbol] :> Simp[((e + f\*x)^m\*Sin[a + b\*x]\*CosIntegral[c + d\*x])/b, x] + (-Dist[d/b, Int[((e + f\*x)^m\*Sin[a + b\*x]\*Cos[c + d\*x])/(c + d\*x), x], x] - Dist[(f\*m)/b, Int[(e + f\*x)^(m - 1)\*Sin[a + b\*x]\*CosIntegral[c + d\*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]

#### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] :> Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b\_)\*(v\_) /; FreeQ[b, x]]

#### Rule 2564

Int[cos[(e\_.) + (f\_.)\*(x\_)]^(n\_.)\*((a\_.)\*sin[(e\_.) + (f\_.)\*(x\_)]^(m\_.), x\_Symbol] :> Dist[1/(a\*f), Subst[Int[x^m\*(1 - x^2/a^2)^((n - 1)/2), x], x, a\*Sin[e + f\*x]], x] /; FreeQ[{a, e, f, m}, x] && IntegerQ[(n - 1)/2] && !(In

tegerQ[(m - 1)/2] && LtQ[0, m, n])

### Rule 30

Int[(x\_)^(m\_.), x\_Symbol] :> Simp[x^(m + 1)/(m + 1), x] /; FreeQ[m, x] && NeQ[m, -1]

### Rule 6518

Int[CosIntegral[(c\_.) + (d\_.)\*(x\_)]\*Sin[(a\_.) + (b\_.)\*(x\_)], x\_Symbol] :> -Simp[(Cos[a + b\*x]\*CosIntegral[c + d\*x])/b, x] + Dist[d/b, Int[(Cos[a + b\*x]\*Cos[c + d\*x])/(c + d\*x), x], x] /; FreeQ[{a, b, c, d}, x]

### Rule 3312

Int[((c\_.) + (d\_.)\*(x\_))^(m\_)\*sin[(e\_.) + (f\_.)\*(x\_)]^(n\_), x\_Symbol] :> Int[ExpandTrigReduce[(c + d\*x)^m, Sin[e + f\*x]^n, x], x] /; FreeQ[{c, d, e, f, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))

### Rule 3302

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] :> Simp[CosIntegral[e - Pi/2 + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*(e - Pi/2) - c\*f, 0]

### Rubi steps

$$\begin{aligned}
 \int x \cos(bx) \operatorname{Ci}(bx) dx &= \frac{x \operatorname{Ci}(bx) \sin(bx)}{b} - \frac{\int \operatorname{Ci}(bx) \sin(bx) dx}{b} - \int \frac{\cos(bx) \sin(bx)}{b} dx \\
 &= \frac{\cos(bx) \operatorname{Ci}(bx)}{b^2} + \frac{x \operatorname{Ci}(bx) \sin(bx)}{b} - \frac{\int \frac{\cos^2(bx)}{bx} dx}{b} - \frac{\int \cos(bx) \sin(bx) dx}{b} \\
 &= \frac{\cos(bx) \operatorname{Ci}(bx)}{b^2} + \frac{x \operatorname{Ci}(bx) \sin(bx)}{b} - \frac{\int \frac{\cos^2(bx)}{x} dx}{b^2} - \frac{\operatorname{Subst}\left(\int x dx, x, \sin(bx)\right)}{b^2} \\
 &= \frac{\cos(bx) \operatorname{Ci}(bx)}{b^2} + \frac{x \operatorname{Ci}(bx) \sin(bx)}{b} - \frac{\sin^2(bx)}{2b^2} - \frac{\int \left(\frac{1}{2x} + \frac{\cos(2bx)}{2x}\right) dx}{b^2} \\
 &= \frac{\cos(bx) \operatorname{Ci}(bx)}{b^2} - \frac{\log(x)}{2b^2} + \frac{x \operatorname{Ci}(bx) \sin(bx)}{b} - \frac{\sin^2(bx)}{2b^2} - \frac{\int \frac{\cos(2bx)}{x} dx}{2b^2} \\
 &= \frac{\cos(bx) \operatorname{Ci}(bx)}{b^2} - \frac{\operatorname{Ci}(2bx)}{2b^2} - \frac{\log(x)}{2b^2} + \frac{x \operatorname{Ci}(bx) \sin(bx)}{b} - \frac{\sin^2(bx)}{2b^2}
 \end{aligned}$$

**Mathematica [A]** time = 0.0458631, size = 42, normalized size = 0.7

$$\frac{-2\text{CosIntegral}(2bx) + 4\text{CosIntegral}(bx)(bx \sin(bx) + \cos(bx)) + \cos(2bx) - 2 \log(x)}{4b^2}$$

Antiderivative was successfully verified.

[In] Integrate[x\*Cos[b\*x]\*CosIntegral[b\*x],x]

[Out] (Cos[2\*b\*x] - 2\*CosIntegral[2\*b\*x] - 2\*Log[x] + 4\*CosIntegral[b\*x]\*(Cos[b\*x] + b\*x\*Sin[b\*x]))/(4\*b^2)

**Maple [A]** time = 0.059, size = 57, normalized size = 1.

$$\frac{x\text{Ci}(bx) \sin(bx)}{b} + \frac{\text{Ci}(bx) \cos(bx)}{b^2} + \frac{(\cos(bx))^2}{2b^2} - \frac{\ln(bx)}{2b^2} - \frac{\text{Ci}(2bx)}{2b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x\*Ci(b\*x)\*cos(b\*x),x)

[Out] x\*Ci(b\*x)\*sin(b\*x)/b+Ci(b\*x)\*cos(b\*x)/b^2+1/2/b^2\*cos(b\*x)^2-1/2/b^2\*ln(b\*x)-1/2\*Ci(2\*b\*x)/b^2

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x\text{Ci}(bx) \cos(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Ci(b\*x)\*cos(b\*x),x, algorithm="maxima")

[Out] integrate(x\*Ci(b\*x)\*cos(b\*x), x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x \cos(bx) \text{Ci}(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x*Ci(b*x)*cos(b*x),x, algorithm="fricas")
```

```
[Out] integral(x*cos(b*x)*cos_integral(b*x), x)
```

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x \cos(bx) \operatorname{Ci}(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x*Ci(b*x)*cos(b*x),x)
```

```
[Out] Integral(x*cos(b*x)*Ci(b*x), x)
```

**Giac [A]** time = 1.19351, size = 59, normalized size = 0.98

$$\left( \frac{x \sin(bx)}{b} + \frac{\cos(bx)}{b^2} \right) \operatorname{Ci}(bx) - \frac{\operatorname{Ci}(2bx) + \operatorname{Ci}(-2bx) + 2 \log(x)}{4b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x*Ci(b*x)*cos(b*x),x, algorithm="giac")
```

```
[Out] (x*sin(b*x)/b + cos(b*x)/b^2)*cos_integral(b*x) - 1/4*(cos_integral(2*b*x)
+ cos_integral(-2*b*x) + 2*log(x))/b^2
```

### 3.119 $\int x^2 \cos(bx) \text{CosIntegral}(bx) dx$

**Optimal.** Leaf size=89

$$-\frac{2\text{CosIntegral}(bx) \sin(bx)}{b^3} + \frac{2x\text{CosIntegral}(bx) \cos(bx)}{b^2} + \frac{\text{Si}(2bx)}{b^3} - \frac{3x}{4b^2} - \frac{x \sin^2(bx)}{2b^2} - \frac{5 \sin(bx) \cos(bx)}{4b^3} + \frac{x^2 \text{CosIntegral}(bx)}{b^3}$$

[Out]  $(-3*x)/(4*b^2) + (2*x*\text{Cos}[b*x]*\text{CosIntegral}[b*x])/b^2 - (5*\text{Cos}[b*x]*\text{Sin}[b*x])/(4*b^3) - (2*\text{CosIntegral}[b*x]*\text{Sin}[b*x])/b^3 + (x^2*\text{CosIntegral}[b*x]*\text{Sin}[b*x])/b - (x*\text{Sin}[b*x]^2)/(2*b^2) + \text{SinIntegral}[2*b*x]/b^3$

**Rubi [A]** time = 0.112837, antiderivative size = 89, normalized size of antiderivative = 1., number of steps used = 14, number of rules used = 9, integrand size = 12,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.75$ , Rules used = {6514, 12, 3443, 2635, 8, 6520, 6512, 4406, 3299}

$$-\frac{2\text{CosIntegral}(bx) \sin(bx)}{b^3} + \frac{2x\text{CosIntegral}(bx) \cos(bx)}{b^2} + \frac{\text{Si}(2bx)}{b^3} - \frac{3x}{4b^2} - \frac{x \sin^2(bx)}{2b^2} - \frac{5 \sin(bx) \cos(bx)}{4b^3} + \frac{x^2 \text{CosIntegral}(bx)}{b^3}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[x^2*\text{Cos}[b*x]*\text{CosIntegral}[b*x], x]$

[Out]  $(-3*x)/(4*b^2) + (2*x*\text{Cos}[b*x]*\text{CosIntegral}[b*x])/b^2 - (5*\text{Cos}[b*x]*\text{Sin}[b*x])/(4*b^3) - (2*\text{CosIntegral}[b*x]*\text{Sin}[b*x])/b^3 + (x^2*\text{CosIntegral}[b*x]*\text{Sin}[b*x])/b - (x*\text{Sin}[b*x]^2)/(2*b^2) + \text{SinIntegral}[2*b*x]/b^3$

#### Rule 6514

$\text{Int}[\text{Cos}[(a_.) + (b_.)*(x_.)]*\text{CosIntegral}[(c_.) + (d_.)*(x_.)]*((e_.) + (f_.)*(x_.))^{(m_.)}, x\_Symbol] \rightarrow \text{Simp}[(e + f*x)^m*\text{Sin}[a + b*x]*\text{CosIntegral}[c + d*x])/b, x] + (-\text{Dist}[d/b, \text{Int}[(e + f*x)^m*\text{Sin}[a + b*x]*\text{Cos}[c + d*x]]/(c + d*x), x], x] - \text{Dist}[(f*m)/b, \text{Int}[(e + f*x)^{(m-1)}*\text{Sin}[a + b*x]*\text{CosIntegral}[c + d*x], x], x) /; \text{FreeQ}\{a, b, c, d, e, f\}, x] \&\& \text{IGtQ}[m, 0]$

#### Rule 12

$\text{Int}[(a_)*(u_), x\_Symbol] \rightarrow \text{Dist}[a, \text{Int}[u, x], x] /; \text{FreeQ}[a, x] \&\& !\text{MatchQ}[u, (b_)*(v_)] /; \text{FreeQ}[b, x]$

#### Rule 3443

$\text{Int}[\text{Cos}[(a_.) + (b_.)*(x_.)^{(n_.)}]*(x_.)^{(m_.)}*\text{Sin}[(a_.) + (b_.)*(x_.)^{(n_.)}]^{(p_.)}, x\_Symbol] \rightarrow \text{Simp}[(x^{(m-n+1)}*\text{Sin}[a + b*x^n]^{(p+1)})/(b*n*(p+1))$

)), x] - Dist[(m - n + 1)/(b\*n\*(p + 1)), Int[x^(m - n)\*Sin[a + b\*x^n]^(p + 1), x], x] /; FreeQ[{a, b, p}, x] && LtQ[0, n, m + 1] && NeQ[p, -1]

### Rule 2635

Int[((b\_.)\*sin[(c\_.) + (d\_.)\*(x\_)])^(n\_), x\_Symbol] := -Simp[(b\*Cos[c + d\*x]\*(b\*Ssin[c + d\*x])^(n - 1))/(d\*n), x] + Dist[(b^2\*(n - 1))/n, Int[(b\*Ssin[c + d\*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1] && IntegerQ[2\*n]

### Rule 8

Int[a\_, x\_Symbol] := Simp[a\*x, x] /; FreeQ[a, x]

### Rule 6520

Int[CosIntegral[(c\_.) + (d\_.)\*(x\_)]\*((e\_.) + (f\_.)\*(x\_))^(m\_.)\*Sin[(a\_.) + (b\_.)\*(x\_)], x\_Symbol] := -Simp[((e + f\*x)^m\*Cos[a + b\*x]\*CosIntegral[c + d\*x])/b, x] + (Dist[d/b, Int[((e + f\*x)^m\*Cos[a + b\*x]\*Cos[c + d\*x])/(c + d\*x), x], x] + Dist[(f\*m)/b, Int[(e + f\*x)^(m - 1)\*Cos[a + b\*x]\*CosIntegral[c + d\*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]

### Rule 6512

Int[Cos[(a\_.) + (b\_.)\*(x\_)]\*CosIntegral[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] := Simp[(Sin[a + b\*x]\*CosIntegral[c + d\*x])/b, x] - Dist[d/b, Int[(Sin[a + b\*x]\*Cos[c + d\*x])/(c + d\*x), x], x] /; FreeQ[{a, b, c, d}, x]

### Rule 4406

Int[Cos[(a\_.) + (b\_.)\*(x\_)]^(p\_.)\*((c\_.) + (d\_.)\*(x\_))^(m\_.)\*Sin[(a\_.) + (b\_.)\*(x\_)]^(n\_.), x\_Symbol] := Int[ExpandTrigReduce[(c + d\*x)^m, Sin[a + b\*x]^n\*Cos[a + b\*x]^p, x], x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IGtQ[p, 0]

### Rule 3299

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] := Simp[SinIntegral[e + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*e - c\*f, 0]

### Rubi steps



$$\begin{aligned}
\int x^2 \cos(bx) \text{Ci}(bx) dx &= \frac{x^2 \text{Ci}(bx) \sin(bx)}{b} - \frac{2 \int x \text{Ci}(bx) \sin(bx) dx}{b} - \int \frac{x \cos(bx) \sin(bx)}{b} dx \\
&= \frac{2x \cos(bx) \text{Ci}(bx)}{b^2} + \frac{x^2 \text{Ci}(bx) \sin(bx)}{b} - \frac{2 \int \cos(bx) \text{Ci}(bx) dx}{b^2} - \frac{\int x \cos(bx) \sin(bx) dx}{b} - \frac{2 \int \cos(bx) \sin(bx) dx}{b^2} \\
&= \frac{2x \cos(bx) \text{Ci}(bx)}{b^2} - \frac{2 \text{Ci}(bx) \sin(bx)}{b^3} + \frac{x^2 \text{Ci}(bx) \sin(bx)}{b} - \frac{x \sin^2(bx)}{2b^2} + \frac{\int \sin^2(bx) dx}{2b^2} - \frac{2 \int \cos(bx) \sin(bx) dx}{b^2} \\
&= \frac{2x \cos(bx) \text{Ci}(bx)}{b^2} - \frac{5 \cos(bx) \sin(bx)}{4b^3} - \frac{2 \text{Ci}(bx) \sin(bx)}{b^3} + \frac{x^2 \text{Ci}(bx) \sin(bx)}{b} - \frac{x \sin^2(bx)}{2b^2} + \frac{\int \sin^2(bx) dx}{2b^2} \\
&= -\frac{3x}{4b^2} + \frac{2x \cos(bx) \text{Ci}(bx)}{b^2} - \frac{5 \cos(bx) \sin(bx)}{4b^3} - \frac{2 \text{Ci}(bx) \sin(bx)}{b^3} + \frac{x^2 \text{Ci}(bx) \sin(bx)}{b} - \frac{x \sin^2(bx)}{2b^2} \\
&= -\frac{3x}{4b^2} + \frac{2x \cos(bx) \text{Ci}(bx)}{b^2} - \frac{5 \cos(bx) \sin(bx)}{4b^3} - \frac{2 \text{Ci}(bx) \sin(bx)}{b^3} + \frac{x^2 \text{Ci}(bx) \sin(bx)}{b} - \frac{x \sin^2(bx)}{2b^2} \\
&= -\frac{3x}{4b^2} + \frac{2x \cos(bx) \text{Ci}(bx)}{b^2} - \frac{5 \cos(bx) \sin(bx)}{4b^3} - \frac{2 \text{Ci}(bx) \sin(bx)}{b^3} + \frac{x^2 \text{Ci}(bx) \sin(bx)}{b} - \frac{x \sin^2(bx)}{2b^2}
\end{aligned}$$

**Mathematica [A]** time = 0.0809702, size = 64, normalized size = 0.72

$$\frac{8 \text{CosIntegral}(bx) \left( (b^2 x^2 - 2) \sin(bx) + 2bx \cos(bx) \right) + 8 \text{Si}(2bx) - 8bx - 5 \sin(2bx) + 2bx \cos(2bx)}{8b^3}$$

Antiderivative was successfully verified.

[In] Integrate[x^2\*Cos[b\*x]\*CosIntegral[b\*x],x]

[Out] (-8\*b\*x + 2\*b\*x\*cos[2\*b\*x] + 8\*CosIntegral[b\*x]\*(2\*b\*x\*cos[b\*x] + (-2 + b^2\*x^2)\*Sin[b\*x]) - 5\*Sin[2\*b\*x] + 8\*SinIntegral[2\*b\*x])/(8\*b^3)

**Maple [A]** time = 0.073, size = 66, normalized size = 0.7

$$\frac{1}{b^3} \left( \text{Ci}(bx) (b^2 x^2 \sin(bx) - 2 \sin(bx) + 2bx \cos(bx)) + \frac{bx (\cos(bx))^2}{2} - \frac{5 \sin(bx) \cos(bx)}{4} - \frac{5bx}{4} + \text{Si}(2bx) \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x^2\*Ci(b\*x)\*cos(b\*x),x)

[Out]  $1/b^3*(Ci(b*x)*(b^2*x^2*\sin(b*x)-2*\sin(b*x))+2*b*x*\cos(b*x))+1/2*b*x*\cos(b*x)^2-5/4*\sin(b*x)*\cos(b*x)-5/4*b*x+Si(2*b*x))$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 Ci(bx) \cos(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Ci(b*x)*cos(b*x),x, algorithm="maxima")`

[Out] `integrate(x^2*Ci(b*x)*cos(b*x), x)`

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x^2 \cos(bx) Ci(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Ci(b*x)*cos(b*x),x, algorithm="fricas")`

[Out] `integral(x^2*cos(b*x)*cos_integral(b*x), x)`

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \cos(bx) Ci(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x**2*Ci(b*x)*cos(b*x),x)`

[Out] `Integral(x**2*cos(b*x)*Ci(b*x), x)`

**Giac [C]** time = 1.19961, size = 88, normalized size = 0.99

$$\left( \frac{2x \cos(bx)}{b^2} + \frac{(b^2x^2 - 2) \sin(bx)}{b^3} \right) \text{Ci}(bx) - \frac{2bx - \Im(\text{Ci}(2bx)) + \Im(\text{Ci}(-2bx)) - 2 \text{Si}(2bx)}{2b^3}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^2\*Ci(b\*x)\*cos(b\*x),x, algorithm="giac")

[Out] (2\*x\*cos(b\*x)/b^2 + (b^2\*x^2 - 2)\*sin(b\*x)/b^3)\*cos\_integral(b\*x) - 1/2\*(2\*b\*x - imag\_part(cos\_integral(2\*b\*x)) + imag\_part(cos\_integral(-2\*b\*x)) - 2\*sin\_integral(2\*b\*x))/b^3

### 3.120 $\int x^3 \cos(bx) \text{CosIntegral}(bx) dx$

**Optimal.** Leaf size=142

$$\frac{3x^2 \text{CosIntegral}(bx) \cos(bx)}{b^2} + \frac{3 \text{CosIntegral}(2bx)}{b^4} - \frac{6x \text{CosIntegral}(bx) \sin(bx)}{b^3} - \frac{6 \text{CosIntegral}(bx) \cos(bx)}{b^4} - \frac{x^2}{2b^2}$$

[Out]  $-x^2/(2*b^2) - (3*\text{Cos}[b*x]^2)/(4*b^4) - (6*\text{Cos}[b*x]*\text{CosIntegral}[b*x])/b^4 + (3*x^2*\text{Cos}[b*x]*\text{CosIntegral}[b*x])/b^2 + (3*\text{CosIntegral}[2*b*x])/b^4 + (3*\text{Log}[x])/b^4 - (2*x*\text{Cos}[b*x]*\text{Sin}[b*x])/b^3 - (6*x*\text{CosIntegral}[b*x]*\text{Sin}[b*x])/b^3 + (x^3*\text{CosIntegral}[b*x]*\text{Sin}[b*x])/b + (13*\text{Sin}[b*x]^2)/(4*b^4) - (x^2*\text{Sin}[b*x]^2)/(2*b^2)$

**Rubi [A]** time = 0.18973, antiderivative size = 142, normalized size of antiderivative = 1., number of steps used = 18, number of rules used = 10, integrand size = 12,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.833$ , Rules used = {6514, 12, 3443, 3310, 30, 6520, 2564, 6518, 3312, 3302}

$$\frac{3x^2 \text{CosIntegral}(bx) \cos(bx)}{b^2} + \frac{3 \text{CosIntegral}(2bx)}{b^4} - \frac{6x \text{CosIntegral}(bx) \sin(bx)}{b^3} - \frac{6 \text{CosIntegral}(bx) \cos(bx)}{b^4} - \frac{x^2}{2b^2}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[x^3*\text{Cos}[b*x]*\text{CosIntegral}[b*x], x]$

[Out]  $-x^2/(2*b^2) - (3*\text{Cos}[b*x]^2)/(4*b^4) - (6*\text{Cos}[b*x]*\text{CosIntegral}[b*x])/b^4 + (3*x^2*\text{Cos}[b*x]*\text{CosIntegral}[b*x])/b^2 + (3*\text{CosIntegral}[2*b*x])/b^4 + (3*\text{Log}[x])/b^4 - (2*x*\text{Cos}[b*x]*\text{Sin}[b*x])/b^3 - (6*x*\text{CosIntegral}[b*x]*\text{Sin}[b*x])/b^3 + (x^3*\text{CosIntegral}[b*x]*\text{Sin}[b*x])/b + (13*\text{Sin}[b*x]^2)/(4*b^4) - (x^2*\text{Sin}[b*x]^2)/(2*b^2)$

#### Rule 6514

$\text{Int}[\text{Cos}[(a_.) + (b_.)*(x_.)]*\text{CosIntegral}[(c_.) + (d_.)*(x_.)]*((e_.) + (f_.)*(x_.))^{(m_.)}, x\_Symbol] \rightarrow \text{Simp}[\frac{(e + f*x)^m*\text{Sin}[a + b*x]*\text{CosIntegral}[c + d*x]}{b}, x] + (-\text{Dist}[d/b, \text{Int}[\frac{(e + f*x)^m*\text{Sin}[a + b*x]*\text{Cos}[c + d*x]}{c + d*x}, x], x] - \text{Dist}[\frac{f*m}{b}, \text{Int}[(e + f*x)^{(m-1)}*\text{Sin}[a + b*x]*\text{CosIntegral}[c + d*x], x], x]) /; \text{FreeQ}\{a, b, c, d, e, f\}, x \&\& \text{IGtQ}[m, 0]$

#### Rule 12

$\text{Int}[(a_)*(u_), x\_Symbol] \rightarrow \text{Dist}[a, \text{Int}[u, x], x] /; \text{FreeQ}[a, x] \&\& !\text{MatchQ}[u, (b_)*(v_)] /; \text{FreeQ}[b, x]$

Rule 3443

```
Int[Cos[(a_.) + (b_.)*(x_)^(n_.)]*(x_)^(m_.)*Sin[(a_.) + (b_.)*(x_)^(n_.)]^(p_.), x_Symbol] :> Simp[(x^(m - n + 1)*Sin[a + b*x^n]^(p + 1))/(b*n*(p + 1)), x] - Dist[(m - n + 1)/(b*n*(p + 1)), Int[x^(m - n)*Sin[a + b*x^n]^(p + 1), x], x] /; FreeQ[{a, b, p}, x] && LtQ[0, n, m + 1] && NeQ[p, -1]
```

Rule 3310

```
Int[((c_.) + (d_.)*(x_))*((b_.)*sin[(e_.) + (f_.)*(x_)])^(n_), x_Symbol] :> Simp[(d*(b*Sine[e + f*x])^n)/(f^2*n^2), x] + (Dist[(b^2*(n - 1))/n, Int[(c + d*x)*(b*Sine[e + f*x])^(n - 2), x], x] - Simp[(b*(c + d*x)*Cos[e + f*x]*(b*Sine[e + f*x])^(n - 1))/(f*n), x]) /; FreeQ[{b, c, d, e, f}, x] && GtQ[n, 1]
```

Rule 30

```
Int[(x_)^(m_.), x_Symbol] :> Simp[x^(m + 1)/(m + 1), x] /; FreeQ[m, x] && NeQ[m, -1]
```

Rule 6520

```
Int[CosIntegral[(c_.) + (d_.)*(x_)]*((e_.) + (f_.)*(x_))^(m_.)*Sin[(a_.) + (b_.)*(x_)], x_Symbol] :> -Simp[((e + f*x)^m*Cos[a + b*x]*CosIntegral[c + d*x])/b, x] + (Dist[d/b, Int[((e + f*x)^m*Cos[a + b*x]*Cos[c + d*x])/(c + d*x), x], x] + Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*Cos[a + b*x]*CosIntegral[c + d*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]
```

Rule 2564

```
Int[cos[(e_.) + (f_.)*(x_)]^(n_.)*((a_.)*sin[(e_.) + (f_.)*(x_)])^(m_.), x_Symbol] :> Dist[1/(a*f), Subst[Int[x^m*(1 - x^2/a^2)^((n - 1)/2), x], x, a*Sine[e + f*x]], x] /; FreeQ[{a, e, f, m}, x] && IntegerQ[(n - 1)/2] && !(IntegerQ[(m - 1)/2] && LtQ[0, m, n])
```

Rule 6518

```
Int[CosIntegral[(c_.) + (d_.)*(x_)]*Sin[(a_.) + (b_.)*(x_)], x_Symbol] :> -Simp[(Cos[a + b*x]*CosIntegral[c + d*x])/b, x] + Dist[d/b, Int[(Cos[a + b*x]*Cos[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

Rule 3312

```
Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)]^(n_), x_Symbol] :> Int[ExpandTrigReduce[(c + d*x)^m, Sine[e + f*x]^n, x], x] /; FreeQ[{c, d, e, f}
```

, m}, x] && IGtQ[n, 1] && ( !RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))

### Rule 3302

Int[sin[(e\_.) + (f\_.)\*(x\_.)]/((c\_.) + (d\_.)\*(x\_.)), x\_Symbol] := Simp[CosIntegral[e - Pi/2 + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*(e - Pi/2) - c\*f, 0]

### Rubi steps

$$\begin{aligned}
 \int x^3 \cos(bx) \text{Ci}(bx) dx &= \frac{x^3 \text{Ci}(bx) \sin(bx)}{b} - \frac{3 \int x^2 \text{Ci}(bx) \sin(bx) dx}{b} - \int \frac{x^2 \cos(bx) \sin(bx)}{b} dx \\
 &= \frac{3x^2 \cos(bx) \text{Ci}(bx)}{b^2} + \frac{x^3 \text{Ci}(bx) \sin(bx)}{b} - \frac{6 \int x \cos(bx) \text{Ci}(bx) dx}{b^2} - \frac{\int x^2 \cos(bx) \sin(bx) dx}{b} - \frac{3}{b^3} \\
 &= \frac{3x^2 \cos(bx) \text{Ci}(bx)}{b^2} - \frac{6x \text{Ci}(bx) \sin(bx)}{b^3} + \frac{x^3 \text{Ci}(bx) \sin(bx)}{b} - \frac{x^2 \sin^2(bx)}{2b^2} + \frac{6 \int \text{Ci}(bx) \sin(bx) dx}{b^3} \\
 &= -\frac{3 \cos^2(bx)}{4b^4} - \frac{6 \cos(bx) \text{Ci}(bx)}{b^4} + \frac{3x^2 \cos(bx) \text{Ci}(bx)}{b^2} - \frac{2x \cos(bx) \sin(bx)}{b^3} - \frac{6x \text{Ci}(bx) \sin(bx)}{b^3} \\
 &= -\frac{x^2}{2b^2} - \frac{3 \cos^2(bx)}{4b^4} - \frac{6 \cos(bx) \text{Ci}(bx)}{b^4} + \frac{3x^2 \cos(bx) \text{Ci}(bx)}{b^2} - \frac{2x \cos(bx) \sin(bx)}{b^3} - \frac{6x \text{Ci}(bx) \sin(bx)}{b^3} \\
 &= -\frac{x^2}{2b^2} - \frac{3 \cos^2(bx)}{4b^4} - \frac{6 \cos(bx) \text{Ci}(bx)}{b^4} + \frac{3x^2 \cos(bx) \text{Ci}(bx)}{b^2} - \frac{2x \cos(bx) \sin(bx)}{b^3} - \frac{6x \text{Ci}(bx) \sin(bx)}{b^3} \\
 &= -\frac{x^2}{2b^2} - \frac{3 \cos^2(bx)}{4b^4} - \frac{6 \cos(bx) \text{Ci}(bx)}{b^4} + \frac{3x^2 \cos(bx) \text{Ci}(bx)}{b^2} + \frac{3 \log(x)}{b^4} - \frac{2x \cos(bx) \sin(bx)}{b^3} - \frac{6x \text{Ci}(bx) \sin(bx)}{b^3} \\
 &= -\frac{x^2}{2b^2} - \frac{3 \cos^2(bx)}{4b^4} - \frac{6 \cos(bx) \text{Ci}(bx)}{b^4} + \frac{3x^2 \cos(bx) \text{Ci}(bx)}{b^2} + \frac{3 \text{Ci}(2bx)}{b^4} + \frac{3 \log(x)}{b^4} - \frac{2x \cos(bx) \sin(bx)}{b^3} - \frac{6x \text{Ci}(bx) \sin(bx)}{b^3}
 \end{aligned}$$

**Mathematica [A]** time = 0.105215, size = 93, normalized size = 0.65

$$\frac{4 \text{CosIntegral}(bx) (bx (b^2 x^2 - 6) \sin(bx) + 3 (b^2 x^2 - 2) \cos(bx)) - 3b^2 x^2 + b^2 x^2 \cos(2bx) + 12 \text{CosIntegral}(2bx) - 4bx \sin(2bx)}{4b^4}$$

Antiderivative was successfully verified.

[In] Integrate[x^3 \* Cos[b\*x] \* CosIntegral[b\*x], x]

[Out] (-3\*b^2\*x^2 - 8\*Cos[2\*b\*x] + b^2\*x^2\*Cos[2\*b\*x] + 12\*CosIntegral[2\*b\*x] + 12\*Log[x] + 4\*CosIntegral[b\*x] \* (3\*(-2 + b^2\*x^2)\*Cos[b\*x] + b\*x\*(-6 + b^2\*x^2))) / (4\*b^4)

$$2) * \sin[b*x]) - 4*b*x*\sin[2*b*x]) / (4*b^4)$$


---

**Maple [A]** time = 0.065, size = 136, normalized size = 1.

$$\frac{x^3 \operatorname{Ci}(bx) \sin(bx)}{b} + 3 \frac{x^2 \operatorname{Ci}(bx) \cos(bx)}{b^2} - 6 \frac{x \operatorname{Ci}(bx) \sin(bx)}{b^3} - 6 \frac{\operatorname{Ci}(bx) \cos(bx)}{b^4} + \frac{x^2 (\cos(bx))^2}{2b^2} - 2 \frac{x \cos(bx) \sin(bx)}{b^3}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x^3\*Ci(b\*x)\*cos(b\*x), x)

[Out] x^3\*Ci(b\*x)\*sin(b\*x)/b+3\*x^2\*Ci(b\*x)\*cos(b\*x)/b^2-6\*x\*Ci(b\*x)\*sin(b\*x)/b^3-6\*Ci(b\*x)\*cos(b\*x)/b^4+1/2/b^2\*x^2\*cos(b\*x)^2-2\*x\*cos(b\*x)\*sin(b\*x)/b^3-x^2/b^2+sin(b\*x)^2/b^4+3/b^4\*ln(b\*x)+3\*Ci(2\*b\*x)/b^4-3\*cos(b\*x)^2/b^4

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^3 \operatorname{Ci}(bx) \cos(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^3\*Ci(b\*x)\*cos(b\*x), x, algorithm="maxima")

[Out] integrate(x^3\*Ci(b\*x)\*cos(b\*x), x)

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(x^3 \cos(bx) \operatorname{Ci}(bx), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^3\*Ci(b\*x)\*cos(b\*x), x, algorithm="fricas")

[Out] integral(x^3\*cos(b\*x)\*cos\_integral(b\*x), x)

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x^3 \cos(bx) \operatorname{Ci}(bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*\*3\*Ci(b\*x)\*cos(b\*x), x)

[Out] Integral(x\*\*3\*cos(b\*x)\*Ci(b\*x), x)

**Giac [A]** time = 1.26308, size = 103, normalized size = 0.73

$$\left( \frac{3(b^2x^2 - 2)\cos(bx)}{b^4} + \frac{(b^3x^3 - 6bx)\sin(bx)}{b^4} \right) \operatorname{Ci}(bx) - \frac{3(b^2x^2 - 2)\operatorname{Ci}(2bx) - 2\operatorname{Ci}(-2bx) - 4\log(x)}{4b^4}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^3\*Ci(b\*x)\*cos(b\*x), x, algorithm="giac")

[Out] (3\*(b^2\*x^2 - 2)\*cos(b\*x)/b^4 + (b^3\*x^3 - 6\*b\*x)\*sin(b\*x)/b^4)\*cos\_integral(b\*x) - 3/4\*(b^2\*x^2 - 2\*cos\_integral(2\*b\*x) - 2\*cos\_integral(-2\*b\*x) - 4\*log(x))/b^4



### 3.121 $\int \text{CosIntegral}(2x) \sin(5x) dx$

**Optimal.** Leaf size=29

$$\frac{1}{10}\text{CosIntegral}(3x) + \frac{1}{10}\text{CosIntegral}(7x) - \frac{1}{5}\text{CosIntegral}(2x) \cos(5x)$$

[Out]  $-(\text{Cos}[5*x]*\text{CosIntegral}[2*x])/5 + \text{CosIntegral}[3*x]/10 + \text{CosIntegral}[7*x]/10$

**Rubi [A]** time = 0.0557009, antiderivative size = 29, normalized size of antiderivative = 1., number of steps used = 6, number of rules used = 4, integrand size = 9,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.444$ , Rules used = {6518, 12, 4429, 3302}

$$\frac{1}{10}\text{CosIntegral}(3x) + \frac{1}{10}\text{CosIntegral}(7x) - \frac{1}{5}\text{CosIntegral}(2x) \cos(5x)$$

Antiderivative was successfully verified.

[In]  $\text{Int}[\text{CosIntegral}[2*x]*\text{Sin}[5*x], x]$

[Out]  $-(\text{Cos}[5*x]*\text{CosIntegral}[2*x])/5 + \text{CosIntegral}[3*x]/10 + \text{CosIntegral}[7*x]/10$

#### Rule 6518

$\text{Int}[\text{CosIntegral}[(c_.) + (d_.)*(x_.)]*\text{Sin}[(a_.) + (b_.)*(x_.)], x\_Symbol] \text{ :> } -\text{Simp}[(\text{Cos}[a + b*x]*\text{CosIntegral}[c + d*x])/b, x] + \text{Dist}[d/b, \text{Int}[(\text{Cos}[a + b*x]*\text{Cos}[c + d*x])/(c + d*x), x], x] \text{ /; FreeQ}\{a, b, c, d\}, x]$

#### Rule 12

$\text{Int}[(a_)*(u_), x\_Symbol] \text{ :> } \text{Dist}[a, \text{Int}[u, x], x] \text{ /; FreeQ}[a, x] \ \&\& \ !\text{MatchQ}[u, (b_)*(v_) \text{ /; FreeQ}[b, x]]]$

#### Rule 4429

$\text{Int}[\text{Cos}[(a_.) + (b_.)*(x_.)]^{(p_.)}*\text{Cos}[(c_.) + (d_.)*(x_.)]^{(q_.)}*((e_.) + (f_.)*(x_.))^{(m_.)}, x\_Symbol] \text{ :> } \text{Int}[\text{ExpandTrigReduce}[(e + f*x)^m, \text{Cos}[a + b*x]^{p*}\text{Cos}[c + d*x]^q, x], x] \text{ /; FreeQ}\{a, b, c, d, e, f\}, x] \ \&\& \ \text{IGtQ}[p, 0] \ \&\& \ \text{IGtQ}[q, 0] \ \&\& \ \text{IntegerQ}[m]$

#### Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[CosIntegral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) - c*f, 0]
```

### Rubi steps

$$\begin{aligned}
 \int \text{Ci}(2x) \sin(5x) dx &= -\frac{1}{5} \cos(5x) \text{Ci}(2x) + \frac{2}{5} \int \frac{\cos(2x) \cos(5x)}{2x} dx \\
 &= -\frac{1}{5} \cos(5x) \text{Ci}(2x) + \frac{1}{5} \int \frac{\cos(2x) \cos(5x)}{x} dx \\
 &= -\frac{1}{5} \cos(5x) \text{Ci}(2x) + \frac{1}{5} \int \left( \frac{\cos(3x)}{2x} + \frac{\cos(7x)}{2x} \right) dx \\
 &= -\frac{1}{5} \cos(5x) \text{Ci}(2x) + \frac{1}{10} \int \frac{\cos(3x)}{x} dx + \frac{1}{10} \int \frac{\cos(7x)}{x} dx \\
 &= -\frac{1}{5} \cos(5x) \text{Ci}(2x) + \frac{\text{Ci}(3x)}{10} + \frac{\text{Ci}(7x)}{10}
 \end{aligned}$$

**Mathematica [A]** time = 0.0262833, size = 23, normalized size = 0.79

$$\frac{1}{10}(\text{CosIntegral}(3x) + \text{CosIntegral}(7x) - 2\text{CosIntegral}(2x) \cos(5x))$$

Antiderivative was successfully verified.

```
[In] Integrate[CosIntegral[2*x]*Sin[5*x], x]
```

```
[Out] (-2*Cos[5*x]*CosIntegral[2*x] + CosIntegral[3*x] + CosIntegral[7*x])/10
```

**Maple [A]** time = 0.104, size = 24, normalized size = 0.8

$$\frac{\text{Ci}(3x)}{10} + \frac{\text{Ci}(7x)}{10} - \frac{\text{Ci}(2x) \cos(5x)}{5}$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(Ci(2*x)*sin(5*x), x)
```

```
[Out] 1/10*Ci(3*x)+1/10*Ci(7*x)-1/5*Ci(2*x)*cos(5*x)
```

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \text{Ci}(2x) \sin(5x) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(2\*x)\*sin(5\*x),x, algorithm="maxima")

[Out] integrate(Ci(2\*x)\*sin(5\*x), x)

---

**Fricas [F(-2)]** time = 0., size = 0, normalized size = 0.

Exception raised: UnboundLocalError

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(2\*x)\*sin(5\*x),x, algorithm="fricas")

[Out] Exception raised: UnboundLocalError

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \sin(5x) \text{Ci}(2x) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(2\*x)\*sin(5\*x),x)

[Out] Integral(sin(5\*x)\*Ci(2\*x), x)

---

**Giac [A]** time = 1.21775, size = 31, normalized size = 1.07

$$-\frac{1}{5} \cos(5x) \text{Ci}(2x) + \frac{1}{10} \text{Ci}(7x) + \frac{1}{10} \text{Ci}(3x)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(2*x)*sin(5*x),x, algorithm="giac")
```

```
[Out] -1/5*cos(5*x)*cos_integral(2*x) + 1/10*cos_integral(7*x) + 1/10*cos_integra  
l(3*x)
```

### 3.122 $\int \cos(5x) \text{CosIntegral}(2x) dx$

Optimal. Leaf size=29

$$\frac{1}{5} \text{CosIntegral}(2x) \sin(5x) - \frac{\text{Si}(3x)}{10} - \frac{\text{Si}(7x)}{10}$$

[Out] (CosIntegral[2\*x]\*Sin[5\*x])/5 - SinIntegral[3\*x]/10 - SinIntegral[7\*x]/10

**Rubi [A]** time = 0.0534955, antiderivative size = 29, normalized size of antiderivative = 1., number of steps used = 6, number of rules used = 4, integrand size = 9,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.444$ , Rules used = {6512, 12, 4430, 3299}

$$\frac{1}{5} \text{CosIntegral}(2x) \sin(5x) - \frac{\text{Si}(3x)}{10} - \frac{\text{Si}(7x)}{10}$$

Antiderivative was successfully verified.

[In] Int[Cos[5\*x]\*CosIntegral[2\*x],x]

[Out] (CosIntegral[2\*x]\*Sin[5\*x])/5 - SinIntegral[3\*x]/10 - SinIntegral[7\*x]/10

#### Rule 6512

Int[Cos[(a\_.) + (b\_.)\*(x\_.)]\*CosIntegral[(c\_.) + (d\_.)\*(x\_.)], x\_Symbol] :> S  
imp[(Sin[a + b\*x]\*CosIntegral[c + d\*x])/b, x] - Dist[d/b, Int[(Sin[a + b\*x]  
\*Cos[c + d\*x])/(c + d\*x), x], x] /; FreeQ[{a, b, c, d}, x]

#### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] :> Dist[a, Int[u, x], x] /; FreeQ[a, x] && !Match  
Q[u, (b\_)\*(v\_)] /; FreeQ[b, x]

#### Rule 4430

Int[Cos[(c\_.) + (d\_.)\*(x\_.)]^(q\_.)\*((e\_.) + (f\_.)\*(x\_.))^(m\_.)\*Sin[(a\_.) + (b  
\_.)\*(x\_.)]^(p\_.), x\_Symbol] :> Int[ExpandTrigReduce[(e + f\*x)^m, Sin[a + b\*x  
]^(p)\*Cos[c + d\*x]^q, x], x] /; FreeQ[{a, b, c, d, e, f, m}, x] && IGtQ[p, 0]  
&& IGtQ[q, 0]

#### Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[SinInte
gral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

### Rubi steps

$$\begin{aligned}
 \int \cos(5x) \operatorname{Ci}(2x) dx &= \frac{1}{5} \operatorname{Ci}(2x) \sin(5x) - \frac{2}{5} \int \frac{\cos(2x) \sin(5x)}{2x} dx \\
 &= \frac{1}{5} \operatorname{Ci}(2x) \sin(5x) - \frac{1}{5} \int \frac{\cos(2x) \sin(5x)}{x} dx \\
 &= \frac{1}{5} \operatorname{Ci}(2x) \sin(5x) - \frac{1}{5} \int \left( \frac{\sin(3x)}{2x} + \frac{\sin(7x)}{2x} \right) dx \\
 &= \frac{1}{5} \operatorname{Ci}(2x) \sin(5x) - \frac{1}{10} \int \frac{\sin(3x)}{x} dx - \frac{1}{10} \int \frac{\sin(7x)}{x} dx \\
 &= \frac{1}{5} \operatorname{Ci}(2x) \sin(5x) - \frac{\operatorname{Si}(3x)}{10} - \frac{\operatorname{Si}(7x)}{10}
 \end{aligned}$$

**Mathematica [A]** time = 0.024018, size = 27, normalized size = 0.93

$$\frac{1}{10} (2 \operatorname{CosIntegral}(2x) \sin(5x) - \operatorname{Si}(3x) - \operatorname{Si}(7x))$$

Antiderivative was successfully verified.

```
[In] Integrate[Cos[5*x]*CosIntegral[2*x], x]
```

```
[Out] (2*CosIntegral[2*x]*Sin[5*x] - SinIntegral[3*x] - SinIntegral[7*x])/10
```

**Maple [A]** time = 0.095, size = 24, normalized size = 0.8

$$-\frac{\operatorname{Si}(3x)}{10} - \frac{\operatorname{Si}(7x)}{10} + \frac{\operatorname{Ci}(2x) \sin(5x)}{5}$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(Ci(2*x)*cos(5*x), x)
```

```
[Out] -1/10*Si(3*x)-1/10*Si(7*x)+1/5*Ci(2*x)*sin(5*x)
```

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \text{Ci}(2x) \cos(5x) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(2\*x)\*cos(5\*x),x, algorithm="maxima")

[Out] integrate(Ci(2\*x)\*cos(5\*x), x)

---

**Fricas [F(-2)]** time = 0., size = 0, normalized size = 0.

Exception raised: UnboundLocalError

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(2\*x)\*cos(5\*x),x, algorithm="fricas")

[Out] Exception raised: UnboundLocalError

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \cos(5x) \text{Ci}(2x) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(2\*x)\*cos(5\*x),x)

[Out] Integral(cos(5\*x)\*Ci(2\*x), x)

---

**Giac [A]** time = 1.2446, size = 31, normalized size = 1.07

$$\frac{1}{5} \text{Ci}(2x) \sin(5x) - \frac{1}{10} \text{Si}(7x) - \frac{1}{10} \text{Si}(3x)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(2*x)*cos(5*x),x, algorithm="giac")
```

```
[Out] 1/5*cos_integral(2*x)*sin(5*x) - 1/10*sin_integral(7*x) - 1/10*sin_integral(3*x)
```



### 3.123 $\int x^2 \text{CosIntegral}(a + bx) \sin(a + bx) dx$

**Optimal.** Leaf size=220

$$\frac{a^2 \text{CosIntegral}(2a + 2bx)}{2b^3} + \frac{a^2 \log(a + bx)}{2b^3} - \frac{\text{CosIntegral}(2a + 2bx)}{b^3} + \frac{2x \text{CosIntegral}(a + bx) \sin(a + bx)}{b^2} + \frac{2 \text{CosIntegral}(a + bx)}{b}$$

```
[Out] -(a*x)/(2*b^2) + x^2/(4*b) + Cos[a + b*x]^2/(4*b^3) + Cos[2*a + 2*b*x]/(2*b^3) + (2*Cos[a + b*x]*CosIntegral[a + b*x])/b^3 - (x^2*Cos[a + b*x]*CosIntegral[a + b*x])/b - CosIntegral[2*a + 2*b*x]/b^3 + (a^2*CosIntegral[2*a + 2*b*x])/(2*b^3) - Log[a + b*x]/b^3 + (a^2*Log[a + b*x])/(2*b^3) - (a*Cos[a + b*x]*Sin[a + b*x])/(2*b^3) + (x*Cos[a + b*x]*Sin[a + b*x])/(2*b^2) + (2*x*CosIntegral[a + b*x]*Sin[a + b*x])/b^2 + (a*SineIntegral[2*a + 2*b*x])/b^3
```

**Rubi [A]** time = 0.719672, antiderivative size = 220, normalized size of antiderivative = 1., number of steps used = 21, number of rules used = 14, integrand size = 16,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.875$ , Rules used = {6520, 6742, 2635, 8, 3310, 30, 3312, 3302, 6514, 4573, 6741, 2638, 3299, 6518}

$$\frac{a^2 \text{CosIntegral}(2a + 2bx)}{2b^3} + \frac{a^2 \log(a + bx)}{2b^3} - \frac{\text{CosIntegral}(2a + 2bx)}{b^3} + \frac{2x \text{CosIntegral}(a + bx) \sin(a + bx)}{b^2} + \frac{2 \text{CosIntegral}(a + bx)}{b}$$

Antiderivative was successfully verified.

```
[In] Int[x^2*CosIntegral[a + b*x]*Sin[a + b*x],x]
```

```
[Out] -(a*x)/(2*b^2) + x^2/(4*b) + Cos[a + b*x]^2/(4*b^3) + Cos[2*a + 2*b*x]/(2*b^3) + (2*Cos[a + b*x]*CosIntegral[a + b*x])/b^3 - (x^2*Cos[a + b*x]*CosIntegral[a + b*x])/b - CosIntegral[2*a + 2*b*x]/b^3 + (a^2*CosIntegral[2*a + 2*b*x])/(2*b^3) - Log[a + b*x]/b^3 + (a^2*Log[a + b*x])/(2*b^3) - (a*Cos[a + b*x]*Sin[a + b*x])/(2*b^3) + (x*Cos[a + b*x]*Sin[a + b*x])/(2*b^2) + (2*x*CosIntegral[a + b*x]*Sin[a + b*x])/b^2 + (a*SineIntegral[2*a + 2*b*x])/b^3
```

#### Rule 6520

```
Int[CosIntegral[(c_.) + (d_.)*(x_)]*((e_.) + (f_.)*(x_))^(m_.)*Sin[(a_.) + (b_.)*(x_)], x_Symbol] :> -Simp[((e + f*x)^m*Cos[a + b*x]*CosIntegral[c + d*x])/b, x] + (Dist[d/b, Int[((e + f*x)^m*Cos[a + b*x]*Cos[c + d*x])/(c + d*x), x], x] + Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*Cos[a + b*x]*CosIntegral[c + d*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]
```

#### Rule 6742

```
Int[u_, x_Symbol] := With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### Rule 2635

```
Int[((b_.)*sin[(c_.) + (d_.)*(x_)])^(n_), x_Symbol] := -Simp[(b*Cos[c + d*x]
)*(b*Sin[c + d*x])^(n - 1))/(d*n), x] + Dist[(b^2*(n - 1))/n, Int[(b*Sin[c
+ d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1] && IntegerQ[2*n
]
```

### Rule 8

```
Int[a_, x_Symbol] := Simp[a*x, x] /; FreeQ[a, x]
```

### Rule 3310

```
Int[((c_.) + (d_.)*(x_))*((b_.)*sin[(e_.) + (f_.)*(x_)])^(n_), x_Symbol] :=
Simp[(d*(b*Sin[e + f*x])^n)/(f^2*n^2), x] + (Dist[(b^2*(n - 1))/n, Int[(c
+ d*x)*(b*Sin[e + f*x])^(n - 2), x], x] - Simp[(b*(c + d*x)*Cos[e + f*x]*(b
*Sin[e + f*x])^(n - 1))/(f*n), x]) /; FreeQ[{b, c, d, e, f}, x] && GtQ[n, 1
]
```

### Rule 30

```
Int[(x_)^(m_.), x_Symbol] := Simp[x^(m + 1)/(m + 1), x] /; FreeQ[m, x] && N
eQ[m, -1]
```

### Rule 3312

```
Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)]^(n_), x_Symbol] := In
t[ExpandTrigReduce[(c + d*x)^m, Sin[e + f*x]^n, x], x] /; FreeQ[{c, d, e, f
, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))
```

### Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[CosInte
gral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) -
c*f, 0]
```

### Rule 6514

```
Int[Cos[(a_.) + (b_.)*(x_)]*CosIntegral[(c_.) + (d_.)*(x_)]*((e_.) + (f_.)*
(x_))^(m_.), x_Symbol] := Simp[((e + f*x)^m*Sin[a + b*x]*CosIntegral[c + d*
x])/b, x] + (-Dist[d/b, Int[((e + f*x)^m*Sin[a + b*x]*Cos[c + d*x])/(c + d*
x), x], x] - Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*Sin[a + b*x]*CosIntegral[c
```

+ d\*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]

### Rule 4573

Int[Cos[w\_]^(p\_)\*(u\_)\*Sin[v\_]^(p\_), x\_Symbol] :=> Dist[1/2^p, Int[u\*SIN[2\*v]^p, x], x] /; EqQ[w, v] && IntegerQ[p]

### Rule 6741

Int[u\_, x\_Symbol] :=> With[{v = NormalizeIntegrand[u, x]}, Int[v, x] /; v != u]

### Rule 2638

Int[sin[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] :=> -Simp[Cos[c + d\*x]/d, x] /; FreeQ[{c, d}, x]

### Rule 3299

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] :=> Simp[SinIntegral[e + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*e - c\*f, 0]

### Rule 6518

Int[CosIntegral[(c\_.) + (d\_.)\*(x\_)]\*Sin[(a\_.) + (b\_.)\*(x\_)], x\_Symbol] :=> -Simp[(Cos[a + b\*x]\*CosIntegral[c + d\*x])/b, x] + Dist[d/b, Int[(Cos[a + b\*x]\*Cos[c + d\*x])/(c + d\*x), x], x] /; FreeQ[{a, b, c, d}, x]

### Rubi steps

$$\begin{aligned}
\int x^2 \text{Ci}(a+bx) \sin(a+bx) dx &= -\frac{x^2 \cos(a+bx) \text{Ci}(a+bx)}{b} + \frac{2 \int x \cos(a+bx) \text{Ci}(a+bx) dx}{b} + \int \frac{x^2 \cos^2(a+bx)}{a+bx} dx \\
&= -\frac{x^2 \cos(a+bx) \text{Ci}(a+bx)}{b} + \frac{2x \text{Ci}(a+bx) \sin(a+bx)}{b^2} - \frac{2 \int \text{Ci}(a+bx) \sin(a+bx) dx}{b^2} \\
&= \frac{2 \cos(a+bx) \text{Ci}(a+bx)}{b^3} - \frac{x^2 \cos(a+bx) \text{Ci}(a+bx)}{b} + \frac{2x \text{Ci}(a+bx) \sin(a+bx)}{b^2} - \frac{2 \int \text{Ci}(a+bx) \sin(a+bx) dx}{b^2} \\
&= \frac{\cos^2(a+bx)}{4b^3} + \frac{2 \cos(a+bx) \text{Ci}(a+bx)}{b^3} - \frac{x^2 \cos(a+bx) \text{Ci}(a+bx)}{b} - \frac{a \cos(a+bx) \sin(a+bx)}{2b^3} \\
&= -\frac{ax}{2b^2} + \frac{x^2}{4b} + \frac{\cos^2(a+bx)}{4b^3} + \frac{2 \cos(a+bx) \text{Ci}(a+bx)}{b^3} - \frac{x^2 \cos(a+bx) \text{Ci}(a+bx)}{b} - \frac{\log(a+bx)}{b} \\
&= -\frac{ax}{2b^2} + \frac{x^2}{4b} + \frac{\cos^2(a+bx)}{4b^3} + \frac{2 \cos(a+bx) \text{Ci}(a+bx)}{b^3} - \frac{x^2 \cos(a+bx) \text{Ci}(a+bx)}{b} - \frac{\text{Ci}(a+bx)}{b} \\
&= -\frac{ax}{2b^2} + \frac{x^2}{4b} + \frac{\cos^2(a+bx)}{4b^3} + \frac{\cos(2a+2bx)}{2b^3} + \frac{2 \cos(a+bx) \text{Ci}(a+bx)}{b^3} - \frac{x^2 \cos(a+bx) \text{Ci}(a+bx)}{b}
\end{aligned}$$

**Mathematica [A]** time = 0.321807, size = 134, normalized size = 0.61

$$\frac{4(a^2 - 2) \text{CosIntegral}(2(a+bx)) + 4a^2 \log(a+bx) - 8 \text{CosIntegral}(a+bx) \left( (b^2 x^2 - 2) \cos(a+bx) - 2bx \sin(a+bx) \right)}{8b^3}$$

Antiderivative was successfully verified.

[In] Integrate[x^2\*CosIntegral[a + b\*x]\*Sin[a + b\*x],x]

[Out] (-4\*a\*b\*x + 2\*b^2\*x^2 + 5\*Cos[2\*(a + b\*x)] + 4\*(-2 + a^2)\*CosIntegral[2\*(a + b\*x)] - 8\*Log[a + b\*x] + 4\*a^2\*Log[a + b\*x] - 8\*CosIntegral[a + b\*x]\*((-2 + b^2\*x^2)\*Cos[a + b\*x] - 2\*b\*x\*Sin[a + b\*x]) - 2\*a\*Sin[2\*(a + b\*x)] + 2\*b\*x\*Sin[2\*(a + b\*x)] + 8\*a\*SinIntegral[2\*(a + b\*x)])/(8\*b^3)

**Maple [A]** time = 0.066, size = 211, normalized size = 1.

$$-\frac{x^2 \text{Ci}(bx+a) \cos(bx+a)}{b} + 2 \frac{x \text{Ci}(bx+a) \sin(bx+a)}{b^2} + 2 \frac{\text{Ci}(bx+a) \cos(bx+a)}{b^3} + \frac{x \cos(bx+a) \sin(bx+a)}{2b^2} - \frac{a \cos(bx+a)}{b}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(x^2*Ci(b*x+a)*sin(b*x+a),x)`

[Out] 
$$-x^2 \operatorname{Ci}(bx+a) \cos(bx+a) / b + 2x \operatorname{Ci}(bx+a) \sin(bx+a) / b^2 + 2 \operatorname{Ci}(bx+a) \cos(bx+a) / b^3 + 1/2 x \cos(bx+a) \sin(bx+a) / b^2 - 1/2 a \cos(bx+a) \sin(bx+a) / b^3 + 1/4 x^2 / b - 1/2 a x / b^2 - 3/4 / b^3 a^2 - 1/4 \sin(bx+a)^2 / b^3 + 1/2 a^2 \ln(bx+a) / b^3 + 1/2 a^2 \operatorname{Ci}(2bx+2a) / b^3 + \cos(bx+a)^2 / b^3 + a \operatorname{Si}(2bx+2a) / b^3 - \ln(bx+a) / b^3 - \operatorname{Ci}(2bx+2a) / b^3$$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \operatorname{Ci}(bx+a) \sin(bx+a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Ci(b*x+a)*sin(b*x+a),x, algorithm="maxima")`

[Out] `integrate(x^2*Ci(b*x + a)*sin(b*x + a), x)`

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(x^2 \operatorname{Ci}(bx+a) \sin(bx+a), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Ci(b*x+a)*sin(b*x+a),x, algorithm="fricas")`

[Out] `integral(x^2*cos_integral(b*x + a)*sin(b*x + a), x)`

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \sin(a+bx) \operatorname{Ci}(a+bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x**2*Ci(b*x+a)*sin(b*x+a),x)`

[Out] Integral(x\*\*2\*sin(a + b\*x)\*Ci(a + b\*x), x)

**Giac [C]** time = 1.31872, size = 230, normalized size = 1.05

$$\left( \frac{2x \sin(bx + a)}{b^2} - \frac{(b^2x^2 - 2) \cos(bx + a)}{b^3} \right) \text{Ci}(bx + a) + \frac{b^2x^2 - 2abx + 2a^2 \log(|bx + a|) + a^2 \Re(\text{Ci}(2bx + 2a)) + a^2 \Im(\text{Ci}(2bx + 2a))}{b^3}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^2\*Ci(b\*x+a)\*sin(b\*x+a),x, algorithm="giac")

[Out] (2\*x\*sin(b\*x + a)/b^2 - (b^2\*x^2 - 2)\*cos(b\*x + a)/b^3)\*cos\_integral(b\*x + a) + 1/4\*(b^2\*x^2 - 2\*a\*b\*x + 2\*a^2\*log(abs(b\*x + a)) + a^2\*real\_part(cos\_integral(2\*b\*x + 2\*a)) + a^2\*real\_part(cos\_integral(-2\*b\*x - 2\*a)) + 2\*a\*imag\_part(cos\_integral(2\*b\*x + 2\*a)) - 2\*a\*imag\_part(cos\_integral(-2\*b\*x - 2\*a))) + 4\*a\*sin\_integral(2\*b\*x + 2\*a) - 4\*log(abs(b\*x + a)) - 2\*real\_part(cos\_integral(2\*b\*x + 2\*a)) - 2\*real\_part(cos\_integral(-2\*b\*x - 2\*a)))/b^3

### 3.124 $\int x \text{CosIntegral}(a + bx) \sin(a + bx) dx$

**Optimal.** Leaf size=109

$$-\frac{a \text{CosIntegral}(2a + 2bx)}{2b^2} + \frac{\text{CosIntegral}(a + bx) \sin(a + bx)}{b^2} - \frac{\text{Si}(2a + 2bx)}{2b^2} - \frac{a \log(a + bx)}{2b^2} + \frac{\sin(a + bx) \cos(a + bx)}{2b^2}$$

[Out]  $x/(2*b) - (x*\text{Cos}[a + b*x]*\text{CosIntegral}[a + b*x])/b - (a*\text{CosIntegral}[2*a + 2*b*x])/(2*b^2) - (a*\text{Log}[a + b*x])/(2*b^2) + (\text{Cos}[a + b*x]*\text{Sin}[a + b*x])/(2*b^2) + (\text{CosIntegral}[a + b*x]*\text{Sin}[a + b*x])/b^2 - \text{SinIntegral}[2*a + 2*b*x]/(2*b^2)$

**Rubi [A]** time = 0.229298, antiderivative size = 109, normalized size of antiderivative = 1., number of steps used = 12, number of rules used = 10, integrand size = 14,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.714$ , Rules used = {6520, 6742, 2635, 8, 3312, 3302, 6512, 4406, 12, 3299}

$$-\frac{a \text{CosIntegral}(2a + 2bx)}{2b^2} + \frac{\text{CosIntegral}(a + bx) \sin(a + bx)}{b^2} - \frac{\text{Si}(2a + 2bx)}{2b^2} - \frac{a \log(a + bx)}{2b^2} + \frac{\sin(a + bx) \cos(a + bx)}{2b^2}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[x*\text{CosIntegral}[a + b*x]*\text{Sin}[a + b*x], x]$

[Out]  $x/(2*b) - (x*\text{Cos}[a + b*x]*\text{CosIntegral}[a + b*x])/b - (a*\text{CosIntegral}[2*a + 2*b*x])/(2*b^2) - (a*\text{Log}[a + b*x])/(2*b^2) + (\text{Cos}[a + b*x]*\text{Sin}[a + b*x])/(2*b^2) + (\text{CosIntegral}[a + b*x]*\text{Sin}[a + b*x])/b^2 - \text{SinIntegral}[2*a + 2*b*x]/(2*b^2)$

#### Rule 6520

$\text{Int}[\text{CosIntegral}[(c_.) + (d_.)*(x_.)]*((e_.) + (f_.)*(x_.))^{(m_.)*\text{Sin}[(a_.) + (b_.)*(x_.)]}, x\_Symbol] \rightarrow -\text{Simp}[(e + f*x)^m*\text{Cos}[a + b*x]*\text{CosIntegral}[c + d*x])/b, x] + (\text{Dist}[d/b, \text{Int}[(e + f*x)^m*\text{Cos}[a + b*x]*\text{Cos}[c + d*x])/(c + d*x), x], x] + \text{Dist}[(f*m)/b, \text{Int}[(e + f*x)^{(m-1)}*\text{Cos}[a + b*x]*\text{CosIntegral}[c + d*x], x], x) /; \text{FreeQ}\{a, b, c, d, e, f\}, x] \&\& \text{IGtQ}[m, 0]$

#### Rule 6742

$\text{Int}[u_, x\_Symbol] \rightarrow \text{With}\{v = \text{ExpandIntegrand}[u, x]\}, \text{Int}[v, x] /; \text{SumQ}[v]$

#### Rule 2635

```
Int[((b_.)*sin[(c_.) + (d_.)*(x_)])^(n_), x_Symbol] := -Simp[(b*cos[c + d*x]
)*(b*sin[c + d*x])^(n - 1))/(d*n), x] + Dist[(b^2*(n - 1))/n, Int[(b*sin[c
+ d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1] && IntegerQ[2*n
]
```

### Rule 8

```
Int[a_, x_Symbol] := Simp[a*x, x] /; FreeQ[a, x]
```

### Rule 3312

```
Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)]^(n_), x_Symbol] := In
t[ExpandTrigReduce[(c + d*x)^m, Sin[e + f*x]^n, x], x] /; FreeQ[{c, d, e, f
, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))
```

### Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[CosInte
gral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) -
c*f, 0]
```

### Rule 6512

```
Int[Cos[(a_.) + (b_.)*(x_)]*CosIntegral[(c_.) + (d_.)*(x_)], x_Symbol] := S
imp[(Sin[a + b*x]*CosIntegral[c + d*x])/b, x] - Dist[d/b, Int[(Sin[a + b*x]
*cos[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

### Rule 4406

```
Int[Cos[(a_.) + (b_.)*(x_)]^(p_.)*((c_.) + (d_.)*(x_))^(m_.)*Sin[(a_.) + (b
_.)*(x_)]^(n_.), x_Symbol] := Int[ExpandTrigReduce[(c + d*x)^m, Sin[a + b*x]
]^(n)*Cos[a + b*x]^p, x], x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IG
tQ[p, 0]
```

### Rule 12

```
Int[(a_)*(u_), x_Symbol] := Dist[a, Int[u, x], x] /; FreeQ[a, x] && !Match
Q[u, (b_)*(v_)] /; FreeQ[b, x]
```

### Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[SinInte
gral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```



Rubi steps

$$\begin{aligned}
\int x \operatorname{Ci}(a+bx) \sin(a+bx) dx &= -\frac{x \cos(a+bx) \operatorname{Ci}(a+bx)}{b} + \frac{\int \cos(a+bx) \operatorname{Ci}(a+bx) dx}{b} + \int \frac{x \cos^2(a+bx)}{a+bx} dx \\
&= -\frac{x \cos(a+bx) \operatorname{Ci}(a+bx)}{b} + \frac{\operatorname{Ci}(a+bx) \sin(a+bx)}{b^2} - \frac{\int \frac{\cos(a+bx) \sin(a+bx)}{a+bx} dx}{b} + \int \left( \frac{\cos^2(a+bx)}{a+bx} \right) dx \\
&= -\frac{x \cos(a+bx) \operatorname{Ci}(a+bx)}{b} + \frac{\operatorname{Ci}(a+bx) \sin(a+bx)}{b^2} + \frac{\int \cos^2(a+bx) dx}{b} - \frac{\int \frac{\sin(2a+2bx)}{2(a+bx)} dx}{b} \\
&= -\frac{x \cos(a+bx) \operatorname{Ci}(a+bx)}{b} + \frac{\cos(a+bx) \sin(a+bx)}{2b^2} + \frac{\operatorname{Ci}(a+bx) \sin(a+bx)}{b^2} + \frac{\int 1 dx}{2b} \\
&= \frac{x}{2b} - \frac{x \cos(a+bx) \operatorname{Ci}(a+bx)}{b} - \frac{a \log(a+bx)}{2b^2} + \frac{\cos(a+bx) \sin(a+bx)}{2b^2} + \frac{\operatorname{Ci}(a+bx)}{b} \\
&= \frac{x}{2b} - \frac{x \cos(a+bx) \operatorname{Ci}(a+bx)}{b} - \frac{a \operatorname{Ci}(2a+2bx)}{2b^2} - \frac{a \log(a+bx)}{2b^2} + \frac{\cos(a+bx) \sin(a+bx)}{2b^2}
\end{aligned}$$

**Mathematica [A]** time = 0.181983, size = 76, normalized size = 0.7

$$\frac{-2a \operatorname{CosIntegral}(2(a+bx)) + \operatorname{CosIntegral}(a+bx)(4 \sin(a+bx) - 4bx \cos(a+bx)) - 2 \operatorname{Si}(2(a+bx)) - 2a \log(a+bx)}{4b^2}$$

Antiderivative was successfully verified.

[In] Integrate[x\*CosIntegral[a + b\*x]\*Sin[a + b\*x], x]

[Out] (2\*b\*x - 2\*a\*CosIntegral[2\*(a + b\*x)] - 2\*a\*Log[a + b\*x] + CosIntegral[a + b\*x]\*(-4\*b\*x\*Cos[a + b\*x] + 4\*Sin[a + b\*x]) + Sin[2\*(a + b\*x)] - 2\*SinIntegral[2\*(a + b\*x)])/(4\*b^2)

**Maple [A]** time = 0.062, size = 106, normalized size = 1.

$$-\frac{x \operatorname{Ci}(bx+a) \cos(bx+a)}{b} + \frac{\operatorname{Ci}(bx+a) \sin(bx+a)}{b^2} + \frac{\cos(bx+a) \sin(bx+a)}{2b^2} + \frac{x}{2b} + \frac{a}{2b^2} - \frac{a \ln(bx+a)}{2b^2} - \frac{a \operatorname{Ci}(2bx+2a)}{2b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x\*Ci(b\*x+a)\*sin(b\*x+a), x)

[Out]  $-x \operatorname{Ci}(bx+a) \cos(bx+a)/b + \operatorname{Ci}(bx+a) \sin(bx+a)/b^2 + 1/2 \cos(bx+a) \sin(bx+a)/b^2 + 1/2 x/b + 1/2/b^2 a - 1/2 a \ln(bx+a)/b^2 - 1/2 a \operatorname{Ci}(2bx+2a)/b^2 - 1/2 \operatorname{Si}(2bx+2a)/b^2$

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x \operatorname{Ci}(bx+a) \sin(bx+a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*Ci(b*x+a)*sin(b*x+a),x, algorithm="maxima")`

[Out] `integrate(x*Ci(b*x + a)*sin(b*x + a), x)`

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(x \operatorname{Ci}(bx+a) \sin(bx+a), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*Ci(b*x+a)*sin(b*x+a),x, algorithm="fricas")`

[Out] `integral(x*cos_integral(b*x + a)*sin(b*x + a), x)`

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x \sin(a+bx) \operatorname{Ci}(a+bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*Ci(b*x+a)*sin(b*x+a),x)`

[Out] `Integral(x*sin(a + b*x)*Ci(a + b*x), x)`

---

**Giac [C]** time = 1.21399, size = 150, normalized size = 1.38

$$-\left(\frac{x \cos(bx + a)}{b} - \frac{\sin(bx + a)}{b^2}\right) \text{Ci}(bx + a) + \frac{2bx - 2a \log(|bx + a|) - a\Re(\text{Ci}(2bx + 2a)) - a\Re(\text{Ci}(-2bx - 2a)) - 2a\Im(\text{Ci}(2bx + 2a)) - 2a\Im(\text{Ci}(-2bx - 2a))}{4b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Ci(b\*x+a)\*sin(b\*x+a),x, algorithm="giac")

[Out] -(x\*cos(b\*x + a)/b - sin(b\*x + a)/b^2)\*cos\_integral(b\*x + a) + 1/4\*(2\*b\*x - 2\*a\*log(abs(b\*x + a)) - a\*real\_part(cos\_integral(2\*b\*x + 2\*a)) - a\*real\_part(cos\_integral(-2\*b\*x - 2\*a)) - imag\_part(cos\_integral(2\*b\*x + 2\*a)) + imag\_part(cos\_integral(-2\*b\*x - 2\*a)) - 2\*sin\_integral(2\*b\*x + 2\*a))/b^2

### 3.125 $\int \text{CosIntegral}(a + bx) \sin(a + bx) dx$

**Optimal.** Leaf size=47

$$\frac{\text{CosIntegral}(2a + 2bx)}{2b} - \frac{\text{CosIntegral}(a + bx) \cos(a + bx)}{b} + \frac{\log(a + bx)}{2b}$$

[Out] -((Cos[a + b\*x]\*CosIntegral[a + b\*x])/b) + CosIntegral[2\*a + 2\*b\*x]/(2\*b) + Log[a + b\*x]/(2\*b)

**Rubi [A]** time = 0.076047, antiderivative size = 47, normalized size of antiderivative = 1., number of steps used = 4, number of rules used = 3, integrand size = 13,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.231$ , Rules used = {6518, 3312, 3302}

$$\frac{\text{CosIntegral}(2a + 2bx)}{2b} - \frac{\text{CosIntegral}(a + bx) \cos(a + bx)}{b} + \frac{\log(a + bx)}{2b}$$

Antiderivative was successfully verified.

[In] Int[CosIntegral[a + b\*x]\*Sin[a + b\*x],x]

[Out] -((Cos[a + b\*x]\*CosIntegral[a + b\*x])/b) + CosIntegral[2\*a + 2\*b\*x]/(2\*b) + Log[a + b\*x]/(2\*b)

#### Rule 6518

Int[CosIntegral[(c\_.) + (d\_.)\*(x\_)]\*Sin[(a\_.) + (b\_.)\*(x\_)], x\_Symbol] := -Simp[(Cos[a + b\*x]\*CosIntegral[c + d\*x])/b, x] + Dist[d/b, Int[(Cos[a + b\*x]\*Cos[c + d\*x])/(c + d\*x), x], x] /; FreeQ[{a, b, c, d}, x]

#### Rule 3312

Int[((c\_.) + (d\_.)\*(x\_))^(m\_)\*sin[(e\_.) + (f\_.)\*(x\_)]^(n\_), x\_Symbol] := Int[ExpandTrigReduce[(c + d\*x)^m, Sin[e + f\*x]^n, x], x] /; FreeQ[{c, d, e, f, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))

#### Rule 3302

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] := Simp[CosIntegral[e - Pi/2 + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*(e - Pi/2) - c\*f, 0]

Rubi steps

$$\begin{aligned}
\int \text{Ci}(a + bx) \sin(a + bx) dx &= -\frac{\cos(a + bx)\text{Ci}(a + bx)}{b} + \int \frac{\cos^2(a + bx)}{a + bx} dx \\
&= -\frac{\cos(a + bx)\text{Ci}(a + bx)}{b} + \int \left( \frac{1}{2(a + bx)} + \frac{\cos(2a + 2bx)}{2(a + bx)} \right) dx \\
&= -\frac{\cos(a + bx)\text{Ci}(a + bx)}{b} + \frac{\log(a + bx)}{2b} + \frac{1}{2} \int \frac{\cos(2a + 2bx)}{a + bx} dx \\
&= -\frac{\cos(a + bx)\text{Ci}(a + bx)}{b} + \frac{\text{Ci}(2a + 2bx)}{2b} + \frac{\log(a + bx)}{2b}
\end{aligned}$$

**Mathematica [A]** time = 0.0241664, size = 46, normalized size = 0.98

$$\frac{\text{CosIntegral}(2(a + bx))}{2b} - \frac{\text{CosIntegral}(a + bx) \cos(a + bx)}{b} + \frac{\log(a + bx)}{2b}$$

Antiderivative was successfully verified.

[In] Integrate[CosIntegral[a + b\*x]\*Sin[a + b\*x], x]

[Out] -((Cos[a + b\*x]\*CosIntegral[a + b\*x])/b) + CosIntegral[2\*(a + b\*x)]/(2\*b) + Log[a + b\*x]/(2\*b)

**Maple [A]** time = 0.052, size = 44, normalized size = 0.9

$$\frac{\text{Ci}(2bx + 2a)}{2b} - \frac{\text{Ci}(bx + a) \cos(bx + a)}{b} + \frac{\ln(bx + a)}{2b}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(b\*x+a)\*sin(b\*x+a), x)

[Out] 1/2\*Ci(2\*b\*x+2\*a)/b-Ci(b\*x+a)\*cos(b\*x+a)/b+1/2\*ln(b\*x+a)/b

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \text{Ci}(bx + a) \sin(bx + a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)\*sin(b\*x+a),x, algorithm="maxima")

[Out] integrate(Ci(b\*x + a)\*sin(b\*x + a), x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

integral(Ci(bx + a) sin(bx + a), x)

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)\*sin(b\*x+a),x, algorithm="fricas")

[Out] integral(cos\_integral(b\*x + a)\*sin(b\*x + a), x)

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \sin(a + bx) \operatorname{Ci}(a + bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)\*sin(b\*x+a),x)

[Out] Integral(sin(a + b\*x)\*Ci(a + b\*x), x)

**Giac [B]** time = 1.19141, size = 130, normalized size = 2.77

$$-\frac{\cos(bx + a) \operatorname{Ci}(bx + a)}{b} + \frac{\cos(2a)^2 \operatorname{Ci}(2bx + 2a) + \cos(2a)^2 \operatorname{Ci}(-2bx - 2a) + \operatorname{Ci}(2bx + 2a) \sin(2a)^2 + \operatorname{Ci}(-2bx - 2a) \sin(2a)^2}{4b}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)\*sin(b\*x+a),x, algorithm="giac")

[Out] -cos(b\*x + a)\*cos\_integral(b\*x + a)/b + 1/4\*(cos(2\*a)^2\*cos\_integral(2\*b\*x + 2\*a) + cos(2\*a)^2\*cos\_integral(-2\*b\*x - 2\*a) + cos\_integral(2\*b\*x + 2\*a)\*

$$\sin(2*a)^2 + \cos\_integral(-2*b*x - 2*a)*\sin(2*a)^2 + 2*\log(b*x + a))/b$$

$$3.126 \quad \int \frac{\text{CosIntegral}(a+bx) \sin(a+bx)}{x} dx$$

**Optimal.** Leaf size=18

$$\text{CannotIntegrate}\left(\frac{\text{CosIntegral}(a+bx) \sin(a+bx)}{x}, x\right)$$

[Out] CannotIntegrate[(CosIntegral[a + b\*x]\*Sin[a + b\*x])/x, x]

**Rubi [A]** time = 0.131469, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\text{CosIntegral}(a+bx) \sin(a+bx)}{x} dx$$

Verification is Not applicable to the result.

[In] Int[(CosIntegral[a + b\*x]\*Sin[a + b\*x])/x,x]

[Out] Defer[Int] [(CosIntegral[a + b\*x]\*Sin[a + b\*x])/x, x]

Rubi steps

$$\int \frac{\text{Ci}(a+bx) \sin(a+bx)}{x} dx = \int \frac{\text{Ci}(a+bx) \sin(a+bx)}{x} dx$$

**Mathematica [A]** time = 6.96945, size = 0, normalized size = 0.

$$\int \frac{\text{CosIntegral}(a+bx) \sin(a+bx)}{x} dx$$

Verification is Not applicable to the result.

[In] Integrate[(CosIntegral[a + b\*x]\*Sin[a + b\*x])/x,x]

[Out] Integrate[(CosIntegral[a + b\*x]\*Sin[a + b\*x])/x, x]



---

**Maple [A]** time = 0.085, size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx + a) \sin(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(b\*x+a)\*sin(b\*x+a)/x,x)

[Out] int(Ci(b\*x+a)\*sin(b\*x+a)/x,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx + a) \sin(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)\*sin(b\*x+a)/x,x, algorithm="maxima")

[Out] integrate(Ci(b\*x + a)\*sin(b\*x + a)/x, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Ci}(bx + a) \sin(bx + a)}{x}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)\*sin(b\*x+a)/x,x, algorithm="fricas")

[Out] integral(cos\_integral(b\*x + a)\*sin(b\*x + a)/x, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\sin(a + bx) \text{Ci}(a + bx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x+a)*sin(b*x+a)/x,x)
```

```
[Out] Integral(sin(a + b*x)*Ci(a + b*x)/x, x)
```

---

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx + a) \sin(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(b*x+a)*sin(b*x+a)/x,x, algorithm="giac")
```

```
[Out] integrate(Ci(b*x + a)*sin(b*x + a)/x, x)
```

### 3.127 $\int x^2 \cos(a + bx) \text{CosIntegral}(a + bx) dx$

**Optimal.** Leaf size=185

$$-\frac{a^2 \text{Si}(2a + 2bx)}{2b^3} + \frac{a \text{CosIntegral}(2a + 2bx)}{b^3} - \frac{2 \text{CosIntegral}(a + bx) \sin(a + bx)}{b^3} + \frac{2x \text{CosIntegral}(a + bx) \cos(a + bx)}{b^2}$$

[Out]  $-(x/b^2) - (a \text{Cos}[2a + 2bx])/(4b^3) + (x \text{Cos}[2a + 2bx])/(4b^2) + (2x \text{Cos}[a + bx] \text{CosIntegral}[a + bx])/b^2 + (a \text{CosIntegral}[2a + 2bx])/b^3 + (a \text{Log}[a + bx])/b^3 - (\text{Cos}[a + bx] \text{Sin}[a + bx])/b^3 - (2 \text{CosIntegral}[a + bx] \text{Sin}[a + bx])/b^3 + (x^2 \text{CosIntegral}[a + bx] \text{Sin}[a + bx])/b - \text{Sin}[2a + 2bx]/(8b^3) + \text{SinIntegral}[2a + 2bx]/b^3 - (a^2 \text{SinIntegral}[2a + 2bx])/(2b^3)$

**Rubi [A]** time = 0.585556, antiderivative size = 185, normalized size of antiderivative = 1., number of steps used = 21, number of rules used = 16, integrand size = 16,  $\frac{\text{number of rules}}{\text{integrand size}} = 1.$ , Rules used = {6514, 4573, 6741, 6742, 2638, 3296, 2637, 3299, 6520, 2635, 8, 3312, 3302, 6512, 4406, 12}

$$-\frac{a^2 \text{Si}(2a + 2bx)}{2b^3} + \frac{a \text{CosIntegral}(2a + 2bx)}{b^3} - \frac{2 \text{CosIntegral}(a + bx) \sin(a + bx)}{b^3} + \frac{2x \text{CosIntegral}(a + bx) \cos(a + bx)}{b^2}$$

Antiderivative was successfully verified.

[In]  $\text{Int}[x^2 \text{Cos}[a + bx] \text{CosIntegral}[a + bx], x]$

[Out]  $-(x/b^2) - (a \text{Cos}[2a + 2bx])/(4b^3) + (x \text{Cos}[2a + 2bx])/(4b^2) + (2x \text{Cos}[a + bx] \text{CosIntegral}[a + bx])/b^2 + (a \text{CosIntegral}[2a + 2bx])/b^3 + (a \text{Log}[a + bx])/b^3 - (\text{Cos}[a + bx] \text{Sin}[a + bx])/b^3 - (2 \text{CosIntegral}[a + bx] \text{Sin}[a + bx])/b^3 + (x^2 \text{CosIntegral}[a + bx] \text{Sin}[a + bx])/b - \text{Sin}[2a + 2bx]/(8b^3) + \text{SinIntegral}[2a + 2bx]/b^3 - (a^2 \text{SinIntegral}[2a + 2bx])/(2b^3)$

#### Rule 6514

$\text{Int}[\text{Cos}[(a_.) + (b_.)(x_.)] \text{CosIntegral}[(c_.) + (d_.)(x_.)] * ((e_.) + (f_.)(x_.))^{(m_.)}, x\_Symbol] \rightarrow \text{Simp}[(e + fx)^m \text{Sin}[a + bx] \text{CosIntegral}[c + dx]/b, x] + (-\text{Dist}[d/b, \text{Int}[(e + fx)^m \text{Sin}[a + bx] \text{Cos}[c + dx]]/(c + dx), x], x) - \text{Dist}[(f*m)/b, \text{Int}[(e + fx)^{(m-1)} \text{Sin}[a + bx] \text{CosIntegral}[c + dx], x], x) /; \text{FreeQ}\{a, b, c, d, e, f\}, x] \&\& \text{IGtQ}[m, 0]$

#### Rule 4573

$\text{Int}[\text{Cos}[w\_]^{\text{p}_.} * (u\_.) * \text{Sin}[v\_]^{\text{p}_.}, x\_Symbol] \text{ :> Dist}[1/2^{\text{p}}, \text{Int}[u * \text{Sin}[2 * v]^{\text{p}}, x], x] \text{ /; EqQ}[w, v] \ \&\& \ \text{IntegerQ}[p]$

#### Rule 6741

$\text{Int}[u_, x\_Symbol] \text{ :> With}[\{v = \text{NormalizeIntegrand}[u, x]\}, \text{Int}[v, x] \text{ /; } v \neq u]$

#### Rule 6742

$\text{Int}[u_, x\_Symbol] \text{ :> With}[\{v = \text{ExpandIntegrand}[u, x]\}, \text{Int}[v, x] \text{ /; SumQ}[v]]$

#### Rule 2638

$\text{Int}[\text{sin}[(c_.) + (d_.)*(x_.)], x\_Symbol] \text{ :> -Simp}[\text{Cos}[c + d*x]/d, x] \text{ /; FreeQ}[\{c, d\}, x]$

#### Rule 3296

$\text{Int}[((c_.) + (d_.)*(x_.))^{\text{m}_.} * \text{sin}[(e_.) + (f_.)*(x_.)], x\_Symbol] \text{ :> -Simp}[(c + d*x)^{\text{m}} * \text{Cos}[e + f*x]/f, x] + \text{Dist}[(d*m)/f, \text{Int}[(c + d*x)^{\text{m} - 1} * \text{Cos}[e + f*x], x], x] \text{ /; FreeQ}[\{c, d, e, f\}, x] \ \&\& \ \text{GtQ}[m, 0]$

#### Rule 2637

$\text{Int}[\text{sin}[\text{Pi}/2 + (c_.) + (d_.)*(x_.)], x\_Symbol] \text{ :> Simp}[\text{Sin}[c + d*x]/d, x] \text{ /; FreeQ}[\{c, d\}, x]$

#### Rule 3299

$\text{Int}[\text{sin}[(e_.) + (f_.)*(x_.)] / ((c_.) + (d_.)*(x_.)), x\_Symbol] \text{ :> Simp}[\text{SinIntegral}[e + f*x]/d, x] \text{ /; FreeQ}[\{c, d, e, f\}, x] \ \&\& \ \text{EqQ}[d*e - c*f, 0]$

#### Rule 6520

$\text{Int}[\text{CosIntegral}[(c_.) + (d_.)*(x_.)] * ((e_.) + (f_.)*(x_.))^{\text{m}_.} * \text{Sin}[(a_.) + (b_.)*(x_.)], x\_Symbol] \text{ :> -Simp}[(e + f*x)^{\text{m}} * \text{Cos}[a + b*x] * \text{CosIntegral}[c + d*x] / b, x] + (\text{Dist}[d/b, \text{Int}[(e + f*x)^{\text{m}} * \text{Cos}[a + b*x] * \text{Cos}[c + d*x] / (c + d*x), x], x] + \text{Dist}[(f*m)/b, \text{Int}[(e + f*x)^{\text{m} - 1} * \text{Cos}[a + b*x] * \text{CosIntegral}[c + d*x], x], x]) \text{ /; FreeQ}[\{a, b, c, d, e, f\}, x] \ \&\& \ \text{IGtQ}[m, 0]$

#### Rule 2635

```
Int[((b_.)*sin[(c_.) + (d_.)*(x_)]^(n_), x_Symbol] := -Simp[(b*cos[c + d*x]
)*(b*sin[c + d*x])^(n - 1))/(d*n), x] + Dist[(b^2*(n - 1))/n, Int[(b*sin[c
+ d*x])^(n - 2), x], x] /; FreeQ[{b, c, d}, x] && GtQ[n, 1] && IntegerQ[2*n]
]
```

### Rule 8

```
Int[a_, x_Symbol] := Simp[a*x, x] /; FreeQ[a, x]
```

### Rule 3312

```
Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)]^(n_), x_Symbol] := In
t[ExpandTrigReduce[(c + d*x)^m, Sin[e + f*x]^n, x], x] /; FreeQ[{c, d, e, f
, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))
```

### Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[CosInte
gral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) -
c*f, 0]
```

### Rule 6512

```
Int[Cos[(a_.) + (b_.)*(x_)]*CosIntegral[(c_.) + (d_.)*(x_)], x_Symbol] := S
imp[(Sin[a + b*x]*CosIntegral[c + d*x])/b, x] - Dist[d/b, Int[(Sin[a + b*x]
*cos[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

### Rule 4406

```
Int[Cos[(a_.) + (b_.)*(x_)]^(p_.)*((c_.) + (d_.)*(x_))^(m_.)*Sin[(a_.) + (b
_.)*(x_)]^(n_.), x_Symbol] := Int[ExpandTrigReduce[(c + d*x)^m, Sin[a + b*x]
]^n*cos[a + b*x]^p, x], x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IG
tQ[p, 0]
```

### Rule 12

```
Int[(a_)*(u_), x_Symbol] := Dist[a, Int[u, x], x] /; FreeQ[a, x] && !Match
Q[u, (b_)*(v_)] /; FreeQ[b, x]
```

### Rubi steps

$$\begin{aligned}
\int x^2 \cos(a + bx) \text{Ci}(a + bx) dx &= \frac{x^2 \text{Ci}(a + bx) \sin(a + bx)}{b} - \frac{2 \int x \text{Ci}(a + bx) \sin(a + bx) dx}{b} - \int \frac{x^2 \cos(a + bx) \sin(a + bx)}{a + bx} \\
&= \frac{2x \cos(a + bx) \text{Ci}(a + bx)}{b^2} + \frac{x^2 \text{Ci}(a + bx) \sin(a + bx)}{b} - \frac{1}{2} \int \frac{x^2 \sin(2(a + bx))}{a + bx} dx - \frac{2}{b} \int \\
&= \frac{2x \cos(a + bx) \text{Ci}(a + bx)}{b^2} - \frac{2 \text{Ci}(a + bx) \sin(a + bx)}{b^3} + \frac{x^2 \text{Ci}(a + bx) \sin(a + bx)}{b} - \frac{1}{2} \int \\
&= \frac{2x \cos(a + bx) \text{Ci}(a + bx)}{b^2} - \frac{2 \text{Ci}(a + bx) \sin(a + bx)}{b^3} + \frac{x^2 \text{Ci}(a + bx) \sin(a + bx)}{b} - \frac{1}{2} \int \\
&= \frac{2x \cos(a + bx) \text{Ci}(a + bx)}{b^2} - \frac{\cos(a + bx) \sin(a + bx)}{b^3} - \frac{2 \text{Ci}(a + bx) \sin(a + bx)}{b^3} + \frac{x^2 \text{Ci}(a + bx) \sin(a + bx)}{b} \\
&= -\frac{x}{b^2} - \frac{a \cos(2a + 2bx)}{4b^3} + \frac{x \cos(2a + 2bx)}{4b^2} + \frac{2x \cos(a + bx) \text{Ci}(a + bx)}{b^2} + \frac{a \log(a + bx)}{b^3} \\
&= -\frac{x}{b^2} - \frac{a \cos(2a + 2bx)}{4b^3} + \frac{x \cos(2a + 2bx)}{4b^2} + \frac{2x \cos(a + bx) \text{Ci}(a + bx)}{b^2} + \frac{a \text{Ci}(2a + 2bx)}{b^3}
\end{aligned}$$

**Mathematica [A]** time = 0.300744, size = 123, normalized size = 0.66

$$\frac{-4a^2 \text{Si}(2(a + bx)) + 8 \text{CosIntegral}(a + bx) \left( (b^2 x^2 - 2) \sin(a + bx) + 2bx \cos(a + bx) \right) + 8a \text{CosIntegral}(2(a + bx)) + 8S}{8b^3}$$

Antiderivative was successfully verified.

[In] Integrate[x^2 \* Cos[a + b\*x] \* CosIntegral[a + b\*x], x]

[Out] (-8\*b\*x - 2\*a \* Cos[2\*(a + b\*x)] + 2\*b\*x \* Cos[2\*(a + b\*x)] + 8\*a \* CosIntegral[2\*(a + b\*x)] + 8\*a \* Log[a + b\*x] + 8 \* CosIntegral[a + b\*x] \* (2\*b\*x \* Cos[a + b\*x] + (-2 + b^2\*x^2) \* Sin[a + b\*x]) - 5 \* Sin[2\*(a + b\*x)] + 8 \* SinIntegral[2\*(a + b\*x)] - 4\*a^2 \* SinIntegral[2\*(a + b\*x)]) / (8\*b^3)

**Maple [A]** time = 0.083, size = 168, normalized size = 0.9

$$\frac{x^2 \text{Ci}(bx + a) \sin(bx + a)}{b} + 2 \frac{x \text{Ci}(bx + a) \cos(bx + a)}{b^2} - 2 \frac{\text{Ci}(bx + a) \sin(bx + a)}{b^3} + \frac{(\cos(bx + a))^2 x}{2b^2} - \frac{a \cos(bx + a)}{2b^3}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `int(x^2*Ci(b*x+a)*cos(b*x+a),x)`

[Out]  $x^2 \operatorname{Ci}(bx+a) \sin(bx+a)/b + 2x \operatorname{Ci}(bx+a) \cos(bx+a)/b^2 - 2 \operatorname{Ci}(bx+a) \sin(bx+a)/b^3 + 1/2/b^2 \cos(bx+a)^2 x - 1/2/b^3 a \cos(bx+a)^2 - 5/4 \cos(bx+a) \sin(bx+a)/b^3 - 5/4 x/b^2 - 5/4/b^3 a - 1/2 a^2 \operatorname{Si}(2bx+2a)/b^3 + a \ln(bx+a)/b^3 + a \operatorname{Ci}(2bx+2a)/b^3 + \operatorname{Si}(2bx+2a)/b^3$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \operatorname{Ci}(bx+a) \cos(bx+a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Ci(b*x+a)*cos(b*x+a),x, algorithm="maxima")`

[Out] `integrate(x^2*Ci(b*x + a)*cos(b*x + a), x)`

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(x^2 \cos(bx+a) \operatorname{Ci}(bx+a), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x^2*Ci(b*x+a)*cos(b*x+a),x, algorithm="fricas")`

[Out] `integral(x^2*cos(b*x + a)*cos_integral(b*x + a), x)`

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x^2 \cos(a+bx) \operatorname{Ci}(a+bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x**2*Ci(b*x+a)*cos(b*x+a),x)`

[Out] Integral(x\*\*2\*cos(a + b\*x)\*Ci(a + b\*x), x)

**Giac [C]** time = 1.20779, size = 221, normalized size = 1.19

$$\left( \frac{2x \cos(bx + a)}{b^2} + \frac{(b^2x^2 - 2) \sin(bx + a)}{b^3} \right) \text{Ci}(bx + a) - \frac{a^2 \Im(\text{Ci}(2bx + 2a)) - a^2 \Im(\text{Ci}(-2bx - 2a)) + 2a^2 \text{Si}(2bx + 2a)}{b^3}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x^2\*Ci(b\*x+a)\*cos(b\*x+a),x, algorithm="giac")

[Out] (2\*x\*cos(b\*x + a)/b^2 + (b^2\*x^2 - 2)\*sin(b\*x + a)/b^3)\*cos\_integral(b\*x + a) - 1/4\*(a^2\*imag\_part(cos\_integral(2\*b\*x + 2\*a)) - a^2\*imag\_part(cos\_integral(-2\*b\*x - 2\*a)) + 2\*a^2\*sin\_integral(2\*b\*x + 2\*a) + 4\*b\*x - 4\*a\*log(abs(b\*x + a)) - 2\*a\*real\_part(cos\_integral(2\*b\*x + 2\*a)) - 2\*a\*real\_part(cos\_integral(-2\*b\*x - 2\*a)) - 2\*imag\_part(cos\_integral(2\*b\*x + 2\*a)) + 2\*imag\_part(cos\_integral(-2\*b\*x - 2\*a)) - 4\*sin\_integral(2\*b\*x + 2\*a))/b^3



### 3.128 $\int x \cos(a + bx) \text{CosIntegral}(a + bx) dx$

**Optimal.** Leaf size=96

$$-\frac{\text{CosIntegral}(2a + 2bx)}{2b^2} + \frac{\text{CosIntegral}(a + bx) \cos(a + bx)}{b^2} + \frac{a \text{Si}(2a + 2bx)}{2b^2} - \frac{\log(a + bx)}{2b^2} + \frac{\cos(2a + 2bx)}{4b^2} + \frac{x \text{CosIntegral}(a + bx)}{b}$$

```
[Out] Cos[2*a + 2*b*x]/(4*b^2) + (Cos[a + b*x]*CosIntegral[a + b*x])/b^2 - CosIntegral[2*a + 2*b*x]/(2*b^2) - Log[a + b*x]/(2*b^2) + (x*CosIntegral[a + b*x]*Sin[a + b*x])/b + (a*SinIntegral[2*a + 2*b*x])/(2*b^2)
```

**Rubi [A]** time = 0.251984, antiderivative size = 96, normalized size of antiderivative = 1., number of steps used = 11, number of rules used = 9, integrand size = 14,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.643$ , Rules used = {6514, 4573, 6741, 6742, 2638, 3299, 6518, 3312, 3302}

$$-\frac{\text{CosIntegral}(2a + 2bx)}{2b^2} + \frac{\text{CosIntegral}(a + bx) \cos(a + bx)}{b^2} + \frac{a \text{Si}(2a + 2bx)}{2b^2} - \frac{\log(a + bx)}{2b^2} + \frac{\cos(2a + 2bx)}{4b^2} + \frac{x \text{CosIntegral}(a + bx)}{b}$$

Antiderivative was successfully verified.

```
[In] Int[x*Cos[a + b*x]*CosIntegral[a + b*x], x]
```

```
[Out] Cos[2*a + 2*b*x]/(4*b^2) + (Cos[a + b*x]*CosIntegral[a + b*x])/b^2 - CosIntegral[2*a + 2*b*x]/(2*b^2) - Log[a + b*x]/(2*b^2) + (x*CosIntegral[a + b*x]*Sin[a + b*x])/b + (a*SinIntegral[2*a + 2*b*x])/(2*b^2)
```

#### Rule 6514

```
Int[Cos[(a_.) + (b_.)*(x_)]*CosIntegral[(c_.) + (d_.)*(x_)]*((e_.) + (f_.)*(x_))^(m_.), x_Symbol] :> Simp[((e + f*x)^m*Sin[a + b*x]*CosIntegral[c + d*x])/b, x] + (-Dist[d/b, Int[((e + f*x)^m*Sin[a + b*x]*Cos[c + d*x])/(c + d*x), x], x] - Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*Sin[a + b*x]*CosIntegral[c + d*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]
```

#### Rule 4573

```
Int[Cos[w_]^(p_.)*(u_.)*Sin[v_]^(p_.), x_Symbol] :> Dist[1/2^p, Int[u*Sin[2*v]^p, x], x] /; EqQ[w, v] && IntegerQ[p]
```

#### Rule 6741

`Int[u_, x_Symbol] := With[{v = NormalizeIntegrand[u, x]}, Int[v, x] /; v != u]`

### Rule 6742

`Int[u_, x_Symbol] := With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]`  
`]`

### Rule 2638

`Int[sin[(c_.) + (d_.)*(x_)], x_Symbol] := -Simp[Cos[c + d*x]/d, x] /; FreeQ`  
`[{c, d}, x]`

### Rule 3299

`Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[SinInte`  
`gral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]`

### Rule 6518

`Int[CosIntegral[(c_.) + (d_.)*(x_)]*Sin[(a_.) + (b_.)*(x_)], x_Symbol] := -`  
`Simp[(Cos[a + b*x]*CosIntegral[c + d*x])/b, x] + Dist[d/b, Int[(Cos[a + b*x]`  
`]*Cos[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]`

### Rule 3312

`Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)]^(n_), x_Symbol] := In`  
`t[ExpandTrigReduce[(c + d*x)^m, Sin[e + f*x]^n, x], x] /; FreeQ[{c, d, e, f`  
`, m}, x] && IGtQ[n, 1] && (!RationalQ[m] || (GeQ[m, -1] && LtQ[m, 1]))`

### Rule 3302

`Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[CosInte`  
`gral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) -`  
`c*f, 0]`

### Rubi steps

$$\begin{aligned}
\int x \cos(a + bx) \text{Ci}(a + bx) dx &= \frac{x \text{Ci}(a + bx) \sin(a + bx)}{b} - \frac{\int \text{Ci}(a + bx) \sin(a + bx) dx}{b} - \int \frac{x \cos(a + bx) \sin(a + bx)}{a + bx} dx \\
&= \frac{\cos(a + bx) \text{Ci}(a + bx)}{b^2} + \frac{x \text{Ci}(a + bx) \sin(a + bx)}{b} - \frac{1}{2} \int \frac{x \sin(2(a + bx))}{a + bx} dx - \frac{\int \frac{\cos^2(a + bx)}{a + bx} dx}{b} \\
&= \frac{\cos(a + bx) \text{Ci}(a + bx)}{b^2} + \frac{x \text{Ci}(a + bx) \sin(a + bx)}{b} - \frac{1}{2} \int \frac{x \sin(2a + 2bx)}{a + bx} dx - \frac{\int \left( \frac{1}{2(a + bx)} \right) dx}{b} \\
&= \frac{\cos(a + bx) \text{Ci}(a + bx)}{b^2} - \frac{\log(a + bx)}{2b^2} + \frac{x \text{Ci}(a + bx) \sin(a + bx)}{b} - \frac{1}{2} \int \left( \frac{\sin(2a + 2bx)}{b} \right) dx \\
&= \frac{\cos(a + bx) \text{Ci}(a + bx)}{b^2} - \frac{\text{Ci}(2a + 2bx)}{2b^2} - \frac{\log(a + bx)}{2b^2} + \frac{x \text{Ci}(a + bx) \sin(a + bx)}{b} - \frac{\int \sin(2a + 2bx) dx}{2b} \\
&= \frac{\cos(2a + 2bx)}{4b^2} + \frac{\cos(a + bx) \text{Ci}(a + bx)}{b^2} - \frac{\text{Ci}(2a + 2bx)}{2b^2} - \frac{\log(a + bx)}{2b^2} + \frac{x \text{Ci}(a + bx) \sin(a + bx)}{b}
\end{aligned}$$

**Mathematica [A]** time = 0.157884, size = 69, normalized size = 0.72

$$\frac{-2\text{CosIntegral}(2(a + bx)) + 4\text{CosIntegral}(a + bx)(bx \sin(a + bx) + \cos(a + bx)) + 2a\text{Si}(2(a + bx)) - 2\log(a + bx) + \text{Ci}(2a + 2bx)}{4b^2}$$

Antiderivative was successfully verified.

[In] Integrate[x\*Cos[a + b\*x]\*CosIntegral[a + b\*x], x]

[Out] (Cos[2\*(a + b\*x)] - 2\*CosIntegral[2\*(a + b\*x)] - 2\*Log[a + b\*x] + 4\*CosIntegral[a + b\*x]\*(Cos[a + b\*x] + b\*x\*Sin[a + b\*x]) + 2\*a\*SinIntegral[2\*(a + b\*x)])/(4\*b^2)

**Maple [A]** time = 0.062, size = 88, normalized size = 0.9

$$\frac{x \text{Ci}(bx + a) \sin(bx + a)}{b} + \frac{\text{Ci}(bx + a) \cos(bx + a)}{b^2} + \frac{(\cos(bx + a))^2}{2b^2} - \frac{\ln(bx + a)}{2b^2} - \frac{\text{Ci}(2bx + 2a)}{2b^2} + \frac{a \text{Si}(2bx + 2a)}{2b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x\*Ci(b\*x+a)\*cos(b\*x+a), x)

[Out] x\*Ci(b\*x+a)\*sin(b\*x+a)/b+Ci(b\*x+a)\*cos(b\*x+a)/b^2+1/2/b^2\*cos(b\*x+a)^2-1/2\*ln(b\*x+a)/b^2-1/2\*Ci(2\*b\*x+2\*a)/b^2+1/2\*a\*Si(2\*b\*x+2\*a)/b^2

---

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x \operatorname{Ci}(bx + a) \cos(bx + a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Ci(b\*x+a)\*cos(b\*x+a),x, algorithm="maxima")

[Out] integrate(x\*Ci(b\*x + a)\*cos(b\*x + a), x)

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(x \cos(bx + a) \operatorname{Ci}(bx + a), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Ci(b\*x+a)\*cos(b\*x+a),x, algorithm="fricas")

[Out] integral(x\*cos(b\*x + a)\*cos\_integral(b\*x + a), x)

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x \cos(a + bx) \operatorname{Ci}(a + bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Ci(b\*x+a)\*cos(b\*x+a),x)

[Out] Integral(x\*cos(a + b\*x)\*Ci(a + b\*x), x)

---

**Giac [C]** time = 1.17762, size = 143, normalized size = 1.49

$$\left( \frac{x \sin(bx + a)}{b} + \frac{\cos(bx + a)}{b^2} \right) \operatorname{Ci}(bx + a) + \frac{a \Im(\operatorname{Ci}(2bx + 2a)) - a \Im(\operatorname{Ci}(-2bx - 2a)) + 2a \operatorname{Si}(2bx + 2a) - 2 \log(|bx + a|)}{4b^2}$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x*Ci(b*x+a)*cos(b*x+a),x, algorithm="giac")
```

```
[Out] (x*sin(b*x + a)/b + cos(b*x + a)/b^2)*cos_integral(b*x + a) + 1/4*(a*imag_p  
art(cos_integral(2*b*x + 2*a)) - a*imag_part(cos_integral(-2*b*x - 2*a)) +  
2*a*sin_integral(2*b*x + 2*a) - 2*log(abs(b*x + a)) - real_part(cos_integra  
l(2*b*x + 2*a)) - real_part(cos_integral(-2*b*x - 2*a)))/b^2
```

### 3.129 $\int \cos(a + bx) \text{CosIntegral}(a + bx) dx$

**Optimal.** Leaf size=33

$$\frac{\text{CosIntegral}(a + bx) \sin(a + bx)}{b} - \frac{\text{Si}(2a + 2bx)}{2b}$$

[Out] (CosIntegral[a + b\*x]\*Sin[a + b\*x])/b - SinIntegral[2\*a + 2\*b\*x]/(2\*b)

**Rubi [A]** time = 0.0562818, antiderivative size = 33, normalized size of antiderivative = 1., number of steps used = 4, number of rules used = 4, integrand size = 13,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.308$ , Rules used = {6512, 4406, 12, 3299}

$$\frac{\text{CosIntegral}(a + bx) \sin(a + bx)}{b} - \frac{\text{Si}(2a + 2bx)}{2b}$$

Antiderivative was successfully verified.

[In] Int[Cos[a + b\*x]\*CosIntegral[a + b\*x],x]

[Out] (CosIntegral[a + b\*x]\*Sin[a + b\*x])/b - SinIntegral[2\*a + 2\*b\*x]/(2\*b)

#### Rule 6512

Int[Cos[(a\_.) + (b\_.)\*(x\_)]\*CosIntegral[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] :> S imp[(Sin[a + b\*x]\*CosIntegral[c + d\*x])/b, x] - Dist[d/b, Int[(Sin[a + b\*x]\*Cos[c + d\*x])/(c + d\*x), x], x] /; FreeQ[{a, b, c, d}, x]

#### Rule 4406

Int[Cos[(a\_.) + (b\_.)\*(x\_)]^(p\_.)\*((c\_.) + (d\_.)\*(x\_))^(m\_.)\*Sin[(a\_.) + (b\_.)\*(x\_)]^(n\_.), x\_Symbol] :> Int[ExpandTrigReduce[(c + d\*x)^m, Sin[a + b\*x]^(n)\*Cos[a + b\*x]^p, x], x] /; FreeQ[{a, b, c, d, m}, x] && IGtQ[n, 0] && IGtQ[p, 0]

#### Rule 12

Int[(a\_)\*(u\_), x\_Symbol] :> Dist[a, Int[u, x], x] /; FreeQ[a, x] && !MatchQ[u, (b\_)\*(v\_)] /; FreeQ[b, x]

#### Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] :> Simp[SinIntegral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

### Rubi steps

$$\begin{aligned} \int \cos(a + bx) \operatorname{Ci}(a + bx) dx &= \frac{\operatorname{Ci}(a + bx) \sin(a + bx)}{b} - \int \frac{\cos(a + bx) \sin(a + bx)}{a + bx} dx \\ &= \frac{\operatorname{Ci}(a + bx) \sin(a + bx)}{b} - \int \frac{\sin(2a + 2bx)}{2(a + bx)} dx \\ &= \frac{\operatorname{Ci}(a + bx) \sin(a + bx)}{b} - \frac{1}{2} \int \frac{\sin(2a + 2bx)}{a + bx} dx \\ &= \frac{\operatorname{Ci}(a + bx) \sin(a + bx)}{b} - \frac{\operatorname{Si}(2a + 2bx)}{2b} \end{aligned}$$

**Mathematica [A]** time = 0.0187926, size = 32, normalized size = 0.97

$$\frac{\operatorname{CosIntegral}(a + bx) \sin(a + bx)}{b} - \frac{\operatorname{Si}(2(a + bx))}{2b}$$

Antiderivative was successfully verified.

```
[In] Integrate[Cos[a + b*x]*CosIntegral[a + b*x], x]
```

```
[Out] (CosIntegral[a + b*x]*Sin[a + b*x])/b - SinIntegral[2*(a + b*x)]/(2*b)
```

**Maple [A]** time = 0.053, size = 30, normalized size = 0.9

$$\frac{1}{b} \left( \operatorname{Ci}(bx + a) \sin(bx + a) - \frac{\operatorname{Si}(2bx + 2a)}{2} \right)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(Ci(b*x+a)*cos(b*x+a), x)
```

```
[Out] 1/b*(Ci(b*x+a)*sin(b*x+a)-1/2*Si(2*b*x+2*a))
```

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \operatorname{Ci}(bx + a) \cos(bx + a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Ci(b*x+a)*cos(b*x+a),x, algorithm="maxima")`

[Out] `integrate(Ci(b*x + a)*cos(b*x + a), x)`

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(\cos(bx + a) \operatorname{Ci}(bx + a), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Ci(b*x+a)*cos(b*x+a),x, algorithm="fricas")`

[Out] `integral(cos(b*x + a)*cos_integral(b*x + a), x)`

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \cos(a + bx) \operatorname{Ci}(a + bx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(Ci(b*x+a)*cos(b*x+a),x)`

[Out] `Integral(cos(a + b*x)*Ci(a + b*x), x)`

---

**Giac [C]** time = 1.16471, size = 76, normalized size = 2.3

$$\frac{\operatorname{Ci}(bx + a) \sin(bx + a)}{b} - \frac{\Im(\operatorname{Ci}(2bx + 2a)) - \Im(\operatorname{Ci}(-2bx - 2a)) + 2 \operatorname{Si}(2bx + 2a)}{4b}$$

Verification of antiderivative is not currently implemented for this CAS.



```
[In] integrate(Ci(b*x+a)*cos(b*x+a),x, algorithm="giac")
```

```
[Out] cos_integral(b*x + a)*sin(b*x + a)/b - 1/4*(imag_part(cos_integral(2*b*x +  
2*a)) - imag_part(cos_integral(-2*b*x - 2*a)) + 2*sin_integral(2*b*x + 2*a)  
)/b
```

$$3.130 \quad \int \frac{\cos(a+bx)\text{CosIntegral}(a+bx)}{x} dx$$

**Optimal.** Leaf size=18

$$\text{CannotIntegrate}\left(\frac{\text{CosIntegral}(a+bx)\cos(a+bx)}{x}, x\right)$$

[Out] CannotIntegrate[(Cos[a + b\*x]\*CosIntegral[a + b\*x])/x, x]

**Rubi [A]** time = 0.07491, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\cos(a+bx)\text{CosIntegral}(a+bx)}{x} dx$$

Verification is Not applicable to the result.

[In] Int[(Cos[a + b\*x]\*CosIntegral[a + b\*x])/x,x]

[Out] Defer[Int] [(Cos[a + b\*x]\*CosIntegral[a + b\*x])/x, x]

Rubi steps

$$\int \frac{\cos(a+bx)\text{Ci}(a+bx)}{x} dx = \int \frac{\cos(a+bx)\text{Ci}(a+bx)}{x} dx$$

**Mathematica [A]** time = 3.23689, size = 0, normalized size = 0.

$$\int \frac{\cos(a+bx)\text{CosIntegral}(a+bx)}{x} dx$$

Verification is Not applicable to the result.

[In] Integrate[(Cos[a + b\*x]\*CosIntegral[a + b\*x])/x,x]

[Out] Integrate[(Cos[a + b\*x]\*CosIntegral[a + b\*x])/x, x]

---

**Maple [A]** time = 0.085, size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx + a) \cos(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(b\*x+a)\*cos(b\*x+a)/x,x)

[Out] int(Ci(b\*x+a)\*cos(b\*x+a)/x,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx + a) \cos(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)\*cos(b\*x+a)/x,x, algorithm="maxima")

[Out] integrate(Ci(b\*x + a)\*cos(b\*x + a)/x, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\cos(bx + a) \text{Ci}(bx + a)}{x}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)\*cos(b\*x+a)/x,x, algorithm="fricas")

[Out] integral(cos(b\*x + a)\*cos\_integral(b\*x + a)/x, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\cos(a + bx) \text{Ci}(a + bx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)\*cos(b\*x+a)/x,x)

[Out] Integral(cos(a + b\*x)\*Ci(a + b\*x)/x, x)

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(bx + a) \cos(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(b\*x+a)\*cos(b\*x+a)/x,x, algorithm="giac")

[Out] integrate(Ci(b\*x + a)\*cos(b\*x + a)/x, x)

### 3.131 $\int x \text{CosIntegral}(c + dx) \sin(a + bx) dx$

**Optimal.** Leaf size=371

$$\frac{\sin\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b-d)}{d} + x(b-d)\right)}{2b^2} - \frac{\sin\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b+d)}{d} + x(b+d)\right)}{2b^2} + \frac{\sin(a + bx) \text{CosIntegral}(c + dx)}{b^2}$$

```
[Out] -(c*cos[a - (b*c)/d]*CosIntegral[(c*(b - d))/d + (b - d)*x])/(2*b*d) - (x*cos[a + b*x]*CosIntegral[c + d*x])/b - (c*cos[a - (b*c)/d]*CosIntegral[(c*(b + d))/d + (b + d)*x])/(2*b*d) - (CosIntegral[(c*(b - d))/d + (b - d)*x]*Sin[a - (b*c)/d])/(2*b^2) - (CosIntegral[(c*(b + d))/d + (b + d)*x]*Sin[a - (b*c)/d])/(2*b^2) + (CosIntegral[c + d*x]*Sin[a + b*x])/b^2 + Sin[a - c + (b - d)*x]/(2*b*(b - d)) + Sin[a + c + (b + d)*x]/(2*b*(b + d)) - (Cos[a - (b*c)/d]*SinIntegral[(c*(b - d))/d + (b - d)*x])/(2*b^2) + (c*sin[a - (b*c)/d]*SinIntegral[(c*(b - d))/d + (b - d)*x])/(2*b*d) - (Cos[a - (b*c)/d]*SinIntegral[(c*(b + d))/d + (b + d)*x])/(2*b^2) + (c*sin[a - (b*c)/d]*SinIntegral[(c*(b + d))/d + (b + d)*x])/(2*b*d)
```

**Rubi [A]** time = 1.01904, antiderivative size = 371, normalized size of antiderivative = 1., number of steps used = 24, number of rules used = 9, integrand size = 14,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.643$ , Rules used = {6520, 4609, 6742, 2637, 3303, 3299, 3302, 6512, 4430}

$$\frac{\sin\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b-d)}{d} + x(b-d)\right)}{2b^2} - \frac{\sin\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b+d)}{d} + x(b+d)\right)}{2b^2} + \frac{\sin(a + bx) \text{CosIntegral}(c + dx)}{b^2}$$

Antiderivative was successfully verified.

```
[In] Int[x*CosIntegral[c + d*x]*Sin[a + b*x],x]
```

```
[Out] -(c*cos[a - (b*c)/d]*CosIntegral[(c*(b - d))/d + (b - d)*x])/(2*b*d) - (x*cos[a + b*x]*CosIntegral[c + d*x])/b - (c*cos[a - (b*c)/d]*CosIntegral[(c*(b + d))/d + (b + d)*x])/(2*b*d) - (CosIntegral[(c*(b - d))/d + (b - d)*x]*Sin[a - (b*c)/d])/(2*b^2) - (CosIntegral[(c*(b + d))/d + (b + d)*x]*Sin[a - (b*c)/d])/(2*b^2) + (CosIntegral[c + d*x]*Sin[a + b*x])/b^2 + Sin[a - c + (b - d)*x]/(2*b*(b - d)) + Sin[a + c + (b + d)*x]/(2*b*(b + d)) - (Cos[a - (b*c)/d]*SinIntegral[(c*(b - d))/d + (b - d)*x])/(2*b^2) + (c*sin[a - (b*c)/d]*SinIntegral[(c*(b - d))/d + (b - d)*x])/(2*b*d) - (Cos[a - (b*c)/d]*SinIntegral[(c*(b + d))/d + (b + d)*x])/(2*b^2) + (c*sin[a - (b*c)/d]*SinIntegral[(c*(b + d))/d + (b + d)*x])/(2*b*d)
```

Rule 6520

```
Int[CosIntegral[(c_.) + (d_.)*(x_)]*((e_.) + (f_.)*(x_))^(m_.)*Sin[(a_.) +
(b_.)*(x_)], x_Symbol] := -Simp[((e + f*x)^m*Cos[a + b*x]*CosIntegral[c + d
*x])/b, x] + (Dist[d/b, Int[((e + f*x)^m*Cos[a + b*x]*Cos[c + d*x])/(c + d*
x), x], x] + Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*Cos[a + b*x]*CosIntegral[c
+ d*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]
```

Rule 4609

```
Int[Cos[(a_.) + (b_.)*(x_)]^(m_.)*Cos[(c_.) + (d_.)*(x_)]^(n_.)*(u_.), x_Sy
mbol] := Int[ExpandTrigReduce[u, Cos[a + b*x]^m*Cos[c + d*x]^n, x], x] /; F
reeQ[{a, b, c, d}, x] && IGtQ[m, 0] && IGtQ[n, 0]
```

Rule 6742

```
Int[u_, x_Symbol] := With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

Rule 2637

```
Int[sin[Pi/2 + (c_.) + (d_.)*(x_)], x_Symbol] := Simp[Sin[c + d*x]/d, x] /;
FreeQ[{c, d}, x]
```

Rule 3303

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Dist[Cos[(d*
e - c*f)/d], Int[Sin[(c*f)/d + f*x]/(c + d*x), x], x] + Dist[Sin[(d*e - c*f
)/d], Int[Cos[(c*f)/d + f*x]/(c + d*x), x], x] /; FreeQ[{c, d, e, f}, x] &&
NeQ[d*e - c*f, 0]
```

Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[SinInte
gral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[CosInte
gral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) -
c*f, 0]
```

Rule 6512

```
Int[Cos[(a_.) + (b_.)*(x_)]*CosIntegral[(c_.) + (d_.)*(x_)], x_Symbol] := S
imp[(Sin[a + b*x]*CosIntegral[c + d*x])/b, x] - Dist[d/b, Int[(Sin[a + b*x]
*Cos[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

### Rule 4430

```
Int[Cos[(c_.) + (d_.)*(x_)]^(q_.)*((e_.) + (f_.)*(x_))^(m_.)*Sin[(a_.) + (b
_.)*(x_)]^(p_.), x_Symbol] := Int[ExpandTrigReduce[(e + f*x)^m, Sin[a + b*x
]^(p)*Cos[c + d*x]^q, x], x] /; FreeQ[{a, b, c, d, e, f, m}, x] && IGtQ[p, 0]
&& IGtQ[q, 0]
```

### Rubi steps

$$\begin{aligned}
\int x \operatorname{Ci}(c+dx) \sin(a+bx) dx &= -\frac{x \cos(a+bx) \operatorname{Ci}(c+dx)}{b} + \frac{\int \cos(a+bx) \operatorname{Ci}(c+dx) dx}{b} + \frac{d \int \frac{x \cos(a+bx) \cos(c+dx)}{c+dx} dx}{b} \\
&= -\frac{x \cos(a+bx) \operatorname{Ci}(c+dx)}{b} + \frac{\operatorname{Ci}(c+dx) \sin(a+bx)}{b^2} - \frac{d \int \frac{\cos(c+dx) \sin(a+bx)}{c+dx} dx}{b^2} + \frac{d \int \left( \frac{x \cos(a+bx) \cos(c+dx)}{c+dx} \right) dx}{b^2} \\
&= -\frac{x \cos(a+bx) \operatorname{Ci}(c+dx)}{b} + \frac{\operatorname{Ci}(c+dx) \sin(a+bx)}{b^2} - \frac{d \int \left( \frac{\sin(a-c+(b-d)x)}{2(c+dx)} + \frac{\sin(a+c+(b+d)x)}{2(c+dx)} \right) dx}{b^2} \\
&= -\frac{x \cos(a+bx) \operatorname{Ci}(c+dx)}{b} + \frac{\operatorname{Ci}(c+dx) \sin(a+bx)}{b^2} - \frac{d \int \frac{\sin(a-c+(b-d)x)}{c+dx} dx}{2b^2} - \frac{d \int \frac{\sin(a+c+(b+d)x)}{c+dx} dx}{2b^2} \\
&= -\frac{x \cos(a+bx) \operatorname{Ci}(c+dx)}{b} + \frac{\operatorname{Ci}(c+dx) \sin(a+bx)}{b^2} + \frac{\int \cos(a-c+(b-d)x) dx}{2b} + \frac{\int \cos(a+c+(b+d)x) dx}{2b} \\
&= -\frac{x \cos(a+bx) \operatorname{Ci}(c+dx)}{b} - \frac{\operatorname{Ci}\left(\frac{c(b-d)}{d} + (b-d)x\right) \sin\left(a - \frac{bc}{d}\right)}{2b^2} - \frac{\operatorname{Ci}\left(\frac{c(b+d)}{d} + (b+d)x\right)}{2b^2} \\
&= -\frac{c \cos\left(a - \frac{bc}{d}\right) \operatorname{Ci}\left(\frac{c(b-d)}{d} + (b-d)x\right)}{2bd} - \frac{x \cos(a+bx) \operatorname{Ci}(c+dx)}{b} - \frac{c \cos\left(a - \frac{bc}{d}\right) \operatorname{Ci}\left(\frac{c(b+d)}{d} + (b+d)x\right)}{2bd}
\end{aligned}$$

**Mathematica [C]** time = 6.40292, size = 328, normalized size = 0.88

$$-4 \operatorname{CosIntegral}(c+dx)(bx \cos(a+bx) - \sin(a+bx)) + \frac{e^{-ia} \left( -(bc+id)e^{\frac{ibc}{d}} \operatorname{ExpIntegralEi}\left(-\frac{i(b-d)(c+dx)}{d}\right) - (bc+id)e^{\frac{ibc}{d}} \operatorname{ExpIntegralEi}\left(-\frac{i(b+d)(c+dx)}{d}\right) \right)}{d}$$

Antiderivative was successfully verified.

```
[In] Integrate[x*CosIntegral[c + d*x]*Sin[a + b*x],x]
```

```
[Out] (((I*b*d*(1/((b + d)*E^(I*(b + d)*x)) + E^(I*(2*c - b*x + d*x))/(b - d)))/E
^(I*c) - (b*c + I*d)*E^((I*b*c)/d)*ExpIntegralEi[((-I)*(b - d)*(c + d*x))/d
] - (b*c + I*d)*E^((I*b*c)/d)*ExpIntegralEi[((-I)*(b + d)*(c + d*x))/d])/(d
*e^(I*a)) - (E^(I*(a - c))*(I*b*d*(E^(I*(b - d)*x)/(b - d) + E^(I*(2*c + (b
+ d)*x))/(b + d)) + ((b*c - I*d)*ExpIntegralEi[(I*(b - d)*(c + d*x))/d])/E
^((I*c*(b - d))/d) + ((b*c - I*d)*ExpIntegralEi[(I*(b + d)*(c + d*x))/d])/E
^((I*c*(b - d))/d))/d - 4*CosIntegral[c + d*x]*(b*x*Cos[a + b*x] - Sin[a +
b*x]))/(4*b^2)
```

**Maple [B]** time = 0.102, size = 1208, normalized size = 3.3

result too large to display

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(x*Ci(d*x+c)*sin(b*x+a),x)
```

```
[Out] (Ci(d*x+c)/b*(1/b*d*(-(b/d*(d*x+c)+(a*d-b*c)/d)*cos(b/d*(d*x+c)+(a*d-b*c)/d
)+sin(b/d*(d*x+c)+(a*d-b*c)/d))+a*d/b*cos(b/d*(d*x+c)+(a*d-b*c)/d))-1/b*(-1
/2/(b-d)*d*sin((b-d)/d*(d*x+c)+(a*d-b*c)/d)-1/2*(a*d-b*c)*d/(b-d)*(Si((b-d)
/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*sin((-a*d+b*c)/d)/d+Ci((b-d)/d*(d*x+c)
+(a*d-b*c)/d+(-a*d+b*c)/d)*cos((-a*d+b*c)/d)/d)+1/2/(b-d)*d^2*a*(Si((b-d)/d
*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*sin((-a*d+b*c)/d)/d+Ci((b-d)/d*(d*x+c)+(
a*d-b*c)/d+(-a*d+b*c)/d)*cos((-a*d+b*c)/d)/d)-1/2/(b-d)*c*d^2*(Si((b-d)/d*(
d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*sin((-a*d+b*c)/d)/d+Ci((b-d)/d*(d*x+c)+(a*
d-b*c)/d+(-a*d+b*c)/d)*cos((-a*d+b*c)/d)/d)-1/2/(b+d)*d*sin((b+d)/d*(d*x+c)
+(a*d-b*c)/d)-1/2*(a*d-b*c)*d/(b+d)*(Si((b+d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b
*c)/d)*sin((-a*d+b*c)/d)/d+Ci((b+d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*cos
((-a*d+b*c)/d)/d)+1/2/(b+d)*d^2*a*(Si((b+d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c
)/d)*sin((-a*d+b*c)/d)/d+Ci((b+d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*cos((
-a*d+b*c)/d)/d)+1/2/(b+d)*c*d^2*(Si((b+d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/
d)*sin((-a*d+b*c)/d)/d+Ci((b+d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*cos((a
*d+b*c)/d)/d)+1/2/b*d^2*(Si((b-d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*cos((
-a*d+b*c)/d)/d-Ci((b-d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*sin((-a*d+b*c)/
d)/d)+1/2/b*d^2*(Si((b+d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*cos((-a*d+b*c
)/d)/d-Ci((b+d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*sin((-a*d+b*c)/d)/d))/
d
```



**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x \operatorname{Ci}(dx + c) \sin(bx + a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*Ci(d*x+c)*sin(b*x+a),x, algorithm="maxima")`

[Out] `integrate(x*Ci(d*x + c)*sin(b*x + a), x)`

---

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\operatorname{integral}(x \operatorname{Ci}(dx + c) \sin(bx + a), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*Ci(d*x+c)*sin(b*x+a),x, algorithm="fricas")`

[Out] `integral(x*cos_integral(d*x + c)*sin(b*x + a), x)`

---

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x \sin(a + bx) \operatorname{Ci}(c + dx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*Ci(d*x+c)*sin(b*x+a),x)`

[Out] `Integral(x*sin(a + b*x)*Ci(c + d*x), x)`

---

**Giac [F(-1)]** time = 0., size = 0, normalized size = 0.

Timed out

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(x*Ci(d*x+c)*sin(b*x+a),x, algorithm="giac")
```

```
[Out] Timed out
```

### 3.132 $\int \text{CosIntegral}(c + dx) \sin(a + bx) dx$

**Optimal.** Leaf size=154

$$\frac{\cos\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b-d)}{d} + x(b-d)\right)}{2b} - \frac{\cos(a + bx) \text{CosIntegral}(c + dx)}{b} + \frac{\cos\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b+d)}{d} + x(b+d)\right)}{2b}$$

```
[Out] (Cos[a - (b*c)/d]*CosIntegral[(c*(b - d))/d + (b - d)*x])/(2*b) - (Cos[a +
b*x]*CosIntegral[c + d*x])/b + (Cos[a - (b*c)/d]*CosIntegral[(c*(b + d))/d
+ (b + d)*x])/(2*b) - (Sin[a - (b*c)/d]*SinIntegral[(c*(b - d))/d + (b - d)
*x])/(2*b) - (Sin[a - (b*c)/d]*SinIntegral[(c*(b + d))/d + (b + d)*x])/(2*b
)
```

---

**Rubi [A]** time = 0.221602, antiderivative size = 154, normalized size of antiderivative = 1., number of steps used = 9, number of rules used = 5, integrand size = 13,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.385$ , Rules used = {6518, 4429, 3303, 3299, 3302}

$$\frac{\cos\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b-d)}{d} + x(b-d)\right)}{2b} - \frac{\cos(a + bx) \text{CosIntegral}(c + dx)}{b} + \frac{\cos\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b+d)}{d} + x(b+d)\right)}{2b}$$

Antiderivative was successfully verified.

```
[In] Int[CosIntegral[c + d*x]*Sin[a + b*x], x]
```

```
[Out] (Cos[a - (b*c)/d]*CosIntegral[(c*(b - d))/d + (b - d)*x])/(2*b) - (Cos[a +
b*x]*CosIntegral[c + d*x])/b + (Cos[a - (b*c)/d]*CosIntegral[(c*(b + d))/d
+ (b + d)*x])/(2*b) - (Sin[a - (b*c)/d]*SinIntegral[(c*(b - d))/d + (b - d)
*x])/(2*b) - (Sin[a - (b*c)/d]*SinIntegral[(c*(b + d))/d + (b + d)*x])/(2*b
)
```

#### Rule 6518

```
Int[CosIntegral[(c_.) + (d_.)*(x_)]*Sin[(a_.) + (b_.)*(x_)], x_Symbol] :-
Simp[(Cos[a + b*x]*CosIntegral[c + d*x])/b, x] + Dist[d/b, Int[(Cos[a + b*x]
]*Cos[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

#### Rule 4429

```
Int[Cos[(a_.) + (b_.)*(x_)]^(p_.)*Cos[(c_.) + (d_.)*(x_)]^(q_.)*((e_.) + (f
_.)*(x_))^(m_.), x_Symbol] :- Int[ExpandTrigReduce[(e + f*x)^m, Cos[a + b*x]
]^(p)*Cos[c + d*x]^q, x], x] /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[p, 0] &&
```

IGtQ[q, 0] && IntegerQ[m]

### Rule 3303

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] := Dist[Cos[(d\*e - c\*f)/d], Int[Sin[(c\*f)/d + f\*x]/(c + d\*x), x], x] + Dist[Sin[(d\*e - c\*f)/d], Int[Cos[(c\*f)/d + f\*x]/(c + d\*x), x], x] /; FreeQ[{c, d, e, f}, x] && NeQ[d\*e - c\*f, 0]

### Rule 3299

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] := Simp[SinIntegral[e + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*e - c\*f, 0]

### Rule 3302

Int[sin[(e\_.) + (f\_.)\*(x\_)]/((c\_.) + (d\_.)\*(x\_)), x\_Symbol] := Simp[CosIntegral[e - Pi/2 + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*(e - Pi/2) - c\*f, 0]

### Rubi steps

$$\begin{aligned}
 \int \text{Ci}(c + dx) \sin(a + bx) dx &= -\frac{\cos(a + bx)\text{Ci}(c + dx)}{b} + \frac{d \int \frac{\cos(a+bx) \cos(c+dx)}{c+dx} dx}{b} \\
 &= -\frac{\cos(a + bx)\text{Ci}(c + dx)}{b} + \frac{d \int \left( \frac{\cos(a-c+(b-d)x)}{2(c+dx)} + \frac{\cos(a+c+(b+d)x)}{2(c+dx)} \right) dx}{b} \\
 &= -\frac{\cos(a + bx)\text{Ci}(c + dx)}{b} + \frac{d \int \frac{\cos(a-c+(b-d)x)}{c+dx} dx}{2b} + \frac{d \int \frac{\cos(a+c+(b+d)x)}{c+dx} dx}{2b} \\
 &= -\frac{\cos(a + bx)\text{Ci}(c + dx)}{b} + \frac{\left( d \cos\left(a - \frac{bc}{d}\right) \right) \int \frac{\cos\left(\frac{c(b-d)}{d} + (b-d)x\right)}{c+dx} dx}{2b} + \frac{\left( d \cos\left(a - \frac{bc}{d}\right) \right) \int \frac{\cos\left(\frac{c(b+d)}{d} + (b+d)x\right)}{c+dx} dx}{2b} \\
 &= \frac{\cos\left(a - \frac{bc}{d}\right) \text{Ci}\left(\frac{c(b-d)}{d} + (b-d)x\right)}{2b} - \frac{\cos(a + bx)\text{Ci}(c + dx)}{b} + \frac{\cos\left(a - \frac{bc}{d}\right) \text{Ci}\left(\frac{c(b+d)}{d} + (b+d)x\right)}{2b}
 \end{aligned}$$

**Mathematica [C]** time = 1.38716, size = 144, normalized size = 0.94

$$\frac{-4 \cos(a + bx) \text{CosIntegral}(c + dx) + \left( \text{ExpIntegralEi}\left(-\frac{i(b-d)(c+dx)}{d}\right) + \text{ExpIntegralEi}\left(-\frac{i(b+d)(c+dx)}{d}\right) \right) \left( \cos\left(a - \frac{bc}{d}\right) - i \right)}{4b}$$

Antiderivative was successfully verified.

[In] Integrate[CosIntegral[c + d\*x]\*Sin[a + b\*x],x]

[Out]  $(-4*\text{Cos}[a + b*x]*\text{CosIntegral}[c + d*x] + (\text{ExpIntegralEi}[((-I)*(b - d)*(c + d*x))/d] + \text{ExpIntegralEi}[((-I)*(b + d)*(c + d*x))/d])*(\text{Cos}[a - (b*c)/d] - I*\text{Sin}[a - (b*c)/d]) + (\text{ExpIntegralEi}[(I*(b - d)*(c + d*x))/d] + \text{ExpIntegralEi}[(I*(b + d)*(c + d*x))/d])*(\text{Cos}[a - (b*c)/d] + I*\text{Sin}[a - (b*c)/d]))/(4*b)$

**Maple [A]** time = 0.078, size = 280, normalized size = 1.8

$$\frac{1}{d} \left( -\frac{\text{Ci}(dx + c)d}{b} \cos\left(\frac{b(dx + c)}{d} + \frac{ad - bc}{d}\right) + \frac{d}{b} \left( \frac{1}{2} \left( \frac{1}{d} \text{Si}\left(\frac{(b - d)(dx + c)}{d} + \frac{ad - bc}{d} + \frac{-ad + bc}{d}\right) \sin\left(\frac{-ad + bc}{d}\right) + \frac{1}{d} \right) \right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(d\*x+c)\*sin(b\*x+a),x)

[Out]  $(-\text{Ci}(d*x+c)/b*d*\cos(b/d*(d*x+c)+(a*d-b*c)/d)+1/b*d*(1/2*d*(\text{Si}((b-d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*\sin((-a*d+b*c)/d)/d+\text{Ci}((b-d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*\cos((-a*d+b*c)/d)/d)+1/2*d*(\text{Si}((b+d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*\sin((-a*d+b*c)/d)/d+\text{Ci}((b+d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*\cos((-a*d+b*c)/d)/d)/d$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \text{Ci}(dx + c) \sin(bx + a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(d\*x+c)\*sin(b\*x+a),x, algorithm="maxima")

[Out] integrate(Ci(d\*x + c)\*sin(b\*x + a), x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(\text{Ci}(dx + c) \sin(bx + a), x)$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(d*x+c)*sin(b*x+a),x, algorithm="fricas")
```

```
[Out] integral(cos_integral(d*x + c)*sin(b*x + a), x)
```

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \sin(a + bx) \operatorname{Ci}(c + dx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(d*x+c)*sin(b*x+a),x)
```

```
[Out] Integral(sin(a + b*x)*Ci(c + d*x), x)
```

**Giac [C]** time = 1.88639, size = 12438, normalized size = 80.77

result too large to display

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(d*x+c)*sin(b*x+a),x, algorithm="giac")
```

```
[Out] 1/4*(real_part(cos_integral(b*x + d*x + c + b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d)^2 + real_part(cos_integral(b*x - d*x - c + b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d)^2 + real_part(cos_integral(-b*x + d*x + c - b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d)^2 + real_part(cos_integral(-b*x - d*x - c - b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d)^2 - 2*imag_part(cos_integral(b*x - d*x - c + b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d) + 2*imag_part(cos_integral(-b*x + d*x + c - b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d) - 4*sin_integral((b*d*x - d^2*x + b*c - c*d)/d)*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d) - 2*imag_part(cos_integral(b*x + d*x + c + b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)*tan(1/2*(b*c - c*d)/d)^2 + 2*imag_part(cos_integral(-b*x - d*x - c - b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)*tan(1/2*(b*c - c*d)/d)^2 -
```



$$\begin{aligned}
& 2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d)^2 - 2*imag\_part(\cos\_ \\
& \text{integral}(b*x + d*x + c + b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2* \\
& \tan(1/2*(b*c + c*d)/d) + 2*imag\_part(\cos\_integral(-b*x - d*x - c - b*c/d))* \\
& \tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d) - 4*\sin\_in \\
& \text{tegral}((b*d*x + d^2*x + b*c + c*d)/d)*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2* \\
& c)^2*\tan(1/2*(b*c + c*d)/d) - 2*imag\_part(\cos\_integral(b*x - d*x - c + b*c/ \\
& d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c + c*d)/d)^2 + 2*im \\
& ag\_part(\cos\_integral(-b*x + d*x + c - b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2* \\
& a - 1/2*c)*\tan(1/2*(b*c + c*d)/d)^2 - 4*\sin\_integral((b*d*x - d^2*x + b*c - \\
& c*d)/d)*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c + c*d)/d)^2 + \\
& 2*imag\_part(\cos\_integral(b*x + d*x + c + b*c/d))*\tan(1/2*a + 1/2*c)*\tan(1/ \\
& 2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 - 2*imag\_part(\cos\_integral(-b*x - d \\
& *x - c - b*c/d))*\tan(1/2*a + 1/2*c)*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d \\
& )/d)^2 + 4*\sin\_integral((b*d*x + d^2*x + b*c + c*d)/d)*\tan(1/2*a + 1/2*c)* \\
& \tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 - 2*imag\_part(\cos\_integral(b*x \\
& - d*x - c + b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c \\
& - c*d)/d) + 2*imag\_part(\cos\_integral(-b*x + d*x + c - b*c/d))*\tan(1/2*a + \\
& 1/2*c)^2*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c - c*d)/d) - 4*\sin\_integral((b*d* \\
& x - d^2*x + b*c - c*d)/d)*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2*\tan(1/2 \\
& *(b*c - c*d)/d) + 2*imag\_part(\cos\_integral(b*x - d*x - c + b*c/d))*\tan(1/2* \\
& a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d) - 2*imag\_part( \\
& \cos\_integral(-b*x + d*x + c - b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c + c \\
& *d)/d)^2*\tan(1/2*(b*c - c*d)/d) + 4*\sin\_integral((b*d*x - d^2*x + b*c - c*d \\
& )/d)*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d) - \\
& 2*imag\_part(\cos\_integral(b*x - d*x - c + b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan( \\
& 1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d) + 2*imag\_part(\cos\_integral(-b*x \\
& + d*x + c - b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2* \\
& (b*c - c*d)/d) - 4*\sin\_integral((b*d*x - d^2*x + b*c - c*d)/d)*\tan(1/2*a - \\
& 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d) + 2*imag\_part(\cos\_ \\
& \text{integral}(b*x - d*x - c + b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)*\tan \\
& (1/2*(b*c - c*d)/d)^2 - 2*imag\_part(\cos\_integral(-b*x + d*x + c - b*c/d))* \\
& \tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c - c*d)/d)^2 + 4*\sin\_in \\
& \text{tegral}((b*d*x - d^2*x + b*c - c*d)/d)*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2* \\
& c)*\tan(1/2*(b*c - c*d)/d)^2 - 2*imag\_part(\cos\_integral(b*x + d*x + c + b*c/ \\
& d))*\tan(1/2*a + 1/2*c)*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c - c*d)/d)^2 + 2*im \\
& ag\_part(\cos\_integral(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)*\tan(1/2*a \\
& - 1/2*c)^2*\tan(1/2*(b*c - c*d)/d)^2 - 4*\sin\_integral((b*d*x + d^2*x + b*c + \\
& c*d)/d)*\tan(1/2*a + 1/2*c)*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c - c*d)/d)^2 - \\
& 2*imag\_part(\cos\_integral(b*x + d*x + c + b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan( \\
& 1/2*(b*c + c*d)/d)*\tan(1/2*(b*c - c*d)/d)^2 + 2*imag\_part(\cos\_integral(-b*x \\
& - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)*\tan(1/2*(b \\
& *c - c*d)/d)^2 - 4*\sin\_integral((b*d*x + d^2*x + b*c + c*d)/d)*\tan(1/2*a + \\
& 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)*\tan(1/2*(b*c - c*d)/d)^2 + 2*imag\_part(\cos\_ \\
& \text{integral}(b*x + d*x + c + b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d \\
& )*\tan(1/2*(b*c - c*d)/d)^2 - 2*imag\_part(\cos\_integral(-b*x - d*x - c - b*c/
\end{aligned}$$



$$\begin{aligned}
& d)) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d) * \tan(1/2*(b*c - c*d)/d)^2 + \\
& 4 * \sin\_integral((b*d*x + d^2*x + b*c + c*d)/d) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2* \\
& (b*c + c*d)/d) * \tan(1/2*(b*c - c*d)/d)^2 + 2 * \text{imag\_part}(\cos\_integral(b*x + d* \\
& x + c + b*c/d)) * \tan(1/2*a + 1/2*c) * \tan(1/2*(b*c + c*d)/d)^2 * \tan(1/2*(b*c - \\
& c*d)/d)^2 - 2 * \text{imag\_part}(\cos\_integral(-b*x - d*x - c - b*c/d)) * \tan(1/2*a + 1 \\
& /2*c) * \tan(1/2*(b*c + c*d)/d)^2 * \tan(1/2*(b*c - c*d)/d)^2 + 4 * \sin\_integral((b \\
& *d*x + d^2*x + b*c + c*d)/d) * \tan(1/2*a + 1/2*c) * \tan(1/2*(b*c + c*d)/d)^2 * \tan \\
& (1/2*(b*c - c*d)/d)^2 + 2 * \text{imag\_part}(\cos\_integral(b*x - d*x - c + b*c/d)) * \tan \\
& (1/2*a - 1/2*c) * \tan(1/2*(b*c + c*d)/d)^2 * \tan(1/2*(b*c - c*d)/d)^2 - 2 * \text{ima} \\
& g\_part(\cos\_integral(-b*x + d*x + c - b*c/d)) * \tan(1/2*a - 1/2*c) * \tan(1/2*(b* \\
& c + c*d)/d)^2 * \tan(1/2*(b*c - c*d)/d)^2 + 4 * \sin\_integral((b*d*x - d^2*x + b* \\
& c - c*d)/d) * \tan(1/2*a - 1/2*c) * \tan(1/2*(b*c + c*d)/d)^2 * \tan(1/2*(b*c - c*d) \\
& /d)^2 - \text{real\_part}(\cos\_integral(b*x + d*x + c + b*c/d)) * \tan(1/2*a + 1/2*c)^2 \\
& * \tan(1/2*a - 1/2*c)^2 - \text{real\_part}(\cos\_integral(b*x - d*x - c + b*c/d)) * \tan( \\
& 1/2*a + 1/2*c)^2 * \tan(1/2*a - 1/2*c)^2 - \text{real\_part}(\cos\_integral(-b*x + d*x + \\
& c - b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*a - 1/2*c)^2 - \text{real\_part}(\cos\_inte \\
& gral(-b*x - d*x - c - b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*a - 1/2*c)^2 + 4 \\
& * \text{real\_part}(\cos\_integral(b*x + d*x + c + b*c/d)) * \tan(1/2*a + 1/2*c) * \tan(1/2* \\
& a - 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d) + 4 * \text{real\_part}(\cos\_integral(-b*x - d*x - \\
& c - b*c/d)) * \tan(1/2*a + 1/2*c) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d) \\
& + \text{real\_part}(\cos\_integral(b*x + d*x + c + b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan( \\
& 1/2*(b*c + c*d)/d)^2 + \text{real\_part}(\cos\_integral(b*x - d*x - c + b*c/d)) * \tan(1 \\
& /2*a + 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d)^2 + \text{real\_part}(\cos\_integral(-b*x + d* \\
& x + c - b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d)^2 + \text{real\_part}(c \\
& os\_integral(-b*x - d*x - c - b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c + c* \\
& d)/d)^2 - \text{real\_part}(\cos\_integral(b*x + d*x + c + b*c/d)) * \tan(1/2*a - 1/2*c) \\
& ^2 * \tan(1/2*(b*c + c*d)/d)^2 - \text{real\_part}(\cos\_integral(b*x - d*x - c + b*c/d) \\
& ) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d)^2 - \text{real\_part}(\cos\_integral(-b \\
& *x + d*x + c - b*c/d)) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d)^2 - \text{real} \\
& \_part(\cos\_integral(-b*x - d*x - c - b*c/d)) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b \\
& *c + c*d)/d)^2 + 4 * \text{real\_part}(\cos\_integral(b*x - d*x - c + b*c/d)) * \tan(1/2*a \\
& + 1/2*c)^2 * \tan(1/2*a - 1/2*c) * \tan(1/2*(b*c - c*d)/d) + 4 * \text{real\_part}(\cos\_int \\
& egral(-b*x + d*x + c - b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*a - 1/2*c) * \tan( \\
& 1/2*(b*c - c*d)/d) + 4 * \text{real\_part}(\cos\_integral(b*x - d*x - c + b*c/d)) * \tan(1 \\
& /2*a - 1/2*c) * \tan(1/2*(b*c + c*d)/d)^2 * \tan(1/2*(b*c - c*d)/d) + 4 * \text{real\_part} \\
& (\cos\_integral(-b*x + d*x + c - b*c/d)) * \tan(1/2*a - 1/2*c) * \tan(1/2*(b*c + c* \\
& d)/d)^2 * \tan(1/2*(b*c - c*d)/d) - \text{real\_part}(\cos\_integral(b*x + d*x + c + b*c \\
& /d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d)^2 - \text{real\_part}(\cos\_integral \\
& (b*x - d*x - c + b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d)^2 - \text{re} \\
& al\_part(\cos\_integral(-b*x + d*x + c - b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2* \\
& (b*c - c*d)/d)^2 - \text{real\_part}(\cos\_integral(-b*x - d*x - c - b*c/d)) * \tan(1/2* \\
& a + 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d)^2 + \text{real\_part}(\cos\_integral(b*x + d*x + \\
& c + b*c/d)) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d)^2 + \text{real\_part}(\cos\_i \\
& ntegral(b*x - d*x - c + b*c/d)) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d) \\
& ^2 + \text{real\_part}(\cos\_integral(-b*x + d*x + c - b*c/d)) * \tan(1/2*a - 1/2*c)^2 * \tan
\end{aligned}$$



$$\begin{aligned}
& c*d)/d)^2 + 2*imag\_part(cos\_integral(-b*x - d*x - c - b*c/d))*tan(1/2*a + 1/2*c)*tan(1/2*(b*c - c*d)/d)^2 - 4*sin\_integral((b*d*x + d^2*x + b*c + c*d)/d)*tan(1/2*a + 1/2*c)*tan(1/2*(b*c - c*d)/d)^2 + 2*imag\_part(cos\_integral(b*x - d*x - c + b*c/d))*tan(1/2*a - 1/2*c)*tan(1/2*(b*c - c*d)/d)^2 - 2*imag\_part(cos\_integral(-b*x + d*x + c - b*c/d))*tan(1/2*a - 1/2*c)*tan(1/2*(b*c - c*d)/d)^2 + 4*sin\_integral((b*d*x - d^2*x + b*c - c*d)/d)*tan(1/2*a - 1/2*c)*tan(1/2*(b*c - c*d)/d)^2 + 2*imag\_part(cos\_integral(b*x + d*x + c + b*c/d))*tan(1/2*(b*c + c*d)/d)*tan(1/2*(b*c - c*d)/d)^2 - 2*imag\_part(cos\_integral(-b*x - d*x - c - b*c/d))*tan(1/2*(b*c + c*d)/d)*tan(1/2*(b*c - c*d)/d)^2 + 4*sin\_integral((b*d*x + d^2*x + b*c + c*d)/d)*tan(1/2*(b*c + c*d)/d)*tan(1/2*(b*c - c*d)/d)^2 - real\_part(cos\_integral(b*x + d*x + c + b*c/d))*tan(1/2*a + 1/2*c)^2 + real\_part(cos\_integral(b*x - d*x - c + b*c/d))*tan(1/2*a + 1/2*c)^2 + real\_part(cos\_integral(-b*x + d*x + c - b*c/d))*tan(1/2*a + 1/2*c)^2 - real\_part(cos\_integral(-b*x - d*x - c - b*c/d))*tan(1/2*a + 1/2*c)^2 + real\_part(cos\_integral(b*x + d*x + c + b*c/d))*tan(1/2*a - 1/2*c)^2 - real\_part(cos\_integral(b*x - d*x - c + b*c/d))*tan(1/2*a - 1/2*c)^2 - real\_part(cos\_integral(-b*x + d*x + c - b*c/d))*tan(1/2*a - 1/2*c)^2 + real\_part(cos\_integral(-b*x - d*x - c - b*c/d))*tan(1/2*a - 1/2*c)^2 + 4*real\_part(cos\_integral(b*x + d*x + c + b*c/d))*tan(1/2*a + 1/2*c)*tan(1/2*(b*c + c*d)/d) + 4*real\_part(cos\_integral(-b*x - d*x - c - b*c/d))*tan(1/2*a + 1/2*c)*tan(1/2*(b*c + c*d)/d) - real\_part(cos\_integral(b*x + d*x + c + b*c/d))*tan(1/2*(b*c + c*d)/d)^2 + real\_part(cos\_integral(b*x - d*x - c + b*c/d))*tan(1/2*(b*c + c*d)/d)^2 + real\_part(cos\_integral(-b*x + d*x + c - b*c/d))*tan(1/2*(b*c + c*d)/d)^2 - real\_part(cos\_integral(-b*x - d*x - c - b*c/d))*tan(1/2*(b*c + c*d)/d)^2 + 4*real\_part(cos\_integral(b*x - d*x - c + b*c/d))*tan(1/2*a - 1/2*c)*tan(1/2*(b*c - c*d)/d) + 4*real\_part(cos\_integral(-b*x + d*x + c - b*c/d))*tan(1/2*a - 1/2*c)*tan(1/2*(b*c - c*d)/d) + real\_part(cos\_integral(b*x + d*x + c + b*c/d))*tan(1/2*(b*c - c*d)/d)^2 - real\_part(cos\_integral(b*x - d*x - c + b*c/d))*tan(1/2*(b*c - c*d)/d)^2 - real\_part(cos\_integral(-b*x + d*x + c - b*c/d))*tan(1/2*(b*c - c*d)/d)^2 + real\_part(cos\_integral(-b*x - d*x - c - b*c/d))*tan(1/2*(b*c - c*d)/d)^2 - 2*imag\_part(cos\_integral(b*x + d*x + c + b*c/d))*tan(1/2*a + 1/2*c) + 2*imag\_part(cos\_integral(-b*x - d*x - c - b*c/d))*tan(1/2*a + 1/2*c) - 4*sin\_integral((b*d*x + d^2*x + b*c + c*d)/d)*tan(1/2*a + 1/2*c) - 2*imag\_part(cos\_integral(b*x - d*x - c + b*c/d))*tan(1/2*a - 1/2*c) + 2*imag\_part(cos\_integral(-b*x + d*x + c - b*c/d))*tan(1/2*a - 1/2*c) - 4*sin\_integral((b*d*x - d^2*x + b*c - c*d)/d)*tan(1/2*a - 1/2*c) + 2*imag\_part(cos\_integral(b*x + d*x + c + b*c/d))*tan(1/2*(b*c + c*d)/d) - 2*imag\_part(cos\_integral(-b*x - d*x - c - b*c/d))*tan(1/2*(b*c + c*d)/d) + 4*sin\_integral((b*d*x + d^2*x + b*c + c*d)/d)*tan(1/2*(b*c + c*d)/d) + 2*imag\_part(cos\_integral(b*x - d*x - c + b*c/d))*tan(1/2*(b*c - c*d)/d) - 2*imag\_part(cos\_integral(-b*x + d*x + c - b*c/d))*tan(1/2*(b*c - c*d)/d) + 4*sin\_integral((b*d*x - d^2*x + b*c - c*d)/d)*tan(1/2*(b*c - c*d)/d) + real\_part(cos\_integral(b*x + d*x + c + b*c/d)) + real\_part(cos\_integral(b*x - d*x - c + b*c/d)) + real\_part(cos\_integral(-b*x + d*x + c - b*c/d)) + real\_part(cos\_integral(-b*x - d*x - c - b*c/d))*d/(b*d*tan
\end{aligned}$$

$$\begin{aligned}
& (1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d)^2 + b*d*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 + b*d*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c - c*d)/d)^2 + b*d*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d)^2 + b*d*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d)^2 + b*d*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2 + b*d*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 + b*d*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 + b*d*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c - c*d)/d)^2 + b*d*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c - c*d)/d)^2 + b*d*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d)^2 + b*d*\tan(1/2*a + 1/2*c)^2 + b*d*\tan(1/2*a - 1/2*c)^2 + b*d*\tan(1/2*(b*c + c*d)/d)^2 + b*d*\tan(1/2*(b*c - c*d)/d)^2 + b*d) - \cos(b*x + a)*\cos\_integral(d*x + c)/b
\end{aligned}$$

$$3.133 \quad \int \frac{\text{CosIntegral}(c+dx) \sin(a+bx)}{x} dx$$

Optimal. Leaf size=18

$$\text{CannotIntegrate}\left(\frac{\sin(a+bx)\text{CosIntegral}(c+dx)}{x}, x\right)$$

[Out] CannotIntegrate[(CosIntegral[c + d\*x]\*Sin[a + b\*x])/x, x]

**Rubi [A]** time = 0.137741, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\text{CosIntegral}(c+dx) \sin(a+bx)}{x} dx$$

Verification is Not applicable to the result.

[In] Int[(CosIntegral[c + d\*x]\*Sin[a + b\*x])/x,x]

[Out] Defer[Int] [(CosIntegral[c + d\*x]\*Sin[a + b\*x])/x, x]

Rubi steps

$$\int \frac{\text{Ci}(c+dx) \sin(a+bx)}{x} dx = \int \frac{\text{Ci}(c+dx) \sin(a+bx)}{x} dx$$

**Mathematica [A]** time = 31.0695, size = 0, normalized size = 0.

$$\int \frac{\text{CosIntegral}(c+dx) \sin(a+bx)}{x} dx$$

Verification is Not applicable to the result.

[In] Integrate[(CosIntegral[c + d\*x]\*Sin[a + b\*x])/x,x]

[Out] Integrate[(CosIntegral[c + d\*x]\*Sin[a + b\*x])/x, x]

---

**Maple [A]** time = 0.088, size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(dx + c) \sin(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(d\*x+c)\*sin(b\*x+a)/x,x)

[Out] int(Ci(d\*x+c)\*sin(b\*x+a)/x,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(dx + c) \sin(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(d\*x+c)\*sin(b\*x+a)/x,x, algorithm="maxima")

[Out] integrate(Ci(d\*x + c)\*sin(b\*x + a)/x, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\text{Ci}(dx + c) \sin(bx + a)}{x}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(d\*x+c)\*sin(b\*x+a)/x,x, algorithm="fricas")

[Out] integral(cos\_integral(d\*x + c)\*sin(b\*x + a)/x, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\sin(a + bx) \text{Ci}(c + dx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(d\*x+c)\*sin(b\*x+a)/x,x)

[Out] Integral(sin(a + b\*x)\*Ci(c + d\*x)/x, x)

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(dx + c) \sin(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(d\*x+c)\*sin(b\*x+a)/x,x, algorithm="giac")

[Out] integrate(Ci(d\*x + c)\*sin(b\*x + a)/x, x)

### 3.134 $\int x \cos(a + bx) \text{CosIntegral}(c + dx) dx$

**Optimal.** Leaf size=370

$$\frac{\cos\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b-d)}{d} + x(b-d)\right)}{2b^2} + \frac{\cos(a + bx) \text{CosIntegral}(c + dx)}{b^2} - \frac{\cos\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b+d)}{d} + x(b+d)\right)}{2b^2}$$

```
[Out] Cos[a - c + (b - d)*x]/(2*b*(b - d)) + Cos[a + c + (b + d)*x]/(2*b*(b + d))
- (Cos[a - (b*c)/d]*CosIntegral[(c*(b - d))/d + (b - d)*x])/(2*b^2) + (Cos
[a + b*x]*CosIntegral[c + d*x])/b^2 - (Cos[a - (b*c)/d]*CosIntegral[(c*(b +
d))/d + (b + d)*x])/(2*b^2) + (c*CosIntegral[(c*(b - d))/d + (b - d)*x]*Si
n[a - (b*c)/d])/(2*b*d) + (c*CosIntegral[(c*(b + d))/d + (b + d)*x]*Sin[a -
(b*c)/d])/(2*b*d) + (x*CosIntegral[c + d*x]*Sin[a + b*x])/b + (c*Cos[a - (
b*c)/d]*SinIntegral[(c*(b - d))/d + (b - d)*x])/(2*b*d) + (Sin[a - (b*c)/d]
*SinIntegral[(c*(b - d))/d + (b - d)*x])/(2*b^2) + (c*Cos[a - (b*c)/d]*SinI
ntegral[(c*(b + d))/d + (b + d)*x])/(2*b*d) + (Sin[a - (b*c)/d]*SinIntegral
[(c*(b + d))/d + (b + d)*x])/(2*b^2)
```

**Rubi [A]** time = 0.801469, antiderivative size = 370, normalized size of antiderivative = 1., number of steps used = 24, number of rules used = 10, integrand size = 14,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.714$ , Rules used = {6514, 6742, 4574, 2638, 4430, 3303, 3299, 3302, 6518, 4429}

$$\frac{\cos\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b-d)}{d} + x(b-d)\right)}{2b^2} + \frac{\cos(a + bx) \text{CosIntegral}(c + dx)}{b^2} - \frac{\cos\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b+d)}{d} + x(b+d)\right)}{2b^2}$$

Antiderivative was successfully verified.

```
[In] Int[x*Cos[a + b*x]*CosIntegral[c + d*x],x]
```

```
[Out] Cos[a - c + (b - d)*x]/(2*b*(b - d)) + Cos[a + c + (b + d)*x]/(2*b*(b + d))
- (Cos[a - (b*c)/d]*CosIntegral[(c*(b - d))/d + (b - d)*x])/(2*b^2) + (Cos
[a + b*x]*CosIntegral[c + d*x])/b^2 - (Cos[a - (b*c)/d]*CosIntegral[(c*(b +
d))/d + (b + d)*x])/(2*b^2) + (c*CosIntegral[(c*(b - d))/d + (b - d)*x]*Si
n[a - (b*c)/d])/(2*b*d) + (c*CosIntegral[(c*(b + d))/d + (b + d)*x]*Sin[a -
(b*c)/d])/(2*b*d) + (x*CosIntegral[c + d*x]*Sin[a + b*x])/b + (c*Cos[a - (
b*c)/d]*SinIntegral[(c*(b - d))/d + (b - d)*x])/(2*b*d) + (Sin[a - (b*c)/d]
*SinIntegral[(c*(b - d))/d + (b - d)*x])/(2*b^2) + (c*Cos[a - (b*c)/d]*SinI
ntegral[(c*(b + d))/d + (b + d)*x])/(2*b*d) + (Sin[a - (b*c)/d]*SinIntegral
[(c*(b + d))/d + (b + d)*x])/(2*b^2)
```



Rule 6514

```
Int[Cos[(a_.) + (b_.)*(x_)]*CosIntegral[(c_.) + (d_.)*(x_)]*((e_.) + (f_.)*
(x_)^(m_.), x_Symbol] := Simp[((e + f*x)^m*Sin[a + b*x]*CosIntegral[c + d*
x])/b, x] + (-Dist[d/b, Int[((e + f*x)^m*Sin[a + b*x]*Cos[c + d*x])/(c + d*
x), x], x] - Dist[(f*m)/b, Int[(e + f*x)^(m - 1)*Sin[a + b*x]*CosIntegral[c
+ d*x], x], x]) /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[m, 0]
```

Rule 6742

```
Int[u_, x_Symbol] := With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

Rule 4574

```
Int[Cos[w_]^(q_.)*Sin[v_]^(p_.), x_Symbol] := Int[ExpandTrigReduce[Sin[v]^p
*Cos[w]^q, x], x] /; IGtQ[p, 0] && IGtQ[q, 0] && ((PolynomialQ[v, x] && Pol
ynomialQ[w, x]) || (BinomialQ[{v, w}, x] && IndependentQ[Cancel[v/w], x]))
```

Rule 2638

```
Int[sin[(c_.) + (d_.)*(x_)], x_Symbol] := -Simp[Cos[c + d*x]/d, x] /; FreeQ
[{c, d}, x]
```

Rule 4430

```
Int[Cos[(c_.) + (d_.)*(x_)]^(q_.)*((e_.) + (f_.)*(x_))^(m_.)*Sin[(a_.) + (b
_.)*(x_)]^(p_.), x_Symbol] := Int[ExpandTrigReduce[(e + f*x)^m, Sin[a + b*x
]^p*Cos[c + d*x]^q, x], x] /; FreeQ[{a, b, c, d, e, f, m}, x] && IGtQ[p, 0]
&& IGtQ[q, 0]
```

Rule 3303

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Dist[Cos[(d*
e - c*f)/d], Int[Sin[(c*f)/d + f*x]/(c + d*x), x], x] + Dist[Sin[(d*e - c*f
)/d], Int[Cos[(c*f)/d + f*x]/(c + d*x), x], x] /; FreeQ[{c, d, e, f}, x] &&
NeQ[d*e - c*f, 0]
```

Rule 3299

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[SinInte
gral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

Rule 3302

```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] := Simp[CosIntegral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) - c*f, 0]
```

### Rule 6518

```
Int[CosIntegral[(c_.) + (d_.)*(x_)]*Sin[(a_.) + (b_.)*(x_)], x_Symbol] := -Simp[(Cos[a + b*x]*CosIntegral[c + d*x])/b, x] + Dist[d/b, Int[(Cos[a + b*x]*Cos[c + d*x])/(c + d*x), x], x] /; FreeQ[{a, b, c, d}, x]
```

### Rule 4429

```
Int[Cos[(a_.) + (b_.)*(x_)]^(p_.)*Cos[(c_.) + (d_.)*(x_)]^(q_.)*((e_.) + (f_.)*(x_))^(m_.), x_Symbol] := Int[ExpandTrigReduce[(e + f*x)^m, Cos[a + b*x]^p*Cos[c + d*x]^q, x], x] /; FreeQ[{a, b, c, d, e, f}, x] && IGtQ[p, 0] && IGtQ[q, 0] && IntegerQ[m]
```

### Rubi steps

$$\begin{aligned}
 \int x \cos(a + bx) \text{Ci}(c + dx) dx &= \frac{x \text{Ci}(c + dx) \sin(a + bx)}{b} - \frac{\int \text{Ci}(c + dx) \sin(a + bx) dx}{b} - \frac{d \int \frac{x \cos(c + dx) \sin(a + bx)}{c + dx} dx}{b} \\
 &= \frac{\cos(a + bx) \text{Ci}(c + dx)}{b^2} + \frac{x \text{Ci}(c + dx) \sin(a + bx)}{b} - \frac{d \int \frac{\cos(a + bx) \cos(c + dx)}{c + dx} dx}{b^2} - \frac{d \int \left( \frac{\cos(c + dx) \sin(a + bx)}{c + dx} \right) dx}{b} \\
 &= \frac{\cos(a + bx) \text{Ci}(c + dx)}{b^2} + \frac{x \text{Ci}(c + dx) \sin(a + bx)}{b} - \frac{\int \cos(c + dx) \sin(a + bx) dx}{b} + \frac{c \int \frac{\cos(c + dx) \sin(a + bx)}{c + dx} dx}{b} \\
 &= \frac{\cos(a + bx) \text{Ci}(c + dx)}{b^2} + \frac{x \text{Ci}(c + dx) \sin(a + bx)}{b} - \frac{\int \left( \frac{1}{2} \sin(a - c + (b - d)x) + \frac{1}{2} \sin(a + c + (b + d)x) \right) dx}{b} \\
 &= \frac{\cos(a + bx) \text{Ci}(c + dx)}{b^2} + \frac{x \text{Ci}(c + dx) \sin(a + bx)}{b} - \frac{\int \sin(a - c + (b - d)x) dx}{2b} - \frac{\int \sin(a + c + (b + d)x) dx}{2b} \\
 &= \frac{\cos(a - c + (b - d)x)}{2b(b - d)} + \frac{\cos(a + c + (b + d)x)}{2b(b + d)} - \frac{\cos\left(a - \frac{bc}{d}\right) \text{Ci}\left(\frac{c(b - d)}{d} + (b - d)x\right)}{2b^2} + \frac{\cos\left(a + \frac{bc}{d}\right) \text{Ci}\left(\frac{c(b + d)}{d} + (b + d)x\right)}{2b^2} \\
 &= \frac{\cos(a - c + (b - d)x)}{2b(b - d)} + \frac{\cos(a + c + (b + d)x)}{2b(b + d)} - \frac{\cos\left(a - \frac{bc}{d}\right) \text{Ci}\left(\frac{c(b - d)}{d} + (b - d)x\right)}{2b^2} + \frac{\cos\left(a + \frac{bc}{d}\right) \text{Ci}\left(\frac{c(b + d)}{d} + (b + d)x\right)}{2b^2}
 \end{aligned}$$

**Mathematica [C]** time = 4.40565, size = 433, normalized size = 1.17

$$-i \exp\left(-\frac{i(d(a+c+dx)+b(c+dx))}{d}\right) \left( (b^2 - d^2)(bc - id)e^{i(2a+x(b+d)+c)} \text{ExpIntegralEi}\left(\frac{i(b-d)(c+dx)}{d}\right) + e^{\frac{ibc}{d}} \left( ibd \left( d(-1 + e^{2i(a+bx)}) + \right. \right. \right.$$

Antiderivative was successfully verified.

[In] Integrate[x\*Cos[a + b\*x]\*CosIntegral[c + d\*x], x]

[Out] (((-I)\*((b\*c - I\*d)\*(b^2 - d^2)\*E^(I\*(2\*a + c + (b + d)\*x))\*ExpIntegralEi[(I\*(b - d)\*(c + d\*x))/d] + E^((I\*b\*c)/d)\*(I\*b\*d\*(d\*(-1 + E^((2\*I)\*(a + b\*x))) + b\*(1 + E^((2\*I)\*(a + b\*x)))) - (b\*c + I\*d)\*(b^2 - d^2)\*E^((I\*(b + d)\*(c + d\*x))/d)\*ExpIntegralEi[(-I)\*(b + d)\*(c + d\*x)/d]))/E^((I\*(b\*(c + d\*x) + d\*(a + c + d\*x))/d) - (I\*(I\*b\*d\*E^((I\*c\*(b + d))/d)\*(b + d + b\*E^((2\*I)\*(a + b\*x)) - d\*E^((2\*I)\*(a + b\*x)))) - (b\*c + I\*d)\*(b^2 - d^2)\*E^((-I)\*d\*x + I\*b\*((2\*c)/d + x))\*ExpIntegralEi[(-I)\*(b - d)\*(c + d\*x)/d] + (b\*c - I\*d)\*(b^2 - d^2)\*E^(I\*(2\*a + (b - d)\*x))\*ExpIntegralEi[(I\*(b + d)\*(c + d\*x))/d]))/E^((I\*(d\*(a - d\*x) + b\*(c + d\*x))/d) + 4\*(b - d)\*d\*(b + d)\*CosIntegral[c + d\*x]\*(Cos[a + b\*x] + b\*x\*Sin[a + b\*x]))/(4\*b^2\*(b - d)\*d\*(b + d))

**Maple [B]** time = 0.105, size = 1212, normalized size = 3.3

result too large to display

Verification of antiderivative is not currently implemented for this CAS.

[In] int(x\*Ci(d\*x+c)\*cos(b\*x+a), x)

[Out] (Ci(d\*x+c)/b\*(1/b\*d\*(sin(b/d\*(d\*x+c)+(a\*d-b\*c)/d)\*(b/d\*(d\*x+c)+(a\*d-b\*c)/d) + cos(b/d\*(d\*x+c)+(a\*d-b\*c)/d) - a\*d/b\*sin(b/d\*(d\*x+c)+(a\*d-b\*c)/d) - 1/b\*(-1/2/(b-d)\*d\*cos((b-d)/d\*(d\*x+c)+(a\*d-b\*c)/d) + 1/2\*(a\*d-b\*c)\*d/(b-d)\*(Si((b-d)/d\*(d\*x+c)+(a\*d-b\*c)/d + (-a\*d+b\*c)/d)\*cos((-a\*d+b\*c)/d)/d - Ci((b-d)/d\*(d\*x+c)+(a\*d-b\*c)/d + (-a\*d+b\*c)/d)\*sin((-a\*d+b\*c)/d)/d - 1/2/(b-d)\*d^2\*a\*(Si((b-d)/d\*(d\*x+c)+(a\*d-b\*c)/d + (-a\*d+b\*c)/d)\*cos((-a\*d+b\*c)/d)/d - Ci((b-d)/d\*(d\*x+c)+(a\*d-b\*c)/d + (-a\*d+b\*c)/d)\*sin((-a\*d+b\*c)/d)/d) + 1/2/(b-d)\*c\*d^2\*(Si((b-d)/d\*(d\*x+c)+(a\*d-b\*c)/d + (-a\*d+b\*c)/d)\*cos((-a\*d+b\*c)/d)/d - Ci((b-d)/d\*(d\*x+c)+(a\*d-b\*c)/d + (-a\*d+b\*c)/d)\*sin((-a\*d+b\*c)/d)/d) - 1/2/(b+d)\*d\*cos((b+d)/d\*(d\*x+c)+(a\*d-b\*c)/d) + 1/2\*(a\*d-b\*c)\*d/(b+d)\*(Si((b+d)/d\*(d\*x+c)+(a\*d-b\*c)/d + (-a\*d+b\*c)/d)\*cos((-a\*d+b\*c)/d)/d - Ci((b+d)/d\*(d\*x+c)+(a\*d-b\*c)/d + (-a\*d+b\*c)/d)\*sin((-a\*d+b\*c)/d)/d) - 1/2/(b+d)\*d^2\*a\*(Si((b+d)/d\*(d\*x+c)+(a\*d-b\*c)/d + (-a\*d+b\*c)/d)

$$\begin{aligned} & /d) * \cos((-a*d+b*c)/d)/d - \text{Ci}((b+d)/d*(d*x+c) + (a*d-b*c)/d + (-a*d+b*c)/d) * \sin((-a*d+b*c)/d)/d \\ & - 1/2/(b+d)*c*d^2*(\text{Si}((b+d)/d*(d*x+c) + (a*d-b*c)/d + (-a*d+b*c)/d) * \cos((-a*d+b*c)/d)/d \\ & - \text{Ci}((b+d)/d*(d*x+c) + (a*d-b*c)/d + (-a*d+b*c)/d) * \sin((-a*d+b*c)/d)/d \\ & + 1/2/b*d^2*(\text{Si}((b-d)/d*(d*x+c) + (a*d-b*c)/d + (-a*d+b*c)/d) * \sin((-a*d+b*c)/d)/d \\ & + \text{Ci}((b-d)/d*(d*x+c) + (a*d-b*c)/d + (-a*d+b*c)/d) * \cos((-a*d+b*c)/d)/d \\ & + 1/2/b*d^2*(\text{Si}((b+d)/d*(d*x+c) + (a*d-b*c)/d + (-a*d+b*c)/d) * \sin((-a*d+b*c)/d)/d \\ & + \text{Ci}((b+d)/d*(d*x+c) + (a*d-b*c)/d + (-a*d+b*c)/d) * \cos((-a*d+b*c)/d)/d \end{aligned}$$

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int x \text{Ci}(dx + c) \cos(bx + a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Ci(d\*x+c)\*cos(b\*x+a),x, algorithm="maxima")

[Out] integrate(x\*Ci(d\*x + c)\*cos(b\*x + a), x)

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(x \cos(bx + a) \text{Ci}(dx + c), x)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Ci(d\*x+c)\*cos(b\*x+a),x, algorithm="fricas")

[Out] integral(x\*cos(b\*x + a)\*cos\_integral(d\*x + c), x)

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int x \cos(a + bx) \text{Ci}(c + dx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(x\*Ci(d\*x+c)\*cos(b\*x+a),x)

[Out]  $\text{Integral}(x \cdot \cos(a + b \cdot x) \cdot \text{Ci}(c + d \cdot x), x)$

---

**Giac [F(-1)]** time = 0., size = 0, normalized size = 0.

Timed out

Verification of antiderivative is not currently implemented for this CAS.

[In] `integrate(x*Ci(d*x+c)*cos(b*x+a),x, algorithm="giac")`

[Out] Timed out

### 3.135 $\int \cos(a + bx) \text{CosIntegral}(c + dx) dx$

**Optimal.** Leaf size=153

$$\frac{\sin\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b-d)}{d} + x(b-d)\right)}{2b} - \frac{\sin\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b+d)}{d} + x(b+d)\right)}{2b} + \frac{\sin(a + bx) \text{CosIntegral}(c + dx)}{b}$$

[Out] -(CosIntegral[(c\*(b - d))/d + (b - d)\*x]\*Sin[a - (b\*c)/d])/(2\*b) - (CosIntegral[(c\*(b + d))/d + (b + d)\*x]\*Sin[a - (b\*c)/d])/(2\*b) + (CosIntegral[c + d\*x]\*Sin[a + b\*x])/b - (Cos[a - (b\*c)/d]\*SinIntegral[(c\*(b - d))/d + (b - d)\*x])/(2\*b) - (Cos[a - (b\*c)/d]\*SinIntegral[(c\*(b + d))/d + (b + d)\*x])/(2\*b)

**Rubi [A]** time = 0.216809, antiderivative size = 153, normalized size of antiderivative = 1., number of steps used = 9, number of rules used = 5, integrand size = 13,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.385$ , Rules used = {6512, 4430, 3303, 3299, 3302}

$$\frac{\sin\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b-d)}{d} + x(b-d)\right)}{2b} - \frac{\sin\left(a - \frac{bc}{d}\right) \text{CosIntegral}\left(\frac{c(b+d)}{d} + x(b+d)\right)}{2b} + \frac{\sin(a + bx) \text{CosIntegral}(c + dx)}{b}$$

Antiderivative was successfully verified.

[In] Int[Cos[a + b\*x]\*CosIntegral[c + d\*x], x]

[Out] -(CosIntegral[(c\*(b - d))/d + (b - d)\*x]\*Sin[a - (b\*c)/d])/(2\*b) - (CosIntegral[(c\*(b + d))/d + (b + d)\*x]\*Sin[a - (b\*c)/d])/(2\*b) + (CosIntegral[c + d\*x]\*Sin[a + b\*x])/b - (Cos[a - (b\*c)/d]\*SinIntegral[(c\*(b - d))/d + (b - d)\*x])/(2\*b) - (Cos[a - (b\*c)/d]\*SinIntegral[(c\*(b + d))/d + (b + d)\*x])/(2\*b)

#### Rule 6512

Int[Cos[(a\_.) + (b\_.)\*(x\_)]\*CosIntegral[(c\_.) + (d\_.)\*(x\_)], x\_Symbol] :> Simp[(Sin[a + b\*x]\*CosIntegral[c + d\*x])/b, x] - Dist[d/b, Int[(Sin[a + b\*x]\*Cos[c + d\*x])/(c + d\*x), x], x] /; FreeQ[{a, b, c, d}, x]

#### Rule 4430

Int[Cos[(c\_.) + (d\_.)\*(x\_)]^(q\_.)\*((e\_.) + (f\_.)\*(x\_))^(m\_.)\*Sin[(a\_.) + (b\_.)\*(x\_)]^(p\_.), x\_Symbol] :> Int[ExpandTrigReduce[(e + f\*x)^m, Sin[a + b\*x]^p\*cos[c + d\*x]^q, x], x] /; FreeQ[{a, b, c, d, e, f, m}, x] && IGtQ[p, 0]

&& IGtQ[q, 0]

### Rule 3303

Int[sin[(e\_.) + (f\_.)\*(x\_.)]/((c\_.) + (d\_.)\*(x\_.)), x\_Symbol] :> Dist[Cos[(d\*e - c\*f)/d], Int[Sin[(c\*f)/d + f\*x]/(c + d\*x), x], x] + Dist[Sin[(d\*e - c\*f)/d], Int[Cos[(c\*f)/d + f\*x]/(c + d\*x), x], x] /; FreeQ[{c, d, e, f}, x] && NeQ[d\*e - c\*f, 0]

### Rule 3299

Int[sin[(e\_.) + (f\_.)\*(x\_.)]/((c\_.) + (d\_.)\*(x\_.)), x\_Symbol] :> Simp[SinIntegral[e + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*e - c\*f, 0]

### Rule 3302

Int[sin[(e\_.) + (f\_.)\*(x\_.)]/((c\_.) + (d\_.)\*(x\_.)), x\_Symbol] :> Simp[CosIntegral[e - Pi/2 + f\*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d\*(e - Pi/2) - c\*f, 0]

### Rubi steps

$$\begin{aligned}
 \int \cos(a + bx) \operatorname{Ci}(c + dx) dx &= \frac{\operatorname{Ci}(c + dx) \sin(a + bx)}{b} - \frac{d \int \frac{\cos(c+dx) \sin(a+bx)}{c+dx} dx}{b} \\
 &= \frac{\operatorname{Ci}(c + dx) \sin(a + bx)}{b} - \frac{d \int \left( \frac{\sin(a-c+(b-d)x)}{2(c+dx)} + \frac{\sin(a+c+(b+d)x)}{2(c+dx)} \right) dx}{b} \\
 &= \frac{\operatorname{Ci}(c + dx) \sin(a + bx)}{b} - \frac{d \int \frac{\sin(a-c+(b-d)x)}{c+dx} dx}{2b} - \frac{d \int \frac{\sin(a+c+(b+d)x)}{c+dx} dx}{2b} \\
 &= \frac{\operatorname{Ci}(c + dx) \sin(a + bx)}{b} - \frac{\left( d \cos \left( a - \frac{bc}{d} \right) \right) \int \frac{\sin \left( \frac{c(b-d)}{d} + (b-d)x \right)}{c+dx} dx}{2b} - \frac{\left( d \cos \left( a - \frac{bc}{d} \right) \right) \int \frac{\sin \left( \frac{c(b+d)}{d} + (b+d)x \right)}{c+dx} dx}{2b} \\
 &= -\frac{\operatorname{Ci} \left( \frac{c(b-d)}{d} + (b-d)x \right) \sin \left( a - \frac{bc}{d} \right)}{2b} - \frac{\operatorname{Ci} \left( \frac{c(b+d)}{d} + (b+d)x \right) \sin \left( a - \frac{bc}{d} \right)}{2b} + \frac{\operatorname{Ci}(c + dx) \sin(a + bx)}{b}
 \end{aligned}$$

**Mathematica [C]** time = 1.57664, size = 153, normalized size = 1.

$$\frac{4 \sin(a + bx) \operatorname{CosIntegral}(c + dx) + i e^{-\frac{i(ad+bc)}{d}} \left( e^{2ia} \operatorname{ExpIntegralEi} \left( \frac{i(b-d)(c+dx)}{d} \right) + e^{2ia} \operatorname{ExpIntegralEi} \left( \frac{i(b+d)(c+dx)}{d} \right) - e^{\frac{2ia}{d}} \right)}{4b}$$

Antiderivative was successfully verified.

```
[In] Integrate[Cos[a + b*x]*CosIntegral[c + d*x],x]
```

```
[Out] ((I*(-(E^(((2*I)*b*c)/d)*ExpIntegralEi[((-I)*(b - d)*(c + d*x))/d]) + E^((2*I)*a)*ExpIntegralEi[(I*(b - d)*(c + d*x))/d] - E^(((2*I)*b*c)/d)*ExpIntegralEi[((-I)*(b + d)*(c + d*x))/d] + E^((2*I)*a)*ExpIntegralEi[(I*(b + d)*(c + d*x))/d]))/E^((I*(b*c + a*d))/d) + 4*CosIntegral[c + d*x]*Sin[a + b*x]/(4*b)
```

**Maple [A]** time = 0.074, size = 282, normalized size = 1.8

$$\frac{1}{d} \left( \frac{\text{Ci}(dx + c)d}{b} \sin \left( \frac{b(dx + c)}{d} + \frac{ad - bc}{d} \right) - \frac{d}{b} \left( \frac{1}{2} \left( \frac{\text{Si} \left( \frac{(b - d)(dx + c)}{d} + \frac{ad - bc}{d} + \frac{-ad + bc}{d} \right)}{\cos \left( \frac{-ad + bc}{d} \right)} - \frac{1}{d} \text{Ci} \right. \right. \right.$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] int(Ci(d*x+c)*cos(b*x+a),x)
```

```
[Out] (Ci(d*x+c)/b*d*sin(b/d*(d*x+c)+(a*d-b*c)/d)-1/b*d*(1/2*d*(Si((b-d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*cos((-a*d+b*c)/d)/d-Ci((b-d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*sin((-a*d+b*c)/d)/d+1/2*d*(Si((b+d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*cos((-a*d+b*c)/d)/d-Ci((b+d)/d*(d*x+c)+(a*d-b*c)/d+(-a*d+b*c)/d)*sin((-a*d+b*c)/d)/d)))/d
```

**Maxima [F]** time = 0., size = 0, normalized size = 0.

$$\int \text{Ci}(dx + c) \cos(bx + a) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(d*x+c)*cos(b*x+a),x, algorithm="maxima")
```

```
[Out] integrate(Ci(d*x + c)*cos(b*x + a), x)
```

**Fricas [F]** time = 0., size = 0, normalized size = 0.

$$\text{integral}(\cos(bx + a) \text{Ci}(dx + c), x)$$



Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(d*x+c)*cos(b*x+a),x, algorithm="fricas")
```

```
[Out] integral(cos(b*x + a)*cos_integral(d*x + c), x)
```

**Sympy [F]** time = 0., size = 0, normalized size = 0.

$$\int \cos(a + bx) \operatorname{Ci}(c + dx) dx$$

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(d*x+c)*cos(b*x+a),x)
```

```
[Out] Integral(cos(a + b*x)*Ci(c + d*x), x)
```

**Giac [C]** time = 1.93965, size = 12879, normalized size = 84.18

result too large to display

Verification of antiderivative is not currently implemented for this CAS.

```
[In] integrate(Ci(d*x+c)*cos(b*x+a),x, algorithm="giac")
```

```
[Out] -1/4*(imag_part(cos_integral(b*x + d*x + c + b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d)^2 + imag_part(cos_integral(b*x - d*x - c + b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d)^2 - imag_part(cos_integral(-b*x + d*x + c - b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d)^2 - imag_part(cos_integral(-b*x - d*x - c - b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d)^2 + 2*sin_integral((b*d*x + d^2*x + b*c + c*d)/d)*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d)^2 + 2*sin_integral((b*d*x - d^2*x + b*c - c*d)/d)*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d)^2 + 2*real_part(cos_integral(b*x - d*x - c + b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c - c*d)/d) + 2*real_part(cos_integral(-b*x + d*x + c - b*c/d))*tan(1/2*a + 1/2*c)^2*tan(1/2*a - 1/2*c)^2*tan(1/2*(b*c + c*d)/d)^2*tan(1/2*(b*c -
```

$$\begin{aligned}
& c*d)/d) + 2*\text{real\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\text{tan}(1/2*a + 1/2*c) \\
& ^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)*\text{tan}(1/2*(b*c - c*d)/d)^2 + \\
& 2*\text{real\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan} \\
& (1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)*\text{tan}(1/2*(b*c - c*d)/d)^2 - 2*\text{real\_} \\
& \text{part}(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - \\
& 1/2*c)*\text{tan}(1/2*(b*c + c*d)/d)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 - 2*\text{real\_part}(\text{cos\_} \\
& \text{integral}(-b*x + d*x + c - b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)*\text{t} \\
& \text{an}(1/2*(b*c + c*d)/d)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 - 2*\text{real\_part}(\text{cos\_integral} \\
& (b*x + d*x + c + b*c/d))*\text{tan}(1/2*a + 1/2*c)*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b \\
& *c + c*d)/d)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 - 2*\text{real\_part}(\text{cos\_integral}(-b*x - d \\
& *x - c - b*c/d))*\text{tan}(1/2*a + 1/2*c)*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d \\
& )/d)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 + \text{imag\_part}(\text{cos\_integral}(b*x + d*x + c + b* \\
& c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)^2 - \\
& \text{imag\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2 \\
& *a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)^2 + \text{imag\_part}(\text{cos\_integral}(-b*x + d*x \\
& + c - b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d) \\
& /d)^2 - \text{imag\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d))*\text{tan}(1/2*a + 1/2*c)^ \\
& 2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)^2 + 2*\text{sin\_integral}((b*d*x + d \\
& ^2*x + b*c + c*d)/d)*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c \\
& + c*d)/d)^2 - 2*\text{sin\_integral}((b*d*x - d^2*x + b*c - c*d)/d)*\text{tan}(1/2*a + 1/ \\
& 2*c)^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)^2 + 4*\text{imag\_part}(\text{cos\_inte} \\
& \text{gral}(b*x - d*x - c + b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)*\text{tan}(1/ \\
& 2*(b*c + c*d)/d)^2*\text{tan}(1/2*(b*c - c*d)/d) - 4*\text{imag\_part}(\text{cos\_integral}(-b*x + \\
& d*x + c - b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)*\text{tan}(1/2*(b*c + c \\
& *d)/d)^2*\text{tan}(1/2*(b*c - c*d)/d) + 8*\text{sin\_integral}((b*d*x - d^2*x + b*c - c*d \\
& )/d)*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)*\text{tan}(1/2*(b*c + c*d)/d)^2*\text{tan}(1 \\
& /2*(b*c - c*d)/d) - \text{imag\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\text{tan}(1/2* \\
& a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 + \text{imag\_part}(\text{cos\_} \\
& \text{integral}(b*x - d*x - c + b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)^2* \\
& \text{tan}(1/2*(b*c - c*d)/d)^2 - \text{imag\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d))* \\
& \text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 + \text{imag\_p} \\
& \text{art}(\text{cos\_integral}(-b*x - d*x - c - b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - \\
& 1/2*c)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 - 2*\text{sin\_integral}((b*d*x + d^2*x + b*c + c \\
& *d)/d)*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 + \\
& 2*\text{sin\_integral}((b*d*x - d^2*x + b*c - c*d)/d)*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2 \\
& *a - 1/2*c)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 + 4*\text{imag\_part}(\text{cos\_integral}(b*x + d*x \\
& + c + b*c/d))*\text{tan}(1/2*a + 1/2*c)*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/ \\
& d)*\text{tan}(1/2*(b*c - c*d)/d)^2 - 4*\text{imag\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c \\
& /d))*\text{tan}(1/2*a + 1/2*c)*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)*\text{tan}(1/2 \\
& *(b*c - c*d)/d)^2 + 8*\text{sin\_integral}((b*d*x + d^2*x + b*c + c*d)/d)*\text{tan}(1/2*a \\
& + 1/2*c)*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)*\text{tan}(1/2*(b*c - c*d)/d \\
& )^2 + \text{imag\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{t} \\
& \text{an}(1/2*(b*c + c*d)/d)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 - \text{imag\_part}(\text{cos\_integral}(b \\
& *x - d*x - c + b*c/d))*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)^2*\text{tan}(1/ \\
& 2*(b*c - c*d)/d)^2 + \text{imag\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\text{tan}(1/
\end{aligned}$$

$$\begin{aligned}
& 2*a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d)^2 - \text{imag\_part} \\
& (\text{cos\_integral}(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c + \\
& c*d)/d)^2*\tan(1/2*(b*c - c*d)/d)^2 + 2*\sin\_integral((b*d*x + d^2*x + b*c + \\
& c*d)/d)*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/ \\
& d)^2 - 2*\sin\_integral((b*d*x - d^2*x + b*c - c*d)/d)*\tan(1/2*a + 1/2*c)^2*t \\
& \tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d)^2 - \text{imag\_part}(\text{cos\_integral}(b \\
& *x + d*x + c + b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/ \\
& 2*(b*c - c*d)/d)^2 + \text{imag\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\tan(1/2 \\
& *a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d)^2 - \text{imag\_part} \\
& (\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + \\
& c*d)/d)^2*\tan(1/2*(b*c - c*d)/d)^2 + \text{imag\_part}(\text{cos\_integral}(-b*x - d*x - c \\
& - b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d) \\
& /d)^2 - 2*\sin\_integral((b*d*x + d^2*x + b*c + c*d)/d)*\tan(1/2*a - 1/2*c)^2* \\
& \tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d)^2 + 2*\sin\_integral((b*d*x - \\
& d^2*x + b*c - c*d)/d)*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/ \\
& 2*(b*c - c*d)/d)^2 + 2*\text{real\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\tan(1 \\
& /2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d) + 2*\text{real\_part}(c \\
& \text{os\_integral}(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c \\
& )^2*\tan(1/2*(b*c + c*d)/d) + 2*\text{real\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d \\
& ))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c + c*d)/d)^2 + 2*\text{rea} \\
& \text{l\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a \\
& - 1/2*c)*\tan(1/2*(b*c + c*d)/d)^2 - 2*\text{real\_part}(\text{cos\_integral}(b*x + d*x + c \\
& + b*c/d))*\tan(1/2*a + 1/2*c)*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 \\
& - 2*\text{real\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)*\tan \\
& (1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 + 2*\text{real\_part}(\text{cos\_integral}(b*x - \\
& d*x - c + b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c - \\
& c*d)/d) + 2*\text{real\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\tan(1/2*a + 1/ \\
& 2*c)^2*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c - c*d)/d) - 2*\text{real\_part}(\text{cos\_integr} \\
& \text{al}(b*x - d*x - c + b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\text{ta} \\
& \text{n}(1/2*(b*c - c*d)/d) - 2*\text{real\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\text{ta} \\
& \text{n}(1/2*a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d) + 2*\text{real} \\
& \_part(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b* \\
& c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d) + 2*\text{real\_part}(\text{cos\_integral}(-b*x + d*x \\
& + c - b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - \\
& c*d)/d) - 2*\text{real\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\tan(1/2*a + 1/2* \\
& c)^2*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c - c*d)/d)^2 - 2*\text{real\_part}(\text{cos\_integral} \\
& (-b*x + d*x + c - b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)*\tan(1/2*( \\
& b*c - c*d)/d)^2 + 2*\text{real\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\tan(1/2* \\
& a + 1/2*c)*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c - c*d)/d)^2 + 2*\text{real\_part}(\text{cos\_} \\
& \text{integral}(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)*\tan(1/2*a - 1/2*c)^2*t \\
& \text{an}(1/2*(b*c - c*d)/d)^2 + 2*\text{real\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))* \\
& \text{tan}(1/2*a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)*\tan(1/2*(b*c - c*d)/d)^2 + 2*\text{re} \\
& \text{al\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2* \\
& (b*c + c*d)/d)*\tan(1/2*(b*c - c*d)/d)^2 - 2*\text{real\_part}(\text{cos\_integral}(b*x + d* \\
& x + c + b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)*\tan(1/2*(b*c -
\end{aligned}$$

$$\begin{aligned}
& c*d)/d)^2 - 2*\text{real\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)*\tan(1/2*(b*c - c*d)/d)^2 - 2*\text{real\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\tan(1/2*a + 1/2*c)*\tan(1/2*(b*c + c*d)/d)^2 \\
& *\tan(1/2*(b*c - c*d)/d)^2 - 2*\text{real\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d)^2 - 2 \\
& *\text{real\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d)^2 - 2*\text{real\_part}(\text{cos\_integral}(-b*x + \\
& d*x + c - b*c/d))*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d)^2 - \text{imag\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2 \\
& - \text{imag\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2 + \text{imag\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2 \\
& + \text{imag\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2 - 2*\text{sin\_integral}((b*d*x + d^2*x + b*c + c*d)/d)*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2 \\
& - 2*\text{sin\_integral}((b*d*x - d^2*x + b*c - c*d)/d)*\tan(1/2*a + 1/2*c)^2*\tan(1/2*a - 1/2*c)^2 + 4*\text{imag\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\tan(1/2*a + 1/2*c)*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d) - \\
& 4*\text{imag\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d) + 8*\text{sin\_integral}((b*d*x + d^2*x + b*c + c*d)/d)*\tan(1/2*a + 1/2*c)*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d) + \\
& \text{imag\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 + \text{imag\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 - \text{imag\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 - \text{imag\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 + 2*\text{sin\_integral}((b*d*x + d^2*x + b*c + c*d)/d)*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 + 2*\text{sin\_integral}((b*d*x - d^2*x + b*c - c*d)/d)*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 - \text{imag\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 - \text{imag\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 + \text{imag\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 + \text{imag\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 - 2*\text{sin\_integral}((b*d*x + d^2*x + b*c + c*d)/d)*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 - 2*\text{sin\_integral}((b*d*x - d^2*x + b*c - c*d)/d)*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c + c*d)/d)^2 + 4*\text{imag\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c - c*d)/d) - 4*\text{imag\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c - c*d)/d) + 8*\text{sin\_integral}((b*d*x - d^2*x + b*c - c*d)/d)*\tan(1/2*a + 1/2*c)^2*\tan(1/2*(b*c - c*d)/d) + 4*\text{imag\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d) - 4*\text{imag\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d) + 8*\text{sin\_integral}((b*d*x - d^2*x + b*c - c*d)/d)*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d) - \text{imag\_part}(\text{cos\_integral}(b*x + d*x + c + b*c
\end{aligned}$$

$$\begin{aligned}
& /d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d)^2 - \text{imag\_part}(\text{cos\_integral} \\
& (b*x - d*x - c + b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d)^2 + \text{im} \\
& \text{ag\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2* \\
& (b*c - c*d)/d)^2 + \text{imag\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d)) * \tan(1/2* \\
& a + 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d)^2 - 2 * \text{sin\_integral}((b*d*x + d^2*x + b*c \\
& + c*d)/d) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d)^2 - 2 * \text{sin\_integral}(( \\
& b*d*x - d^2*x + b*c - c*d)/d) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d)^2 \\
& + \text{imag\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d)) * \tan(1/2*a - 1/2*c)^2 * \tan( \\
& 1/2*(b*c - c*d)/d)^2 + \text{imag\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d)) * \tan(1 \\
& /2*a - 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d)^2 - \text{imag\_part}(\text{cos\_integral}(-b*x + d*x \\
& + c - b*c/d)) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d)^2 - \text{imag\_part}(c \\
& \text{os\_integral}(-b*x - d*x - c - b*c/d)) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c - c* \\
& d)/d)^2 + 2 * \text{sin\_integral}((b*d*x + d^2*x + b*c + c*d)/d) * \tan(1/2*a - 1/2*c)^ \\
& 2 * \tan(1/2*(b*c - c*d)/d)^2 + 2 * \text{sin\_integral}((b*d*x - d^2*x + b*c - c*d)/d) * \\
& \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d)^2 + 4 * \text{imag\_part}(\text{cos\_integral}(b* \\
& x + d*x + c + b*c/d)) * \tan(1/2*a + 1/2*c) * \tan(1/2*(b*c + c*d)/d) * \tan(1/2*(b* \\
& c - c*d)/d)^2 - 4 * \text{imag\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d)) * \tan(1/2*a \\
& + 1/2*c) * \tan(1/2*(b*c + c*d)/d) * \tan(1/2*(b*c - c*d)/d)^2 + 8 * \text{sin\_integral} \\
& ((b*d*x + d^2*x + b*c + c*d)/d) * \tan(1/2*a + 1/2*c) * \tan(1/2*(b*c + c*d)/d) * \text{ta} \\
& \text{n}(1/2*(b*c - c*d)/d)^2 - \text{imag\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d)) * \tan \\
& (1/2*(b*c + c*d)/d)^2 * \tan(1/2*(b*c - c*d)/d)^2 - \text{imag\_part}(\text{cos\_integral}(b*x \\
& - d*x - c + b*c/d)) * \tan(1/2*(b*c + c*d)/d)^2 * \tan(1/2*(b*c - c*d)/d)^2 + \text{im} \\
& \text{ag\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d)) * \tan(1/2*(b*c + c*d)/d)^2 * \tan( \\
& 1/2*(b*c - c*d)/d)^2 + \text{imag\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d)) * \tan( \\
& 1/2*(b*c + c*d)/d)^2 * \tan(1/2*(b*c - c*d)/d)^2 - 2 * \text{sin\_integral}((b*d*x + d^2 \\
& *x + b*c + c*d)/d) * \tan(1/2*(b*c + c*d)/d)^2 * \tan(1/2*(b*c - c*d)/d)^2 - 2 * \text{si} \\
& \text{n\_integral}((b*d*x - d^2*x + b*c - c*d)/d) * \tan(1/2*(b*c + c*d)/d)^2 * \tan(1/2* \\
& (b*c - c*d)/d)^2 + 2 * \text{real\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d)) * \tan(1/2 \\
& *a + 1/2*c)^2 * \tan(1/2*a - 1/2*c) + 2 * \text{real\_part}(\text{cos\_integral}(-b*x + d*x + c \\
& - b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*a - 1/2*c) + 2 * \text{real\_part}(\text{cos\_integra} \\
& \text{l}(b*x + d*x + c + b*c/d)) * \tan(1/2*a + 1/2*c) * \tan(1/2*a - 1/2*c)^2 + 2 * \text{real\_} \\
& \text{part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d)) * \tan(1/2*a + 1/2*c) * \tan(1/2*a - 1 \\
& /2*c)^2 + 2 * \text{real\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d)) * \tan(1/2*a + 1/2* \\
& c)^2 * \tan(1/2*(b*c + c*d)/d) + 2 * \text{real\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c \\
& /d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d) - 2 * \text{real\_part}(\text{cos\_integral} \\
& (b*x + d*x + c + b*c/d)) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2*(b*c + c*d)/d) - 2 * \text{re} \\
& \text{al\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d)) * \tan(1/2*a - 1/2*c)^2 * \tan(1/2* \\
& (b*c + c*d)/d) - 2 * \text{real\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d)) * \tan(1/2*a \\
& + 1/2*c) * \tan(1/2*(b*c + c*d)/d)^2 - 2 * \text{real\_part}(\text{cos\_integral}(-b*x - d*x - \\
& c - b*c/d)) * \tan(1/2*a + 1/2*c) * \tan(1/2*(b*c + c*d)/d)^2 + 2 * \text{real\_part}(\text{cos\_i} \\
& \text{ntegral}(b*x - d*x - c + b*c/d)) * \tan(1/2*a - 1/2*c) * \tan(1/2*(b*c + c*d)/d)^2 \\
& + 2 * \text{real\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d)) * \tan(1/2*a - 1/2*c) * \tan \\
& (1/2*(b*c + c*d)/d)^2 - 2 * \text{real\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d)) * \text{ta} \\
& \text{n}(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d) - 2 * \text{real\_part}(\text{cos\_integral}(-b*x + \\
& d*x + c - b*c/d)) * \tan(1/2*a + 1/2*c)^2 * \tan(1/2*(b*c - c*d)/d) + 2 * \text{real\_par}
\end{aligned}$$

$$\begin{aligned}
& t(\cos\_integral(b*x - d*x - c + b*c/d))*\tan(1/2*a - 1/2*c)^2*\tan(1/2*(b*c - \\
& c*d)/d) + 2*real\_part(\cos\_integral(-b*x + d*x + c - b*c/d))*\tan(1/2*a - 1/2 \\
& *c)^2*\tan(1/2*(b*c - c*d)/d) - 2*real\_part(\cos\_integral(b*x - d*x - c + b*c \\
& /d))*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/d) - 2*real\_part(\cos\_inte \\
& gral(-b*x + d*x + c - b*c/d))*\tan(1/2*(b*c + c*d)/d)^2*\tan(1/2*(b*c - c*d)/ \\
& d) + 2*real\_part(\cos\_integral(b*x + d*x + c + b*c/d))*\tan(1/2*a + 1/2*c)*\ta \\
& n(1/2*(b*c - c*d)/d)^2 + 2*real\_part(\cos\_integral(-b*x - d*x - c - b*c/d))* \\
& \tan(1/2*a + 1/2*c)*\tan(1/2*(b*c - c*d)/d)^2 - 2*real\_part(\cos\_integral(b*x \\
& - d*x - c + b*c/d))*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c - c*d)/d)^2 - 2*real\_pa \\
& rt(\cos\_integral(-b*x + d*x + c - b*c/d))*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c - \\
& c*d)/d)^2 - 2*real\_part(\cos\_integral(b*x + d*x + c + b*c/d))*\tan(1/2*(b*c + \\
& c*d)/d)*\tan(1/2*(b*c - c*d)/d)^2 - 2*real\_part(\cos\_integral(-b*x - d*x - c \\
& - b*c/d))*\tan(1/2*(b*c + c*d)/d)*\tan(1/2*(b*c - c*d)/d)^2 - imag\_part(\cos\_ \\
& integral(b*x + d*x + c + b*c/d))*\tan(1/2*a + 1/2*c)^2 + imag\_part(\cos\_integ \\
& ral(b*x - d*x - c + b*c/d))*\tan(1/2*a + 1/2*c)^2 - imag\_part(\cos\_integral(- \\
& b*x + d*x + c - b*c/d))*\tan(1/2*a + 1/2*c)^2 + imag\_part(\cos\_integral(-b*x \\
& - d*x - c - b*c/d))*\tan(1/2*a + 1/2*c)^2 - 2*\sin\_integral((b*d*x + d^2*x + \\
& b*c + c*d)/d)*\tan(1/2*a + 1/2*c)^2 + 2*\sin\_integral((b*d*x - d^2*x + b*c - \\
& c*d)/d)*\tan(1/2*a + 1/2*c)^2 + imag\_part(\cos\_integral(b*x + d*x + c + b*c/d \\
& ))*\tan(1/2*a - 1/2*c)^2 - imag\_part(\cos\_integral(b*x - d*x - c + b*c/d))*\ta \\
& n(1/2*a - 1/2*c)^2 + imag\_part(\cos\_integral(-b*x + d*x + c - b*c/d))*\tan(1/ \\
& 2*a - 1/2*c)^2 - imag\_part(\cos\_integral(-b*x - d*x - c - b*c/d))*\tan(1/2*a \\
& - 1/2*c)^2 + 2*\sin\_integral((b*d*x + d^2*x + b*c + c*d)/d)*\tan(1/2*a - 1/2* \\
& c)^2 - 2*\sin\_integral((b*d*x - d^2*x + b*c - c*d)/d)*\tan(1/2*a - 1/2*c)^2 + \\
& 4*imag\_part(\cos\_integral(b*x + d*x + c + b*c/d))*\tan(1/2*a + 1/2*c)*\tan(1/ \\
& 2*(b*c + c*d)/d) - 4*imag\_part(\cos\_integral(-b*x - d*x - c - b*c/d))*\tan(1/ \\
& 2*a + 1/2*c)*\tan(1/2*(b*c + c*d)/d) + 8*\sin\_integral((b*d*x + d^2*x + b*c + \\
& c*d)/d)*\tan(1/2*a + 1/2*c)*\tan(1/2*(b*c + c*d)/d) - imag\_part(\cos\_integral \\
& (b*x + d*x + c + b*c/d))*\tan(1/2*(b*c + c*d)/d)^2 + imag\_part(\cos\_integral( \\
& b*x - d*x - c + b*c/d))*\tan(1/2*(b*c + c*d)/d)^2 - imag\_part(\cos\_integral(- \\
& b*x + d*x + c - b*c/d))*\tan(1/2*(b*c + c*d)/d)^2 + imag\_part(\cos\_integral(- \\
& b*x - d*x - c - b*c/d))*\tan(1/2*(b*c + c*d)/d)^2 - 2*\sin\_integral((b*d*x + \\
& d^2*x + b*c + c*d)/d)*\tan(1/2*(b*c + c*d)/d)^2 + 2*\sin\_integral((b*d*x - d^ \\
& 2*x + b*c - c*d)/d)*\tan(1/2*(b*c + c*d)/d)^2 + 4*imag\_part(\cos\_integral(b*x \\
& - d*x - c + b*c/d))*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c - c*d)/d) - 4*imag\_par \\
& t(\cos\_integral(-b*x + d*x + c - b*c/d))*\tan(1/2*a - 1/2*c)*\tan(1/2*(b*c - c \\
& *d)/d) + 8*\sin\_integral((b*d*x - d^2*x + b*c - c*d)/d)*\tan(1/2*a - 1/2*c)*\t \\
& an(1/2*(b*c - c*d)/d) + imag\_part(\cos\_integral(b*x + d*x + c + b*c/d))*\tan( \\
& 1/2*(b*c - c*d)/d)^2 - imag\_part(\cos\_integral(b*x - d*x - c + b*c/d))*\tan(1 \\
& /2*(b*c - c*d)/d)^2 + imag\_part(\cos\_integral(-b*x + d*x + c - b*c/d))*\tan(1 \\
& /2*(b*c - c*d)/d)^2 - imag\_part(\cos\_integral(-b*x - d*x - c - b*c/d))*\tan(1 \\
& /2*(b*c - c*d)/d)^2 + 2*\sin\_integral((b*d*x + d^2*x + b*c + c*d)/d)*\tan(1/2 \\
& *(b*c - c*d)/d)^2 - 2*\sin\_integral((b*d*x - d^2*x + b*c - c*d)/d)*\tan(1/2*( \\
& b*c - c*d)/d)^2 + 2*real\_part(\cos\_integral(b*x + d*x + c + b*c/d))*\tan(1/2*a \\
& + 1/2*c) + 2*real\_part(\cos\_integral(-b*x - d*x - c - b*c/d))*\tan(1/2*a +
\end{aligned}$$

$$\begin{aligned}
& 1/2*c) + 2*\text{real\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\text{tan}(1/2*a - 1/2*c) \\
& ) + 2*\text{real\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\text{tan}(1/2*a - 1/2*c) - \\
& 2*\text{real\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d))*\text{tan}(1/2*(b*c + c*d)/d) - 2 \\
& *\text{real\_part}(\text{cos\_integral}(-b*x - d*x - c - b*c/d))*\text{tan}(1/2*(b*c + c*d)/d) - 2 \\
& *\text{real\_part}(\text{cos\_integral}(b*x - d*x - c + b*c/d))*\text{tan}(1/2*(b*c - c*d)/d) - 2* \\
& \text{real\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d))*\text{tan}(1/2*(b*c - c*d)/d) + \text{im} \\
& \text{ag\_part}(\text{cos\_integral}(b*x + d*x + c + b*c/d)) + \text{imag\_part}(\text{cos\_integral}(b*x - \\
& d*x - c + b*c/d)) - \text{imag\_part}(\text{cos\_integral}(-b*x + d*x + c - b*c/d)) - \text{imag} \\
& \_part(\text{cos\_integral}(-b*x - d*x - c - b*c/d)) + 2*\text{sin\_integral}((b*d*x + d^2*x \\
& + b*c + c*d)/d) + 2*\text{sin\_integral}((b*d*x - d^2*x + b*c - c*d)/d))*d/(b*d*\text{ta} \\
& \text{n}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)^2*\text{tan}(1/2*(b \\
& *c - c*d)/d)^2 + b*d*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c \\
& + c*d)/d)^2 + b*d*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c - \\
& c*d)/d)^2 + b*d*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)^2*\text{tan}(1/2*(b*c \\
& - c*d)/d)^2 + b*d*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)^2*\text{tan}(1/2*(b \\
& *c - c*d)/d)^2 + b*d*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*a - 1/2*c)^2 + b*d*\text{tan}(1/ \\
& 2*a + 1/2*c)^2*\text{tan}(1/2*(b*c + c*d)/d)^2 + b*d*\text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2* \\
& (b*c + c*d)/d)^2 + b*d*\text{tan}(1/2*a + 1/2*c)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 + b*d* \\
& \text{tan}(1/2*a - 1/2*c)^2*\text{tan}(1/2*(b*c - c*d)/d)^2 + b*d*\text{tan}(1/2*(b*c + c*d)/d)^ \\
& 2*\text{tan}(1/2*(b*c - c*d)/d)^2 + b*d*\text{tan}(1/2*a + 1/2*c)^2 + b*d*\text{tan}(1/2*a - 1/2 \\
& *c)^2 + b*d*\text{tan}(1/2*(b*c + c*d)/d)^2 + b*d*\text{tan}(1/2*(b*c - c*d)/d)^2 + b*d) \\
& + \text{cos\_integral}(d*x + c)*\text{sin}(b*x + a)/b
\end{aligned}$$

$$3.136 \quad \int \frac{\cos(a+bx)\text{CosIntegral}(c+dx)}{x} dx$$

**Optimal.** Leaf size=18

$$\text{CannotIntegrate}\left(\frac{\cos(a+bx)\text{CosIntegral}(c+dx)}{x}, x\right)$$

[Out] CannotIntegrate[(Cos[a + b\*x]\*CosIntegral[c + d\*x])/x, x]

**Rubi [A]** time = 0.0921269, antiderivative size = 0, normalized size of antiderivative = 0., number of steps used = 0, number of rules used = 0, integrand size = 0,  $\frac{\text{number of rules}}{\text{integrand size}} = 0.$ , Rules used = {}

$$\int \frac{\cos(a+bx)\text{CosIntegral}(c+dx)}{x} dx$$

Verification is Not applicable to the result.

[In] Int[(Cos[a + b\*x]\*CosIntegral[c + d\*x])/x,x]

[Out] Defer[Int] [(Cos[a + b\*x]\*CosIntegral[c + d\*x])/x, x]

Rubi steps

$$\int \frac{\cos(a+bx)\text{Ci}(c+dx)}{x} dx = \int \frac{\cos(a+bx)\text{Ci}(c+dx)}{x} dx$$

**Mathematica [A]** time = 18.7056, size = 0, normalized size = 0.

$$\int \frac{\cos(a+bx)\text{CosIntegral}(c+dx)}{x} dx$$

Verification is Not applicable to the result.

[In] Integrate[(Cos[a + b\*x]\*CosIntegral[c + d\*x])/x,x]

[Out] Integrate[(Cos[a + b\*x]\*CosIntegral[c + d\*x])/x, x]



---

**Maple [A]** time = 0.089, size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(dx + c) \cos(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] int(Ci(d\*x+c)\*cos(b\*x+a)/x,x)

[Out] int(Ci(d\*x+c)\*cos(b\*x+a)/x,x)

---

**Maxima [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(dx + c) \cos(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(d\*x+c)\*cos(b\*x+a)/x,x, algorithm="maxima")

[Out] integrate(Ci(d\*x + c)\*cos(b\*x + a)/x, x)

---

**Fricas [A]** time = 0., size = 0, normalized size = 0.

$$\text{integral}\left(\frac{\cos(bx + a) \text{Ci}(dx + c)}{x}, x\right)$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(d\*x+c)\*cos(b\*x+a)/x,x, algorithm="fricas")

[Out] integral(cos(b\*x + a)\*cos\_integral(d\*x + c)/x, x)

---

**Sympy [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\cos(a + bx) \text{Ci}(c + dx)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(d\*x+c)\*cos(b\*x+a)/x,x)

[Out] Integral(cos(a + b\*x)\*Ci(c + d\*x)/x, x)

**Giac [A]** time = 0., size = 0, normalized size = 0.

$$\int \frac{\text{Ci}(dx + c) \cos(bx + a)}{x} dx$$

Verification of antiderivative is not currently implemented for this CAS.

[In] integrate(Ci(d\*x+c)\*cos(b\*x+a)/x,x, algorithm="giac")

[Out] integrate(Ci(d\*x + c)\*cos(b\*x + a)/x, x)

# Chapter 4

## Listing of Grading functions

The following are the current version of the grading functions used for grading the quality of the antiderivative with reference to the optimal antiderivative included in the test suite.

There is a version for Maple and for Mathematica/Rubi. There is a version for grading Sympy and version for use with Sagemath.

The following are links to the current source code.

The following are the listings of source code of the grading functions.

### 4.0.1 Mathematica and Rubi grading function

```
1 (* Original version thanks to Albert Rich emailed on 03/21/2017 *)
2 (* ::Package:: *)
3
4 (* ::Subsection:: *)
5 (*GradeAntiderivative[result,optimal]*)
6
7
8 (* ::Text:: *)
9 (*If result and optimal are mathematical expressions, *)
10 (*      GradeAntiderivative[result,optimal] returns*)
11 (* "F" if the result fails to integrate an expression that*)
12 (*      is integrable*)
13 (* "C" if result involves higher level functions than necessary*)
14 (* "B" if result is more than twice the size of the optimal*)
15 (*      antiderivative*)
16 (* "A" if result can be considered optimal*)
17
18
19 GradeAntiderivative[result_,optimal_] :=
20   If[ExpnType[result]<=ExpnType[optimal],
21     If[FreeQ[result,Complex] || Not[FreeQ[optimal,Complex]],
```

```

22     If[LeafCount[result]<=2*LeafCount[optimal],
23         "A",
24         "B"],
25     "C"],
26 If[FreeQ[result,Integrate] && FreeQ[result,Int],
27     "C",
28     "F"]]
29
30
31 (* ::Text:: *)
32 (*The following summarizes the type number assigned an *)
33 (*expression based on the functions it involves*)
34 (*1 = rational function*)
35 (*2 = algebraic function*)
36 (*3 = elementary function*)
37 (*4 = special function*)
38 (*5 = hyperpergeometric function*)
39 (*6 = appell function*)
40 (*7 = rootsum function*)
41 (*8 = integrate function*)
42 (*9 = unknown function*)
43
44
45 ExpnType[expn_] :=
46     If[AtomQ[expn],
47         1,
48     If[ListQ[expn],
49         Max[Map[ExpnType,expn]],
50     If[Head[expn]===Power,
51         If[IntegerQ[expn[[2]]],
52             ExpnType[expn[[1]]],
53         If[Head[expn[[2]]]===Rational,
54             If[IntegerQ[expn[[1]]] || Head[expn[[1]]]===Rational,
55                 1,
56                 Max[ExpnType[expn[[1]],2]],
57             Max[ExpnType[expn[[1]],ExpnType[expn[[2]],3]],
58     If[Head[expn]===Plus || Head[expn]===Times,
59         Max[ExpnType[First[expn]],ExpnType[Rest[expn]]],
60     If[ElementaryFunctionQ[Head[expn]],
61         Max[3,ExpnType[expn[[1]]]],
62     If[SpecialFunctionQ[Head[expn]],
63         Apply[Max,Append[Map[ExpnType,Apply[List,expn]],4]],
64     If[HypergeometricFunctionQ[Head[expn]],
65         Apply[Max,Append[Map[ExpnType,Apply[List,expn]],5]],
66     If[AppellFunctionQ[Head[expn]],
67         Apply[Max,Append[Map[ExpnType,Apply[List,expn]],6]],
68     If[Head[expn]===RootSum,

```

```

69   Apply[Max, Append[Map[ExpnType, Apply[List, expn]], 7]],
70   If[Head[expn]===Integrate || Head[expn]===Int,
71     Apply[Max, Append[Map[ExpnType, Apply[List, expn]], 8]],
72   9]]]]]]]]]]
73
74
75 ElementaryFunctionQ[func_] :=
76   MemberQ[{
77     Exp, Log,
78     Sin, Cos, Tan, Cot, Sec, Csc,
79     ArcSin, ArcCos, ArcTan, ArcCot, ArcSec, ArcCsc,
80     Sinh, Cosh, Tanh, Coth, Sech, Csch,
81     ArcSinh, ArcCosh, ArcTanh, ArcCoth, ArcSech, ArcCsch
82   }, func]
83
84
85 SpecialFunctionQ[func_] :=
86   MemberQ[{
87     Erf, Erfc, Erfi,
88     FresnelS, FresnelC,
89     ExpIntegralE, ExpIntegralEi, LogIntegral,
90     SinIntegral, CosIntegral, SinhIntegral, CoshIntegral,
91     Gamma, LogGamma, PolyGamma,
92     Zeta, PolyLog, ProductLog,
93     EllipticF, EllipticE, EllipticPi
94   }, func]
95
96
97 HypergeometricFunctionQ[func_] :=
98   MemberQ[{Hypergeometric1F1, Hypergeometric2F1, HypergeometricPFQ}, func]
99
100
101 AppellFunctionQ[func_] :=
102   MemberQ[{AppellF1}, func]

```

## 4.0.2 Maple grading function

```

1 # File: GradeAntiderivative.mpl
2 # Original version thanks to Albert Rich emailed on 03/21/2017
3
4 #Nasser 03/22/2017 Use Maple leaf count instead since buildin
5 #Nasser 03/23/2017 missing 'ln' for ElementaryFunctionQ added
6 #Nasser 03/24/2017 corrected the check for complex result
7 #Nasser 10/27/2017 check for leafsize and do not call ExpnType()
8 #
9 #Nasser 12/22/2019 Added debug flag, added 'dilog' to special functions
10 #
11 see problem 156, file Apostol_Problems

```

```

11
12 GradeAntiderivative := proc(result,optimal)
13 local leaf_count_result, leaf_count_optimal,ExpnType_result,ExpnType_optimal,
    debug:=false;
14
15     leaf_count_result:=leafcount(result);
16     #do NOT call ExpnType() if leaf size is too large. Recursion problem
17     if leaf_count_result > 500000 then
18         return "B";
19     fi;
20
21     leaf_count_optimal:=leafcount(optimal);
22
23     ExpnType_result:=ExpnType(result);
24     ExpnType_optimal:=ExpnType(optimal);
25
26     if debug then
27         print("ExpnType_result",ExpnType_result," ExpnType_optimal=",
    ExpnType_optimal);
28     fi;
29
30 # If result and optimal are mathematical expressions,
31 # GradeAntiderivative[result,optimal] returns
32 #   "F" if the result fails to integrate an expression that
33 #     is integrable
34 #   "C" if result involves higher level functions than necessary
35 #   "B" if result is more than twice the size of the optimal
36 #     antiderivative
37 #   "A" if result can be considered optimal
38
39 #This check below actually is not needed, since I only
40 #call this grading only for passed integrals. i.e. I check
41 #for "F" before calling this. But no harm of keeping it here.
42 #just in case.
43
44
45 if not type(result,freeof('int')) then
46     return "F";
47 end if;
48
49
50 if ExpnType_result<=ExpnType_optimal then
51     if debug then
52         print("ExpnType_result<=ExpnType_optimal");
53     fi;
54     if is_contains_complex(result) then
55         if is_contains_complex(optimal) then

```

```

56     if debug then
57         print("both result and optimal complex");
58     fi;
59     #both result and optimal complex
60     if leaf_count_result<=2*leaf_count_optimal then
61         return "A";
62     else
63         return "B";
64     end if
65 else #result contains complex but optimal is not
66     if debug then
67         print("result contains complex but optimal is not");
68     fi;
69     return "C";
70 end if
71 else # result do not contain complex
72     # this assumes optimal do not as well
73     if debug then
74         print("result do not contain complex, this assumes optimal do not
as well");
75     fi;
76     if leaf_count_result<=2*leaf_count_optimal then
77         if debug then
78             print("leaf_count_result<=2*leaf_count_optimal");
79         fi;
80         return "A";
81     else
82         if debug then
83             print("leaf_count_result>2*leaf_count_optimal");
84         fi;
85         return "B";
86     end if
87 end if
88 else #ExpnType(result) > ExpnType(optimal)
89     if debug then
90         print("ExpnType(result) > ExpnType(optimal)");
91     fi;
92     return "C";
93 end if
94
95 end proc:
96
97 #
98 # is_contains_complex(result)
99 # takes expressions and returns true if it contains "I" else false
100 #
101 #Nasser 032417

```

```

102 is_contains_complex:= proc(expression)
103   return (has(expression,I));
104 end proc:
105
106 # The following summarizes the type number assigned an expression
107 # based on the functions it involves
108 # 1 = rational function
109 # 2 = algebraic function
110 # 3 = elementary function
111 # 4 = special function
112 # 5 = hyperpergeometric function
113 # 6 = appell function
114 # 7 = rootsum function
115 # 8 = integrate function
116 # 9 = unknown function
117
118 ExpnType := proc(expn)
119   if type(expn,'atomic') then
120     1
121   elif type(expn,'list') then
122     apply(max,map(ExpnType,expn))
123   elif type(expn,'sqrt') then
124     if type(op(1,expn),'rational') then
125       1
126     else
127       max(2,ExpnType(op(1,expn)))
128     end if
129   elif type(expn,'^^') then
130     if type(op(2,expn),'integer') then
131       ExpnType(op(1,expn))
132     elif type(op(2,expn),'rational') then
133       if type(op(1,expn),'rational') then
134         1
135       else
136         max(2,ExpnType(op(1,expn)))
137       end if
138     else
139       max(3,ExpnType(op(1,expn)),ExpnType(op(2,expn)))
140     end if
141   elif type(expn,'^+^') or type(expn,'`*`') then
142     max(ExpnType(op(1,expn)),max(ExpnType(rest(expn))))
143   elif ElementaryFunctionQ(op(0,expn)) then
144     max(3,ExpnType(op(1,expn)))
145   elif SpecialFunctionQ(op(0,expn)) then
146     max(4,apply(max,map(ExpnType,[op(expn)])))
147   elif HypergeometricFunctionQ(op(0,expn)) then
148     max(5,apply(max,map(ExpnType,[op(expn)])))

```



```

149   elif AppellFunctionQ(op(0,expn)) then
150       max(6,apply(max,map(ExpnType,[op(expn)])))
151   elif op(0,expn)='int' then
152       max(8,apply(max,map(ExpnType,[op(expn)]))) else
153       9
154   end if
155 end proc:
156
157
158 ElementaryFunctionQ := proc(func)
159     member(func,[
160         exp,log,ln,
161         sin,cos,tan,cot,sec,csc,
162         arcsin,arccos,arctan,arccot,arcsec,arccsc,
163         sinh,cosh,tanh,coth,sech,csch,
164         arcsinh,arccosh,arctanh,arccoth,arcsech,arccsch])
165 end proc:
166
167 SpecialFunctionQ := proc(func)
168     member(func,[
169         erf,erfc,erfi,
170         FresnelS,FresnelC,
171         Ei,Ei,Li,Si,Ci,Shi,Chi,
172         GAMMA,lnGAMMA,Psi,Zeta,polylog,dilog,LambertW,
173         EllipticF,EllipticE,EllipticPi])
174 end proc:
175
176 HypergeometricFunctionQ := proc(func)
177     member(func,[Hypergeometric1F1,hypergeom,HypergeometricPFQ])
178 end proc:
179
180 AppellFunctionQ := proc(func)
181     member(func,[AppellF1])
182 end proc:
183
184 # u is a sum or product. rest(u) returns all but the
185 # first term or factor of u.
186 rest := proc(u) local v;
187     if nops(u)=2 then
188         op(2,u)
189     else
190         apply(op(0,u),op(2..nops(u),u))
191     end if
192 end proc:
193
194 #leafcount(u) returns the number of nodes in u.
195 #Nasser 3/23/17 Replaced by build-in leafCount from package in Maple

```

```

196 leafcount := proc(u)
197     MmaTranslator[Mma][LeafCount](u);
198 end proc:

```

### 4.0.3 Sympy grading function

```

1 #Dec 24, 2019. Nasser M. Abbasi:
2 #           Port of original Maple grading function by
3 #           Albert Rich to use with Sympy/Python
4 #Dec 27, 2019 Nasser. Added `RootSum`. See problem 177, Timofeev file
5 #           added 'exp_polar'
6 from sympy import *
7
8 def leaf_count(expr):
9     #sympy do not have leaf count function. This is approximation
10    return round(1.7*count_ops(expr))
11
12 def is_sqrt(expr):
13     if isinstance(expr,Pow):
14         if expr.args[1] == Rational(1,2):
15             return True
16         else:
17             return False
18     else:
19         return False
20
21 def is_elementary_function(func):
22     return func in [exp,log,ln,sin,cos,tan,cot,sec,csc,
23                    asin,acos,atan,acot,asec,acsc,sinh,cosh,tanh,coth,sech,csch,
24                    asinh,acosh,atanh,acoth,asech,acsch
25                    ]
26
27 def is_special_function(func):
28     return func in [ erf,erfc,erfi,
29                    fresnels,fresnelc,Ei,Ei,Li,Si,Ci,Shi,Chi,
30                    gamma,loggamma,digamma,zeta,polylog,LambertW,
31                    elliptic_f,elliptic_e,elliptic_pi,exp_polar
32                    ]
33
34 def is_hypergeometric_function(func):
35     return func in [hyper]
36
37 def is_appell_function(func):
38     return func in [appellf1]
39
40 def is_atom(expn):
41     try:

```

```

42     if expn.isAtom or isinstance(expn,int) or isinstance(expn,float):
43         return True
44     else:
45         return False
46
47     except AttributeError as error:
48         return False
49
50 def expnType(expn):
51     debug=False
52     if debug:
53         print("expn=",expn,"type(expn)=",type(expn))
54
55     if is_atom(expn):
56         return 1
57     elif isinstance(expn,list):
58         return max(map(expnType, expn)) #apply(max,map(ExpnType,expn))
59     elif is_sqrt(expn):
60         if isinstance(expn.args[0],Rational): #type(op(1,expn),'rational')
61             return 1
62         else:
63             return max(2,expnType(expn.args[0])) #max(2,ExpnType(op(1,expn)))
64     elif isinstance(expn,Pow): #type(expn,'^^')
65         if isinstance(expn.args[1],Integer): #type(op(2,expn),'integer')
66             return expnType(expn.args[0]) #ExpnType(op(1,expn))
67         elif isinstance(expn.args[1],Rational): #type(op(2,expn),'rational')
68             if isinstance(expn.args[0],Rational): #type(op(1,expn),'rational')
69                 return 1
70             else:
71                 return max(2,expnType(expn.args[0])) #max(2,ExpnType(op(1,expn)
72 ))
73     else:
74         return max(3,expnType(expn.args[0]),expnType(expn.args[1])) #max(3,
75 ExpnType(op(1,expn)),ExpnType(op(2,expn)))
76     elif isinstance(expn,Add) or isinstance(expn,Mul): #type(expn,'+' or type
77 (expn,'*')
78         m1 = expnType(expn.args[0])
79         m2 = expnType(list(expn.args[1:]))
80         return max(m1,m2) #max(ExpnType(op(1,expn)),max(ExpnType(rest(expn))))
81     elif is_elementary_function(expn.func): #ElementaryFunctionQ(op(0,expn))
82         return max(3,expnType(expn.args[0])) #max(3,ExpnType(op(1,expn)))
83     elif is_special_function(expn.func): #SpecialFunctionQ(op(0,expn))
84         m1 = max(map(expnType, list(expn.args)))
85         return max(4,m1) #max(4,apply(max,map(ExpnType,[op(expn)])))
86     elif is_hypergeometric_function(expn.func): #HypergeometricFunctionQ(op(0,
87 expn))
88         m1 = max(map(expnType, list(expn.args)))

```

```

85     return max(5,m1)    #max(5,apply(max,map(ExpnType,[op(expn)])))
86 elif is_appell_function(expn.func):
87     m1 = max(map(expnType, list(expn.args)))
88     return max(6,m1)    #max(5,apply(max,map(ExpnType,[op(expn)])))
89 elif isinstance(expn,RootSum):
90     m1 = max(map(expnType, list(expn.args))) #Apply[Max,Append[Map[ExpnType,
Apply[List,expn]],7]],
91     return max(7,m1)
92 elif str(expn).find("Integral") != -1:
93     m1 = max(map(expnType, list(expn.args)))
94     return max(8,m1)    #max(5,apply(max,map(ExpnType,[op(expn)])))
95 else:
96     return 9
97
98 #main function
99 def grade_antiderivative(result,optimal):
100
101     leaf_count_result  = leaf_count(result)
102     leaf_count_optimal = leaf_count(optimal)
103
104     expnType_result  = expnType(result)
105     expnType_optimal = expnType(optimal)
106
107     if str(result).find("Integral") != -1:
108         return "F"
109
110     if expnType_result <= expnType_optimal:
111         if result.has(I):
112             if optimal.has(I): #both result and optimal complex
113                 if leaf_count_result <= 2*leaf_count_optimal:
114                     return "A"
115                 else:
116                     return "B"
117             else: #result contains complex but optimal is not
118                 return "C"
119         else: # result do not contain complex, this assumes optimal do not as
well
120             if leaf_count_result <= 2*leaf_count_optimal:
121                 return "A"
122             else:
123                 return "B"
124     else:
125         return "C"

```

## 4.0.4 SageMath grading function

1 #Dec 24, 2019. Nasser: Ported original Maple grading function by

```

2 #           Albert Rich to use with Sagemath. This is used to
3 #           grade Fracas, Giac and Maxima results.
4 #Dec 24, 2019. Nasser: Added 'exp_integral_e' and 'sng', 'sin_integral'
5 #           'arctan2','floor','abs','log_integral'
6
7 from sage.all import *
8 from sage.symbolic.operators import add_vararg, mul_vararg
9
10 def tree(expr):
11     debug=False;
12     if debug:
13         print ("Enter tree(expr), expr=",expr)
14         print ("expr.operator()=",expr.operator())
15         print ("expr.operands()=",expr.operands())
16         print ("map(tree, expr.operands()=",map(tree, expr.operands()))
17
18     if expr.operator() is None:
19         return expr
20     else:
21         return [expr.operator()+list(map(tree, expr.operands()))
22
23 def leaf_count(anti):
24     debug=False;
25
26     if debug: print ("Enter leaf_count, anti=", anti, " len(anti)=", len(anti))
27
28     if len(anti) == 0: #special check for optimal being 0 for some test cases.
29         if debug: print ("len(anti) == 0")
30         return 1
31     else:
32         if debug: print ("round(1.35*len(flatten(tree(anti))))=",round(1.35*len(
33         flatten(tree(anti))))
34         return round(1.35*len(flatten(tree(anti)))) #fudge factor
35         #since this estimate of leaf count is bit lower than
36         #what it should be compared to Mathematica's
37
38 def is_sqrt(expr):
39     debug=False;
40     if expr.operator() == operator.pow: #isinstance(expr,Pow):
41         if expr.operands()[1]==1/2: #expr.args[1] == Rational(1,2):
42             if debug: print ("expr is sqrt")
43             return True
44         else:
45             return False
46     else:
47         return False

```

```

48 def is_elementary_function(func):
49     debug = False
50
51     m = func.name() in ['exp','log','ln',
52         'sin','cos','tan','cot','sec','csc',
53         'arcsin','arccos','arctan','arccot','arcsec','arccsc',
54         'sinh','cosh','tanh','coth','sech','csch',
55         'arcsinh','arccosh','arctanh','arccoth','arcsech','arccsch','sgn',
56         'arctan2','floor','abs'
57     ]
58     if debug:
59         if m:
60             print ("func ", func , " is elementary_function")
61         else:
62             print ("func ", func , " is NOT elementary_function")
63
64
65     return m
66
67 def is_special_function(func):
68     debug = False
69
70     if debug: print ("type(func)=", type(func))
71
72     m= func.name() in ['erf','erfc','erfi','fresnel_sin','fresnel_cos','Ei',
73         'Ei','Li','Si','sin_integral','Ci','cos_integral','Shi','
74     sinh_integral'
75         'Chi','cosh_integral','gamma','log_gamma','psi,zeta',
76         'polylog','lambert_w','elliptic_f','elliptic_e',
77         'elliptic_pi','exp_integral_e','log_integral']
78
79     if debug:
80         print ("m=",m)
81         if m:
82             print ("func ", func ," is special_function")
83         else:
84             print ("func ", func ," is NOT special_function")
85
86     return m
87
88
89 def is_hypergeometric_function(func):
90     return func.name() in ['hypergeometric','hypergeometric_M','hypergeometric_U
91     ']
92
93 def is_appell_function(func):

```

```

93     return func.name() in ['hypergeometric']    #[appellf1] can't find this in
          sagemath
94
95 def is_atom(expn):
96
97     #thanks to answer at https://ask.sagemath.org/question/49179/what-is-sagemath-equivalent-to-atomic-type-in-maple/
98     try:
99         if expn.parent() is SR:
100             return expn.operator() is None
101         if expn.parent() in (ZZ, QQ, AA, QQbar):
102             return expn in expn.parent() # Should always return True
103         if hasattr(expn.parent(),"base_ring") and hasattr(expn.parent(),"gens"):
104             return expn in expn.parent().base_ring() or expn in expn.parent().
          gens()
105         return False
106
107     except AttributeError as error:
108         return False
109
110
111 def expnType(expn):
112     debug=False
113
114     if debug:
115         print(">>>>Enter expnType, expn=", expn)
116         print(">>>>is_atom(expn)=", is_atom(expn))
117
118     if is_atom(expn):
119         return 1
120     elif type(expn)==list:    #isinstance(expn,list):
121         return max(map(expnType, expn))    #apply(max,map(ExpnType,expn))
122     elif is_sqrt(expn):
123         if type(expn.operands()[0])==Rational: #type(isinstance(expn.args[0],
          Rational):
124             return 1
125         else:
126             return max(2,expnType(expn.operands()[0]))    #max(2,expnType(expn.
          args[0]))
127     elif expn.operator() == operator.pow:    #isinstance(expn,Pow)
128         if type(expn.operands()[1])==Integer:    #isinstance(expn.args[1],Integer)
129             return expnType(expn.operands()[0])    #expnType(expn.args[0])
130         elif type(expn.operands()[1])==Rational:    #isinstance(expn.args[1],
          Rational)
131             if type(expn.operands()[0])==Rational: #isinstance(expn.args[0],
          Rational)
132                 return 1

```

```

133         else:
134             return max(2,expnType(expn.operands()[0])) #max(2,expnType(expn.
args[0]))
135         else:
136             return max(3,expnType(expn.operands()[0]),expnType(expn.operands()
[1])) #max(3,expnType(expn.operands()[0]),expnType(expn.operands()[1]))
137         elif expn.operator() == add_vararg or expn.operator() == mul_vararg: #
isinstance(expn,Add) or isinstance(expn,Mul)
138             m1 = expnType(expn.operands()[0]) #expnType(expn.args[0])
139             m2 = expnType(expn.operands()[1:]) #expnType(list(expn.args[1:]))
140             return max(m1,m2) #max(ExpnType(op(1,expn)),max(ExpnType(rest(expn))))
141         elif is_elementary_function(expn.operator()): #is_elementary_function(expn.
func)
142             return max(3,expnType(expn.operands()[0]))
143         elif is_special_function(expn.operator()): #is_special_function(expn.func)
144             m1 = max(map(expnType, expn.operands())) #max(map(expnType, list(
expn.args)))
145             return max(4,m1) #max(4,m1)
146         elif is_hypergeometric_function(expn.operator()): #
is_hypergeometric_function(expn.func)
147             m1 = max(map(expnType, expn.operands())) #max(map(expnType, list(
expn.args)))
148             return max(5,m1) #max(5,m1)
149         elif is_appell_function(expn.operator()):
150             m1 = max(map(expnType, expn.operands())) #max(map(expnType, list(
expn.args)))
151             return max(6,m1) #max(6,m1)
152         elif str(expn).find("Integral") != -1: #this will never happen, since it
153             #is checked before calling the grading function that is passed.
154             #but kept it here.
155             m1 = max(map(expnType, expn.operands())) #max(map(expnType, list(
expn.args)))
156             return max(8,m1) #max(5,apply(max,map(ExpnType,[op(expn)])))
157         else:
158             return 9
159
160 #main function
161 def grade_antiderivative(result,optimal):
162     debug = False;
163
164     if debug: print ("Enter grade_antiderivative for sagemath")
165
166     leaf_count_result = leaf_count(result)
167     leaf_count_optimal = leaf_count(optimal)
168
169     if debug: print ("leaf_count_result=", leaf_count_result, "
leaf_count_optimal=",leaf_count_optimal)

```



```
170
171
172     expnType_result = expnType(result)
173     expnType_optimal = expnType(optimal)
174
175     if debug: print ("expnType_result=", expnType_result, "expnType_optimal=",
176                     expnType_optimal)
177
178     if expnType_result <= expnType_optimal:
179         if result.has(I):
180             if optimal.has(I): #both result and optimal complex
181                 if leaf_count_result <= 2*leaf_count_optimal:
182                     return "A"
183             else:
184                 return "B"
185             else: #result contains complex but optimal is not
186                 return "C"
187         else: # result do not contain complex, this assumes optimal do not as
188             well
189                 if leaf_count_result <= 2*leaf_count_optimal:
190                     return "A"
191                 else:
192                     return "B"
193         else:
194             return "C"
```