

```
In[41]= Remove["Global`*"]
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In[42]= (* This code solves u''''+u=1 by Collocation. By Nasser M. Abbasi*)
```

```
p      = 1; (*right hand side of ode*)
nBasis = 5;
nPoints = 5;
coeff  = Table[a_n, {n, 1, nBasis}]
basisFunction[x_, n_] := coeff[[n]] (x (x - 1))^n
u[x_]  := Sum[basisFunction[x, n], {n, 1, nBasis}
error[x_] := u''''[x] + u[x] - p
A = Table[error[x] /. x -> {frac{n}{2 nPoints - 1}}, {n, 1, nPoints - 1}];
A = Flatten[Append[A, {a_1 + a_2}]];
```

```
Out[44]= {a_1, a_2, a_3, a_4, a_5}
```

```
In[50]= Print["Set of equations to solve are "]
```

```
A // MatrixForm
N[%] // MatrixForm
```

```
Out[51]//MatrixForm=
```

$$\begin{pmatrix} -1 - \frac{8 a_1}{81} + \frac{157 528 a_2}{6561} + \frac{19 367 560 a_3}{531 441} - \frac{302 169 320 a_4}{43 046 721} - \frac{1 114 877 888 a_5}{3 486 784 401} \\ -1 - \frac{14 a_1}{81} + \frac{157 660 a_2}{6561} + \frac{5 193 568 a_3}{531 441} - \frac{377 717 720 a_4}{43 046 721} + \frac{11 936 808 016 a_5}{3 486 784 401} \\ -1 - \frac{2 a_1}{9} + \frac{1948 a_2}{81} - \frac{5840 a_3}{729} + \frac{1960 a_4}{6561} + \frac{58 288 a_5}{59 049} \\ -1 - \frac{20 a_1}{81} + \frac{157 864 a_2}{6561} - \frac{8 983 448 a_3}{531 441} + \frac{340 439 704 a_4}{43 046 721} - \frac{10 726 498 400 a_5}{3 486 784 401} \\ a_1 + a_2 \end{pmatrix}$$

```
Out[52]//MatrixForm=
```

$$\begin{pmatrix} -1. - 0.0987654 a_1 + 24.0098 a_2 + 36.4435 a_3 - 7.01957 a_4 - 0.319744 a_5 \\ -1. - 0.17284 a_1 + 24.0299 a_2 + 9.77261 a_3 - 8.7746 a_4 + 3.42344 a_5 \\ -1. - 0.222222 a_1 + 24.0494 a_2 - 8.01097 a_3 + 0.298735 a_4 + 0.987112 a_5 \\ -1. - 0.246914 a_1 + 24.061 a_2 - 16.9039 a_3 + 7.90861 a_4 - 3.07633 a_5 \\ a_1 + a_2 \end{pmatrix}$$

```
In[53]=
```

```
Solve[A == 0, coeff]
N[%]
```

```
Out[53]= { {a_1 -> -frac{2 179 796 858 395 129 608 273}{52 844 426 917 618 938 573 842},
a_2 -> frac{2 179 796 858 395 129 608 273}{52 844 426 917 618 938 573 842}, a_3 -> frac{15 566 753 176 631 152 407}{105 688 853 835 237 877 147 684},
a_4 -> -frac{5 183 668 474 801 954 587}{211 377 707 670 475 754 295 368}, a_5 -> -frac{13 877 316 209 958 489}{422 755 415 340 951 508 590 736} } }
```

```
Out[54]= { {a_1 -> -0.0412493, a_2 -> 0.0412493, a_3 -> 0.000147289, a_4 -> -0.0000245233, a_5 -> -3.28259 x 10^-8} }
```