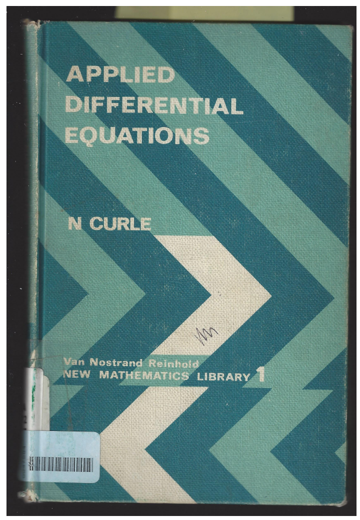
A Solution Manual For

Applied Differential equations, N Curle, 1971



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1 Examples, page 35

1.1 problem 1

Internal problem ID [2489]

Book: Applied Differential equations, N Curle, 1971
Section: Examples, page 35
Problem number: 1.
ODE order: 1.
ODE degree: 2.

CAS Maple gives this as type `[_quadrature]`

$$y - y' - \frac{y'^2}{2} = 0$$

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 145

```
dsolve(y(x)=diff(y(x),x)+1/2*(diff(y(x),x))^2,y(x), singsol=all)
```

$$y(x) = \frac{e^{-2\,\mathrm{LambertW}\left(-\sqrt{2}\,e^{-c_1+x-1}\right)-2c_1+2x+\ln(2)-2}}{2} - e^{-\mathrm{LambertW}\left(-e^{-c_1}e^{x}\sqrt{2}\,e^{-1}\right)-c_1+x+\frac{\ln(2)}{2}-1}$$

$$y(x) = \frac{e^{2\,\mathrm{RootOf}\left(-\_Z-2x+2\,e^{\_Z}-2+2c_1+\ln\left(\frac{e^{3\_Z}}{2}-2\,e^{2\_Z}+2\,e^{\_Z}\right)\right)}}{2} - e^{\mathrm{RootOf}\left(-\_Z-2x+2\,e^{\_Z}-2+2c_1+\ln\left(\frac{e^{3\_Z}}{2}-2\,e^{2\_Z}+2\,e^{\_Z}\right)\right)}$$

✓ Solution by Mathematica

Time used: 16.942 (sec). Leaf size: 66

```
DSolve[y[x]==y'[x]+1/2*(y'[x])^2,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to \frac{1}{2}W\left(-e^{x-1-c_1}\right)\left(2+W\left(-e^{x-1-c_1}\right)\right)$$

$$y(x) \to \frac{1}{2}W\left(e^{x-1+c_1}\right)\left(2+W\left(e^{x-1+c_1}\right)\right)$$

$$y(x) \to 0$$

1.2 problem 2

Internal problem ID [2490]

Book: Applied Differential equations, N Curle, 1971
Section: Examples, page 35
Problem number: 2.
ODE order: 1.
ODE degree: 2.

CAS Maple gives this as type `[[_1st_order, _with_linear_symmetries], _rational, _Clairaut]`

$$\boxed{(y - y'x)^2 - 1 - y'^2 = 0}$$

✓ Solution by Maple

Time used: 0.078 (sec). Leaf size: 57

```
dsolve((y(x)-x*diff(y(x),x))^2=1+(diff(y(x),x))^2,y(x), singsol=all)
```

$$y(x) = \sqrt{-x^2+1}$$
$$y(x) = -\sqrt{-x^2+1}$$
$$y(x) = c_1 x - \sqrt{c_1^2+1}$$
$$y(x) = c_1 x + \sqrt{c_1^2+1}$$

✓ Solution by Mathematica

Time used: 0.114 (sec). Leaf size: 73

```
DSolve[(y[x]-x*y'[x])^2==1+(y'[x])^2,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to c_1 x - \sqrt{1+c_1{}^2}$$
$$y(x) \to c_1 x + \sqrt{1+c_1{}^2}$$
$$y(x) \to -\sqrt{1-x^2}$$
$$y(x) \to \sqrt{1-x^2}$$

1.3 problem 3

Internal problem ID [2491]

Book: Applied Differential equations, N Curle, 1971
Section: Examples, page 35
Problem number: 3.
ODE order: 1.
ODE degree: 3.

CAS Maple gives this as type `[[_homogeneous, ‘class C‘], _dAlembert]`

$$y - x - y'^2\left(1 - \frac{2y'}{3}\right) = 0$$

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 35

```
dsolve(y(x)-x=(diff(y(x),x))^2*(1-2/3* diff(y(x),x)),y(x), singsol=all)
```

$$y(x) = x + \frac{1}{3}$$
$$y(x) = c_1 - \frac{2(c_1 - x)^{\frac{3}{2}}}{3}$$
$$y(x) = c_1 + \frac{2(c_1 - x)^{\frac{3}{2}}}{3}$$

✗ Solution by Mathematica

Time used: 0.0 (sec). Leaf size: 0

```
DSolve[y[x]-x==(y'[x])^2*(1-2/3* y'[x]),y[x],x,IncludeSingularSolutions -> True]
```

Timed out

1.4 problem 4

Internal problem ID [2492]

Book: Applied Differential equations, N Curle, 1971
Section: Examples, page 35
Problem number: 4.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[[_homogeneous, 'class C'], _rational, _Riccati]`

$$\boxed{y'x^2 - x(y-1) - (y-1)^2 = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 15

```
dsolve(x^2*diff(y(x),x)=x*(y(x)-1)+(y(x)-1)^2,y(x), singsol=all)
```

$$y(x) = 1 - \frac{x}{\ln(x) + c_1}$$

✓ Solution by Mathematica

Time used: 0.194 (sec). Leaf size: 23

```
DSolve[x^2*y'[x]==x*(y[x]-1)+(y[x]-1)^2,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to 1 + \frac{x}{-\log(x) + c_1}$$

$$y(x) \to 1$$