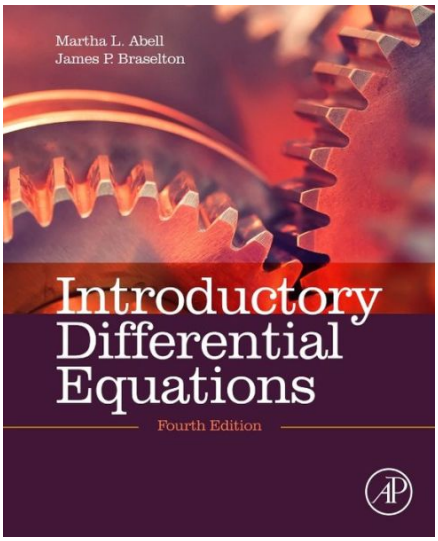
A Solution Manual For

INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014



Nasser M. Abbasi

March 3, 2024

Contents

1 Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10

1.1 problem 1

Internal problem ID [13725]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 1.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _linear, _nonhomogeneous]]`

$$\boxed{y'' + y' - 2y = x^3}$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 29

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

$$y(x) = \mathrm{e}^{x} c_2 + \mathrm{e}^{-2x} c_1 - \frac{x^3}{2} - \frac{3x^2}{4} - \frac{9x}{4} - \frac{15}{8}$$

✓ Solution by Mathematica

Time used: 0.077 (sec). Leaf size: 39

```
DSolve[y''[x]+y'[x]-2*y[x]==x^3,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to \frac{1}{8}\left(-4x^3 - 6x^2 - 18x - 15\right) + c_1 e^{-2x} + c_2 e^{x}$$

1.2 problem 2

Internal problem ID [13726]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 2.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[‘y=_G(x,y’)‘]`

$$\boxed{yy' + y^4 = \sin(x)}$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 164

```
dsolve(y(x)*diff(y(x),x)+y(x)^4=sin(x),y(x), singsol=all)
```

$$y(x) = -\frac{\sqrt{\left(c_1 \operatorname{MathieuC}\left(0,8,-\frac{\pi}{4}+\frac{x}{2}\right)+\operatorname{MathieuS}\left(0,8,-\frac{\pi}{4}+\frac{x}{2}\right)\right)\left(c_1 \operatorname{MathieuCPrime}\left(0,8,-\frac{\pi}{4}+\frac{x}{2}\right)+\text{Ma}\right.}}{2c_1 \operatorname{MathieuC}\left(0,8,-\frac{\pi}{4}+\frac{x}{2}\right)+2\operatorname{MathieuS}\left(0,8,-\frac{\pi}{4}+\frac{x}{2}\right)}$$

$$y(x) = \frac{\sqrt{\left(c_1 \operatorname{MathieuC}\left(0,8,-\frac{\pi}{4}+\frac{x}{2}\right)+\operatorname{MathieuS}\left(0,8,-\frac{\pi}{4}+\frac{x}{2}\right)\right)\left(c_1 \operatorname{MathieuCPrime}\left(0,8,-\frac{\pi}{4}+\frac{x}{2}\right)+\text{Math}\right.}}{2c_1 \operatorname{MathieuC}\left(0,8,-\frac{\pi}{4}+\frac{x}{2}\right)+2\operatorname{MathieuS}\left(0,8,-\frac{\pi}{4}+\frac{x}{2}\right)}$$

✗ Solution by Mathematica

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

```
DSolve[y[x]*y'[x]+y[x]^4==Sin[x],y[x],x,IncludeSingularSolutions -> True]
```

Not solved

1.3 problem 4

Internal problem ID [13727]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 4.
ODE order: 3.
ODE degree: 1.

CAS Maple gives this as type `[[_3rd_order, _with_linear_symmetries]]`

$$y''' - 2y'' + 5y' + y = \mathrm{e}^{x}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 227

```
dsolve(diff(y(x),x$3)-2*diff(y(x),x$2)+5*diff(y(x),x)+y(x)=exp(x),y(x), singsol=all)
```

$$y(x) = \frac{\mathrm{e}^{x}}{5} + c_1 \mathrm{e}^{\frac{\left(15\sqrt{69}\left(404+60\sqrt{69}\right)^{\frac{2}{3}}-101\left(404+60\sqrt{69}\right)^{\frac{2}{3}}-484\left(404+60\sqrt{69}\right)^{\frac{1}{3}}+1936\right)x}{2904}}$$
$$+c_2 \mathrm{e}^{-\frac{\left(15\sqrt{69}\left(404+60\sqrt{69}\right)^{\frac{2}{3}}-101\left(404+60\sqrt{69}\right)^{\frac{2}{3}}-484\left(404+60\sqrt{69}\right)^{\frac{1}{3}}-3872\right)x}{5808}} \cos\left(\frac{\left(404+60\sqrt{69}\right)^{\frac{1}{3}}\sqrt{3}\left(15\left(404+60\sqrt{69}\right)^{\frac{1}{3}}\right.}{580}\right.$$
$$+c_3 \mathrm{e}^{-\frac{\left(15\sqrt{69}\left(404+60\sqrt{69}\right)^{\frac{2}{3}}-101\left(404+60\sqrt{69}\right)^{\frac{2}{3}}-484\left(404+60\sqrt{69}\right)^{\frac{1}{3}}-3872\right)x}{5808}} \sin\left(\frac{\left(404+60\sqrt{69}\right)^{\frac{1}{3}}\sqrt{3}\left(15\left(404+60\sqrt{69}\right)^{\frac{1}{3}}\right.}{580}\right.$$

✓ Solution by Mathematica

Time used: 0.389 (sec). Leaf size: 2831

```
DSolve[y'''[x]-2*y''[x]+5*y'[x]+y[x]==Exp[x],y[x],x,IncludeSingularSolutions -> True]
```

Too large to display

1.4 problem 5

Internal problem ID [13728]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 5.
ODE order: 1.
ODE degree: 2.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y'^2 + y = 0}$$

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 23

```
dsolve(diff(y(x),x)^2+y(x)=0,y(x), singsol=all)
```

$$y(x) = 0$$
$$y(x) = -\frac{1}{4}x^2 + \frac{1}{2}c_1 x - \frac{1}{4}c_1^2$$

✓ Solution by Mathematica

Time used: 0.062 (sec). Leaf size: 42

```
DSolve[y'[x]^2+y[x]==0,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to -\frac{1}{4}(x + ic_1)^2$$
$$y(x) \to -\frac{1}{4}(x - ic_1)^2$$
$$y(x) \to 0$$

1.5 problem 6

Internal problem ID [13729]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 6.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_Emden, _Fowler], [_2nd_order, _linear, '_with_symmetry_[0,F`

$$\boxed{t^2y'' + ty' + 2y = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 23

```
dsolve(t^2*diff(y(t),t$2)+t*diff(y(t),t)+2*y(t)=0,y(t), singsol=all)
```

$$y = c_1 \sin\left(\sqrt{2}\,\ln(t)\right) + c_2 \cos\left(\sqrt{2}\,\ln(t)\right)$$

✓ Solution by Mathematica

Time used: 0.027 (sec). Leaf size: 30

```
DSolve[t^2*y''[t]+t*y'[t]+2*y[t]==0,y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to c_1 \cos\left(\sqrt{2}\log(t)\right) + c_2 \sin\left(\sqrt{2}\log(t)\right)$$

1.6 problem 9

Internal problem ID [13730]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 9.
ODE order: 2.
ODE degree: 2.

CAS Maple gives this as type `[[_2nd_order, _with_linear_symmetries]]`

$$\boxed{xy''^2 + 2y = 2x}$$

✗ Solution by Maple

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

No solution found

✗ Solution by Mathematica

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

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

Not solved

1.7 problem 10

Internal problem ID [13731]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 10.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[NONE]`

$$\boxed{x'' + 2\sin(x) = \sin(2t)}$$

✗ Solution by Maple

```
dsolve(diff(x(t),t$2)+2*sin(x(t))=sin(2*t),x(t), singsol=all)
```

No solution found

✗ Solution by Mathematica

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

```
DSolve[x''[t]+2*Sin[x[t]]==Sin[2*t],x[t],t,IncludeSingularSolutions -> True]
```

Not solved

1.8 problem 12

Internal problem ID [13732]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 12.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{-y' = -2x + 1}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 12

```
dsolve((2*x-1)-diff(y(x),x)=0,y(x), singsol=all)
```

$$y(x) = x^2 + c_1 - x$$

✓ Solution by Mathematica

Time used: 0.002 (sec). Leaf size: 7

```
DSolve[(2*x-1)*y'[x]==0,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to c_1$$

1.9 problem 15

Internal problem ID [13733]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 15.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[[_homogeneous, ‘class A‘], _rational, [_Abel, ‘2nd type‘, ‘cl`

$$\boxed{-y - yy' = -2x}$$

✓ Solution by Maple

Time used: 0.125 (sec). Leaf size: 2300

```
dsolve((2*x-y(x))-y(x)*diff(y(x),x)=0,y(x), singsol=all)
```

$$y(x)=-\frac{8x\left(\left(4c_1x^3+4\sqrt{4c_1^3x^9+c_1^2x^6}\right)^{\frac{1}{3}}-\frac{4x^3c_1}{\left(4c_1x^3+4\sqrt{4c_1^3x^9+c_1^2x^6}\right)^{\frac{1}{3}}}-1\right)}{4\left(4c_1x^3+4\sqrt{4c_1^3x^9+c_1^2x^6}\right)^{\frac{1}{3}}-\frac{16x^3c_1}{\left(4c_1x^3+4\sqrt{4c_1^3x^9+c_1^2x^6}\right)^{\frac{1}{3}}}}$$

$$y(x)=-\frac{8x\left(\frac{\left(-\frac{1}{2}-\frac{i\sqrt{3}}{2}\right)^3\left(4\left(4c_1x^3+4\sqrt{4c_1^3x^9+c_1^2x^6}\right)^{\frac{1}{3}}-\frac{16x^3c_1}{\left(4c_1x^3+4\sqrt{4c_1^3x^9+c_1^2x^6}\right)^{\frac{1}{3}}}\right)}{4}-1\right)}{\left(-\frac{1}{2}-\frac{i\sqrt{3}}{2}\right)^3\left(4\left(4c_1x^3+4\sqrt{4c_1^3x^9+c_1^2x^6}\right)^{\frac{1}{3}}-\frac{16x^3c_1}{\left(4c_1x^3+4\sqrt{4c_1^3x^9+c_1^2x^6}\right)^{\frac{1}{3}}}\right)}$$

$$y(x)=-\frac{8x\left(\frac{\left(-\frac{1}{2}+\frac{i\sqrt{3}}{2}\right)^3\left(4\left(4c_1x^3+4\sqrt{4c_1^3x^9+c_1^2x^6}\right)^{\frac{1}{3}}-\frac{16x^3c_1}{\left(4c_1x^3+4\sqrt{4c_1^3x^9+c_1^2x^6}\right)^{\frac{1}{3}}}\right)}{4}-1\right)}{\left(-\frac{1}{2}+\frac{i\sqrt{3}}{2}\right)^3\left(4\left(4c_1x^3+4\sqrt{4c_1^3x^9+c_1^2x^6}\right)^{\frac{1}{3}}-\frac{16x^3c_1}{\left(4c_1x^3+4\sqrt{4c_1^3x^9+c_1^2x^6}\right)^{\frac{1}{3}}}\right)}$$

$$y(x)=$$

$$-\frac{8x\left(-\frac{\left(4c_1x^3+4\sqrt{4c_1^3x^9+c_1^2x^6}\right)^{\frac{1}{3}}}{2}+\frac{2x^3c_1}{\left(4c_1x^3+4\sqrt{4c_1^3x^9+c_1^2x^6}\right)^{\frac{1}{3}}}-i\sqrt{3}\left(\frac{\left(4c_1x^3+4\sqrt{4c_1^3x^9+c_1^2x^6}\right)^{\frac{1}{3}}}{2}+\frac{2x^3c_1}{\left(4c_1x^3+4\sqrt{4c_1^3x^9+\right.}\right.\right.}{-2\left(4c_1x^3+4\sqrt{4c_1^3x^9+c_1^2x^6}\right)^{\frac{1}{3}}+\frac{8x^3c_1}{\left(4c_1x^3+4\sqrt{4c_1^3x^9+c_1^2x^6}\right)^{\frac{1}{3}}}-4i\sqrt{3}\left(\frac{\left(4c_1x^3+4\sqrt{4c_1^3x^9+c_1^2x^6}\right)^{\frac{1}{3}}}{2}+\frac{2}{\left(4c_1x^3+4\sqrt{\right.}\right.}$$

$$y(x)=$$

$$-\frac{8x\left(-\frac{\left(4c_1x^3+4\sqrt{4c_1^3x^9+c_1^2x^6}\right)^{\frac{1}{3}}}{2}+\frac{2x^3c_1}{\left(4c_1x^3+4\sqrt{4c_1^3x^9+c_1^2x^6}\right)^{\frac{1}{3}}}+i\sqrt{3}\left(\frac{\left(4c_1x^3+4\sqrt{4c_1^3x^9+c_1^2x^6}\right)^{\frac{1}{3}}}{2}+\frac{2x^3c_1}{\left(4c_1x^3+4\sqrt{4c_1^3x^9+\right.}\right.\right.}{-2\left(4c_1x^3+4\sqrt{4c_1^3x^9+c_1^2x^6}\right)^{\frac{1}{3}}+\frac{13}{\frac{8x^3c_1}{\left(4c_1x^3+4\sqrt{4c_1^3x^9+c_1^2x^6}\right)^{\frac{1}{3}}}}+4i\sqrt{3}\left(\frac{\left(4c_1x^3+4\sqrt{4c_1^3x^9+c_1^2x^6}\right)^{\frac{1}{3}}}{2}+\frac{2}{\left(4c_1x^3+4\sqrt{\right.}\right.}$$

✓ Solution by Mathematica

Time used: 54.579 (sec). Leaf size: 496

```
DSolve[(2*x-y[x])-y[x]*y'[x]==0,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to \frac{\sqrt[3]{2x^3+\sqrt{e^{6c_1}-4e^{3c_1}x^3}-e^{3c_1}}}{\sqrt[3]{2}}+\frac{\sqrt[3]{2}x^2}{\sqrt[3]{2x^3+\sqrt{e^{6c_1}-4e^{3c_1}x^3}-e^{3c_1}}}-x$$

$$y(x) \to \frac{i\left(\sqrt{3}+i\right)\sqrt[3]{2x^3+\sqrt{e^{6c_1}-4e^{3c_1}x^3}-e^{3c_1}}}{2\sqrt[3]{2}}-\frac{\left(1+i\sqrt{3}\right)x^2}{2^{2/3}\sqrt[3]{2x^3+\sqrt{e^{6c_1}-4e^{3c_1}x^3}-e^{3c_1}}}-x$$

$$y(x) \to -\frac{\left(1+i\sqrt{3}\right)\sqrt[3]{2x^3+\sqrt{e^{6c_1}-4e^{3c_1}x^3}-e^{3c_1}}}{2\sqrt[3]{2}}+\frac{i\left(\sqrt{3}+i\right)x^2}{2^{2/3}\sqrt[3]{2x^3+\sqrt{e^{6c_1}-4e^{3c_1}x^3}-e^{3c_1}}}-x$$

$$y(x) \to \sqrt[3]{x^3}+\frac{\left(x^3\right)^{2/3}}{x}-x$$

$$y(x) \to \frac{1}{2}\left(i\left(\sqrt{3}+i\right)\sqrt[3]{x^3}+\frac{\left(-1-i\sqrt{3}\right)\left(x^3\right)^{2/3}}{x}-2x\right)$$

$$y(x) \to \frac{1}{2}\left(\left(-1-i\sqrt{3}\right)\sqrt[3]{x^3}+\frac{i\left(\sqrt{3}+i\right)\left(x^3\right)^{2/3}}{x}-2x\right)$$

1.10 problem 17

Internal problem ID [13734]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 17.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' + 2y = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 10

```
dsolve(diff(y(x),x)+2*y(x)=0,y(x), singsol=all)
```

$$y(x) = \mathrm{e}^{-2x} c_1$$

✓ Solution by Mathematica

Time used: 0.022 (sec). Leaf size: 18

```
DSolve[y'[x]+2*y[x]==0,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to c_1 e^{-2x}$$
$$y(x) \to 0$$

1.11 problem 18

Internal problem ID [13735]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 18.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' + yx = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 12

```
dsolve(diff(y(x),x)+x*y(x)=0,y(x), singsol=all)
```

$$y(x) = c_1 \mathrm{e}^{-\frac{x^2}{2}}$$

✓ Solution by Mathematica

Time used: 0.021 (sec). Leaf size: 22

```
DSolve[y'[x]+x*y[x]==0,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to c_1 e^{-\frac{x^2}{2}}$$
$$y(x) \to 0$$

1.12 problem 19

Internal problem ID [13736]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 19.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[[_linear, 'class A']]`

$$\boxed{y' + y = \sin(x)}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 19

```
dsolve(diff(y(x),x)+y(x)=sin(x),y(x), singsol=all)
```

$$y(x) = \frac{\sin(x)}{2} - \frac{\cos(x)}{2} + c_1 \mathrm{e}^{-x}$$

✓ Solution by Mathematica

Time used: 0.056 (sec). Leaf size: 25

```
DSolve[y'[x]+y[x]==Sin[x],y[x],x,IncludeSingularSolutions -> True]
```

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

1.13 problem 20

Internal problem ID [13737]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 20.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _missing_x]]`

$$\boxed{y'' - y' - 12y = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 17

```
dsolve(diff(y(t),t$2)-diff(y(t),t)-12*y(t)=0,y(t), singsol=all)
```

$$y = c_1 \mathrm{e}^{4t} + c_2 \mathrm{e}^{-3t}$$

✓ Solution by Mathematica

Time used: 0.014 (sec). Leaf size: 22

```
DSolve[y''[t]-y'[t]-12*y[t]==0,y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to e^{-3t}\left(c_2 e^{7t} + c_1\right)$$

1.14 problem 21

Internal problem ID [13738]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 21.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _missing_x]]`

$$\boxed{y'' + 9y' = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 12

```
dsolve(diff(y(t),t$2)+9*diff(y(t),t)=0,y(t), singsol=all)
```

$$y = c_1 + c_2 \mathrm{e}^{-9t}$$

✓ Solution by Mathematica

Time used: 0.015 (sec). Leaf size: 19

```
DSolve[y''[t]+9*y'[t]==0,y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to c_2 - \frac{1}{9} c_1 e^{-9t}$$

1.15 problem 22

Internal problem ID [13739]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 22.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _missing_x]]`

$$\boxed{x'' + 2x' - 10x = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 26

```
dsolve(diff(x(t),t$2)+2*diff(x(t),t)-10*x(t)=0,x(t), singsol=all)
```

$$x(t) = c_1 \mathrm{e}^{\left(-1+\sqrt{11}\right)t} + c_2 \mathrm{e}^{-\left(1+\sqrt{11}\right)t}$$

✓ Solution by Mathematica

Time used: 0.023 (sec). Leaf size: 34

```
DSolve[x''[t]+2*x'[t]-10*x[t]==0,x[t],t,IncludeSingularSolutions -> True]
```

$$x(t) \to e^{-\left(\left(1+\sqrt{11}\right)t\right)}\left(c_2 e^{2\sqrt{11}t} + c_1\right)$$

1.16 problem 23

Internal problem ID [13740]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 23.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _linear, _nonhomogeneous]]`

$$\boxed{x'' + x = t\cos(t) - \cos(t)}$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 32

```
dsolve(diff(x(t),t$2)+x(t)=t*cos(t)-cos(t),x(t), singsol=all)
```

$$x(t) = c_2 \sin(t) + c_1 \cos(t) + \frac{(t^2 - 2t - 1)\sin(t)}{4} + \frac{\cos(t)(t-2)}{4}$$

✓ Solution by Mathematica

Time used: 0.089 (sec). Leaf size: 38

```
DSolve[x''[t]+x[t]==t*Cos[t]-Cos[t],x[t],t,IncludeSingularSolutions -> True]
```

$$x(t) \to \frac{1}{8}\left(\left(2t^2 - 4t - 1 + 8c_2\right)\sin(t) + 2(t - 2 + 4c_1)\cos(t)\right)$$

1.17 problem 24

Internal problem ID [13741]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 24.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _missing_x]]`

$$\boxed{y'' - 12y' + 40y = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 25

```
dsolve(diff(y(x),x$2)-12*diff(y(x),x)+40*y(x)=0,y(x), singsol=all)
```

$$y(x) = c_1 \mathrm{e}^{6x} \sin(2x) + c_2 \mathrm{e}^{6x} \cos(2x)$$

✓ Solution by Mathematica

Time used: 0.017 (sec). Leaf size: 26

```
DSolve[y''[x]-12*y'[x]+40*y[x]==0,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to e^{6x}(c_2 \cos(2x) + c_1 \sin(2x))$$

1.18 problem 25

Internal problem ID [13742]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 25.
ODE order: 3.
ODE degree: 1.

CAS Maple gives this as type `[[_3rd_order, _missing_x]]`

$$\boxed{y''' - 4y'' = 0}$$

✓ Solution by Maple

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

```
dsolve(diff(y(x),x$3)-4*diff(y(x),x$2)=0,y(x), singsol=all)
```

$$y(x) = c_2 x + c_1 + \mathrm{e}^{4x} c_3$$

✓ Solution by Mathematica

Time used: 0.035 (sec). Leaf size: 23

```
DSolve[y'''[x]-4*y''[x]==0,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to \frac{1}{16} c_1 e^{4x} + c_3 x + c_2$$

1.19 problem 26

Internal problem ID [13743]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 26.
ODE order: 3.
ODE degree: 1.

CAS Maple gives this as type `[[_3rd_order, _missing_x]]`

$$\boxed{y''' - 2y'' = 0}$$

✓ Solution by Maple

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

```
dsolve(diff(y(x),x$3)-2*diff(y(x),x$2)=0,y(x), singsol=all)
```

$$y(x) = c_2 x + c_1 + \mathrm{e}^{2x} c_3$$

✓ Solution by Mathematica

Time used: 0.035 (sec). Leaf size: 23

```
DSolve[y'''[x]-2*y''[x]==0,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to \frac{1}{4} c_1 e^{2x} + c_3 x + c_2$$

1.20 problem 27

Internal problem ID [13744]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 27.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_Emden, _Fowler]]`

$$\boxed{x^2y'' - 12y'x + 42y = 0}$$

✓ Solution by Maple

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

```
dsolve(x^2*diff(y(x),x$2)-12*x*diff(y(x),x)+42*y(x)=0,y(x), singsol=all)
```

$$y(x) = c_1x^7 + c_2x^6$$

✓ Solution by Mathematica

Time used: 0.011 (sec). Leaf size: 16

```
DSolve[x^2*y''[x]-12*x*y'[x]+42*y[x]==0,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to x^6(c_2x + c_1)$$

1.21 problem 28

Internal problem ID [13745]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 28.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_Emden, _Fowler]]`

$$\boxed{t^2y'' + 3ty' + 5y = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 25

```
dsolve(t^2*diff(y(t),t$2)+3*t*diff(y(t),t)+5*y(t)=0,y(t), singsol=all)
```

$$y = \frac{c_1 \sin(2\ln(t))}{t} + \frac{c_2 \cos(2\ln(t))}{t}$$

✓ Solution by Mathematica

Time used: 0.028 (sec). Leaf size: 26

```
DSolve[t^2*y''[t]+3*t*y'[t]+5*y[t]==0,y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{c_2 \cos(2\log(t)) + c_1 \sin(2\log(t))}{t}$$

1.22 problem 29

Internal problem ID [13746]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 29.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' + \frac{x}{y} = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 27

```
dsolve(diff(y(x),x)=-x/y(x),y(x), singsol=all)
```

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

✓ Solution by Mathematica

Time used: 0.201 (sec). Leaf size: 39

```
DSolve[y'[x]==-x/y[x],y[x],x,IncludeSingularSolutions -> True]
```

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

1.23 problem 30

Internal problem ID [13747]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 30.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[[_homogeneous, 'class G'], _exact, _rational, [_Abel, '2nd ty`

$$\boxed{3y\left(t^2+y\right)+t\left(t^2+6y\right)y'=0}$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 47

```
dsolve(3*y(t)*(t^2+y(t))+t*(t^2+6*y(t))*diff(y(t),t)=0,y(t), singsol=all)
```

$$y=\frac{-t^3+\sqrt{t^6+12c_1t}}{6t}$$
$$y=-\frac{t^3+\sqrt{t^6+12c_1t}}{6t}$$

✓ Solution by Mathematica

Time used: 0.003 (sec). Leaf size: 114

```
DSolve[3*y[t]*(t^2+y[t])+t*(t^2+6*y[t])*y'[x]==0,y[t],t,IncludeSingularSolutions -> True]
```

$$y(t)\to\frac{1}{6}\left(-\sqrt{3}\sqrt{t^2\left(3t^2+8ty'(x)+12y'(x)^2\right)}-3t^2-6ty'(x)\right)$$
$$y(t)\to\frac{1}{6}\left(\sqrt{3}\sqrt{t^2\left(3t^2+8ty'(x)+12y'(x)^2\right)}-3t^2-6ty'(x)\right)$$

1.24 problem 31

Internal problem ID [13748]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 31.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y' + \frac{2y}{x} = -3}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 13

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

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

✓ Solution by Mathematica

Time used: 0.022 (sec). Leaf size: 15

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

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

1.25 problem 32

Internal problem ID [13749]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 32.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_exact, [_1st_order, '_with_symmetry_[F(x),G(y)]'], [_Abel, '`

$$\boxed{y\cos(t)+(2y+\sin(t))\,y'=0}$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 41

```
dsolve(y(t)*cos(t)+(2*y(t)+sin(t))*diff(y(t),t)=0,y(t), singsol=all)
```

$$y=-\frac{\sin(t)}{2}-\frac{\sqrt{\sin(t)^2-4c_1}}{2}$$
$$y=-\frac{\sin(t)}{2}+\frac{\sqrt{\sin(t)^2-4c_1}}{2}$$

✓ Solution by Mathematica

Time used: 0.151 (sec). Leaf size: 60

```
DSolve[y[t]*Cos[t]+(2*y[t]+Sin[t])*y'[t]==0,y[t],t,IncludeSingularSolutions -> True]
```

$$y(t)\to\frac{1}{2}\left(-\sin(t)-\sqrt{\sin^2(t)+4c_1}\right)$$
$$y(t)\to\frac{1}{2}\left(-\sin(t)+\sqrt{\sin^2(t)+4c_1}\right)$$
$$y(t)\to 0$$

1.26 problem 33

Internal problem ID [13750]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 33.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_exact]`

$$\boxed{\frac{y}{x}+\cos\left(y\right)+\left(\ln\left(x\right)-x\sin\left(y\right)\right)y'=0}$$

✓ Solution by Maple

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

```
dsolve((y(x)/x+cos(y(x)))+(ln(x)-x*sin(y(x)))*diff(y(x),x)=0,y(x), singsol=all)
```

$$\cos\left(y(x)\right)x+\ln\left(x\right)y(x)+c_1=0$$

✓ Solution by Mathematica

Time used: 0.221 (sec). Leaf size: 19

```
DSolve[(y[x]/x+Cos[y[x]])+(Log[x]-x*Sin[y[x]])*y'[x]==0,y[x],x,IncludeSingularSolutions -> T
```

$$\text{Solve}[-y(x)\log(x)-x\cos(y(x))=c_1,y(x)]$$

1.27 problem 34

Internal problem ID [13751]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 34.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 31

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

$$y(x) = \frac{1}{12}x^{12} - x^{10} + \frac{9}{2}x^8 - 9x^6 + \frac{27}{4}x^4 + c_1$$

✓ Solution by Mathematica

Time used: 0.002 (sec). Leaf size: 39

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

$$y(x) \to \frac{x^{12}}{12} - x^{10} + \frac{9x^8}{2} - 9x^6 + \frac{27x^4}{4} + c_1$$

1.28 problem 35

Internal problem ID [13752]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 35.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' = x \sin\left(x^2\right)}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 12

```
dsolve(diff(y(x),x)=x*sin(x^2),y(x), singsol=all)
```

$$y(x) = -\frac{\cos\left(x^2\right)}{2} + c_1$$

✓ Solution by Mathematica

Time used: 0.014 (sec). Leaf size: 16

```
DSolve[y'[x]==x*Sin[x^2],y[x],x,IncludeSingularSolutions -> True]
```

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

1.29 problem 36

Internal problem ID [13753]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 36.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' = \frac{x}{\sqrt{x^2 - 16}}}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 20

```
dsolve(diff(y(x),x)=x/sqrt(x^2-16),y(x), singsol=all)
```

$$y(x) = \frac{(x-4)(x+4)}{\sqrt{x^2-16}} + c_1$$

✓ Solution by Mathematica

Time used: 0.004 (sec). Leaf size: 17

```
DSolve[y'[x]==x/Sqrt[x^2-16],y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to \sqrt{x^2 - 16} + c_1$$

1.30 problem 37

Internal problem ID [13754]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 37.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' = \frac{1}{x \ln(x)}}$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 9

```
dsolve(diff(y(x),x)=1/(x*ln(x)),y(x), singsol=all)
```

$$y(x) = \ln(\ln(x)) + c_1$$

✓ Solution by Mathematica

Time used: 0.006 (sec). Leaf size: 11

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

$$y(x) \to \log(\log(x)) + c_1$$

1.31 problem 38

Internal problem ID [13755]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 38.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' = x \ln(x)}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 18

```
dsolve(diff(y(x),x)=x*ln(x),y(x), singsol=all)
```

$$y(x) = \frac{\ln(x)\, x^2}{2} - \frac{x^2}{4} + c_1$$

✓ Solution by Mathematica

Time used: 0.003 (sec). Leaf size: 24

```
DSolve[y'[x]==x*Log[x],y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to -\frac{x^2}{4} + \frac{1}{2}x^2 \log(x) + c_1$$

1.32 problem 39

Internal problem ID [13756]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 39.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' = x\,\mathrm{e}^{-x}}$$

✓ Solution by Maple

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

```
dsolve(diff(y(x),x)=x*exp(-x),y(x), singsol=all)
```

$$y(x) = -(x+1)\,\mathrm{e}^{-x} + c_1$$

✓ Solution by Mathematica

Time used: 0.012 (sec). Leaf size: 18

```
DSolve[y'[x]==x*Exp[-x],y[x],x,IncludeSingularSolutions -> True]
```

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

1.33 problem 40

Internal problem ID [13757]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 40.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' = \frac{-2x - 10}{(x+2)(x-4)}}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 16

```
dsolve(diff(y(x),x)=(-2*(x+5))/((x+2)*(x-4)),y(x), singsol=all)
```

$$y(x) = \ln(x+2) - 3\ln(x-4) + c_1$$

✓ Solution by Mathematica

Time used: 0.005 (sec). Leaf size: 20

```
DSolve[y'[x]==(-2*(x+5))/((x+2)*(x-4)),y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to -3\log(4-x) + \log(x+2) + c_1$$

1.34 problem 41

Internal problem ID [13758]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 41.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 14

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

$$y(x) = -\ln(x+1) + \arctan(x) + c_1$$

✓ Solution by Mathematica

Time used: 0.009 (sec). Leaf size: 16

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

$$y(x) \to \arctan(x) - \log(x+1) + c_1$$

1.35 problem 42

Internal problem ID [13759]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 42.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' = \frac{\sqrt{x^2-16}}{x}}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 25

```
dsolve(diff(y(x),x)=sqrt(x^2-16)/x,y(x), singsol=all)
```

$$y(x) = \sqrt{x^2-16} + 4\arctan\left(\frac{4}{\sqrt{x^2-16}}\right) + c_1$$

✓ Solution by Mathematica

Time used: 0.016 (sec). Leaf size: 33

```
DSolve[y'[x]==Sqrt[x^2-16]/x,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to -4\arctan\left(\frac{\sqrt{x^2-16}}{4}\right) + \sqrt{x^2-16} + c_1$$

1.36 problem 43

Internal problem ID [13760]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 43.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' = \left(-x^2+4\right)^{\frac{3}{2}}}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 36

```
dsolve(diff(y(x),x)=(4-x^2)^(3/2),y(x), singsol=all)
```

$$y(x) = \frac{x\left(-x^2+4\right)^{\frac{3}{2}}}{4} + \frac{3\sqrt{-x^2+4}\,x}{2} + 6\arcsin\left(\frac{x}{2}\right) + c_1$$

✓ Solution by Mathematica

Time used: 0.062 (sec). Leaf size: 49

```
DSolve[y'[x]==(4-x^2)^(3/2),y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to -12\arctan\left(\frac{\sqrt{4-x^2}}{x+2}\right) - \frac{1}{4}x\sqrt{4-x^2}\left(x^2-10\right) + c_1$$

1.37 problem 44

Internal problem ID [13761]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 44.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' = \frac{1}{x^2 - 16}}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 18

```
dsolve(diff(y(x),x)=1/(x^2-16),y(x), singsol=all)
```

$$y(x) = -\frac{\ln(x+4)}{8} + \frac{\ln(x-4)}{8} + c_1$$

✓ Solution by Mathematica

Time used: 0.004 (sec). Leaf size: 26

```
DSolve[y'[x]==1/(x^2-16),y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to \frac{1}{8}(\log(4-x) - \log(x+4) + 8c_1)$$

1.38 problem 45

Internal problem ID [13762]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 45.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' = \cos(x)\cot(x)}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 16

```
dsolve(diff(y(x),x)=cos(x)*cot(x),y(x), singsol=all)
```

$$y(x) = \cos(x) + \ln(\csc(x) - \cot(x)) + c_1$$

✓ Solution by Mathematica

Time used: 0.021 (sec). Leaf size: 26

```
DSolve[y'[x]==Cos[x]*Cot[x],y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to \cos(x) + \log\left(\sin\left(\frac{x}{2}\right)\right) - \log\left(\cos\left(\frac{x}{2}\right)\right) + c_1$$

1.39 problem 46

Internal problem ID [13763]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 46.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' = \sin(x)^3 \tan(x)}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 22

```
dsolve(diff(y(x),x)=sin(x)^3*tan(x),y(x), singsol=all)
```

$$y(x) = -\frac{\sin(x)^3}{3} - \sin(x) + \ln(\sec(x) + \tan(x)) + c_1$$

✓ Solution by Mathematica

Time used: 0.014 (sec). Leaf size: 23

```
DSolve[y'[x]==Sin[x]^3*Tan[x],y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to \operatorname{arctanh}(\sin(x)) - \frac{1}{3}\sin^3(x) - \sin(x) + c_1$$

1.40 problem 47

Internal problem ID [13764]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 47.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' + 2y = 0}$$

With initial conditions

$$[y(0) = 2]$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 10

```
dsolve([diff(y(x),x)+2*y(x)=0,y(0) = 2],y(x), singsol=all)
```

$$y(x) = 2\,\mathrm{e}^{-2x}$$

✓ Solution by Mathematica

Time used: 0.072 (sec). Leaf size: 12

```
DSolve[{y'[x]+2*y[x]==0,{y[0]==2}},y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to 2e^{-2x}$$

1.41 problem 48

Internal problem ID [13765]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 48.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[[_linear, 'class A']]`

$$\boxed{y' + y = \sin(t)}$$

With initial conditions

$$[y(0) = -1]$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 19

```
dsolve([diff(y(t),t)+y(t)=sin(t),y(0) = -1],y(t), singsol=all)
```

$$y = -\frac{\cos(t)}{2} + \frac{\sin(t)}{2} - \frac{e^{-t}}{2}$$

✓ Solution by Mathematica

Time used: 0.057 (sec). Leaf size: 23

```
DSolve[{y'[t]+y[t]==Sin[t],{y[0]==-1}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{2}\left(-e^{-t} + \sin(t) - \cos(t)\right)$$

1.42 problem 49

Internal problem ID [13766]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 49.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _missing_x]]`

$$\boxed{y'' - y' - 12y = 0}$$

With initial conditions

$$[y(0) = 1, y'(0) = -1]$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 18

```
dsolve([diff(y(x),x$2)-diff(y(x),x)-12*y(x)=0,y(0) = 1, D(y)(0) = -1],y(x), singsol=all)
```

$$y(x) = \frac{(2\,\mathrm{e}^{7x} + 5)\,\mathrm{e}^{-3x}}{7}$$

✓ Solution by Mathematica

Time used: 0.024 (sec). Leaf size: 23

```
DSolve[{y''[x]-y'[x]-12*y[x]==0,{y[0]==1,y'[0]==-1}},y[x],x,IncludeSingularSolutions -> True
```

$$y(x) \to \frac{1}{7}e^{-3x}\left(2e^{7x} + 5\right)$$

1.43 problem 50

Internal problem ID [13767]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 50.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _missing_x]]`

$$\boxed{y'' + 9y' = 0}$$

With initial conditions

$$[y(0) = 2, y'(0) = -1]$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 12

```
dsolve([diff(y(x),x$2)+9*diff(y(x),x)=0,y(0) = 2, D(y)(0) = -1],y(x), singsol=all)
```

$$y(x) = \frac{17}{9} + \frac{\mathrm{e}^{-9x}}{9}$$

✓ Solution by Mathematica

Time used: 0.014 (sec). Leaf size: 16

```
DSolve[{y''[x]+9*y'[x]==0,{y[0]==2,y'[0]==-1}},y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to \frac{1}{9}\left(e^{-9x} + 17\right)$$

1.44 problem 51

Internal problem ID [13768]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 51.
ODE order: 3.
ODE degree: 1.

CAS Maple gives this as type `[[_3rd_order, _missing_x]]`

$$\boxed{y''' - 2y'' = 0}$$

With initial conditions

$$[y(0) = 0, y'(0) = 1, y''(0) = 3]$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 15

```
dsolve([diff(y(x),x$3)-2*diff(y(x),x$2)=0,y(0) = 0, D(y)(0) = 1, (D@@2)(y)(0) = 3],y(x), sin
```

$$y(x) = -\frac{3}{4} - \frac{x}{2} + \frac{3\,\mathrm{e}^{2x}}{4}$$

✓ Solution by Mathematica

Time used: 0.033 (sec). Leaf size: 21

```
DSolve[{y'''[x]-2*y''[x]==0,{y[0]==0,y'[0]==1,y''[0]==3}},y[x],x,IncludeSingularSolutions ->
```

$$y(x) \to \frac{1}{4}\left(-2x + 3e^{2x} - 3\right)$$

1.45 problem 52

Internal problem ID [13769]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 52.
ODE order: 3.
ODE degree: 1.

CAS Maple gives this as type `[[_3rd_order, _missing_x]]`

$$\boxed{y''' - 4y' = 0}$$

With initial conditions

$$[y(0) = 1, y'(0) = -1, y''(0) = 0]$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 18

```
dsolve([diff(y(x),x$3)-4*diff(y(x),x)=0,y(0) = 1, D(y)(0) = -1, (D@@2)(y)(0) = 0],y(x), sing
```

$$y(x) = 1 + \frac{\mathrm{e}^{-2x}}{4} - \frac{\mathrm{e}^{2x}}{4}$$

✓ Solution by Mathematica

Time used: 0.026 (sec). Leaf size: 23

```
DSolve[{y'''[x]-4*y'[x]==0,{y[0]==1,y'[0]==-1,y''[0]==0}},y[x],x,IncludeSingularSolutions ->
```

$$y(x) \to \frac{1}{4}\left(e^{-2x} - e^{2x} + 4\right)$$

1.46 problem 53

Internal problem ID [13770]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 53.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_Emden, _Fowler]]`

$$\boxed{t^2y'' - 12ty' + 42y = 0}$$

With initial conditions

$$[y(1) = 0, y'(1) = -1]$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 13

```
dsolve([t^2*diff(y(t),t$2)-12*t*diff(y(t),t)+42*y(t)=0,y(1) = 0, D(y)(1) = -1],y(t), singsol
```

$$y = -t^7 + t^6$$

✓ Solution by Mathematica

Time used: 0.01 (sec). Leaf size: 13

```
DSolve[{t^2*y''[t]-12*t*y'[t]+42*y[t]==0,{y[1]==0,y'[1]==-1}},y[t],t,IncludeSingularSolution
```

$$y(t) \to -\left((t-1)t^6\right)$$

1.47 problem 54

Internal problem ID [13771]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 54.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_Emden, _Fowler]]`

$$\boxed{x^2y'' + 3y'x + 5y = 0}$$

With initial conditions

$$[y(1) = 0, y'(1) = 1]$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 14

```
dsolve([x^2*diff(y(x),x$2)+3*x*diff(y(x),x)+5*y(x)=0,y(1) = 0, D(y)(1) = 1],y(x), singsol=al
```

$$y(x) = \frac{\sin(2\ln(x))}{2x}$$

✓ Solution by Mathematica

Time used: 0.032 (sec). Leaf size: 15

```
DSolve[{x^2*y''[x]+3*x*y'[x]+5*y[x]==0,{y[1]==0,y'[1]==1}},y[x],x,IncludeSingularSolutions -
```

$$y(x) \to \frac{\sin(\log(x))\cos(\log(x))}{x}$$

1.48 problem 55

Internal problem ID [13772]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 55.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' = 4x^3 - x + 2}$$

With initial conditions

$$[y(0) = 1]$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 17

```
dsolve([diff(y(x),x)=4*x^3-x+2,y(0) = 1],y(x), singsol=all)
```

$$y(x) = x^4 - \frac{1}{2}x^2 + 1 + 2x$$

✓ Solution by Mathematica

Time used: 0.003 (sec). Leaf size: 20

```
DSolve[{y'[x]==4*x^3-x+2,{y[0]==1}},y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to x^4 - \frac{x^2}{2} + 2x + 1$$

1.49 problem 56

Internal problem ID [13773]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 56.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' = \sin(2t) - \cos(2t)}$$

With initial conditions

$$[y(0) = 0]$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 18

```
dsolve([diff(y(t),t)=sin(2*t)-cos(2*t),y(0) = 0],y(t), singsol=all)
```

$$y = -\frac{\sin(2t)}{2} - \frac{\cos(2t)}{2} + \frac{1}{2}$$

✓ Solution by Mathematica

Time used: 0.044 (sec). Leaf size: 23

```
DSolve[{y'[t]==Sin[2*t]-Cos[2*t],{y[0]==0}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{2}(-\sin(2t) - \cos(2t) + 1)$$

1.50 problem 57

Internal problem ID [13774]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 57.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' = \frac{\cos\left(\frac{1}{x}\right)}{x^2}}$$

With initial conditions

$$\left[y\left(\frac{2}{\pi}\right) = 1\right]$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 12

```
dsolve([diff(y(x),x)=cos(1/x)/x^2,y(2/Pi) = 1],y(x), singsol=all)
```

$$y(x) = -\sin\left(\frac{1}{x}\right) + 2$$

✓ Solution by Mathematica

Time used: 0.008 (sec). Leaf size: 13

```
DSolve[{y'[x]==Cos[1/x]/x^2,{y[2/Pi]==1}},y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to 2 - \sin\left(\frac{1}{x}\right)$$

1.51 problem 58

Internal problem ID [13775]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 58.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' = \frac{\ln(x)}{x}}$$

With initial conditions

$$[y(1) = 0]$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 10

```
dsolve([diff(y(x),x)=ln(x)/x,y(1) = 0],y(x), singsol=all)
```

$$y(x) = \frac{\ln(x)^2}{2}$$

✓ Solution by Mathematica

Time used: 0.004 (sec). Leaf size: 13

```
DSolve[{y'[x]==Log[x]/x,{y[1]==0}},y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to \frac{\log^2(x)}{2}$$

1.52 problem 72

Internal problem ID [13776]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 72.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - \frac{(x-4)\,y^3}{x^3\,(y-2)} = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 75

```
dsolve(diff(y(x),x)=(x-4)*y(x)^3/(x^3*(y(x)-2)),y(x), singsol=all)
```

$$y(x) = -\frac{\left(x + \sqrt{4c_1x^2 + x^2 - 4x + 8}\right)x}{2\left(c_1x^2 - x + 2\right)}$$
$$y(x) = \frac{\left(-x + \sqrt{4c_1x^2 + x^2 - 4x + 8}\right)x}{2c_1x^2 - 2x + 4}$$

✓ Solution by Mathematica

Time used: 0.66 (sec). Leaf size: 91

```
DSolve[y'[x]==(x-4)*y[x]^3/(x^3*(y[x]-2)),y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to \frac{x\left(-x + \sqrt{x^2 + 4c_1x^2 - 4x + 8}\right)}{2c_1x^2 - 2x + 4}$$
$$y(x) \to -\frac{x\left(x + \sqrt{x^2 + 4c_1x^2 - 4x + 8}\right)}{2c_1x^2 - 2x + 4}$$
$$y(x) \to 0$$

1.53 problem 73

Internal problem ID [13777]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 73.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[[_homogeneous, 'class A'], _rational, _Bernoulli]`

$$\boxed{y' - \frac{y^2 + 2xy}{x^2} = 0}$$

✓ Solution by Maple

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

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

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

✓ Solution by Mathematica

Time used: 0.124 (sec). Leaf size: 23

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

$$y(x) \to -\frac{x^2}{x - c_1}$$
$$y(x) \to 0$$

1.54 problem 75

Internal problem ID [13778]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 75.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y'x + y = \cos(x)}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 12

```
dsolve(x*diff(y(x),x)+y(x)=cos(x),y(x), singsol=all)
```

$$y(x) = \frac{\sin(x) + c_1}{x}$$

✓ Solution by Mathematica

Time used: 0.035 (sec). Leaf size: 14

```
DSolve[x*y'[x]+y[x]==Cos[x],y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to \frac{\sin(x) + c_1}{x}$$

1.55 problem 76

Internal problem ID [13779]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 76.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _missing_x]]`

$$\boxed{16y'' + 24y' + 153y = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 25

```
dsolve(16*diff(y(x),x$2)+24*diff(y(x),x)+153*y(x)=0,y(x), singsol=all)
```

$$y(x) = c_1 \mathrm{e}^{-\frac{3x}{4}} \sin(3x) + c_2 \mathrm{e}^{-\frac{3x}{4}} \cos(3x)$$

✓ Solution by Mathematica

Time used: 0.018 (sec). Leaf size: 28

```
DSolve[16*y''[x]+24*y'[x]+153*y[x]==0,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to e^{-3x/4}(c_2 \cos(3x) + c_1 \sin(3x))$$

1.56 problem 77

Internal problem ID [13780]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 77.
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = 4y(t)$$
$$y'(t) = -x(t) - 2y(t)$$

✓ Solution by Maple

Time used: 0.032 (sec). Leaf size: 77

```
dsolve([diff(x(t),t)=4*y(t),diff(y(t),t)=-x(t)-2*y(t)],[x(t), y(t)], singsol=all)
```

$$x(t) = \mathrm{e}^{-t}\left(\sqrt{3}\,\sin\left(\sqrt{3}\,t\right)c_2 - \sqrt{3}\,\cos\left(\sqrt{3}\,t\right)c_1 - \sin\left(\sqrt{3}\,t\right)c_1 - \cos\left(\sqrt{3}\,t\right)c_2\right)$$
$$y = \mathrm{e}^{-t}\left(\sin\left(\sqrt{3}\,t\right)c_1 + \cos\left(\sqrt{3}\,t\right)c_2\right)$$

✓ Solution by Mathematica

Time used: 0.034 (sec). Leaf size: 93

```
DSolve[{x'[t]==4*y[t],y'[t]==-x[t]-2*y[t]},{x[t],y[t]},t,IncludeSingularSolutions -> True]
```

$$x(t) \to \frac{1}{3}e^{-t}\left(3c_1\cos\left(\sqrt{3}t\right) + \sqrt{3}(c_1+4c_2)\sin\left(\sqrt{3}t\right)\right)$$
$$y(t) \to \frac{1}{3}e^{-t}\left(3c_2\cos\left(\sqrt{3}t\right) - \sqrt{3}(c_1+c_2)\sin\left(\sqrt{3}t\right)\right)$$

1.57 problem 79

Internal problem ID [13781]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 79.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_rational]`

$$\boxed{4x\left(y^2+x^2\right)-5y+4y\left(x^2+y^2-5x\right)y'=0}$$

✗ Solution by Maple

```
dsolve((4*x*(x^2+y(x)^2)-5*y(x))+(4*y(x)*(x^2+y(x)^2-5*x))*diff(y(x),x)=0,y(x), singsol=all)
```

No solution found

✗ Solution by Mathematica

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

```
DSolve[(4*x*(x^2+y[x]^2)-5*y[x])+(4*y[x]*(x^2+y[x]^2-5*x))*y'[x]==0,y[x],x,IncludeSingularSo
```

Not solved

1.58 problem 80

Internal problem ID [13782]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 80.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' = \sin(x)^4}$$

With initial conditions

$$[y(0) = 0]$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 20

```
dsolve([diff(y(x),x)=sin(x)^4,y(0) = 0],y(x), singsol=all)
```

$$y(x) = \frac{3x}{8} - \frac{\sin(2x)}{4} + \frac{\sin(4x)}{32}$$

✓ Solution by Mathematica

Time used: 0.012 (sec). Leaf size: 23

```
DSolve[{y'[x]==Sin[x]^4,{y[0]==0}},y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to \frac{1}{32}(12x - 8\sin(2x) + \sin(4x))$$

1.59 problem 81

Internal problem ID [13783]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 81.
ODE order: 4.
ODE degree: 1.

CAS Maple gives this as type `[[_high_order, _missing_x]]`

$$\boxed{y'''' + \frac{25y''}{2} - 5y' + \frac{629y}{16} = 0}$$

With initial conditions

$$[y(0) = 0, y'(0) = 1, y''(0) = -1, y'''(0) = 1]$$

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 41

```
dsolve([diff(y(x),x$4)+25/2*diff(y(x),x$2)-5*diff(y(x),x)+629/16*y(x)=0,y(0) = 0, D(y)(0) =
```

$$y(x) = \frac{(74\cos(3x) + 20\sin(3x))\,\mathrm{e}^{-\frac{x}{2}}}{208} - \frac{37\,\mathrm{e}^{\frac{x}{2}}\left(\cos(2x) - \frac{3\sin(2x)}{2}\right)}{104}$$

✓ Solution by Mathematica

Time used: 0.01 (sec). Leaf size: 47

```
DSolve[{y''''[x]+25/2*y''[x]-5*y'[x]+629/16*y[x]==0,{y[0]==0,y'[0]==1,y''[0]==-1,y'''[0]==1}
```

$$y(x) \to \frac{1}{208}e^{-x/2}(111e^x\sin(2x) + 20\sin(3x) - 74e^x\cos(2x) + 74\cos(3x))$$

1.60 problem 82

Internal problem ID [13784]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 82.
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = 4y(t)$$
$$y'(t) = -4x(t)$$

With initial conditions

$$[x(0) = 4, y(0) = 0]$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 20

```
dsolve([diff(x(t),t) = 4*y(t), diff(y(t),t) = -4*x(t), x(0) = 4, y(0) = 0],[x(t), y(t)], sin
```

$$x(t) = 4\cos(4t)$$
$$y = -4\sin(4t)$$

✓ Solution by Mathematica

Time used: 0.002 (sec). Leaf size: 20

```
DSolve[{x'[t]==4*y[t],y'[t]==-4*x[t]},{x[0]==4,y[0]==0},{x[t],y[t]},t,IncludeSingularSolutio
```

$$x(t) \to 4\cos(4t)$$
$$y(t) \to -4\sin(4t)$$

1.61 problem 83

Internal problem ID [13785]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Exercises 1.1, page 10
Problem number: 83.
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = -5x(t) + 4y(t)$$
$$y'(t) = 2x(t) + 2y(t)$$

With initial conditions

$$[x(0) = 4, y(0) = 0]$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 34

```
dsolve([diff(x(t),t) = -5*x(t)+4*y(t), diff(y(t),t) = 2*x(t)+2*y(t), x(0) = 4, y(0) = 0],[x(
```

$$x(t) = \frac{4\,\mathrm{e}^{3t}}{9} + \frac{32\,\mathrm{e}^{-6t}}{9}$$
$$y = \frac{8\,\mathrm{e}^{3t}}{9} - \frac{8\,\mathrm{e}^{-6t}}{9}$$

✓ Solution by Mathematica

Time used: 0.008 (sec). Leaf size: 40

```
DSolve[{x'[t]==-5*x[t]+4*y[t],y'[t]==2*x[t]+2*y[t]},{x[0]==4,y[0]==0},{x[t],y[t]},t,IncludeS
```

$$x(t) \to \frac{4}{9}e^{-6t}\left(e^{9t} + 8\right)$$
$$y(t) \to \frac{8}{9}e^{-6t}\left(e^{9t} - 1\right)$$

2 Chapter 1. Introduction to Differential Equations. Review exercises, page 23

2.1 problem 6

Internal problem ID [13786]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Review exercises, page 23
Problem number: 6.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' + y\cos(x) = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 11

```
dsolve(diff(y(x),x)+y(x)*cos(x)=0,y(x), singsol=all)
```

$$y(x) = c_1 \mathrm{e}^{-\sin(x)}$$

✓ Solution by Mathematica

Time used: 0.028 (sec). Leaf size: 19

```
DSolve[y'[x]+y[x]*Cos[x]==0,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to c_1 e^{-\sin(x)}$$
$$y(x) \to 0$$

2.2 problem 7

Internal problem ID [13787]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Review exercises, page 23
Problem number: 7.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[[_linear, 'class A']]`

$$\boxed{y' - y = \sin(x)}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 17

```
dsolve(diff(y(x),x)-y(x)=sin(x),y(x), singsol=all)
```

$$y(x) = -\frac{\cos(x)}{2} - \frac{\sin(x)}{2} + \mathrm{e}^{x} c_1$$

✓ Solution by Mathematica

Time used: 0.046 (sec). Leaf size: 24

```
DSolve[y'[x]-y[x]==Sin[x],y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to -\frac{\sin(x)}{2} - \frac{\cos(x)}{2} + c_1 e^{x}$$

2.3 problem 8

Internal problem ID [13788]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Review exercises, page 23
Problem number: 8.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _missing_x]]`

$$\boxed{y'' + 4y' - 5y = 0}$$

✓ Solution by Maple

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

```
dsolve(diff(y(x),x$2)+4*diff(y(x),x)-5*y(x)=0,y(x), singsol=all)
```

$$y(x) = \mathrm{e}^{x} c_1 + c_2 \mathrm{e}^{-5x}$$

✓ Solution by Mathematica

Time used: 0.011 (sec). Leaf size: 20

```
DSolve[y''[x]+4*y'[x]-5*y[x]==0,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to c_1 e^{-5x} + c_2 e^{x}$$

2.4 problem 9

Internal problem ID [13789]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Review exercises, page 23
Problem number: 9.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _missing_x]]`

$$\boxed{y'' - 6y' + 45y = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 25

```
dsolve(diff(y(x),x$2)-6*diff(y(x),x)+45*y(x)=0,y(x), singsol=all)
```

$$y(x) = c_1 \mathrm{e}^{3x} \sin(6x) + c_2 \mathrm{e}^{3x} \cos(6x)$$

✓ Solution by Mathematica

Time used: 0.022 (sec). Leaf size: 26

```
DSolve[y''[x]-6*y'[x]+45*y[x]==0,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to e^{3x}(c_2 \cos(6x) + c_1 \sin(6x))$$

2.5 problem 10

Internal problem ID [13790]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Review exercises, page 23
Problem number: 10.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_Emden, _Fowler]]`

$$\boxed{x^2y'' - y'x - 16y = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 25

```
dsolve(x^2*diff(y(x),x$2)-x*diff(y(x),x)-16*y(x)=0,y(x), singsol=all)
```

$$y(x) = c_1 x^{1+\sqrt{17}} + c_2 x^{1-\sqrt{17}}$$

✓ Solution by Mathematica

Time used: 0.014 (sec). Leaf size: 32

```
DSolve[x^2*y''[x]-x*y'[x]-16*y[x]==0,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to x^{1-\sqrt{17}}\left(c_2 x^{2\sqrt{17}} + c_1\right)$$

2.6 problem 11

Internal problem ID [13791]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Review exercises, page 23
Problem number: 11.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_Emden, _Fowler]]`

$$\boxed{x^2y'' + 3y'x + 2y = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 21

```
dsolve(x^2*diff(y(x),x$2)+3*x*diff(y(x),x)+2*y(x)=0,y(x), singsol=all)
```

$$y(x) = \frac{c_1 \sin(\ln(x))}{x} + \frac{c_2 \cos(\ln(x))}{x}$$

✓ Solution by Mathematica

Time used: 0.024 (sec). Leaf size: 22

```
DSolve[x^2*y''[x]+3*x*y'[x]+2*y[x]==0,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to \frac{c_2 \cos(\log(x)) + c_1 \sin(\log(x))}{x}$$

2.7 problem 12

Internal problem ID [13792]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Review exercises, page 23
Problem number: 12.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _with_linear_symmetries]]`

$$\boxed{y'' + 2y' + 2y = x}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 25

```
dsolve(diff(y(x),x$2)+2*diff(y(x),x)+2*y(x)=x,y(x), singsol=all)
```

$$y(x) = \sin(x)\,\mathrm{e}^{-x}c_2 + \cos(x)\,\mathrm{e}^{-x}c_1 + \frac{x}{2} - \frac{1}{2}$$

✓ Solution by Mathematica

Time used: 0.015 (sec). Leaf size: 33

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

$$y(x) \to \frac{x-1}{2} + c_2 e^{-x}\cos(x) + c_1 e^{-x}\sin(x)$$

2.8 problem 13

Internal problem ID [13793]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Review exercises, page 23
Problem number: 13.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _missing_x]]`

$$\boxed{y'' - 7y' + 12y = 2}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 18

```
dsolve(diff(y(x),x$2)-7*diff(y(x),x)+12*y(x)=2,y(x), singsol=all)
```

$$y(x) = \mathrm{e}^{3x} c_2 + \mathrm{e}^{4x} c_1 + \frac{1}{6}$$

✓ Solution by Mathematica

Time used: 0.013 (sec). Leaf size: 25

```
DSolve[y''[x]-7*y'[x]+12*y[x]==2,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to c_1 e^{3x} + c_2 e^{4x} + \frac{1}{6}$$

2.9 problem 14

Internal problem ID [13794]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Review exercises, page 23
Problem number: 14.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[[_homogeneous, ‘class A‘], _exact, _rational, [_Abel, ‘2nd ty`

$$\boxed{-3y + (2y - 3x)\,y' = -2x}$$

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 53

```
dsolve((2*x-3*y(x))+(2*y(x)-3*x)*diff(y(x),x)=0,y(x), singsol=all)
```

$$y(x) = \frac{\frac{3c_1 x}{2} - \frac{\sqrt{5c_1^2 x^2+4}}{2}}{c_1}$$

$$y(x) = \frac{\frac{3c_1 x}{2} + \frac{\sqrt{5c_1^2 x^2+4}}{2}}{c_1}$$

✓ Solution by Mathematica

Time used: 0.48 (sec). Leaf size: 110

```
DSolve[(2*x-3*y[x])+(2*y[x]-3*x)*y'[x]==0,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to \frac{1}{2}\left(3x - \sqrt{5x^2 + 4e^{c_1}}\right)$$
$$y(x) \to \frac{1}{2}\left(3x + \sqrt{5x^2 + 4e^{c_1}}\right)$$
$$y(x) \to \frac{1}{2}\left(3x - \sqrt{5}\sqrt{x^2}\right)$$
$$y(x) \to \frac{1}{2}\left(\sqrt{5}\sqrt{x^2} + 3x\right)$$

2.10 problem 15

Internal problem ID [13795]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Review exercises, page 23
Problem number: 15.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_exact, [_1st_order, '_with_symmetry_[F(x),G(x)*y+H(x)]']]`

$$\boxed{y \cos(xy) + x \cos(xy) y' = -\sin(x)}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 16

```
dsolve((y(x)*cos(x*y(x))+sin(x))+(x*cos(x*y(x)))*diff(y(x),x)=0,y(x), singsol=all)
```

$$y(x) = -\frac{\arcsin(-\cos(x) + c_1)}{x}$$

✓ Solution by Mathematica

Time used: 1.144 (sec). Leaf size: 15

```
DSolve[(y[x]*Cos[x*y[x]]+Sin[x])+(x*Cos[x*y[x]])*y'[x]==0,y[x],x,IncludeSingularSolutions ->
```

$$y(x) \to \frac{\arcsin(\cos(x) + c_1)}{x}$$

2.11 problem 16

Internal problem ID [13796]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Review exercises, page 23
Problem number: 16.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' = x\,\mathrm{e}^{-x^2}}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 14

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

$$y(x) = -\frac{\mathrm{e}^{-x^2}}{2} + c_1$$

✓ Solution by Mathematica

Time used: 0.013 (sec). Leaf size: 19

```
DSolve[y'[x]==x*Exp[-x^2],y[x],x,IncludeSingularSolutions -> True]
```

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

2.12 problem 17

Internal problem ID [13797]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Review exercises, page 23
Problem number: 17.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' = x^2 \sin(x)}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 22

```
dsolve(diff(y(x),x)=x^2*sin(x),y(x), singsol=all)
```

$$y(x) = -\cos(x)\, x^2 + 2\cos(x) + 2x \sin(x) + c_1$$

✓ Solution by Mathematica

Time used: 0.018 (sec). Leaf size: 22

```
DSolve[y'[x]==x^2*Sin[x],y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to -\left(x^2 - 2\right)\cos(x) + 2x \sin(x) + c_1$$

2.13 problem 18

Internal problem ID [13798]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Review exercises, page 23
Problem number: 18.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 18

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

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

✓ Solution by Mathematica

Time used: 0.007 (sec). Leaf size: 24

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

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

2.14 problem 19

Internal problem ID [13799]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Review exercises, page 23
Problem number: 19.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' = \frac{x^2}{\sqrt{x^2-1}}}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 28

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

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

✓ Solution by Mathematica

Time used: 0.028 (sec). Leaf size: 40

```
DSolve[y'[x]==x^2/Sqrt[x^2-1],y[x],x,IncludeSingularSolutions -> True]
```

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

2.15 problem 20

Internal problem ID [13800]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Review exercises, page 23
Problem number: 20.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[[_linear, 'class A']]`

$$\boxed{y' + 2y = x^2}$$

With initial conditions

$$[y(0) = 1]$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 20

```
dsolve([diff(y(x),x)+2*y(x)=x^2,y(0) = 1],y(x), singsol=all)
```

$$y(x) = \frac{x^2}{2} - \frac{x}{2} + \frac{1}{4} + \frac{3\,\mathrm{e}^{-2x}}{4}$$

✓ Solution by Mathematica

Time used: 0.048 (sec). Leaf size: 26

```
DSolve[{y'[x]+2*y[x]==x^2,{y[0]==1}},y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to \frac{1}{4}\left(2x^2 - 2x + 3e^{-2x} + 1\right)$$

2.16 problem 21

Internal problem ID [13801]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Review exercises, page 23
Problem number: 21.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _with_linear_symmetries]]`

$$\boxed{y'' + 4y = t}$$

With initial conditions

$$\left[y(0) = 1, y'\left(\frac{\pi}{4}\right) = \frac{\pi}{16}\right]$$

✗ Solution by Maple

```
dsolve([diff(y(t),t$2)+4*y(t)=t,y(0) = 1, D(y)(1/4*Pi) = 1/16*Pi],y(t), singsol=all)
```

No solution found

✗ Solution by Mathematica

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

```
DSolve[{y''[t]+4*y[t]==t,{y[0]==1,y'[Pi/4]==Pi/16}},y[t],t,IncludeSingularSolutions -> True]
```

{}

2.17 problem 22

Internal problem ID [13802]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Review exercises, page 23
Problem number: 22.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_Emden, _Fowler]]`

$$\boxed{x^2y'' + 5y'x + 4y = 0}$$

With initial conditions

$$[y(1) = 1, y'(1) = 0]$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 14

```
dsolve([x^2*diff(y(x),x$2)+5*x*diff(y(x),x)+4*y(x)=0,y(1) = 1, D(y)(1) = 0],y(x), singsol=al
```

$$y(x) = \frac{1 + 2\ln(x)}{x^2}$$

✓ Solution by Mathematica

Time used: 0.016 (sec). Leaf size: 15

```
DSolve[{x^2*y''[x]+5*x*y'[x]+4*y[x]==0,{y[1]==1,y'[1]==0}},y[x],x,IncludeSingularSolutions -
```

$$y(x) \to \frac{2\log(x) + 1}{x^2}$$

2.18 problem 23

Internal problem ID [13803]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Review exercises, page 23
Problem number: 23.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' = \cos(x)^2 \sin(x)}$$

With initial conditions

$$[y(0) = 0]$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 12

```
dsolve([diff(y(x),x)=cos(x)^2*sin(x),y(0) = 0],y(x), singsol=all)
```

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

✓ Solution by Mathematica

Time used: 0.006 (sec). Leaf size: 17

```
DSolve[{y'[x]==Cos[x]^2*Sin[x],{y[0]==0}},y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to \frac{1}{3}\left(1 - \cos^3(x)\right)$$

2.19 problem 24

Internal problem ID [13804]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 1. Introduction to Differential Equations. Review exercises, page 23
Problem number: 24.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' = \frac{4x-9}{3\left(x-3\right)^{\frac{2}{3}}}}$$

With initial conditions

$$[y(0) = 0]$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 11

```
dsolve([diff(y(x),x)=1/3*(4*x-9)*(x-3)^(-2/3),y(0) = 0],y(x), singsol=all)
```

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

✓ Solution by Mathematica

Time used: 0.04 (sec). Leaf size: 14

```
DSolve[{y'[x]==1/3*(4*x-9)*(x-3)^(-2/3),{y[0]==0}},y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to \sqrt[3]{x-3}x$$

3 Chapter 2. First Order Equations. Exercises 2.1, page 32

3.1 problem 1 (a)

Internal problem ID [13805]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 1 (a).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_Riccati]`

$$\boxed{y' - y^2 = -t^2}$$

With initial conditions

$$[y(0) = 0]$$

✓ Solution by Maple

Time used: 0.204 (sec). Leaf size: 59

```
dsolve([diff(y(t),t)+t^2=y(t)^2,y(0) = 0],y(t), singsol=all)
```

$$y = -\left(\begin{cases} 0 & t = 0 \\ \frac{\left(\text{BesselI}\left(-\frac{3}{4},\frac{t^2}{2}\right)\pi\sqrt{2}-2\,\text{BesselK}\left(\frac{3}{4},\frac{t^2}{2}\right)\right)t}{\pi\sqrt{2}\,\text{BesselI}\left(\frac{1}{4},\frac{t^2}{2}\right)+2\,\text{BesselK}\left(\frac{1}{4},\frac{t^2}{2}\right)} & \text{otherwise} \end{cases}\right)$$

✓ Solution by Mathematica

Time used: 0.663 (sec). Leaf size: 81

```
DSolve[{y'[t]+t^2==y[t]^2,{y[0]==0}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to -\frac{it^2\,\text{BesselJ}\left(-\frac{5}{4},\frac{it^2}{2}\right) - it^2\,\text{BesselJ}\left(\frac{3}{4},\frac{it^2}{2}\right) + \text{BesselJ}\left(-\frac{1}{4},\frac{it^2}{2}\right)}{2t\,\text{BesselJ}\left(-\frac{1}{4},\frac{it^2}{2}\right)}$$

3.2 problem 1 (b)

Internal problem ID [13806]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 1 (b).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_rational]`

$$\boxed{y' - \frac{1}{y^2} = -t^2}$$

With initial conditions

$$[y(0) = 0]$$

✗ Solution by Maple

```
dsolve([diff(y(t),t)+t^2=1/y(t)^2,y(0) = 0],y(t), singsol=all)
```

No solution found

✗ Solution by Mathematica

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

```
DSolve[{y'[t]+t^2==1/y[t]^2,{y[0]==0}},y[t],t,IncludeSingularSolutions -> True]
```

Not solved

3.3 problem 1 (c)

Internal problem ID [13807]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 1 (c).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y' - y = \frac{1}{1-t}}$$

With initial conditions

$$[y(1) = 0]$$

✗ Solution by Maple

```
dsolve([diff(y(t),t)=y(t)+1/(1-t),y(1) = 0],y(t), singsol=all)
```

No solution found

✗ Solution by Mathematica

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

```
DSolve[{y'[t]==y[t]+1/(1-t),{y[1]==0}},y[t],t,IncludeSingularSolutions -> True]
```

{}

3.4 problem 3

Internal problem ID [13808]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 3.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - y^{\frac{1}{5}} = 0}$$

With initial conditions

$$[y(0) = 0]$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 5

```
dsolve([diff(y(t),t)=y(t)^(1/5),y(0) = 0],y(t), singsol=all)
```

$$y = 0$$

✓ Solution by Mathematica

Time used: 0.004 (sec). Leaf size: 24

```
DSolve[{y'[t]==y[t]^(1/5),{y[0]==0}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{4\sqrt{2}t^{5/4}}{5\sqrt[4]{5}}$$

3.5 problem 4

Internal problem ID [13809]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 4.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{\frac{y'}{t} - \sqrt{y} = 0}$$

With initial conditions

$$[y(0) = 0]$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 5

```
dsolve([1/t*diff(y(t),t)=sqrt(y(t)),y(0) = 0],y(t), singsol=all)
```

$$y = 0$$

✓ Solution by Mathematica

Time used: 0.111 (sec). Leaf size: 17

```
DSolve[{1/t*y'[t]==Sqrt[y[t]],{y[0]==0}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to 0$$
$$y(t) \to \frac{t^4}{16}$$

3.6 problem 6

Internal problem ID [13810]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 6.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_Riccati]`

$$\boxed{y' + ty^2 = 4t^2}$$

With initial conditions

$$[y(2) = 1]$$

✓ Solution by Maple

Time used: 0.094 (sec). Leaf size: 127

```
dsolve([diff(y(t),t)=4*t^2-t*y(t)^2,y(2) = 1],y(t), singsol=all)
```

$$y = -\frac{2\left(\left(2\sqrt{2}\,\text{BesselK}\left(\frac{3}{5},\frac{16\sqrt{2}}{5}\right)+\text{BesselK}\left(\frac{2}{5},\frac{16\sqrt{2}}{5}\right)\right)\text{BesselI}\left(-\frac{3}{5},\frac{4t^{\frac{5}{2}}}{5}\right)+\text{BesselK}\left(\frac{3}{5},\frac{4t^{\frac{5}{2}}}{5}\right)\left(-2\sqrt{2}\,\text{Bes}\right.}{\left(-2\sqrt{2}\,\text{BesselK}\left(\frac{3}{5},\frac{16\sqrt{2}}{5}\right)-\text{BesselK}\left(\frac{2}{5},\frac{16\sqrt{2}}{5}\right)\right)\text{BesselI}\left(\frac{2}{5},\frac{4t^{\frac{5}{2}}}{5}\right)+\text{BesselK}\left(\frac{2}{5},\frac{4t^{\frac{5}{2}}}{5}\right)\left(-2\sqrt{2}\,\text{Be}\right.}$$

✓ Solution by Mathematica

Time used: 0.268 (sec). Leaf size: 709

```
DSolve[{y'[t]==4*t^2-t*y[t]^2,{y[2]==1}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{-3t^{5/2}\,\text{BesselI}\left(\frac{2}{5},\frac{16\sqrt{2}}{5}\right)\text{BesselI}\left(\frac{3}{5},\frac{4t^{5/2}}{5}\right)+4\sqrt{2}t^{5/2}\,\text{BesselI}\left(-\frac{3}{5},\frac{16\sqrt{2}}{5}\right)\text{BesselI}\left(\frac{3}{5},\frac{4t^{5/2}}{5}\right)-4\sqrt{2}t^{5/2}\,\text{Be}}{}$$

3.7 problem 7

Internal problem ID [13811]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 7.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - y\sqrt{t} = 0}$$

With initial conditions

$$[y(1) = 1]$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 13

```
dsolve([diff(y(t),t)=y(t)*sqrt(t),y(1) = 1],y(t), singsol=all)
```

$$y = \mathrm{e}^{\frac{2(\sqrt{t}-1)(t+\sqrt{t}+1)}{3}}$$

✓ Solution by Mathematica

Time used: 0.028 (sec). Leaf size: 18

```
DSolve[{y'[t]==y[t]*Sqrt[t],{y[1]==1}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to e^{\frac{2}{3}(t^{3/2}-1)}$$

3.8 problem 8

Internal problem ID [13812]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 8.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - 6y^{\frac{2}{3}} = 0}$$

With initial conditions

$$[y(1) = 0]$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 5

```
dsolve([diff(y(t),t)=6*y(t)^(2/3),y(1) = 0],y(t), singsol=all)
```

$$y = 0$$

✓ Solution by Mathematica

Time used: 0.001 (sec). Leaf size: 6

```
DSolve[{y'[t]==6*y[t]^(2/3),{y[1]==0}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to 0$$

3.9 problem 9

Internal problem ID [13813]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 9.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `['y=_G(x,y')']`

$$\boxed{y' - \sin(y) = -\cos(t)}$$

With initial conditions

$$[y(\pi) = 0]$$

✗ Solution by Maple

```
dsolve([diff(y(t),t)=sin(y(t))-cos(t),y(Pi) = 0],y(t), singsol=all)
```

No solution found

✗ Solution by Mathematica

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

```
DSolve[{y'[t]==Sin[y[t]]-Cos[t],{y[Pi]==0}},y[t],t,IncludeSingularSolutions -> True]
```

Not solved

3.10 problem 10

Internal problem ID [13814]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 10.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y't - y = 0}$$

With initial conditions

$$[y(0) = 1]$$

✗ Solution by Maple

```
dsolve([t*diff(y(t),t)=y(t),y(0) = 1],y(t), singsol=all)
```

No solution found

✗ Solution by Mathematica

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

```
DSolve[{t*y'[t]==y[t],{y[0]==1}},y[t],t,IncludeSingularSolutions -> True]
```

{}

3.11 problem 11

Internal problem ID [13815]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 11.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - y\tan(t) = 0}$$

With initial conditions

$$[y(0) = 1]$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 6

```
dsolve([diff(y(t),t)=y(t)*tan(t),y(0) = 1],y(t), singsol=all)
```

$$y = \sec(t)$$

✓ Solution by Mathematica

Time used: 0.042 (sec). Leaf size: 7

```
DSolve[{y'[t]==y[t]*Tan[t],{y[0]==1}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \sec(t)$$

3.12 problem 12

Internal problem ID [13816]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 12.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' = \frac{1}{t^2+1}}$$

With initial conditions

$$[y(0) = 0]$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 6

```
dsolve([diff(y(t),t)=1/(1+t^2),y(0) = 0],y(t), singsol=all)
```

$$y = \arctan(t)$$

✓ Solution by Mathematica

Time used: 0.005 (sec). Leaf size: 7

```
DSolve[{y'[t]==1/(1+t^2),{y[0]==0}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \arctan(t)$$

3.13 problem 13 (a)

Internal problem ID [13817]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 13 (a).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - \sqrt{y^2 - 1} = 0}$$

With initial conditions

$$[y(0) = 2]$$

✓ Solution by Maple

Time used: 0.156 (sec). Leaf size: 27

```
dsolve([diff(y(t),t)=sqrt(y(t)^2-1),y(0) = 2],y(t), singsol=all)
```

$$y = \frac{\mathrm{e}^{t}\sqrt{3}}{2} + \mathrm{e}^{t} - \frac{\sqrt{3}\,\mathrm{e}^{-t}}{2} + \mathrm{e}^{-t}$$

✓ Solution by Mathematica

Time used: 0.067 (sec). Leaf size: 49

```
DSolve[{y'[t]==Sqrt[y[t]^2-1],{y[0]==2}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{2}e^{-t}\sqrt{2e^{2t} + \left(7 + 4\sqrt{3}\right)e^{4t} + 7 - 4\sqrt{3}}$$

3.14 problem 13 (b)

Internal problem ID [13818]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 13 (b).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - \sqrt{y^2 - 1} = 0}$$

With initial conditions

$$[y(4) = -1]$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 5

```
dsolve([diff(y(t),t)=sqrt(y(t)^2-1),y(4) = -1],y(t), singsol=all)
```

$$y = -1$$

✓ Solution by Mathematica

Time used: 0.002 (sec). Leaf size: 6

```
DSolve[{y'[t]==Sqrt[y[t]^2-1],{y[4]==-1}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to -1$$

3.15 problem 13 (c)

Internal problem ID [13819]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 13 (c).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - \sqrt{y^2 - 1} = 0}$$

With initial conditions

$$\left[y(0) = \frac{1}{2}\right]$$

✓ Solution by Maple

Time used: 0.094 (sec). Leaf size: 26

```
dsolve([diff(y(t),t)=sqrt(y(t)^2-1),y(0) = 1/2],y(t), singsol=all)
```

$$y = \frac{i\sqrt{3}\,\mathrm{e}^{t}}{4} - \frac{i\sqrt{3}\,\mathrm{e}^{-t}}{4} + \frac{\mathrm{e}^{t}}{4} + \frac{\mathrm{e}^{-t}}{4}$$

✓ Solution by Mathematica

Time used: 0.076 (sec). Leaf size: 59

```
DSolve[{y'[t]==Sqrt[y[t]^2-1],{y[0]==1/2}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{e^{-t}\sqrt{4e^{2t} + i\left(\sqrt{3}+i\right)e^{4t} - 1 - i\sqrt{3}}}{2\sqrt{2}}$$

3.16 problem 13 (d)

Internal problem ID [13820]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 13 (d).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - \sqrt{y^2 - 1} = 0}$$

With initial conditions

$$[y(2) = 1]$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 5

```
dsolve([diff(y(t),t)=sqrt(y(t)^2-1),y(2) = 1],y(t), singsol=all)
```

$$y = 1$$

✓ Solution by Mathematica

Time used: 0.002 (sec). Leaf size: 6

```
DSolve[{y'[t]==Sqrt[y[t]^2-1],{y[2]==1}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to 1$$

3.17 problem 14 (a)

Internal problem ID [13821]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 14 (a).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - \sqrt{25 - y^2} = 0}$$

With initial conditions

$$[y(-4) = 3]$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 12

```
dsolve([diff(y(t),t)=sqrt(25-y(t)^2),y(-4) = 3],y(t), singsol=all)
```

$$y = 5 \sin\left(t + 4 + \arcsin\left(\frac{3}{5}\right)\right)$$

✓ Solution by Mathematica

Time used: 0.047 (sec). Leaf size: 17

```
DSolve[{y'[t]==Sqrt[25-y[t]^2],{y[-4]==3}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to 5 \cos\left(-2 \arctan\left(\frac{1}{2}\right) + t + 4\right)$$

3.18 problem 14 (b)

Internal problem ID [13822]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 14 (b).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - \sqrt{25 - y^2} = 0}$$

With initial conditions

$$[y(0) = 5]$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 5

```
dsolve([diff(y(t),t)=sqrt(25-y(t)^2),y(0) = 5],y(t), singsol=all)
```

$$y = 5$$

✓ Solution by Mathematica

Time used: 0.001 (sec). Leaf size: 6

```
DSolve[{y'[t]==Sqrt[25-y[t]^2],{y[0]==5}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to 5$$

3.19 problem 14 (c)

Internal problem ID [13823]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 14 (c).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - \sqrt{25 - y^2} = 0}$$

With initial conditions

$$[y(3) = -6]$$

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 14

```
dsolve([diff(y(t),t)=sqrt(25-y(t)^2),y(3) = -6],y(t), singsol=all)
```

$$y = 5 \sin\left(t - 3 - \arcsin\left(\frac{6}{5}\right)\right)$$

✓ Solution by Mathematica

Time used: 0.043 (sec). Leaf size: 23

```
DSolve[{y'[t]==Sqrt[25-y[t]^2],{y[3]==-6}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to 5 \cos\left(-2i \operatorname{arctanh}\left(\sqrt{11}\right) - t + 3\right)$$

3.20 problem 14 (c)

Internal problem ID [13824]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 14 (c).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - \sqrt{25 - y^2} = 0}$$

With initial conditions

$$[y(4) = -5]$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 5

```
dsolve([diff(y(t),t)=sqrt(25-y(t)^2),y(4) = -5],y(t), singsol=all)
```

$$y = -5$$

✓ Solution by Mathematica

Time used: 0.001 (sec). Leaf size: 6

```
DSolve[{y'[t]==Sqrt[25-y[t]^2],{y[4]==-5}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to -5$$

3.21 problem 15

Internal problem ID [13825]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 15.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y't + y = t^3}$$

With initial conditions

$$[y(1) = 0]$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 14

```
dsolve([t*diff(y(t),t)+y(t)=t^3,y(1) = 0],y(t), singsol=all)
```

$$y = \frac{t^4 - 1}{4t}$$

✓ Solution by Mathematica

Time used: 0.025 (sec). Leaf size: 17

```
DSolve[{t*y'[t]+y[t]==t^3,{y[1]==0}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{t^4 - 1}{4t}$$

3.22 problem 16

Internal problem ID [13826]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 16.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y't^3 + yt^4 = 2t^3}$$

With initial conditions

$$[y(0) = 0]$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 27

```
dsolve([t^3*diff(y(t),t)+t^4*y(t)=2*t^3,y(0) = 0],y(t), singsol=all)
```

$$y = -ie^{-\frac{t^2}{2}}\sqrt{\pi}\,\sqrt{2}\,\operatorname{erf}\left(\frac{i\sqrt{2}\,t}{2}\right)$$

✓ Solution by Mathematica

Time used: 0.067 (sec). Leaf size: 30

```
DSolve[{t^3*y'[t]+t^4*y[t]==2*t^3,{y[0]==0}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \sqrt{2\pi}e^{-\frac{t^2}{2}}\operatorname{erfi}\left(\frac{t}{\sqrt{2}}\right)$$

3.23 problem 17

Internal problem ID [13827]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 17.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{2y' + ty = \ln(t)}$$

With initial conditions

$$[y(\mathrm{e}) = 0]$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 28

```
dsolve([2*diff(y(t),t)+t*y(t)=ln(t),y(exp(1)) = 0],y(t), singsol=all)
```

$$y = \frac{\left(\int_{\mathrm{e}}^{t} \ln(\_z1)\, \mathrm{e}^{-\frac{\_z1^2}{4}} d\_z1\right) \mathrm{e}^{-\frac{t^2}{4}}}{2}$$

✓ Solution by Mathematica

Time used: 0.052 (sec). Leaf size: 95

```
DSolve[{2*y'[t]+t*y[t]==Log[t],{y[Exp[1]]==0}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{2} e^{-\frac{t^2}{4}} \left(-t\, {}_2F_2\left(\frac{1}{2}, \frac{1}{2}; \frac{3}{2}, \frac{3}{2}; \frac{t^2}{4}\right) + e\, {}_2F_2\left(\frac{1}{2}, \frac{1}{2}; \frac{3}{2}, \frac{3}{2}; \frac{e^2}{4}\right) + \sqrt{\pi}\,\mathrm{erfi}\left(\frac{t}{2}\right) \log(t) - \sqrt{\pi}\,\mathrm{erfi}\left(\frac{e}{2}\right) \right)$$

3.24 problem 18

Internal problem ID [13828]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 18.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y' + y \sec(t) = t}$$

With initial conditions

$$[y(0) = 0]$$

✓ Solution by Maple

Time used: 0.032 (sec). Leaf size: 59

```
dsolve([diff(y(t),t)+y(t)*sec(t)=t,y(0) = 0],y(t), singsol=all)
```

$$y = \frac{i\pi^2 + 12it^2 - 48t \ln\left(1 + ie^{it}\right) + 48i \operatorname{polylog}\left(2, -ie^{it}\right) - 48 \operatorname{Catalan}}{24 \sec(t) + 24 \tan(t)}$$

✓ Solution by Mathematica

Time used: 0.209 (sec). Leaf size: 146

```
DSolve[{y'[t]+y[t]*Sec[t]==t,{y[0]==0}},y[t],t,IncludeSingularSolutions -> True]
```

$$\begin{aligned} y(t) \to \frac{1}{24} e^{-2\operatorname{arctanh}\left(\tan\left(\frac{t}{2}\right)\right)} \Bigg(& -48C + 48i \operatorname{PolyLog}\left(2, -ie^{it}\right) + 12it^2 - 36i\pi t \\ & - 48t \log\left(1 + ie^{it}\right) - 48\pi \log\left(1 + e^{-it}\right) + 24\pi \log\left(1 + ie^{it}\right) + 48\pi \log\left(\cos\left(\frac{t}{2}\right)\right) \\ & - 24\pi \log\left(-\cos\left(\frac{1}{4}(2t + \pi)\right)\right) + 25i\pi^2 + 36\pi \log(2) - 24\pi \log(1 + i)\Bigg) \end{aligned}$$

3.25 problem 19

Internal problem ID [13829]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 19.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y' + \frac{y}{-3+t} = \frac{1}{t-1}}$$

With initial conditions

$$[y(-1) = 0]$$

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 27

```
dsolve([diff(y(t),t)+1/(t-3)*y(t)=1/(t-1),y(-1) = 0],y(t), singsol=all)
```

$$y = \frac{t - 2\ln(t-1) + 1 + 2\ln(2) + 2i\pi}{t-3}$$

✓ Solution by Mathematica

Time used: 0.034 (sec). Leaf size: 27

```
DSolve[{y'[t]+1/(t-3)*y[t]==1/(t-1),{y[-1]==0}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{t - 2\log(t-1) + 2i\pi + 1 + \log(4)}{t-3}$$

3.26 problem 20

Internal problem ID [13830]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 20.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{(t-2)\,y' + \left(t^2-4\right)y = \frac{1}{t+2}}$$

With initial conditions

$$[y(0) = 3]$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 35

```
dsolve([(t-2)*diff(y(t),t)+(t^2-4)*y(t)=1/(t+2),y(0) = 3],y(t), singsol=all)
```

$$y = \left(\int_0^t \frac{\mathrm{e}^{\frac{\_z1(\_z1+4)}{2}}}{\_z1^2-4}\,d\_z1 + 3\right)\mathrm{e}^{-\frac{t(t+4)}{2}}$$

✓ Solution by Mathematica

Time used: 0.435 (sec). Leaf size: 46

```
DSolve[{(t-2)*y'[t]+(t^2-4)*y[t]==1/(t+2),{y[0]==3}},y[t],t,IncludeSingularSolutions -> True
```

$$y(t) \to e^{-\frac{1}{2}t(t+4)}\left(\int_0^t \frac{e^{\frac{1}{2}K[1](K[1]+4)}}{K[1]^2-4}\,dK[1] + 3\right)$$

3.27 problem 21

Internal problem ID [13831]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 21.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y' + \frac{y}{\sqrt{-t^2+4}} = t}$$

With initial conditions

$$[y(0) = 0]$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 25

```
dsolve([diff(y(t),t)+y(t)/sqrt(4-t^2)=t,y(0) = 0],y(t), singsol=all)
```

$$y = \left(\int_0^t \_z1 \, \mathrm{e}^{\arcsin\left(\frac{\_z1}{2}\right)} d\_z1 \right) \mathrm{e}^{-\arcsin\left(\frac{t}{2}\right)}$$

✓ Solution by Mathematica

Time used: 0.159 (sec). Leaf size: 62

```
DSolve[{y'[t]+y[t]/Sqrt[4-t^2]==t,{y[0]==0}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to e^{2\arctan\left(\frac{\sqrt{4-t^2}}{t+2}\right)} \int_0^t e^{-2\arctan\left(\frac{\sqrt{4-K[1]^2}}{K[1]+2}\right)} K[1] dK[1]$$

3.28 problem 22

Internal problem ID [13832]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 22.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y' + \frac{y}{\sqrt{-t^2+4}} = t}$$

With initial conditions

$$[y(3) = -1]$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 31

```
dsolve([diff(y(t),t)+y(t)/sqrt(4-t^2)=t,y(3) = -1],y(t), singsol=all)
```

$$y = \left(\int_3^t \_z1 \, \mathrm{e}^{\arcsin\left(\frac{\_z1}{2}\right)} d\_z1 - \mathrm{e}^{\arcsin\left(\frac{3}{2}\right)} \right) \mathrm{e}^{-\arcsin\left(\frac{t}{2}\right)}$$

✓ Solution by Mathematica

Time used: 0.085 (sec). Leaf size: 88

```
DSolve[{y'[t]+y[t]/Sqrt[4-t^2]==t,{y[3]==-1}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t)$$
$$\to e^{2\arctan\left(\frac{\sqrt{4-t^2}}{t+2}\right)-2i\operatorname{arctanh}\left(\frac{1}{\sqrt{5}}\right)} \left(-1 + e^{2i\operatorname{arctanh}\left(\frac{1}{\sqrt{5}}\right)} \int_3^t e^{-2\arctan\left(\frac{\sqrt{4-K[1]^2}}{K[1]+2}\right)} K[1] dK[1] \right)$$

3.29 problem 23

Internal problem ID [13833]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 23.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y't + y = t\sin(t)}$$

With initial conditions

$$[y(\pi) = 1]$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 16

```
dsolve([t*diff(y(t),t)+y(t)=t*sin(t),y(Pi) = 1],y(t), singsol=all)
```

$$y = \frac{\sin(t) - \cos(t)\,t}{t}$$

✓ Solution by Mathematica

Time used: 0.05 (sec). Leaf size: 16

```
DSolve[{t*y'[t]+y[t]==t*Sin[t],{y[Pi]==1}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{\sin(t)}{t} - \cos(t)$$

3.30 problem 24

Internal problem ID [13834]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 24.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y' + y\tan(t) = \sin(t)}$$

With initial conditions

$$[y(0) = 0]$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 11

```
dsolve([diff(y(t),t)+y(t)*tan(t)=sin(t),y(0) = 0],y(t), singsol=all)
```

$$y = -\cos(t)\ln(\cos(t))$$

✓ Solution by Mathematica

Time used: 0.054 (sec). Leaf size: 12

```
DSolve[{y'[t]+y[t]*Tan[t]==Sin[t],{y[0]==0}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to -\cos(t)\log(\cos(t))$$

3.31 problem 25

Internal problem ID [13835]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 25.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

With initial conditions

$$\left[y(0) = \frac{1}{2}\right]$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 11

```
dsolve([diff(y(t),t)=y(t)^2,y(0) = 1/2],y(t), singsol=all)
```

$$y = -\frac{1}{t-2}$$

✓ Solution by Mathematica

Time used: 0.003 (sec). Leaf size: 12

```
DSolve[{y'[t]==y[t]^2,{y[0]==1/2}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{2-t}$$

3.32 problem 26

Internal problem ID [13836]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 26.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - ty^2 = 0}$$

With initial conditions

$$\left[y(0) = \frac{1}{2}\right]$$

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 13

```
dsolve([diff(y(t),t)=t*y(t)^2,y(0) = 1/2],y(t), singsol=all)
```

$$y = -\frac{2}{t^2 - 4}$$

✓ Solution by Mathematica

Time used: 0.101 (sec). Leaf size: 14

```
DSolve[{y'[t]==t*y[t]^2,{y[0]==1/2}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to -\frac{2}{t^2 - 4}$$

3.33 problem 27

Internal problem ID [13837]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 27.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' + \frac{t}{y} = 0}$$

With initial conditions

$$\left[y(0) = \frac{1}{2}\right]$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 15

```
dsolve([diff(y(t),t)=-t/y(t),y(0) = 1/2],y(t), singsol=all)
```

$$y = \frac{\sqrt{-4t^2 + 1}}{2}$$

✓ Solution by Mathematica

Time used: 0.084 (sec). Leaf size: 20

```
DSolve[{y'[t]==-t/y[t],{y[0]==1/2}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{2}\sqrt{1 - 4t^2}$$

3.34 problem 28

Internal problem ID [13838]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.1, page 32
Problem number: 28.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' + y^3 = 0}$$

With initial conditions

$$\left[y(0) = \frac{1}{2}\right]$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 11

```
dsolve([diff(y(t),t)=-y(t)^3,y(0) = 1/2],y(t), singsol=all)
```

$$y = \frac{1}{\sqrt{2t+4}}$$

✓ Solution by Mathematica

Time used: 0.003 (sec). Leaf size: 18

```
DSolve[{y'[t]==-y[t]^3,{y[0]==1/2}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{i}{\sqrt{-2t-4}}$$

4 Chapter 2. First Order Equations. Exercises 2.2, page 39

4.1 problem 1

Internal problem ID [13839]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 1.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

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

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 85

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

$$y(x) = \frac{(12x^2 + 8c_1)^{\frac{1}{3}}}{2}$$

$$y(x) = -\frac{(12x^2 + 8c_1)^{\frac{1}{3}}}{4} - \frac{i\sqrt{3}\,(12x^2 + 8c_1)^{\frac{1}{3}}}{4}$$

$$y(x) = -\frac{(12x^2 + 8c_1)^{\frac{1}{3}}}{4} + \frac{i\sqrt{3}\,(12x^2 + 8c_1)^{\frac{1}{3}}}{4}$$

✓ Solution by Mathematica

Time used: 0.179 (sec). Leaf size: 79

```
DSolve[y'[x]==x/y[x]^2,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to -\sqrt[3]{-\frac{3}{2}}\sqrt[3]{x^2+2c_1}$$

$$y(x) \to \sqrt[3]{\frac{3}{2}}\sqrt[3]{x^2+2c_1}$$

$$y(x) \to (-1)^{2/3}\sqrt[3]{\frac{3}{2}}\sqrt[3]{x^2+2c_1}$$

4.2 problem 2

Internal problem ID [13840]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 2.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y^2 y' = -\frac{1}{2\sqrt{t}}}$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 73

```
dsolve(1/2/t^(1/2)+y(t)^2*diff(y(t),t)=0,y(t), singsol=all)
```

$$y = \left(-3\sqrt{t} + c_1\right)^{\frac{1}{3}}$$

$$y = -\frac{\left(-3\sqrt{t} + c_1\right)^{\frac{1}{3}}}{2} - \frac{i\sqrt{3}\left(-3\sqrt{t} + c_1\right)^{\frac{1}{3}}}{2}$$

$$y = -\frac{\left(-3\sqrt{t} + c_1\right)^{\frac{1}{3}}}{2} + \frac{i\sqrt{3}\left(-3\sqrt{t} + c_1\right)^{\frac{1}{3}}}{2}$$

✓ Solution by Mathematica

Time used: 1.899 (sec). Leaf size: 79

```
DSolve[1/2/t^(1/2)+y[t]^2*y'[t]==0,y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to -\sqrt[3]{-3}\sqrt[3]{-\sqrt{t}+c_1}$$

$$y(t) \to \sqrt[3]{3}\sqrt[3]{-\sqrt{t}+c_1}$$

$$y(t) \to (-1)^{2/3}\sqrt[3]{3}\sqrt[3]{-\sqrt{t}+c_1}$$

4.3 problem 3

Internal problem ID [13841]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 3.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

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

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 16

```
dsolve(diff(y(x),x)=sqrt(y(x))/x^2,y(x), singsol=all)
```

$$\sqrt{y(x)} + \frac{1}{2x} - c_1 = 0$$

✓ Solution by Mathematica

Time used: 0.125 (sec). Leaf size: 25

```
DSolve[y'[x]==Sqrt[y[x]]/x^2,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to \frac{(-1 + c_1 x)^2}{4x^2}$$
$$y(x) \to 0$$

4.4 problem 4

Internal problem ID [13842]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 4.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - \frac{1+y^2}{y} = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 29

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

$$y = \sqrt{\mathrm{e}^{2t} c_1 - 1}$$
$$y = -\sqrt{\mathrm{e}^{2t} c_1 - 1}$$

✓ Solution by Mathematica

Time used: 2.441 (sec). Leaf size: 53

```
DSolve[y'[t]==(1+y[t]^2)/y[t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to -\sqrt{-1 + e^{2(t+c_1)}}$$
$$y(t) \to \sqrt{-1 + e^{2(t+c_1)}}$$
$$y(t) \to -i$$
$$y(t) \to i$$

4.5 problem 5

Internal problem ID [13843]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 5.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{\left(5+\frac{9}{y^8}\right)y' = -4t^3-6}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 23

```
dsolve((6+4*t^3)+(5+9/y(t)^8)*diff(y(t),t)=0,y(t), singsol=all)
```

$$\frac{t^4}{2}+3t+\frac{5y}{2}-\frac{9}{14y^7}+c_1=0$$

✓ Solution by Mathematica

Time used: 3.593 (sec). Leaf size: 265

```
DSolve[(6+4*t^3)+(5+9/y[t]^8)*y'[t]==0,y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \text{Root}\left[35\#1^8 + \#1^7\left(7t^4 + 42t - 7c_1\right) - 9\&, 1\right]$$
$$y(t) \to \text{Root}\left[35\#1^8 + \#1^7\left(7t^4 + 42t - 7c_1\right) - 9\&, 2\right]$$
$$y(t) \to \text{Root}\left[35\#1^8 + \#1^7\left(7t^4 + 42t - 7c_1\right) - 9\&, 3\right]$$
$$y(t) \to \text{Root}\left[35\#1^8 + \#1^7\left(7t^4 + 42t - 7c_1\right) - 9\&, 4\right]$$
$$y(t) \to \text{Root}\left[35\#1^8 + \#1^7\left(7t^4 + 42t - 7c_1\right) - 9\&, 5\right]$$
$$y(t) \to \text{Root}\left[35\#1^8 + \#1^7\left(7t^4 + 42t - 7c_1\right) - 9\&, 6\right]$$
$$y(t) \to \text{Root}\left[35\#1^8 + \#1^7\left(7t^4 + 42t - 7c_1\right) - 9\&, 7\right]$$
$$y(t) \to \text{Root}\left[35\#1^8 + \#1^7\left(7t^4 + 42t - 7c_1\right) - 9\&, 8\right]$$

4.6 problem 6

Internal problem ID [13844]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 6.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{\left(9+\frac{1}{s^2}-4s^8\right)s'=-\frac{6}{t^9}+\frac{6}{t^3}-t^7}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 36

```
dsolve((6/t^9-6/t^3+t^7)+(9+1/s(t)^2-4*s(t)^8)*diff(s(t),t)=0,s(t), singsol=all)
```

$$\frac{t^8}{8}-\frac{3}{4t^8}+\frac{3}{t^2}-\frac{4s(t)^9}{9}+9s(t)-\frac{1}{s(t)}+c_1=0$$

✓ Solution by Mathematica

Time used: 17.496 (sec). Leaf size: 531

```
DSolve[(6/t^9-6/t^3+t^7)+(9+1/s[t]^2-4*s[t]^8)*s'[t]==0,s[t],t,IncludeSingularSolutions -> T
```

$$s(t) \to \text{Root}\left[32\#1^{10}t^8 - 648\#1^2t^8 + \#1\left(-9t^{16} - 72c_1t^8 - 216t^6 + 54\right) + 72t^8\&, 1\right]$$
$$s(t) \to \text{Root}\left[32\#1^{10}t^8 - 648\#1^2t^8 + \#1\left(-9t^{16} - 72c_1t^8 - 216t^6 + 54\right) + 72t^8\&, 2\right]$$
$$s(t) \to \text{Root}\left[32\#1^{10}t^8 - 648\#1^2t^8 + \#1\left(-9t^{16} - 72c_1t^8 - 216t^6 + 54\right) + 72t^8\&, 3\right]$$
$$s(t) \to \text{Root}\left[32\#1^{10}t^8 - 648\#1^2t^8 + \#1\left(-9t^{16} - 72c_1t^8 - 216t^6 + 54\right) + 72t^8\&, 4\right]$$
$$s(t) \to \text{Root}\left[32\#1^{10}t^8 - 648\#1^2t^8 + \#1\left(-9t^{16} - 72c_1t^8 - 216t^6 + 54\right) + 72t^8\&, 5\right]$$
$$s(t) \to \text{Root}\left[32\#1^{10}t^8 - 648\#1^2t^8 + \#1\left(-9t^{16} - 72c_1t^8 - 216t^6 + 54\right) + 72t^8\&, 6\right]$$
$$s(t) \to \text{Root}\left[32\#1^{10}t^8 - 648\#1^2t^8 + \#1\left(-9t^{16} - 72c_1t^8 - 216t^6 + 54\right) + 72t^8\&, 7\right]$$
$$s(t) \to \text{Root}\left[32\#1^{10}t^8 - 648\#1^2t^8 + \#1\left(-9t^{16} - 72c_1t^8 - 216t^6 + 54\right) + 72t^8\&, 8\right]$$
$$s(t) \to \text{Root}\left[32\#1^{10}t^8 - 648\#1^2t^8 + \#1\left(-9t^{16} - 72c_1t^8 - 216t^6 + 54\right) + 72t^8\&, 9\right]$$
$$s(t) \to \text{Root}\left[32\#1^{10}t^8 - 648\#1^2t^8 + \#1\left(-9t^{16} - 72c_1t^8 - 216t^6 + 54\right) + 72t^8\&, 10\right]$$

4.7 problem 7

Internal problem ID [13845]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 7.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{4\sinh(4y)\,y' = 6\cosh(3x)}$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 17

```
dsolve(4*sinh(4*y(x))*diff(y(x),x)=6*cosh(3*x),y(x), singsol=all)
```

$$y(x) = \frac{\operatorname{arccosh}(2\sinh(3x) + 6c_1)}{4}$$

✓ Solution by Mathematica

Time used: 2.75 (sec). Leaf size: 41

```
DSolve[4*Sinh[4*y[x]]*y'[x]==6*Cosh[3*x],y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to -\frac{1}{4}\operatorname{arccosh}(2(\sinh(3x) + 2c_1))$$
$$y(x) \to \frac{1}{4}\operatorname{arccosh}(2(\sinh(3x) + 2c_1))$$

4.8 problem 8

Internal problem ID [13846]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 8.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - \frac{y+1}{t+1} = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 11

```
dsolve(diff(y(t),t)=(y(t)+1)/(t+1),y(t), singsol=all)
```

$$y = -1 + (t+1)\,c_1$$

✓ Solution by Mathematica

Time used: 0.027 (sec). Leaf size: 18

```
DSolve[y'[t]==(y[t]+1)/(t+1),y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to -1 + c_1(t+1)$$
$$y(t) \to -1$$

4.9 problem 9

Internal problem ID [13847]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 9.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - \frac{y+2}{2t+1} = 0}$$

✓ Solution by Maple

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

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

$$y = \sqrt{2t+1}\, c_1 - 2$$

✓ Solution by Mathematica

Time used: 0.03 (sec). Leaf size: 24

```
DSolve[y'[t]==(y[t]+2)/(2*t+1),y[t],t,IncludeSingularSolutions -> True]
```

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

4.10 problem 10

Internal problem ID [13848]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 10.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{-\left(\frac{1}{\sqrt{y}}+\sqrt{y}\right)y'=-\frac{3}{t^2}}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 20

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

$$-\frac{1}{t}-\frac{2\sqrt{y}\,(y+3)}{9}+c_1=0$$

✓ Solution by Mathematica

Time used: 6.594 (sec). Leaf size: 445

```
DSolve[3/t^2==(1/y[t]^(1/2)+y[t]^(1/2))*y'[t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{\left(-2+\sqrt[3]{\frac{81}{t^2}+3\sqrt{\frac{(-3+c_1 t)^2\left(\left(16+9{c_1}^2\right)t^2-54c_1 t+81\right)}{t^4}}-\frac{54c_1}{t}+8+9{c_1}^2}\right)^2}{2\sqrt[3]{\frac{81}{t^2}+3\sqrt{\frac{(-3+c_1 t)^2\left(\left(16+9{c_1}^2\right)t^2-54c_1 t+81\right)}{t^4}}-\frac{54c_1}{t}+8+9{c_1}^2}}$$

$$y(t) \to \frac{1}{4}i\left(\sqrt{3}+i\right)\sqrt[3]{\frac{81}{t^2}+3\sqrt{\frac{(-3+c_1 t)^2\left(\left(16+9{c_1}^2\right)t^2-54c_1 t+81\right)}{t^4}}-\frac{54c_1}{t}+8+9{c_1}^2}+\frac{-1-i\sqrt{3}}{\sqrt[3]{\frac{81}{t^2}+3\sqrt{\frac{(-3+c_1 t)^2\left(\left(16+9{c_1}^2\right)t^2-54c_1 t+81\right)}{t^4}}-\frac{54c_1}{t}+8+9{c_1}^2}}-2$$

$$y(t) \to -\frac{1}{4}i\left(\sqrt{3}-i\right)\sqrt[3]{\frac{81}{t^2}+3\sqrt{\frac{(-3+c_1 t)^2\left(\left(16+9{c_1}^2\right)t^2-54c_1 t+81\right)}{t^4}}-\frac{54c_1}{t}+8+9{c_1}^2}+\frac{-1+i\sqrt{3}}{\sqrt[3]{\frac{81}{t^2}+3\sqrt{\frac{(-3+c_1 t)^2\left(\left(16+9{c_1}^2\right)t^2-54c_1 t+81\right)}{t^4}}-\frac{54c_1}{t}+8+9{c_1}^2}}-2$$

4.11 problem 11

Internal problem ID [13849]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 11.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{-4\cos(y)\,y' = -3\sin(x)}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 13

```
dsolve(3*sin(x)-4*cos(y(x))*diff(y(x),x)=0,y(x), singsol=all)
```

$$y(x) = \arcsin\left(-\frac{3\cos(x)}{4} + \frac{3c_1}{4}\right)$$

✓ Solution by Mathematica

Time used: 0.563 (sec). Leaf size: 29

```
DSolve[3*Sin[x]-4*Cos[y[x]]*y'[x]==0,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to \arcsin\left(-\frac{3\cos(x)}{4} + c_1\right)$$
$$y(x) \to \arcsin\left(-\frac{3\cos(x)}{4} + c_1\right)$$

4.12 problem 12

Internal problem ID [13850]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 12.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{\cos(y)\, y' = 8\sin(8t)}$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 15

```
dsolve(cos(y(t))*diff(y(t),t)=8*sin(8*t),y(t), singsol=all)
```

$$y = \arcsin(-\cos(8t) + 64c_1)$$

✓ Solution by Mathematica

Time used: 0.509 (sec). Leaf size: 15

```
DSolve[Cos[y[t]]*y'[t]==8*Sin[8*t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \arcsin(-\cos(8t) + c_1)$$

4.13 problem 13

Internal problem ID [13851]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 13.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' + ky = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 11

```
dsolve(diff(y(x),x)+k*y(x)=0,y(x), singsol=all)
```

$$y(x) = c_1 \mathrm{e}^{-kx}$$

✓ Solution by Mathematica

Time used: 0.025 (sec). Leaf size: 19

```
DSolve[y'[x]+k*y[x]==0,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to c_1 e^{-kx}$$
$$y(x) \to 0$$

4.14 problem 14

Internal problem ID [13852]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 14.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{\left(5x^5 - 4\cos\left(x\right)\right)x' = -2\cos\left(9t\right) - 2\sin\left(7t\right)}$$

✓ Solution by Maple

Time used: 0.047 (sec). Leaf size: 28

```
dsolve((5*x(t)^5-4*cos(x(t)))*diff(x(t),t)+(2*cos(9*t)+2*sin(7*t))=0,x(t), singsol=all)
```

$$\frac{\sin\left(9t\right)}{9} - \frac{\cos\left(7t\right)}{7} + \frac{5x(t)^6}{12} - 2\sin\left(x(t)\right) + c_1 = 0$$

✓ Solution by Mathematica

Time used: 0.667 (sec). Leaf size: 40

```
DSolve[(5*x[t]^5-4*Cos[x[t]])*x'[t]+(2*Cos[9*t]+2*Sin[7*t])==0,x[t],t,IncludeSingularSolutio
```

$$x(t) \to \text{InverseFunction}\left[\frac{5\#1^6}{6} - 4\sin(\#1)\&\right]\left[-\frac{2}{9}\sin(9t) + \frac{2}{7}\cos(7t) + c_1\right]$$

4.15 problem 15

Internal problem ID [13853]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 15.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{20\sinh(y)\,y' = -\cosh(6t) - 5\sinh(4t)}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 21

```
dsolve((cosh(6*t)+5*sinh(4*t))+(20*sinh(y(t)))*diff(y(t),t)=0,y(t), singsol=all)
```

$$y = \operatorname{arccosh}\left(-\frac{\cosh(4t)}{16} - \frac{\sinh(6t)}{120} - \frac{c_1}{20}\right)$$

✓ Solution by Mathematica

Time used: 3.811 (sec). Leaf size: 51

```
DSolve[(Cosh[6*t]+5*Sinh[4*t])+(20*Sinh[y[t]])*y'[t]==0,y[t],t,IncludeSingularSolutions -> T
```

$$y(t) \to -\operatorname{arccosh}\left(-\frac{1}{120}\sinh(6t) - \frac{1}{16}\cosh(4t) + c_1\right)$$
$$y(t) \to \operatorname{arccosh}\left(-\frac{1}{120}\sinh(6t) - \frac{1}{16}\cosh(4t) + c_1\right)$$

4.16 problem 16

Internal problem ID [13854]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 16.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - \mathrm{e}^{2y+10t} = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 17

```
dsolve(diff(y(t),t)=exp(2*y(t)+10*t),y(t), singsol=all)
```

$$y = -\frac{\ln\left(-\frac{\mathrm{e}^{10t}}{5} - 2c_1\right)}{2}$$

✓ Solution by Mathematica

Time used: 0.928 (sec). Leaf size: 24

```
DSolve[y'[t]==Exp[2*y[t]+10*t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to -\frac{1}{2}\log\left(-\frac{e^{10t}}{5} - 2c_1\right)$$

4.17 problem 17

Internal problem ID [13855]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 17.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - \mathrm{e}^{3y+2t} = 0}$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 17

```
dsolve(diff(y(t),t)=exp(3*y(t)+2*t),y(t), singsol=all)
```

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

✓ Solution by Mathematica

Time used: 0.927 (sec). Leaf size: 24

```
DSolve[y'[t]==Exp[3*y[t]+2*t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to -\frac{1}{3}\log\left(-\frac{3}{2}\left(e^{2t} + 2c_1\right)\right)$$

4.18 problem 18

Internal problem ID [13856]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 18.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{-\cos(y)^2 y' = -\sin(t)^2}$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 27

```
dsolve(sin(t)^2=cos(y(t))^2*diff(y(t),t),y(t), singsol=all)
```

$$y = \frac{\text{RootOf}\left(-\_Z + 2t + 4c_1 - \sin(2t) - \sin(\_Z)\right)}{2}$$

✓ Solution by Mathematica

Time used: 0.492 (sec). Leaf size: 35

```
DSolve[Sin[t]^2==Cos[y[t]]^2*y'[t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \text{InverseFunction}\left[2\left(\frac{\#1}{2} + \frac{1}{4}\sin(2\#1)\right)\&\right][t - \sin(t)\cos(t) + c_1]$$

4.19 problem 19

Internal problem ID [13857]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 19.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{-(\cos(4y) - 4\cos(y))\, y' = -3\sin(t) + \sin(3t)}$$

✓ Solution by Maple

Time used: 0.047 (sec). Leaf size: 238

```
dsolve(3*sin(t)-sin(3*t)=(cos(4*y(t))-4*cos(y(t)))*diff(y(t),t),y(t), singsol=all)
```

$$y = \arctan\left(-\frac{}{6\,\mathrm{RootOf}\left(72\_Z^8 - 144\_Z^6 - 288\_Z^5 + 90\_Z^4 + 432\_Z^3 + 432\cos(t)\,c_1 - 48c_1\cos(3t) + 2\right.}\right.$$
$$\left.\left. - 144\_Z^6 - 288\_Z^5 + 90\_Z^4 + 432\_Z^3 + 432\cos(t)\,c_1 - 48c_1\cos(3t) + 288c_1^2 \right.\right.$$
$$\left.\left. + 270\_Z^2 + \cos(6t) - 18\cos(4t) + 63\cos(2t) - 144\_Z - 206\right)\right)$$

✓ Solution by Mathematica

Time used: 60.315 (sec). Leaf size: 2033

```
DSolve[3*Sin[t]-Sin[3*t]==(Cos[4*y[t]]-4*Cos[y[t]])*y'[t],y[t],t,IncludeSingularSolutions ->
```

Too large to display

4.20 problem 20

Internal problem ID [13858]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 20.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{x' - \frac{\sec(t)^2}{\sec(x)\tan(x)} = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 11

```
dsolve(diff(x(t),t)=sec(t)^2/(sec(x(t))*tan(x(t))),x(t), singsol=all)
```

$$x(t) = \arccos\left(\frac{1}{\tan(t) + c_1}\right)$$

✓ Solution by Mathematica

Time used: 0.848 (sec). Leaf size: 45

```
DSolve[x'[t]==Sec[t]^2/(Sec[x[t]]*Tan[x[t]]),x[t],t,IncludeSingularSolutions -> True]
```

$$x(t) \to -\sec^{-1}(\tan(t) + 2c_1)$$
$$x(t) \to \sec^{-1}(\tan(t) + 2c_1)$$
$$x(t) \to -\frac{\pi}{2}$$
$$x(t) \to \frac{\pi}{2}$$

4.21 problem 21

Internal problem ID [13859]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 21.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{\left(2-\frac{5}{y^2}\right)y' = -4\cos(x)^2}$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 107

```
dsolve((2-5/y(x)^2)*diff(y(x),x)+4*cos(x)^2=0,y(x), singsol=all)
```

$$y(x) = -c_1 - \frac{x}{2} - \frac{\sin(2x)}{4} - \frac{\sqrt{4c_1^2+4c_1x+x^2-\frac{79}{8}-\frac{\cos(4x)}{8}+2c_1\sin(2x)+x\sin(2x)}}{2}$$
$$y(x) = -c_1 - \frac{x}{2} - \frac{\sin(2x)}{4} + \frac{\sqrt{4c_1^2+4c_1x+x^2-\frac{79}{8}-\frac{\cos(4x)}{8}+2c_1\sin(2x)+x\sin(2x)}}{2}$$

✓ Solution by Mathematica

Time used: 0.672 (sec). Leaf size: 88

```
DSolve[(2-5/y[x]^2)*y'[x]+4*Cos[x]^2==0,y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to \frac{1}{4}\left(-2x-\sin(2x)-\sqrt{-40+(2x+\sin(2x)-c_1)^2}+c_1\right)$$
$$y(x) \to \frac{1}{4}\left(-2x-\sin(2x)+\sqrt{-40+(2x+\sin(2x)-c_1)^2}+c_1\right)$$
$$y(x) \to 0$$

4.22 problem 22

Internal problem ID [13860]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 22.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[[_1st_order, '_with_symmetry_[F(x),G(x)*y+H(x)]']]`

$$\boxed{y' - \frac{t^3}{y\sqrt{(1-y^2)\left(t^4+9\right)}} = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 62

```
dsolve(diff(y(t),t)=t^3/(y(t)*sqrt((1-y(t)^2)*(t^4+9))),y(t), singsol=all)
```

$$\frac{(y-1)^{\frac{3}{2}}(y+1)^{\frac{3}{2}}}{3} + \int^{t} -\frac{\_a^3\sqrt{y+1}\sqrt{y-1}}{\sqrt{-\_a^4y^2+\_a^4-9y^2+9}}d\_a + c_1 = 0$$

✓ Solution by Mathematica

Time used: 1.286 (sec). Leaf size: 519

```
DSolve[y'[t]==t^3/(y[t]*Sqrt[(1-y[t]^2)*(t^4+9)]),y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to -\sqrt{1+\left(\frac{3}{2}\right)^{2/3}\sqrt[3]{-t^4-4ic_1\sqrt{t^4+9}-9+4{c_1}^2}}$$

$$y(t) \to \sqrt{1+\left(\frac{3}{2}\right)^{2/3}\sqrt[3]{-t^4-4ic_1\sqrt{t^4+9}-9+4{c_1}^2}}$$

$$y(t) \to -\frac{1}{2}\sqrt{-\sqrt[3]{2}2^{2/3}\sqrt[3]{-t^4-4ic_1\sqrt{t^4+9}-9+4{c_1}^2}-3i\sqrt[3]{2}\sqrt[6]{3}\sqrt[3]{-t^4-4ic_1\sqrt{t^4+9}-9+4{c_1}^2}+4}$$

$$y(t) \to \frac{1}{2}\sqrt{-\sqrt[3]{2}2^{2/3}\sqrt[3]{-t^4-4ic_1\sqrt{t^4+9}-9+4{c_1}^2}-3i\sqrt[3]{2}\sqrt[6]{3}\sqrt[3]{-t^4-4ic_1\sqrt{t^4+9}-9+4{c_1}^2}+4}$$

$$y(t) \to -\frac{1}{2}\sqrt{-\sqrt[3]{2}2^{2/3}\sqrt[3]{-t^4-4ic_1\sqrt{t^4+9}-9+4{c_1}^2}+3i\sqrt[3]{2}\sqrt[6]{3}\sqrt[3]{-t^4-4ic_1\sqrt{t^4+9}-9+4{c_1}^2}+4}$$

$$y(t) \to \frac{1}{2}\sqrt{-\sqrt[3]{2}2^{2/3}\sqrt[3]{-t^4-4ic_1\sqrt{t^4+9}-9+4{c_1}^2}+3i\sqrt[3]{2}\sqrt[6]{3}\sqrt[3]{-t^4-4ic_1\sqrt{t^4+9}-9+4{c_1}^2}+4}$$

4.23 problem 23

Internal problem ID [13861]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 23.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{\tan(y)\sec(y)^2 y' = -\cos(2x)^3 \sin(2x)}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 53

```
dsolve(tan(y(x))*sec(y(x))^2*diff(y(x),x)+cos(2*x)^3*sin(2*x)=0,y(x), singsol=all)
```

$$y(x) = \operatorname{arccot}\left(\frac{8}{\sqrt{-256c_1 + 2\cos(8x) + 8\cos(4x)}}\right)$$
$$y(x) = \pi - \operatorname{arccot}\left(\frac{8}{\sqrt{-256c_1 + 2\cos(8x) + 8\cos(4x)}}\right)$$

✓ Solution by Mathematica

Time used: 2.982 (sec). Leaf size: 139

```
DSolve[Tan[y[x]]*Sec[y[x]]^2*y'[x]+Cos[2*x]^3*Sin[2*x]==0,y[x],x,IncludeSingularSolutions ->
```

$$y(x) \to -\sec^{-1}\left(-\frac{\sqrt{8\cos^4(2x)+c_1}}{4\sqrt{2}}\right)$$

$$y(x) \to \sec^{-1}\left(-\frac{\sqrt{8\cos^4(2x)+c_1}}{4\sqrt{2}}\right)$$

$$y(x) \to -\sec^{-1}\left(\frac{\sqrt{8\cos^4(2x)+c_1}}{4\sqrt{2}}\right)$$

$$y(x) \to \sec^{-1}\left(\frac{\sqrt{8\cos^4(2x)+c_1}}{4\sqrt{2}}\right)$$

$$y(x) \to -\frac{\pi}{2}$$

$$y(x) \to \frac{\pi}{2}$$

4.24 problem 24

Internal problem ID [13862]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 24.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - \frac{(1+2\,\mathrm{e}^{y})\,\mathrm{e}^{-y}}{t\ln(t)} = 0}$$

✓ Solution by Maple

Time used: 0.125 (sec). Leaf size: 19

```
dsolve(diff(y(t),t)=(1+2*exp(y(t)))/(exp(y(t))*t*ln(t)),y(t), singsol=all)
```

$$y = -\ln\left(\frac{2}{\ln(t)^2 c_1 - 1}\right)$$

✓ Solution by Mathematica

Time used: 0.685 (sec). Leaf size: 51

```
DSolve[y'[t]==(1+2*Exp[y[t]])/(Exp[y[t]]*t*Log[t]),y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \log\left(\frac{1}{2}\left(-1 + e^{2c_1}\log^2(t)\right)\right)$$
$$y(t) \to -\log(2) - i\pi$$
$$y(t) \to -\log(2) + i\pi$$

4.25 problem 25

Internal problem ID [13863]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 25.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{-\frac{\cos\left(\sqrt{y}\right) y'}{\sqrt{y}} = -x \sin\left(x^2\right)}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 18

```
dsolve(x*sin(x^2)=cos(sqrt(y(x)))/sqrt(y(x))*diff(y(x),x),y(x), singsol=all)
```

$$-\frac{\cos\left(x^2\right)}{2} - 2\sin\left(\sqrt{y\left(x\right)}\right) + c_1 = 0$$

✓ Solution by Mathematica

Time used: 1.996 (sec). Leaf size: 43

```
DSolve[x*Sin[x^2]==Cos[Sqrt[y[x]]]/Sqrt[y[x]]*y'[x],y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to \arcsin\left(\frac{1}{4}\left(-\cos\left(x^2\right) + 2c_1\right)\right)^2$$
$$y(x) \to \arcsin\left(\frac{1}{4}\left(\cos\left(x^2\right) - 2c_1\right)\right)^2$$

4.26 problem 26

Internal problem ID [13864]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 26.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{-\frac{\left(1-\frac{1}{y}\right)^2 y'}{y^2} = -\frac{x-2}{x^2-4x+3}}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 1790

```
dsolve((x-2)/(x^2-4*x+3)=(1-1/y(x))^2*1/y(x)^2*diff(y(x),x),y(x), singsol=all)
```

$$y(x) = \frac{\left(-9\ln\left((x-1)(x-3)\right)^2+3\sqrt{9\ln\left((x-1)(x-3)\right)^2+36\ln\left((x-1)(x-3)\right)c_1+36c_1^2+12\ln\left((x-1\right.\right.}}{}$$

$$+\frac{}{\left(\ln\left((x-1)(x-3)\right)+2c_1\right)\left(-9\ln\left((x-1)(x-3)\right)^2+3\sqrt{9\ln\left((x-1)(x-3)\right)^2+36\ln\left((x-1)(x-\right.\right.}$$

$$-\frac{2}{3\left(\ln\left((x-1)(x-3)\right)+2c_1\right)}$$

Expression too large to display

Expression too large to display

✓ Solution by Mathematica

Time used: 1.679 (sec). Leaf size: 1134

```
DSolve[(x-2)/(x^2-4*x+3)==(1-1/y[x])^2*1/y[x]^2*y'[x],y[x],x,IncludeSingularSolutions -> Tru
```

$$y(x)$$

$$\to \frac{-6\log(x-3)-6\log(x-1)-\left(9\log^2(x-3)+9\log^2(x-1)+18\log(x-3)+18\log(x-3)\log(x-1\right.}{}$$

$$y(x)$$

$$\to \frac{}{\sqrt[3]{9\log^2(x-3)+9\log^2(x-1)+18\log(x-3)+18\log(x-3)\log(x-1)+18\log(x-1)+3\sqrt{(3\log^2}}$$

$$y(x)$$

$$\to \frac{}{\sqrt[3]{9\log^2(x-3)+9\log^2(x-1)+18\log(x-3)+18\log(x-3)\log(x-1)+18\log(x-1)+3\sqrt{(3\log^2}}$$

$$y(x)\to 0$$

4.27 problem 27

Internal problem ID [13865]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 27.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{\frac{\cos(y)\,y'}{(1-\sin(y))^2} = \sin(x)^3\cos(x)}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 42

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

$$y(x) = \arcsin\left(\frac{-32c_1 + 29 - \cos(4x) + 4\cos(2x)}{-32c_1 - 3 - \cos(4x) + 4\cos(2x)}\right)$$

✓ Solution by Mathematica

Time used: 28.843 (sec). Leaf size: 705

```
DSolve[Cos[y[x]]/(1-Sin[y[x]])^2*y'[x]==Sin[x]^3*Cos[x],y[x],x,IncludeSingularSolutions -> T
```

$$y(x) \to -2 \arccos\left(-\frac{4+\sqrt{-4\cos(2x)+\cos(4x)-13+c_1}}{\sqrt{2}\sqrt{8\sin^4(x)+c_1}}\right)$$

$$y(x) \to 2 \arccos\left(-\frac{4+\sqrt{-4\cos(2x)+\cos(4x)-13+c_1}}{\sqrt{2}\sqrt{8\sin^4(x)+c_1}}\right)$$

$$y(x) \to -2 \arccos\left(\frac{-4+\sqrt{-4\cos(2x)+\cos(4x)-13+c_1}}{\sqrt{2}\sqrt{8\sin^4(x)+c_1}}\right)$$

$$y(x) \to 2 \arccos\left(\frac{-4+\sqrt{-4\cos(2x)+\cos(4x)-13+c_1}}{\sqrt{2}\sqrt{8\sin^4(x)+c_1}}\right)$$

$$y(x) \to -2 \arccos\left(-\frac{-4+\sqrt{-4\cos(2x)+\cos(4x)-13+c_1}}{\sqrt{2}\sqrt{8\sin^4(x)+c_1}}\right)$$

$$y(x) \to 2 \arccos\left(-\frac{-4+\sqrt{-4\cos(2x)+\cos(4x)-13+c_1}}{\sqrt{2}\sqrt{8\sin^4(x)+c_1}}\right)$$

$$y(x) \to -2 \arccos\left(\frac{4+\sqrt{-4\cos(2x)+\cos(4x)-13+c_1}}{\sqrt{2}\sqrt{8\sin^4(x)+c_1}}\right)$$

$$y(x) \to 2 \arccos\left(\frac{4+\sqrt{-4\cos(2x)+\cos(4x)-13+c_1}}{\sqrt{2}\sqrt{8\sin^4(x)+c_1}}\right)$$

$$y(x) \to -\frac{3\pi}{2}$$

$$y(x) \to -\frac{\pi}{2}$$

$$y(x) \to \frac{\pi}{2}$$

$$y(x) \to \frac{3\pi}{2}$$

$$y(x) \to -2 \arccos\left(-\frac{\sqrt{-4\cos(2x)+\cos(4x)-13}-4}{4\sqrt{\sin^4(x)}}\right)$$

$$y(x) \to 2 \arccos\left(-\frac{\sqrt{-4\cos(2x)+\cos(4x)-13}-4}{4\sqrt{\sin^4(x)}}\right)$$

$$y(x) \to -2 \arccos\left(\frac{\sqrt{-4\cos(2x)+\cos(4x)-13}-4}{4\sqrt{\sin^4(x)}}\right)$$

4.28 problem 28

Internal problem ID [13866]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 28.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - \frac{(5-2\cos(x))^3 \sin(x) \cos(y)^4}{\sin(y)} = 0}$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 230

```
dsolve(diff(y(x),x)=((5-2*cos(x))^3*sin(x)*cos(y(x))^4)/sin(y(x)),y(x), singsol=all)
```

$$y(x) = \pi - \arccos\left(\frac{2\,9^{\frac{1}{3}}\left(\left(-8c_1+931+2\cos(4x)+308\cos(2x)-40\cos(3x)-1120\cos(x)\right)^2\right)^{\frac{1}{3}}}{24c_1-2793-6\cos(4x)-924\cos(2x)+120\cos(3x)+3360\cos(x)}\right)$$

$$y(x) = \pi - \arccos\left(\frac{\left(-1+i\sqrt{3}\right)9^{\frac{1}{3}}\left(\left(-8c_1+931+2\cos(4x)+308\cos(2x)-40\cos(3x)-1120\cos(x)\right)^2\right)^{\frac{1}{3}}}{24c_1-2793-6\cos(4x)-924\cos(2x)+120\cos(3x)+3360\cos(x)}\right)$$

$$y(x) = \arccos\left(\frac{\left(1+i\sqrt{3}\right)9^{\frac{1}{3}}\left(\left(-8c_1+931+2\cos(4x)+308\cos(2x)-40\cos(3x)-1120\cos(x)\right)^2\right)^{\frac{1}{3}}}{24c_1-2793-6\cos(4x)-924\cos(2x)+120\cos(3x)+3360\cos(x)}\right)$$

✓ Solution by Mathematica

Time used: 9.673 (sec). Leaf size: 311

```
DSolve[y'[x]==((5-2*Cos[x])^3*Sin[x]*Cos[y[x]]^4)/Sin[y[x]],y[x],x,IncludeSingularSolutions
```

$$y(x) \to -\sec^{-1}\left(-\frac{1}{2}\sqrt[3]{-\frac{3}{2}}\sqrt[3]{-2240\cos(x)+616\cos(2x)-80\cos(3x)+4\cos(4x)+1862+c_1}\right)$$

$$y(x) \to \sec^{-1}\left(-\frac{1}{2}\sqrt[3]{-\frac{3}{2}}\sqrt[3]{-2240\cos(x)+616\cos(2x)-80\cos(3x)+4\cos(4x)+1862+c_1}\right)$$

$$y(x) \to -\sec^{-1}\left(\frac{1}{2}\sqrt[3]{\frac{3}{2}}\sqrt[3]{-2240\cos(x)+616\cos(2x)-80\cos(3x)+4\cos(4x)+1862+c_1}\right)$$

$$y(x) \to \sec^{-1}\left(\frac{1}{2}\sqrt[3]{\frac{3}{2}}\sqrt[3]{-2240\cos(x)+616\cos(2x)-80\cos(3x)+4\cos(4x)+1862+c_1}\right)$$

$$y(x) \to -\sec^{-1}\left(\frac{1}{2}(-1)^{2/3}\sqrt[3]{\frac{3}{2}}\sqrt[3]{-2240\cos(x)+616\cos(2x)-80\cos(3x)+4\cos(4x)+1862+c_1}\right)$$

$$y(x) \to \sec^{-1}\left(\frac{1}{2}(-1)^{2/3}\sqrt[3]{\frac{3}{2}}\sqrt[3]{-2240\cos(x)+616\cos(2x)-80\cos(3x)+4\cos(4x)+1862+c_1}\right)$$

$$y(x) \to -\frac{\pi}{2}$$

$$y(x) \to \frac{\pi}{2}$$

4.29 problem 29

Internal problem ID [13867]

Book: INTRODUCTORY DIFFERENTIAL EQUATIONS. Martha L. Abell, James P. Braselton. Fourth edition 2014. ElScAe. 2014
Section: Chapter 2. First Order Equations. Exercises 2.2, page 39
Problem number: 29.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{-\frac{e^{\frac{3}{y}} y'}{y} = -\frac{\sqrt{\ln(x)}}{x}}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 24

```
dsolve(sqrt(ln(x))/x=exp(3/y(x))/y(x)*diff(y(x),x),y(x), singsol=all)
```

$$y(x) = -\frac{3}{\text{RootOf}\left(2\ln(x)^{\frac{3}{2}} - 3\,\text{expIntegral}_1(\_Z) + 3c_1\right)}$$

✓ Solution by Mathematica

Time used: 0.425 (sec). Leaf size: 29

```
DSolve[Sqrt[Log[x]]/x==Exp[3/y[x]]/y[x]*y'[x],y[x],x,IncludeSingularSolutions -> True]
```

$$y(x) \to \text{InverseFunction}\left[-\text{ExpIntegralEi}\left(\frac{3}{\#1}\right)\&\right]\left[\frac{2}{3}\log^{\frac{3}{2}}(x) + c_1\right]$$