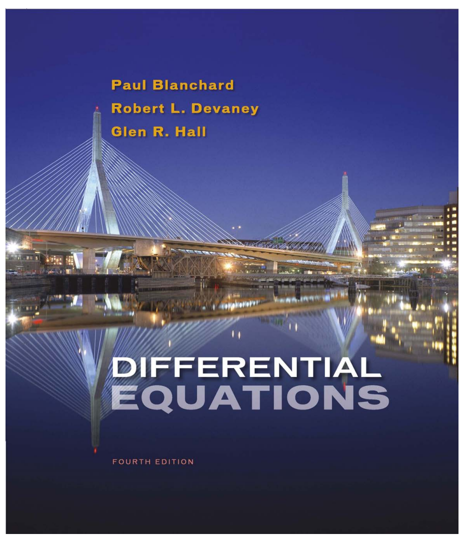
A Solution Manual For

DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012



Nasser M. Abbasi

March 3, 2024

Contents

1 Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33

1.1 problem 1

Internal problem ID [12545]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 1.
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)
```

$$y(t) = -1 + (t+1)\, c_1$$

✓ Solution by Mathematica

Time used: 0.045 (sec). Leaf size: 18

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

$$y(t) \to -1 + c_1(t+1)$$
$$y(t) \to -1$$

1.2 problem 5

Internal problem ID [12546]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 5.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

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

✓ Solution by Maple

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

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

$$y(t) = \frac{3}{-t^3 + 3c_1}$$

✓ Solution by Mathematica

Time used: 0.214 (sec). Leaf size: 22

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

$$y(t) \to -\frac{3}{t^3 + 3c_1}$$
$$y(t) \to 0$$

1.3 problem 6

Internal problem ID [12547]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 6.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - t^4 y = 0}$$

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)=t^4*y(t),y(t), singsol=all)
```

$$y(t) = c_1 \mathrm{e}^{\frac{t^5}{5}}$$

✓ Solution by Mathematica

Time used: 0.041 (sec). Leaf size: 22

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

$$y(t) \to c_1 e^{\frac{t^5}{5}}$$
$$y(t) \to 0$$

1.4 problem 7

Internal problem ID [12548]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 7.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)=2*y(t)+1,y(t), singsol=all)
```

$$y(t) = -\frac{1}{2} + c_1 \mathrm{e}^{2t}$$

✓ Solution by Mathematica

Time used: 0.041 (sec). Leaf size: 24

```
DSolve[y'[t]==2*y[t]+1,y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to -\frac{1}{2} + c_1 e^{2t}$$
$$y(t) \to -\frac{1}{2}$$

1.5 problem 8

Internal problem ID [12549]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 8.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)=2-y(t),y(t), singsol=all)
```

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

✓ Solution by Mathematica

Time used: 0.038 (sec). Leaf size: 20

```
DSolve[y'[t]==2-y[t],y[t],t,IncludeSingularSolutions -> True]
```

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

1.6 problem 9

Internal problem ID [12550]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 9.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - e^{-y} = 0}$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 8

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

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

✓ Solution by Mathematica

Time used: 0.369 (sec). Leaf size: 10

```
DSolve[y'[t]==Exp[-y[t]],y[t],t,IncludeSingularSolutions -> True]
```

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

1.7 problem 10

Internal problem ID [12551]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 10.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 8

```
dsolve(diff(x(t),t)=1+x(t)^2,x(t), singsol=all)
```

$$x(t) = \tan(t + c_1)$$

✓ Solution by Mathematica

Time used: 0.222 (sec). Leaf size: 24

```
DSolve[x'[t]==1+x[t]^2,x[t],t,IncludeSingularSolutions -> True]
```

$$x(t) \to \tan(t + c_1)$$
$$x(t) \to -i$$
$$x(t) \to i$$

1.8 problem 11

Internal problem ID [12552]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 11.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 16

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

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

✓ Solution by Mathematica

Time used: 0.218 (sec). Leaf size: 23

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

$$y(t) \to -\frac{1}{t^2 + 3t + c_1}$$
$$y(t) \to 0$$

1.9 problem 12

Internal problem ID [12553]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 12.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

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

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)=t/y(t),y(t), singsol=all)
```

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

✓ Solution by Mathematica

Time used: 0.14 (sec). Leaf size: 35

```
DSolve[y'[t]==t/y[t],y[t],t,IncludeSingularSolutions -> True]
```

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

1.10 problem 13

Internal problem ID [12554]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 13.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

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

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 29

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

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

✓ Solution by Mathematica

Time used: 0.162 (sec). Leaf size: 41

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

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

1.11 problem 14

Internal problem ID [12555]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 14.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - ty^{\frac{1}{3}} = 0}$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 16

```
dsolve(diff(y(t),t)=t*y(t)^(1/3),y(t), singsol=all)
```

$$y(t)^{\frac{2}{3}} - \frac{t^2}{3} - c_1 = 0$$

✓ Solution by Mathematica

Time used: 0.346 (sec). Leaf size: 31

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

$$y(t) \to \frac{(t^2 + 2c_1)^{3/2}}{3\sqrt{3}}$$
$$y(t) \to 0$$

1.12 problem 15

Internal problem ID [12556]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 15.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - \frac{1}{2y+1} = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 35

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

$$y(t) = -\frac{1}{2} - \frac{\sqrt{1+4t+4c_1}}{2}$$
$$y(t) = -\frac{1}{2} + \frac{\sqrt{1+4t+4c_1}}{2}$$

✓ Solution by Mathematica

Time used: 0.14 (sec). Leaf size: 49

```
DSolve[y'[t]==1/(2*y[t]+1),y[t],t,IncludeSingularSolutions -> True]
```

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

1.13 problem 16

Internal problem ID [12557]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 16.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - \frac{2y+1}{t} = 0}$$

✓ Solution by Maple

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

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

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

✓ Solution by Mathematica

Time used: 0.04 (sec). Leaf size: 22

```
DSolve[y'[t]==(2*y[t]+1)/t,y[t],t,IncludeSingularSolutions -> True]
```

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

1.14 problem 17

Internal problem ID [12558]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 17.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)=y(t)*(1-y(t)),y(t), singsol=all)
```

$$y(t) = \frac{1}{1 + c_1 \mathrm{e}^{-t}}$$

✓ Solution by Mathematica

Time used: 0.394 (sec). Leaf size: 29

```
DSolve[y'[t]==y[t]*(1-y[t]),y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{e^t}{e^t + e^{c_1}}$$
$$y(t) \to 0$$
$$y(t) \to 1$$

1.15 problem 18

Internal problem ID [12559]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 18.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - \frac{4t}{1 + 3y^2} = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 373

```
dsolve(diff(y(t),t)=4*t/(1+3*y(t)^2),y(t), singsol=all)
```

$$
\begin{aligned}
y(t) &= \frac{\left(27t^2+54c_1+3\sqrt{81t^4+324c_1t^2+324c_1^2+3}\right)^{\frac{1}{3}}}{3} \\
&\quad - \frac{1}{\left(27t^2+54c_1+3\sqrt{81t^4+324c_1t^2+324c_1^2+3}\right)^{\frac{1}{3}}}
\end{aligned}
$$

$$
\begin{aligned}
y(t) &= -\frac{\left(27t^2+54c_1+3\sqrt{81t^4+324c_1t^2+324c_1^2+3}\right)^{\frac{1}{3}}}{6} \\
&\quad + \frac{1}{2\left(27t^2+54c_1+3\sqrt{81t^4+324c_1t^2+324c_1^2+3}\right)^{\frac{1}{3}}} \\
&\quad - \frac{i\sqrt{3}\left(\frac{\left(27t^2+54c_1+3\sqrt{81t^4+324c_1t^2+324c_1^2+3}\right)^{\frac{1}{3}}}{3}+\frac{1}{\left(27t^2+54c_1+3\sqrt{81t^4+324c_1t^2+324c_1^2+3}\right)^{\frac{1}{3}}}\right)}{2}
\end{aligned}
$$

$$
\begin{aligned}
y(t) &= -\frac{\left(27t^2+54c_1+3\sqrt{81t^4+324c_1t^2+324c_1^2+3}\right)^{\frac{1}{3}}}{6} \\
&\quad + \frac{1}{2\left(27t^2+54c_1+3\sqrt{81t^4+324c_1t^2+324c_1^2+3}\right)^{\frac{1}{3}}} \\
&\quad + \frac{i\sqrt{3}\left(\frac{\left(27t^2+54c_1+3\sqrt{81t^4+324c_1t^2+324c_1^2+3}\right)^{\frac{1}{3}}}{3}+\frac{1}{\left(27t^2+54c_1+3\sqrt{81t^4+324c_1t^2+324c_1^2+3}\right)^{\frac{1}{3}}}\right)}{2}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 3.132 (sec). Leaf size: 298

```
DSolve[y'[t]==4*t/(1+3*y[t]^2),y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{\sqrt[3]{54t^2 + \sqrt{108 + 729\left(2t^2 + c_1\right)^2} + 27c_1}}{3\sqrt[3]{2}} - \frac{\sqrt[3]{2}}{\sqrt[3]{54t^2 + \sqrt{108 + 729\left(2t^2 + c_1\right)^2} + 27c_1}}$$

$$y(t) \to \frac{\left(-1 + i\sqrt{3}\right)\sqrt[3]{54t^2 + \sqrt{108 + 729\left(2t^2 + c_1\right)^2} + 27c_1}}{6\sqrt[3]{2}} + \frac{1 + i\sqrt{3}}{2^{2/3}\sqrt[3]{54t^2 + \sqrt{108 + 729\left(2t^2 + c_1\right)^2} + 27c_1}}$$

$$y(t) \to \frac{1 - i\sqrt{3}}{2^{2/3}\sqrt[3]{54t^2 + \sqrt{108 + 729\left(2t^2 + c_1\right)^2} + 27c_1}} - \frac{\left(1 + i\sqrt{3}\right)\sqrt[3]{54t^2 + \sqrt{108 + 729\left(2t^2 + c_1\right)^2} + 27c_1}}{6\sqrt[3]{2}}$$

1.16 problem 19

Internal problem ID [12560]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 19.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{v' - t^2 v + 2v = t^2 - 2}$$

✓ Solution by Maple

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

```
dsolve(diff(v(t),t)=t^2*v(t)-2-2*v(t)+t^2,v(t), singsol=all)
```

$$v(t) = -1 + c_1 \mathrm{e}^{\frac{t(t^2-6)}{3}}$$

✓ Solution by Mathematica

Time used: 0.086 (sec). Leaf size: 27

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

$$v(t) \to -1 + c_1 e^{\frac{1}{3}t(t^2-6)}$$
$$v(t) \to -1$$

1.17 problem 20

Internal problem ID [12561]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 20.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - \frac{1}{1 + yt + y + t} = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 39

```
dsolve(diff(y(t),t)=1/(t*y(t)+t+y(t)+1),y(t), singsol=all)
```

$$y(t) = -1 - \sqrt{1 + 2\ln(t+1) + 2c_1}$$
$$y(t) = -1 + \sqrt{1 + 2\ln(t+1) + 2c_1}$$

✓ Solution by Mathematica

Time used: 0.217 (sec). Leaf size: 47

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

$$y(t) \to -1 - \sqrt{2\log(t+1) + 1 + 2c_1}$$
$$y(t) \to -1 + \sqrt{2\log(t+1) + 1 + 2c_1}$$

1.18 problem 21

Internal problem ID [12562]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 21.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - \frac{e^t y}{1 + y^2} = 0}$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 21

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

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

✓ Solution by Mathematica

Time used: 33.022 (sec). Leaf size: 46

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

$$y(t) \to -\sqrt{W\left(e^{2(e^t+c_1)}\right)}$$

$$y(t) \to \sqrt{W\left(e^{2(e^t+c_1)}\right)}$$

$$y(t) \to 0$$

1.19 problem 22

Internal problem ID [12563]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 22.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 24

```
dsolve(diff(y(t),t)=y(t)^2-4,y(t), singsol=all)
```

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

✓ Solution by Mathematica

Time used: 1.053 (sec). Leaf size: 40

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

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

1.20 problem 23

Internal problem ID [12564]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 23.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{w' - \frac{w}{t} = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 7

```
dsolve(diff(w(t),t)=w(t)/t,w(t), singsol=all)
```

$$w(t) = c_1 t$$

✓ Solution by Mathematica

Time used: 0.036 (sec). Leaf size: 14

```
DSolve[w'[t]==w[t]/t,w[t],t,IncludeSingularSolutions -> True]
```

$$w(t) \to c_1 t$$
$$w(t) \to 0$$

1.21 problem 24

Internal problem ID [12565]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 24.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - \sec(y) = 0}$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 8

```
dsolve(diff(y(x),x)=sec(y(x)),y(x), singsol=all)
```

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

✓ Solution by Mathematica

Time used: 0.35 (sec). Leaf size: 10

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

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

1.22 problem 25

Internal problem ID [12566]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 25.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{x' + tx = 0}$$

With initial conditions

$$\left[x(0) = \frac{1}{\sqrt{\pi}}\right]$$

✓ Solution by Maple

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

```
dsolve([diff(x(t),t)=-x(t)*t,x(0) = 1/Pi^(1/2)],x(t), singsol=all)
```

$$x(t) = \frac{e^{-\frac{t^2}{2}}}{\sqrt{\pi}}$$

✓ Solution by Mathematica

Time used: 0.042 (sec). Leaf size: 20

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

$$x(t) \to \frac{e^{-\frac{t^2}{2}}}{\sqrt{\pi}}$$

1.23 problem 26

Internal problem ID [12567]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 26.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

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

With initial conditions

$$[y(0) = 3]$$

✓ Solution by Maple

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

```
dsolve([diff(y(t),t)=t*y(t),y(0) = 3],y(t), singsol=all)
```

$$y(t) = 3\,\mathrm{e}^{\frac{t^2}{2}}$$

✓ Solution by Mathematica

Time used: 0.04 (sec). Leaf size: 16

```
DSolve[{y'[t]==t*y[t],{y[0]==3}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \rightarrow 3e^{\frac{t^2}{2}}$$

1.24 problem 27

Internal problem ID [12568]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 27.
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: 0.015 (sec). Leaf size: 9

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

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

✓ Solution by Mathematica

Time used: 0.005 (sec). Leaf size: 10

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

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

1.25 problem 28

Internal problem ID [12569]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 28.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - t^2 y^3 = 0}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.063 (sec). Leaf size: 15

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

$$y(t) = -\frac{3}{\sqrt{-6t^3 + 9}}$$

✓ Solution by Mathematica

Time used: 0.285 (sec). Leaf size: 20

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

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

1.26 problem 29

Internal problem ID [12570]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 29.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

With initial conditions

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

✓ Solution by Maple

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

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

$$y(t) = 0$$

✓ Solution by Mathematica

Time used: 0.002 (sec). Leaf size: 6

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

$$y(t) \to 0$$

1.27 problem 30

Internal problem ID [12571]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 30.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - \frac{t}{y - t^2 y} = 0}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 24

```
dsolve([diff(y(t),t)=t/(y(t)-t^2*y(t)),y(0) = 4],y(t), singsol=all)
```

$$y(t) = \sqrt{-\ln (t-1) - \ln (t+1) + i\pi + 16}$$

✓ Solution by Mathematica

Time used: 0.15 (sec). Leaf size: 24

```
DSolve[{y'[t]==t/(y[t]-t^2*y[t]),{y[0]==4}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \sqrt{-\log (t^2 - 1) + i\pi + 16}$$

1.28 problem 31

Internal problem ID [12572]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 31.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

With initial conditions

$$[y(0) = 3]$$

✓ Solution by Maple

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

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

$$y(t) = \frac{7\,\mathrm{e}^{2t}}{2} - \frac{1}{2}$$

✓ Solution by Mathematica

Time used: 0.045 (sec). Leaf size: 18

```
DSolve[{y'[t]==2*y[t]+1,{y[0]==3}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{2}(7e^{2t} - 1)$$

1.29 problem 32

Internal problem ID [12573]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 32.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.062 (sec). Leaf size: 16

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

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

✓ Solution by Mathematica

Time used: 0.219 (sec). Leaf size: 17

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

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

1.30 problem 33

Internal problem ID [12574]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 33.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{x' - \frac{t^2}{x + t^3 x} = 0}$$

With initial conditions

$$[x(0) = -2]$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 18

```
dsolve([diff(x(t),t)=t^2/(x(t)+t^3*x(t)),x(0) = -2],x(t), singsol=all)
```

$$x(t) = -\frac{\sqrt{6\ln(t^3+1) + 36}}{3}$$

✓ Solution by Mathematica

Time used: 0.202 (sec). Leaf size: 26

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

$$x(t) \to -\sqrt{\frac{2}{3}}\sqrt{\log(t^3+1) + 6}$$

1.31 problem 34

Internal problem ID [12575]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 34.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 16

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

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

✓ Solution by Mathematica

Time used: 0.013 (sec). Leaf size: 20

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

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

1.32 problem 35

Internal problem ID [12576]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 35.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - (1 + y^2)\, t = 0}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 14

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

$$y(t) = \tan\left(\frac{t^2}{2} + \frac{\pi}{4}\right)$$

✓ Solution by Mathematica

Time used: 0.29 (sec). Leaf size: 17

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

$$y(t) \to \tan\left(\frac{1}{4}(2t^2 + \pi)\right)$$

1.33 problem 36

Internal problem ID [12577]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 36.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - \frac{1}{2y+3} = 0}$$

With initial conditions

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

✓ Solution by Maple

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

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

$$y(t) = -\frac{3}{2} + \frac{\sqrt{25+4t}}{2}$$

✓ Solution by Mathematica

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

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

$$y(t) \to \frac{1}{2}\left(\sqrt{4t+25} - 3\right)$$

1.34 problem 37

Internal problem ID [12578]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 37.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 16

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

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

✓ Solution by Mathematica

Time used: 0.222 (sec). Leaf size: 17

```
DSolve[{y'[t]==2*t*y[t]^2+3*t^2*y[t]^2,{y[1]==-1}},y[t],t,IncludeSingularSolutions -> True]
```

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

1.35 problem 38

Internal problem ID [12579]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.2. page 33
Problem number: 38.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - \frac{y^2+5}{y} = 0}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 16

```
dsolve([diff(y(t),t)=(y(t)^2+5)/y(t),y(0) = -2],y(t), singsol=all)
```

$$y(t) = -\sqrt{-5 + 9\,\mathrm{e}^{2t}}$$

✓ Solution by Mathematica

Time used: 0.01 (sec). Leaf size: 20

```
DSolve[{y'[t]==(y[t]^2+5)/y[t],{y[0]==-2}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to -\sqrt{9e^{2t} - 5}$$

2 Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47

2.1 problem 1

Internal problem ID [12580]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 1.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 16

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

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

✓ Solution by Mathematica

Time used: 0.004 (sec). Leaf size: 22

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

$$y(t) \to \frac{t^3}{3} + \frac{t^2}{2} + c_1$$

2.2 problem 2

Internal problem ID [12581]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 2.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)=t^2+1,y(t), singsol=all)
```

$$y(t) = \frac{1}{3}t^3 + t + c_1$$

✓ Solution by Mathematica

Time used: 0.004 (sec). Leaf size: 16

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

$$y(t) \to \frac{t^3}{3} + t + c_1$$

2.3 problem 3

Internal problem ID [12582]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 3.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

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

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

$$y(t) = \frac{1}{2} + c_1 \mathrm{e}^{-2t}$$

✓ Solution by Mathematica

Time used: 0.04 (sec). Leaf size: 24

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

$$y(t) \to \frac{1}{2} + c_1 e^{-2t}$$
$$y(t) \to \frac{1}{2}$$

2.4 problem 4

Internal problem ID [12583]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 4.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - 4y^2 = 0}$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 11

```
dsolve(diff(y(t),t)=4*y(t)^2,y(t), singsol=all)
```

$$y(t) = \frac{1}{-4t + c_1}$$

✓ Solution by Mathematica

Time used: 0.157 (sec). Leaf size: 20

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

$$y(t) \to -\frac{1}{4t + c_1}$$
$$y(t) \to 0$$

2.5 problem 5

Internal problem ID [12584]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 5.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

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

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

$$y(t) = \frac{1}{1 + c_1 \mathrm{e}^{-2t}}$$

✓ Solution by Mathematica

Time used: 0.404 (sec). Leaf size: 33

```
DSolve[y'[t]==2*y[t]*(1-y[t]),y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{e^{2t}}{e^{2t} + e^{c_1}}$$
$$y(t) \to 0$$
$$y(t) \to 1$$

2.6 problem 6

Internal problem ID [12585]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 6.
ODE order: 1.
ODE degree: 1.

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

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

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)=y(t)+t+1,y(t), singsol=all)
```

$$y(t) = -t - 2 + c_1 e^t$$

✓ Solution by Mathematica

Time used: 0.1 (sec). Leaf size: 16

```
DSolve[y'[t]==y[t]+t+1,y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to -t + c_1 e^t - 2$$

2.7 problem 7

Internal problem ID [12586]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 7.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - 3y(1-y) = 0}$$

With initial conditions

$$\left[y(0) = \frac{1}{2}\right]$$

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 12

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

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

✓ Solution by Mathematica

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

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

$$y(t) \to \frac{e^{3t}}{e^{3t} + 1}$$

2.8 problem 8

Internal problem ID [12587]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 8.
ODE order: 1.
ODE degree: 1.

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

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

With initial conditions

$$\left[y(0) = \frac{1}{2}\right]$$

✓ Solution by Maple

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

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

$$y(t) = \frac{t}{2} + \frac{1}{4} + \frac{e^{2t}}{4}$$

✓ Solution by Mathematica

Time used: 0.047 (sec). Leaf size: 19

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

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

2.9 problem 9

Internal problem ID [12588]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 9.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_Riccati]`

$$\boxed{y' - \left(y + \frac{1}{2}\right)(t + y) = 0}$$

With initial conditions

$$\left[y(0) = \frac{1}{2}\right]$$

✓ Solution by Maple

Time used: 0.094 (sec). Leaf size: 65

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

$$y(t) = \frac{-i\sqrt{\pi}\,\mathrm{e}^{-\frac{1}{8}}\sqrt{2}\,\operatorname{erf}\left(\frac{i\sqrt{2}\,(-1+2t)}{4}\right) - i\sqrt{\pi}\,\mathrm{e}^{-\frac{1}{8}}\sqrt{2}\,\operatorname{erf}\left(\frac{i\sqrt{2}}{4}\right) + 4\,\mathrm{e}^{\frac{t(t-1)}{2}} - 2}{2i\sqrt{\pi}\,\mathrm{e}^{-\frac{1}{8}}\sqrt{2}\,\operatorname{erf}\left(\frac{i\sqrt{2}\,(-1+2t)}{4}\right) + 2i\sqrt{\pi}\,\mathrm{e}^{-\frac{1}{8}}\sqrt{2}\,\operatorname{erf}\left(\frac{i\sqrt{2}}{4}\right) + 4}$$

✓ Solution by Mathematica

Time used: 0.332 (sec). Leaf size: 124

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

$$y(t) \to \frac{-\sqrt{2\pi}\operatorname{erfi}\left(\frac{1-2t}{2\sqrt{2}}\right) + \sqrt{2\pi}\operatorname{erfi}\left(\frac{1}{2\sqrt{2}}\right) + 4e^{\frac{1}{8}(1-2t)^2} - 2\sqrt[8]{e}}{2\sqrt{2\pi}\operatorname{erfi}\left(\frac{1-2t}{2\sqrt{2}}\right) - 2\sqrt{2\pi}\operatorname{erfi}\left(\frac{1}{2\sqrt{2}}\right) + 4\sqrt[8]{e}}$$

2.10 problem 10

Internal problem ID [12589]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 10.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - (t+1)\, y = 0}$$

With initial conditions

$$\left[y(0) = \frac{1}{2}\right]$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 13

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

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

✓ Solution by Mathematica

Time used: 0.042 (sec). Leaf size: 19

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

$$y(t) \to \frac{1}{2} e^{\frac{1}{2}t(t+2)}$$

2.11 problem 15 b(1)

Internal problem ID [12590]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 15 b(1).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{S' - S^3 + 2S^2 - S = 0}$$

With initial conditions

$$\left[S(0) = \frac{1}{2}\right]$$

✓ Solution by Maple

Time used: 1.0 (sec). Leaf size: 37

```
dsolve([diff(S(t),t)=S(t)^3-2*S(t)^2+S(t),S(0) = 1/2],S(t), singsol=all)
```

$$S(t) = \mathrm{e}^{\mathrm{RootOf}\left(-i\pi\,\mathrm{e}^{\_Z} - \ln\left(\mathrm{e}^{\_Z}+1\right)\mathrm{e}^{\_Z} + \_Z\,\mathrm{e}^{\_Z} + t\,\mathrm{e}^{\_Z} + 2\,\mathrm{e}^{\_Z} + 1\right)} + 1$$

✗ Solution by Mathematica

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

```
DSolve[{S'[t]==S[t]^3-2*S[t]^2+S[t],{S[0]==1/2}},S[t],t,IncludeSingularSolutions -> True]
```

{}

2.12 problem 15 b(2)

Internal problem ID [12591]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 15 b(2).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{S' - S^3 + 2S^2 - S = 0}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.703 (sec). Leaf size: 35

```
dsolve([diff(S(t),t)=S(t)^3-2*S(t)^2+S(t),S(1) = 1/2],S(t), singsol=all)
```

$$S(t) = \mathrm{e}^{\mathrm{RootOf}\left(-i\pi\,\mathrm{e}^{\_Z}-\ln\left(\mathrm{e}^{\_Z}+1\right)\mathrm{e}^{\_Z}+\_Z\,\mathrm{e}^{\_Z}+t\,\mathrm{e}^{\_Z}+\mathrm{e}^{\_Z}+1\right)}+1$$

✗ Solution by Mathematica

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

```
DSolve[{S'[t]==S[t]^3-2*S[t]^2+S[t],{S[1]==1/2}},S[t],t,IncludeSingularSolutions -> True]
```

{}

2.13 problem 15 b(3)

Internal problem ID [12592]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 15 b(3).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{S' - S^3 + 2S^2 - S = 0}$$

With initial conditions

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

✓ Solution by Maple

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

```
dsolve([diff(S(t),t)=S(t)^3-2*S(t)^2+S(t),S(0) = 1],S(t), singsol=all)
```

$$S(t) = 1$$

✓ Solution by Mathematica

Time used: 0.002 (sec). Leaf size: 6

```
DSolve[{S'[t]==S[t]^3-2*S[t]^2+S[t],{S[0]==1}},S[t],t,IncludeSingularSolutions -> True]
```

$$S(t) \to 1$$

2.14 problem 15 b(4)

Internal problem ID [12593]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 15 b(4).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{S' - S^3 + 2S^2 - S = 0}$$

With initial conditions

$$\left[S(0) = \frac{3}{2}\right]$$

✓ Solution by Maple

Time used: 0.25 (sec). Leaf size: 41

```
dsolve([diff(S(t),t)=S(t)^3-2*S(t)^2+S(t),S(0) = 3/2],S(t), singsol=all)
```

$$S(t) = \mathrm{e}^{\mathrm{RootOf}\left(\mathrm{e}^{-Z}\ln(3)-\ln\left(\mathrm{e}^{-Z}+1\right)\mathrm{e}^{-Z}+\_Z\,\mathrm{e}^{-Z}+t\,\mathrm{e}^{-Z}-2\,\mathrm{e}^{-Z}+1\right)} + 1$$

✓ Solution by Mathematica

Time used: 0.885 (sec). Leaf size: 31

```
DSolve[{S'[t]==S[t]^3-2*S[t]^2+S[t],{S[0]==3/2}},S[t],t,IncludeSingularSolutions -> True]
```

$$S(t) \to \text{InverseFunction}\left[-\frac{1}{\#1-1} - \log(\#1-1) + \log(\#1)\&\right][t - 2 + \log(3)]$$

2.15 problem 15 b(5)

Internal problem ID [12594]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 15 b(5).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{S' - S^3 + 2S^2 - S = 0}$$

With initial conditions

$$\left[S(0) = -\frac{1}{2}\right]$$

✓ Solution by Maple

Time used: 0.687 (sec). Leaf size: 45

```
dsolve([diff(S(t),t)=S(t)^3-2*S(t)^2+S(t),S(0) = -1/2],S(t), singsol=all)
```

$$S(t) = e^{\operatorname{RootOf}\left(-3\ln\left(e^{-\_Z}+1\right)e^{-\_Z}-3\,e^{-\_Z}\ln(3)+3\_Z\,e^{-\_Z}+3t\,e^{-\_Z}+2\,e^{-\_Z}+3\right)} + 1$$

✗ Solution by Mathematica

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

```
DSolve[{S'[t]==S[t]^3-2*S[t]^2+S[t],{S[0]==-1/2}},S[t],t,IncludeSingularSolutions -> True]
```

{}

2.16 problem 16 (i)

Internal problem ID [12595]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 16 (i).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

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

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

$$y(t) = \frac{1}{-1 + c_1 \mathrm{e}^{-t}}$$

✓ Solution by Mathematica

Time used: 0.384 (sec). Leaf size: 33

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

$$y(t) \to -\frac{e^{t+c_1}}{-1 + e^{t+c_1}}$$
$$y(t) \to -1$$
$$y(t) \to 0$$

2.17 problem 16 (ii)

Internal problem ID [12596]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 16 (ii).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)=y(t)^2-y(t),y(t), singsol=all)
```

$$y(t) = \frac{1}{1 + c_1 e^t}$$

✓ Solution by Mathematica

Time used: 0.294 (sec). Leaf size: 25

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

$$y(t) \to \frac{1}{1 + e^{t+c_1}}$$
$$y(t) \to 0$$
$$y(t) \to 1$$

2.18 problem 16 (iii)

Internal problem ID [12597]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 16 (iii).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

Time used: 0.063 (sec). Leaf size: 18

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

$$y(t) = -\frac{1}{\text{LambertW}\left(-c_1 e^{t-1}\right) + 1}$$

✓ Solution by Mathematica

Time used: 0.318 (sec). Leaf size: 38

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

$$y(t) \to \text{InverseFunction}\left[-\frac{1}{\#1} - \log(\#1) + \log(\#1 + 1)\&\right][t + c_1]$$

$$y(t) \to -1$$

$$y(t) \to 0$$

2.19 problem 16 (iv)

Internal problem ID [12598]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 16 (iv).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)=2-t^2,y(t), singsol=all)
```

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

✓ Solution by Mathematica

Time used: 0.004 (sec). Leaf size: 18

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

$$y(t) \to -\frac{t^3}{3} + 2t + c_1$$

2.20 problem 16 (v)

Internal problem ID [12599]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 16 (v).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - yt - ty^2 = 0}$$

✓ Solution by Maple

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

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

$$y(t) = \frac{1}{-1 + \mathrm{e}^{-\frac{t^2}{2}} c_1}$$

✓ Solution by Mathematica

Time used: 0.396 (sec). Leaf size: 45

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

$$y(t) \to -\frac{e^{\frac{t^2}{2}+c_1}}{-1 + e^{\frac{t^2}{2}+c_1}}$$
$$y(t) \to -1$$
$$y(t) \to 0$$

2.21 problem 16 (vi)

Internal problem ID [12600]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 16 (vi).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

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

✓ Solution by Maple

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

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

$$y(t) = -1 + \mathrm{e}^{\frac{t^3}{3}} c_1$$

✓ Solution by Mathematica

Time used: 0.064 (sec). Leaf size: 24

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

$$y(t) \to -1 + c_1 e^{\frac{t^3}{3}}$$
$$y(t) \to -1$$

2.22 problem 16 (vii)

Internal problem ID [12601]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 16 (vii).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

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

✓ Solution by Maple

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

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

$$y(t) = -1 + \mathrm{e}^{\frac{t^2}{2}} c_1$$

✓ Solution by Mathematica

Time used: 0.072 (sec). Leaf size: 24

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

$$y(t) \to -1 + c_1 e^{\frac{t^2}{2}}$$
$$y(t) \to -1$$

2.23 problem 16 (viii)

Internal problem ID [12602]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 16 (viii).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)=t^2-2,y(t), singsol=all)
```

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

✓ Solution by Mathematica

Time used: 0.004 (sec). Leaf size: 18

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

$$y(t) \to \frac{t^3}{3} - 2t + c_1$$

2.24 problem 19 a(i)

Internal problem ID [12603]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 19 a(i).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{\theta' + \frac{11\cos(\theta)}{10} = \frac{9}{10}}$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 21

```
dsolve(diff(theta(t),t)=1-cos(theta(t))+(1+cos(theta(t)))*(-1/10),theta(t), singsol=all)
```

$$\theta(t) = -2\arctan\left(\frac{\tanh\left(\frac{(t+c_1)\sqrt{10}}{10}\right)\sqrt{10}}{10}\right)$$

✓ Solution by Mathematica

Time used: 1.026 (sec). Leaf size: 69

```
DSolve[theta'[t]==1-Cos[theta[t]]+(1+Cos[theta[t]])*(-1/10),theta[t],t,IncludeSingularSoluti
```

$$\theta(t) \to -2\arctan\left(\frac{\tanh\left(\frac{t-10c_1}{\sqrt{10}}\right)}{\sqrt{10}}\right)$$

$$\theta(t) \to -\arccos\left(\frac{9}{11}\right)$$

$$\theta(t) \to \arccos\left(\frac{9}{11}\right)$$

$$\theta(t) \to -2\arctan\left(\frac{1}{\sqrt{10}}\right)$$

$$\theta(t) \to 2\arctan\left(\frac{1}{\sqrt{10}}\right)$$

2.25 problem 19 a(ii)

Internal problem ID [12604]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 19 a(ii).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{\theta' = 2}$$

✓ Solution by Maple

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

```
dsolve(diff(theta(t),t)=1-cos(theta(t))+(1+cos(theta(t))),theta(t), singsol=all)
```

$$\theta(t) = -2 \arctan\left(\frac{1}{t + c_1}\right)$$

✓ Solution by Mathematica

Time used: 0.003 (sec). Leaf size: 11

```
DSolve[theta'[t]==1-Cos[theta[t]]+(1+Cos[theta[t]]),theta[t],t,IncludeSingularSolutions -> T
```

$$\theta(t) \to 2t + c_1$$

2.26 problem 19 a(iii)

Internal problem ID [12605]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 19 a(iii).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{\theta' + \frac{9\cos(\theta)}{10} = \frac{11}{10}}$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 21

```
dsolve(diff(theta(t),t)=1-cos(theta(t))+(1+cos(theta(t)))*(1/10),theta(t), singsol=all)
```

$$\theta(t) = 2\arctan\left(\frac{\tan\left(\frac{(t+c_1)\sqrt{10}}{10}\right)\sqrt{10}}{10}\right)$$

✓ Solution by Mathematica

Time used: 10.277 (sec). Leaf size: 55

```
DSolve[theta'[t]==1-Cos[theta[t]]+(1+Cos[theta[t]])*(1/10),theta[t],t,IncludeSingularSolutio
```

$$\theta(t) \to 2\arctan\left(\frac{\tan\left(\frac{t-10c_1}{\sqrt{10}}\right)}{\sqrt{10}}\right)$$

$$\theta(t) \to -\arccos\left(\frac{11}{9}\right)$$

$$\theta(t) \to \arccos\left(\frac{11}{9}\right)$$

$$\theta(t) \to \text{Interval}[\{-\pi, \pi\}]$$

2.27 problem 20

Internal problem ID [12606]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 20.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{v' + \frac{v}{RC} = 0}$$

✓ Solution by Maple

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

```
dsolve(diff(v(t),t)=-v(t)/(R*C),v(t), singsol=all)
```

$$v(t) = c_1 \mathrm{e}^{-\frac{t}{RC}}$$

✓ Solution by Mathematica

Time used: 0.042 (sec). Leaf size: 24

```
DSolve[v'[t]==-v[t]/(r*c),v[t],t,IncludeSingularSolutions -> True]
```

$$v(t) \to c_1 e^{-\frac{t}{cr}}$$
$$v(t) \to 0$$

2.28 problem 21

Internal problem ID [12607]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 21.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{v' - \frac{K - v}{RC} = 0}$$

✓ Solution by Maple

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

```
dsolve(diff(v(t),t)=(K-v(t))/(R*C),v(t), singsol=all)
```

$$v(t) = K + c_1 \mathrm{e}^{-\frac{t}{RC}}$$

✓ Solution by Mathematica

Time used: 0.068 (sec). Leaf size: 26

```
DSolve[v'[t]==(k-v[t])/(r*c),v[t],t,IncludeSingularSolutions -> True]
```

$$v(t) \to k + c_1 e^{-\frac{t}{cr}}$$
$$v(t) \to k$$

2.29 problem 22

Internal problem ID [12608]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.3 page 47
Problem number: 22.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{v' + 2v = 2V(t)}$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 21

```
dsolve(diff(v(t),t)=(V(t)-v(t))/(1/2*1),v(t), singsol=all)
```

$$v(t) = \left(\int 2V(t)\,\mathrm{e}^{2t}dt + c_1\right)\mathrm{e}^{-2t}$$

✓ Solution by Mathematica

Time used: 0.082 (sec). Leaf size: 32

```
DSolve[v'[t]==(V[t]-v[t])/(1/2*1),v[t],t,IncludeSingularSolutions -> True]
```

$$v(t) \to e^{-2t}\left(\int_1^t 2e^{2K[1]}V(K[1])dK[1] + c_1\right)$$

3 Chapter 1. First-Order Differential Equations. Exercises section 1.4 page 61

3.1 problem 1

Internal problem ID [12609]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.4 page 61
Problem number: 1.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

With initial conditions

$$[y(0) = 3]$$

✓ Solution by Maple

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

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

$$y(t) = -\frac{1}{2} + \frac{7\,\mathrm{e}^{2t}}{2}$$

✓ Solution by Mathematica

Time used: 0.044 (sec). Leaf size: 18

```
DSolve[{y'[t]==2*y[t]+1,{y[0]==3}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{2}\left(7e^{2t} - 1\right)$$

3.2 problem 2

Internal problem ID [12610]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.4 page 61
Problem number: 2.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[[_Riccati, _special]]`

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.094 (sec). Leaf size: 89

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

$$y(t) = \frac{2\,\mathrm{AiryAi}\left(1,t\right)\pi 3^{\frac{5}{6}} - 3\,\mathrm{AiryAi}\left(1,t\right)\Gamma\left(\frac{2}{3}\right)^{2} 3^{\frac{2}{3}} - 3\,\mathrm{AiryBi}\left(1,t\right)3^{\frac{1}{6}}\Gamma\left(\frac{2}{3}\right)^{2} - 2\,\mathrm{AiryBi}\left(1,t\right)\pi 3^{\frac{1}{3}}}{2\,\mathrm{AiryAi}\left(t\right)\pi 3^{\frac{5}{6}} - 3\,\mathrm{AiryAi}\left(t\right)\Gamma\left(\frac{2}{3}\right)^{2} 3^{\frac{2}{3}} - 3\,\mathrm{AiryBi}\left(t\right)3^{\frac{1}{6}}\Gamma\left(\frac{2}{3}\right)^{2} - 2\,\mathrm{AiryBi}\left(t\right)\pi 3^{\frac{1}{3}}}$$

✓ Solution by Mathematica

Time used: 11.27 (sec). Leaf size: 163

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

$$y(t) \rightarrow \frac{2it^{3/2}\,\mathrm{Gamma}\left(\frac{1}{3}\right)\mathrm{BesselJ}\left(-\frac{2}{3},\frac{2}{3}it^{3/2}\right) + \sqrt[3]{-3}\,\mathrm{Gamma}\left(\frac{2}{3}\right)\left(it^{3/2}\,\mathrm{BesselJ}\left(-\frac{4}{3},\frac{2}{3}it^{3/2}\right) - it^{3/2}\,\mathrm{BesselJ}\left(\frac{2}{3}\right.\right.}{2t\left(\sqrt[3]{-3}\,\mathrm{Gamma}\left(\frac{2}{3}\right)\mathrm{BesselJ}\left(-\frac{1}{3},\frac{2}{3}it^{3/2}\right) + \mathrm{Gamma}\left(\frac{1}{3}\right)\mathrm{BesselJ}\left(\frac{1}{3},\frac{2}{3}it^{3/2}\right.\right.}$$

3.3 problem 3

Internal problem ID [12611]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.4 page 61
Problem number: 3.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[[_Riccati, _special]]`

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

With initial conditions

$$\left[y(0) = \frac{1}{2}\right]$$

✓ Solution by Maple

Time used: 0.094 (sec). Leaf size: 113

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

$$y(t) = \frac{\left(\left(3\,3^{\frac{1}{6}}\Gamma\left(\frac{2}{3}\right)^2 2^{\frac{2}{3}} - \pi 3^{\frac{1}{3}}\right)\operatorname{AiryBi}\left(1, 2^{\frac{2}{3}}t\right) + \left(\pi 3^{\frac{5}{6}} + 3\Gamma\left(\frac{2}{3}\right)^2 6^{\frac{2}{3}}\right)\operatorname{AiryAi}\left(1, 2^{\frac{2}{3}}t\right)\right)2^{\frac{2}{3}}}{\left(-\pi 3^{\frac{5}{6}} - 3\Gamma\left(\frac{2}{3}\right)^2 6^{\frac{2}{3}}\right)\operatorname{AiryAi}\left(2^{\frac{2}{3}}t\right) + \operatorname{AiryBi}\left(2^{\frac{2}{3}}t\right)\left(-3\,3^{\frac{1}{6}}\Gamma\left(\frac{2}{3}\right)^2 2^{\frac{2}{3}} + \pi 3^{\frac{1}{3}}\right)}$$

✓ Solution by Mathematica

Time used: 10.151 (sec). Leaf size: 193

```
DSolve[{y'[t]==y[t]^2-4*t,{y[0]==1/2}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to -\frac{4it^{3/2}\operatorname{Gamma}\left(\frac{1}{3}\right)\operatorname{BesselJ}\left(-\frac{2}{3}, \frac{4}{3}it^{3/2}\right) + 2^{2/3}\sqrt[3]{3}(\sqrt{3}-i)\operatorname{Gamma}\left(\frac{2}{3}\right)\left(2t^{3/2}\operatorname{BesselJ}\left(-\frac{4}{3}, \frac{4}{3}it^{3/2}\right) - 2\right.}{2t\left(2^{2/3}\sqrt[3]{3}\left(-1-i\sqrt{3}\right)\operatorname{Gamma}\left(\frac{2}{3}\right)\operatorname{BesselJ}\left(-\frac{1}{3}, \frac{4}{3}it^{3/2}\right) + \operatorname{Gamma}\left(\frac{1}{3}\right)\right.}$$

3.4 problem 4

Internal problem ID [12612]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.4 page 61
Problem number: 4.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - \sin(y) = 0}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.609 (sec). Leaf size: 63

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

$$y(t) = \arctan\left(-\frac{2\,\mathrm{e}^{t}\sin(1)}{(-1+\cos(1))\,\mathrm{e}^{2t} - \cos(1) - 1}, \frac{(1-\cos(1))\,\mathrm{e}^{2t} - \cos(1) - 1}{(-1+\cos(1))\,\mathrm{e}^{2t} - \cos(1) - 1}\right)$$

✓ Solution by Mathematica

Time used: 0.008 (sec). Leaf size: 16

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

$$y(t) \to \arccos(-\tanh(t - \operatorname{arctanh}(\cos(1))))$$

3.5 problem 5

Internal problem ID [12613]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.4 page 61
Problem number: 5.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{w' - (3 - w)(w + 1) = 0}$$

With initial conditions

$$[w(0) = 4]$$

✓ Solution by Maple

Time used: 0.078 (sec). Leaf size: 23

```
dsolve([diff(w(t),t)=(3-w(t))*(w(t)+1),w(0) = 4],w(t), singsol=all)
```

$$w(t) = \frac{15\,e^{4t} + 1}{-1 + 5\,e^{4t}}$$

✓ Solution by Mathematica

Time used: 0.02 (sec). Leaf size: 26

```
DSolve[{w'[t]==(3-w[t])*(w[t]+1),{w[0]==4}},w[t],t,IncludeSingularSolutions -> True]
```

$$w(t) \to \frac{15e^{4t} + 1}{5e^{4t} - 1}$$

3.6 problem 6

Internal problem ID [12614]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.4 page 61
Problem number: 6.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{w' - (3 - w)(w + 1) = 0}$$

With initial conditions

$$[w(0) = 0]$$

✓ Solution by Maple

Time used: 0.063 (sec). Leaf size: 21

```
dsolve([diff(w(t),t)=(3-w(t))*(w(t)+1),w(0) = 0],w(t), singsol=all)
```

$$w(t) = \frac{3\,\mathrm{e}^{4t} - 3}{3 + \mathrm{e}^{4t}}$$

✓ Solution by Mathematica

Time used: 0.016 (sec). Leaf size: 23

```
DSolve[{w'[t]==(3-w[t])*(w[t]+1),{w[0]==0}},w[t],t,IncludeSingularSolutions -> True]
```

$$w(t) \to \frac{3(e^{4t} - 1)}{e^{4t} + 3}$$

3.7 problem 7

Internal problem ID [12615]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.4 page 61
Problem number: 7.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.109 (sec). Leaf size: 37

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

$$y(t) = -\frac{2}{\operatorname{RootOf}\left(-2\_Z \operatorname{Ei}_1\left(-\_Z\right) - 2\_Z e^{-1} + 2\_Z \operatorname{Ei}_1\left(1\right) - \_Zt - 2\,e^{-\_Z}\right)}$$

✗ Solution by Mathematica

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

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

$$\{\}$$

3.8 problem 8

Internal problem ID [12616]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.4 page 61
Problem number: 8.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.062 (sec). Leaf size: 38

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

$$y(t) = -\frac{2}{\operatorname{RootOf}\left(-2\_Z \operatorname{Ei}_1\left(-\_Z\right) - 2\_Z e^{-1} + 2\_Z \operatorname{Ei}_1\left(1\right) - \_Zt - 2\,e^{-\_Z} + \_Z\right)}$$

✗ Solution by Mathematica

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

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

{}

3.9 problem 9

Internal problem ID [12617]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.4 page 61
Problem number: 9.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

With initial conditions

$$\left[y(0) = \frac{1}{5}\right]$$

✓ Solution by Maple

Time used: 1.391 (sec). Leaf size: 21

```
dsolve([diff(y(t),t)=y(t)^2-y(t)^3,y(0) = 1/5],y(t), singsol=all)
```

$$y(t) = \frac{1}{\operatorname{LambertW}\left(4\,\mathrm{e}^{-t+4}\right) + 1}$$

✓ Solution by Mathematica

Time used: 0.495 (sec). Leaf size: 31

```
DSolve[{y'[t]==y[t]^2-y[t]^3,{y[0]==2/10}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \text{InverseFunction}\left[\frac{1}{\#1} + \log(1 - \#1) - \log(\#1)\&\right][-t + 5 + \log(4)]$$

3.10 problem 10

Internal problem ID [12618]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.4 page 61
Problem number: 10.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_Abel]`

$$\boxed{y' - 2y^3 = t^2}$$

With initial conditions

$$\left[y(0) = -\frac{1}{2}\right]$$

✗ Solution by Maple

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

No solution found

✗ Solution by Mathematica

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

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

Not solved

3.11 problem 15

Internal problem ID [12619]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.4 page 61
Problem number: 15.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 11

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

$$y(t) = \frac{(t+2)^2}{4}$$

✓ Solution by Mathematica

Time used: 0.006 (sec). Leaf size: 14

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

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

3.12 problem 16

Internal problem ID [12620]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.4 page 61
Problem number: 16.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.422 (sec). Leaf size: 12

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

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

✓ Solution by Mathematica

Time used: 0.039 (sec). Leaf size: 14

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

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

3.13 problem 17

Internal problem ID [12621]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.4 page 61
Problem number: 17.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{\theta' + \frac{11\cos(\theta)}{10} = \frac{9}{10}}$$

With initial conditions

$$[\theta(0) = 1]$$

✓ Solution by Maple

Time used: 0.11 (sec). Leaf size: 29

```
dsolve([diff(theta(t),t)=1-cos( theta(t)) + (1+cos(theta(t)))*(-1/10),theta(0) = 1],theta(t)
```

$$\theta(t) = -2\arctan\left(\frac{\tanh\left(-\operatorname{arctanh}\left(\tan\left(\frac{1}{2}\right)\sqrt{10}\right) + \frac{\sqrt{10}\,t}{10}\right)\sqrt{10}}{10}\right)$$

✓ Solution by Mathematica

Time used: 0.061 (sec). Leaf size: 36

```
DSolve[{theta'[t]==1-Cos[ theta[t]] + (1+Cos[theta[t]])*(-1/10),{theta[0]==1}},theta[t],t,In
```

$$\theta(t) \to -2\arctan\left(\frac{\tanh\left(\frac{t}{\sqrt{10}} - \operatorname{arctanh}\left(\sqrt{10}\tan\left(\frac{1}{2}\right)\right)\right)}{\sqrt{10}}\right)$$

4 Chapter 1. First-Order Differential Equations. Exercises section 1.5 page 71

4.1 problem 5

Internal problem ID [12622]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.5 page 71
Problem number: 5.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type **[_quadrature]**

$$\boxed{y' - y(y-1)(y-3) = 0}$$

With initial conditions

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

✓ Solution by Maple

Time used: 1.125 (sec). Leaf size: 133

```
dsolve([diff(y(t),t)=y(t)*(y(t)-1)*(y(t)-3),y(0) = 4],y(t), singsol=all)
```

$$y(t) = \frac{48\left(\frac{e^{6t}}{3} - \frac{9}{16}\right)\left(27 - 32\,e^{6t} + 8\sqrt{16\,e^{12t} - 27\,e^{6t}}\right)^{\frac{2}{3}} + 48\left(\left(27 - 32\,e^{6t} + 8\sqrt{16\,e^{12t} - 27\,e^{6t}}\right)^{\frac{1}{3}} + 3\right)\left(e^{6t} - \right.}{\left(27 - 32\,e^{6t} + 8\sqrt{16\,e^{12t} - 27\,e^{6t}}\right)^{\frac{2}{3}}\left(16\,e^{6t} - 27\right)}$$

✓ Solution by Mathematica

Time used: 0.172 (sec). Leaf size: 132

```
DSolve[{y'[t]==y[t]*(y[t]-1)*(y[t]-3),{y[0]==4}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{3i(\sqrt{3}+i)\sqrt[3]{4\sqrt{e^{6t}(16e^{6t}-27)^3}+864e^{6t}-256e^{12t}-729}}{32e^{6t}-54} + \frac{9(1+i\sqrt{3})}{2\sqrt[3]{4\sqrt{e^{6t}(16e^{6t}-27)^3}+864e^{6t}-256e^{12t}-729}} + 1$$

4.2 problem 6

Internal problem ID [12623]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.5 page 71
Problem number: 6.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - y(y-1)(y-3) = 0}$$

With initial conditions

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

✓ Solution by Maple

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

```
dsolve([diff(y(t),t)=y(t)*(y(t)-1)*(y(t)-3),y(0) = 0],y(t), singsol=all)
```

$$y(t) = 0$$

✓ Solution by Mathematica

Time used: 0.002 (sec). Leaf size: 6

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

$$y(t) \to 0$$

4.3 problem 7

Internal problem ID [12624]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.5 page 71
Problem number: 7.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - y(y-1)(y-3) = 0}$$

With initial conditions

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

✓ Solution by Maple

Time used: 9.141 (sec). Leaf size: 6167

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

Expression too large to display

Expression too large to display

✓ Solution by Mathematica

Time used: 0.091 (sec). Leaf size: 105

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

$$y(t) \to \frac{\sqrt[3]{2\sqrt{e^{6t}(4e^{6t}+1)^3} + 8e^{6t} + 16e^{12t} + 1}}{4e^{6t}+1} + \frac{1}{\sqrt[3]{2\sqrt{e^{6t}(4e^{6t}+1)^3} + 8e^{6t} + 16e^{12t} + 1}} + 1$$

4.4 problem 8

Internal problem ID [12625]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.5 page 71
Problem number: 8.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - y(y-1)(y-3) = 0}$$

With initial conditions

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

✓ Solution by Maple

Time used: 1.125 (sec). Leaf size: 133

```
dsolve([diff(y(t),t)=y(t)*(y(t)-1)*(y(t)-3),y(0) = -1],y(t), singsol=all)
```

$$y(t) = \frac{(2\,\mathrm{e}^{6t}-4)\left(1-\mathrm{e}^{6t}+\sqrt{\mathrm{e}^{6t}\,(\mathrm{e}^{6t}-2)}\right)^{\frac{2}{3}} + \left(\left(i\sqrt{3}-1\right)\left(1-\mathrm{e}^{6t}+\sqrt{\mathrm{e}^{6t}\,(\mathrm{e}^{6t}-2)}\right)^{\frac{1}{3}} - i\sqrt{3}-1\right)\left(\mathrm{e}^{6t}-\sqrt{}\right.}{\left(1-\mathrm{e}^{6t}+\sqrt{\mathrm{e}^{6t}\,(\mathrm{e}^{6t}-2)}\right)^{\frac{2}{3}}(2\,\mathrm{e}^{6t}-4)}$$

✓ Solution by Mathematica

Time used: 0.068 (sec). Leaf size: 104

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

$$y(t) \to \frac{\sqrt[3]{2\sqrt{e^{6t}\,(e^{6t}-2)^3}+8e^{6t}-2e^{12t}-8}}{e^{6t}-2} - \frac{2^{2/3}}{\sqrt[3]{\sqrt{e^{6t}\,(e^{6t}-2)^3}+4e^{6t}-e^{12t}-4}} + 1$$

4.5 problem 12

Internal problem ID [12626]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.5 page 71
Problem number: 12.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 9

```
dsolve(diff(y(t),t)=-y(t)^2,y(t), singsol=all)
```

$$y(t) = \frac{1}{t + c_1}$$

✓ Solution by Mathematica

Time used: 0.156 (sec). Leaf size: 18

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

$$y(t) \to \frac{1}{t - c_1}$$
$$y(t) \to 0$$

4.6 problem 13

Internal problem ID [12627]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.5 page 71
Problem number: 13.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

With initial conditions

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

✓ Solution by Maple

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

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

$$y(t) = \frac{1}{\sqrt{1 - 2t}}$$

✓ Solution by Mathematica

Time used: 0.004 (sec). Leaf size: 14

```
DSolve[{y'[t]==y[t]^3,{y[0]==1}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{\sqrt{1 - 2t}}$$

4.7 problem 14

Internal problem ID [12628]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.5 page 71
Problem number: 14.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - \frac{1}{(y+1)(-2+t)} = 0}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.062 (sec). Leaf size: 24

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

$$y(t) = -1 + \sqrt{1 + 2\ln(t-2) - 2\ln(2) - 2i\pi}$$

✓ Solution by Mathematica

Time used: 0.188 (sec). Leaf size: 28

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

$$y(t) \to -1 + \sqrt{2\log(t-2) - 2i\pi + 1 - \log(4)}$$

4.8 problem 15

Internal problem ID [12629]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.5 page 71
Problem number: 15.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 13

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

$$y(t) = (27 + 3t)^{\frac{1}{3}} - 2$$

✓ Solution by Mathematica

Time used: 0.015 (sec). Leaf size: 20

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

$$y(t) \to \sqrt[3]{3}\sqrt[3]{t+9} - 2$$

4.9 problem 16

Internal problem ID [12630]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.5 page 71
Problem number: 16.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - \frac{t}{-2+y} = 0}$$

With initial conditions

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

✓ Solution by Maple

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

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

$$y(t) = 2 - \sqrt{t^2 + 3}$$

✓ Solution by Mathematica

Time used: 0.004 (sec). Leaf size: 21

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

$$y(t) \to 2 - \sqrt{2}\sqrt{t+3}$$

5 Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89

5.1 problem 1 and 13 (i)

Internal problem ID [12631]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 1 and 13 (i).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - 3y(-2 + y) = 0}$$

With initial conditions

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

✓ Solution by Maple

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

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

$$y(t) = \frac{2}{e^{6t} + 1}$$

✓ Solution by Mathematica

Time used: 0.012 (sec). Leaf size: 16

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

$$y(t) \to \frac{2}{e^{6t} + 1}$$

5.2 problem 1 and 13 (ii)

Internal problem ID [12632]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 1 and 13 (ii).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - 3y(-2 + y) = 0}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 18

```
dsolve([diff(y(t),t)=3*y(t)*(y(t)-2),y(-2) = -1],y(t), singsol=all)
```

$$y(t) = -\frac{2}{3\,\mathrm{e}^{6t+12} - 1}$$

✓ Solution by Mathematica

Time used: 0.013 (sec). Leaf size: 20

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

$$y(t) \to \frac{2}{1 - 3e^{6(t+2)}}$$

5.3 problem 1 and 13 (iii)

Internal problem ID [12633]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 1 and 13 (iii).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - 3y(-2 + y) = 0}$$

With initial conditions

$$[y(0) = 3]$$

✓ Solution by Maple

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

```
dsolve([diff(y(t),t)=3*y(t)*(y(t)-2),y(0) = 3],y(t), singsol=all)
```

$$y(t) = -\frac{6}{e^{6t} - 3}$$

✓ Solution by Mathematica

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

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

$$y(t) \to -\frac{6}{e^{6t} - 3}$$

5.4 problem 1 and 13 (iv)

Internal problem ID [12634]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 1 and 13 (iv).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - 3y(-2 + y) = 0}$$

With initial conditions

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

✓ Solution by Maple

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

```
dsolve([diff(y(t),t)=3*y(t)*(y(t)-2),y(0) = 2],y(t), singsol=all)
```

$$y(t) = 2$$

✓ Solution by Mathematica

Time used: 0.002 (sec). Leaf size: 6

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

$$y(t) \to 2$$

5.5 problem 2 and 14(i)

Internal problem ID [12635]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 2 and 14(i).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - y^2 + 4y = -12}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.062 (sec). Leaf size: 23

```
dsolve([diff(y(t),t)=y(t)^2-4*y(t)-12,y(0) = 1],y(t), singsol=all)
```

$$y(t) = \frac{-10\,\mathrm{e}^{8t} + 18}{5\,\mathrm{e}^{8t} + 3}$$

✓ Solution by Mathematica

Time used: 0.018 (sec). Leaf size: 26

```
DSolve[{y'[t]==y[t]^2-4*y[t]-12,{y[0]==1}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{18 - 10e^{8t}}{5e^{8t} + 3}$$

5.6 problem 2 and 14(ii)

Internal problem ID [12636]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 2 and 14(ii).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - y^2 + 4y = -12}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.047 (sec). Leaf size: 26

```
dsolve([diff(y(t),t)=y(t)^2-4*y(t)-12,y(1) = 0],y(t), singsol=all)
```

$$y(t) = \frac{-6\,\mathrm{e}^{8t-8} + 6}{3\,\mathrm{e}^{8t-8} + 1}$$

✓ Solution by Mathematica

Time used: 0.018 (sec). Leaf size: 32

```
DSolve[{y'[t]==y[t]^2-4*y[t]-12,{y[1]==0}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{6e^8 - 6e^{8t}}{3e^{8t} + e^8}$$

5.7 problem 2 and 14(iii)

Internal problem ID [12637]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 2 and 14(iii).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - y^2 + 4y = -12}$$

With initial conditions

$$[y(0) = 6]$$

✓ Solution by Maple

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

```
dsolve([diff(y(t),t)=y(t)^2-4*y(t)-12,y(0) = 6],y(t), singsol=all)
```

$$y(t) = 6$$

✓ Solution by Mathematica

Time used: 0.002 (sec). Leaf size: 6

```
DSolve[{y'[t]==y[t]^2-4*y[t]-12,{y[0]==6}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to 6$$

5.8 problem 2 and 14(iv)

Internal problem ID [12638]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 2 and 14(iv).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - y^2 + 4y = -12}$$

With initial conditions

$$[y(0) = 5]$$

✓ Solution by Maple

Time used: 0.047 (sec). Leaf size: 20

```
dsolve([diff(y(t),t)=y(t)^2-4*y(t)-12,y(0) = 5],y(t), singsol=all)
```

$$y(t) = \frac{-2\,e^{8t} + 42}{e^{8t} + 7}$$

✓ Solution by Mathematica

Time used: 0.014 (sec). Leaf size: 24

```
DSolve[{y'[t]==y[t]^2-4*y[t]-12,{y[0]==5}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{42 - 2e^{8t}}{e^{8t} + 7}$$

5.9 problem 3 and 15(i)

Internal problem ID [12639]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 3 and 15(i).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.047 (sec). Leaf size: 32

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

$$y(t) = \arctan\left(\frac{e^{2t}-1}{e^{2t}+1}, \frac{2\,e^{t}}{e^{2t}+1}\right)$$

✓ Solution by Mathematica

Time used: 0.01 (sec). Leaf size: 8

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

$$y(t) \to \arcsin(\tanh(t))$$

5.10 problem 3 and 15(ii)

Internal problem ID [12640]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 3 and 15(ii).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.421 (sec). Leaf size: 79

```
dsolve([diff(y(t),t)=cos( y(t)),y(-1) = 1],y(t), singsol=all)
```

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

✓ Solution by Mathematica

Time used: 0.017 (sec). Leaf size: 13

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

$$y(t) \to \arcsin\left(\coth\left(t + 1 + \coth^{-1}(\sin(1))\right)\right)$$

5.11 problem 3 and 15(iii)

Internal problem ID [12641]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 3 and 15(iii).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type **[_quadrature]**

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

With initial conditions

$$\left[y(0) = -\frac{\pi}{2}\right]$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 7

```
dsolve([diff(y(t),t)=cos( y(t)),y(0) = -1/2*Pi],y(t), singsol=all)
```

$$y(t) = -\frac{\pi}{2}$$

✓ Solution by Mathematica

Time used: 0.002 (sec). Leaf size: 10

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

$$y(t) \to -\frac{\pi}{2}$$

5.12 problem 3 and 15(iv)

Internal problem ID [12642]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 3 and 15(iv).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 32

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

$$y(t) = \arctan\left(\frac{e^{2t}-1}{e^{2t}+1}, -\frac{2\,e^{t}}{e^{2t}+1}\right)$$

✗ Solution by Mathematica

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

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

{}

5.13 problem 4

Internal problem ID [12643]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 4.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{w' - w\cos(w) = 0}$$

✓ Solution by Maple

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

```
dsolve(diff(w(t),t)=w(t)*cos( w(t)),w(t), singsol=all)
```

$$t - \left(\int^{w(t)} \frac{1}{\_a\cos(\_a)} d\_a\right) + c_1 = 0$$

✓ Solution by Mathematica

Time used: 7.857 (sec). Leaf size: 50

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

$$w(t) \to \text{InverseFunction}\left[\int_1^{\#1} \frac{\sec(K[1])}{K[1]} dK[1]\&\right][t + c_1]$$

$$w(t) \to 0$$

$$w(t) \to -\frac{\pi}{2}$$

$$w(t) \to \frac{\pi}{2}$$

5.14 problem 4 and 16(i)

Internal problem ID [12644]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 4 and 16(i).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{w' - w\cos(w) = 0}$$

With initial conditions

$$[w(0) = 0]$$

✓ Solution by Maple

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

```
dsolve([diff(w(t),t)=w(t)*cos( w(t)),w(0) = 0],w(t), singsol=all)
```

$$w(t) = 0$$

✓ Solution by Mathematica

Time used: 0.002 (sec). Leaf size: 6

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

$$w(t) \to 0$$

5.15 problem 4 and 16(ii)

Internal problem ID [12645]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 4 and 16(ii).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{w' - w\cos(w) = 0}$$

With initial conditions

$$[w(3) = 1]$$

✓ Solution by Maple

Time used: 0.266 (sec). Leaf size: 38

```
dsolve([diff(w(t),t)=w(t)*cos( w(t)),w(3) = 1],w(t), singsol=all)
```

$$w(t) = \mathrm{RootOf}\left(\int_{\_Z}^{1} \frac{\sec(\_a)}{\_a} d\_a + t - 3\right)$$

✗ Solution by Mathematica

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

```
DSolve[{w'[t]==w[t]*Cos[ w[t]],{w[3]==1}},w[t],t,IncludeSingularSolutions -> True]
```

{}

5.16 problem 4 and 16(iii)

Internal problem ID [12646]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 4 and 16(iii).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{w' - w\cos(w) = 0}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.032 (sec). Leaf size: 37

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

$$w(t) = \operatorname{RootOf}\left(\int_{\_Z}^{2} \frac{\sec(\_a)}{\_a} d\_a + t\right)$$

✗ Solution by Mathematica

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

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

{}

5.17 problem 4 and 16(iv)

Internal problem ID [12647]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 4 and 16(iv).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{w' - w\cos(w) = 0}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.047 (sec). Leaf size: 37

```
dsolve([diff(w(t),t)=w(t)*cos( w(t)),w(0) = -1],w(t), singsol=all)
```

$$w(t) = \text{RootOf}\left(\int_{\_Z}^{-1} \frac{\sec(\_a)}{\_a} d\_a + t\right)$$

✗ Solution by Mathematica

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

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

{}

5.18 problem 5

Internal problem ID [12648]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 5.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{w' - (1 - w)\sin(w) = 0}$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 21

```
dsolve(diff(w(t),t)=(1-w(t))*sin( w(t)),w(t), singsol=all)
```

$$t + \int^{w(t)} \frac{1}{(-1 + \_a)\sin(\_a)} d\_a + c_1 = 0$$

✓ Solution by Mathematica

Time used: 12.825 (sec). Leaf size: 41

```
DSolve[w'[t]==(1-w[t])*Sin[ w[t]],w[t],t,IncludeSingularSolutions -> True]
```

$$w(t) \to \text{InverseFunction}\left[\int_1^{\#1} \frac{\csc(K[1])}{K[1]-1} dK[1]\&\right][-t + c_1]$$

$$w(t) \to 0$$

$$w(t) \to 1$$

5.19 problem 6

Internal problem ID [12649]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 6.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - \frac{1}{-2+y} = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 33

```
dsolve(diff(y(t),t)=1/(y(t)-2),y(t), singsol=all)
```

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

✓ Solution by Mathematica

Time used: 0.145 (sec). Leaf size: 44

```
DSolve[y'[t]==1/(y[t]-2),y[t],t,IncludeSingularSolutions -> True]
```

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

5.20 problem 7

Internal problem ID [12650]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 7.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{v' + v^2 + 2v = -2}$$

✓ Solution by Maple

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

```
dsolve(diff(v(t),t)=-v(t)^2-2*v(t)-2,v(t), singsol=all)
```

$$v(t) = -1 - \tan(t + c_1)$$

✓ Solution by Mathematica

Time used: 0.699 (sec). Leaf size: 30

```
DSolve[v'[t]==-v[t]^2-2*v[t]-2,v[t],t,IncludeSingularSolutions -> True]
```

$$v(t) \to -1 - \tan(t - c_1)$$
$$v(t) \to -1 - i$$
$$v(t) \to -1 + i$$

5.21 problem 8

Internal problem ID [12651]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 8.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{w' - 3w^3 + 12w^2 = 0}$$

✓ Solution by Maple

Time used: 0.047 (sec). Leaf size: 49

```
dsolve(diff(w(t),t)=3*w(t)^3-12*w(t)^2,w(t), singsol=all)
```

$$w(t) = \mathrm{e}^{\mathrm{RootOf}\left(\ln\left(\mathrm{e}^{-Z}+4\right)\mathrm{e}^{-Z}+48c_1\mathrm{e}^{-Z}-\_Z\,\mathrm{e}^{-Z}+48t\,\mathrm{e}^{-Z}+4\ln\left(\mathrm{e}^{-Z}+4\right)+192c_1-4\_Z+192t-4\right)} + 4$$

✓ Solution by Mathematica

Time used: 0.392 (sec). Leaf size: 50

```
DSolve[w'[t]==3*w[t]^3-12*w[t]^2,w[t],t,IncludeSingularSolutions -> True]
```

$$w(t) \to \text{InverseFunction}\left[\frac{1}{4\#1} + \frac{1}{16}\log(4-\#1) - \frac{\log(\#1)}{16}\&\right][3t + c_1]$$
$$w(t) \to 0$$
$$w(t) \to 4$$

5.22 problem 9

Internal problem ID [12652]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 9.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - \cos(y) = 1}$$

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)=1+cos(y(t)),y(t), singsol=all)
```

$$y(t) = 2\arctan(t + c_1)$$

✓ Solution by Mathematica

Time used: 0.462 (sec). Leaf size: 35

```
DSolve[y'[t]==1+cos[y[t]],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \text{InverseFunction}\left[\int_1^{\#1} \frac{1}{\cos(K[1]) + 1} dK[1]\&\right][t + c_1]$$
$$y(t) \to \cos^{(-1)}(-1)$$

5.23 problem 10

Internal problem ID [12653]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 10.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - \tan(y) = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 9

```
dsolve(diff(y(t),t)=tan( y(t)),y(t), singsol=all)
```

$$y(t) = \arcsin\left(c_1 \mathrm{e}^t\right)$$

✓ Solution by Mathematica

Time used: 50.012 (sec). Leaf size: 17

```
DSolve[y'[t]==Tan[y[t]],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \arcsin\left(e^{t+c_1}\right)$$
$$y(t) \to 0$$

5.24 problem 11

Internal problem ID [12654]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 11.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - y\ln(|y|) = 0}$$

✓ Solution by Maple

Time used: 0.047 (sec). Leaf size: 21

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

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

✓ Solution by Mathematica

Time used: 0.321 (sec). Leaf size: 35

```
DSolve[y'[t]==y[t]*Log[Abs[y[t]]],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \text{InverseFunction}\left[\int_1^{\#1} \frac{1}{K[1]\log(|K[1]|)} dK[1]\&\right][t + c_1]$$
$$y(t) \to 1$$

5.25 problem 12

Internal problem ID [12655]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 12.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{w' - (w^2 - 2)\arctan(w) = 0}$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 25

```
dsolve(diff(w(t),t)=(w(t)^2-2)*arctan( w(t) ),w(t), singsol=all)
```

$$t - \left(\int^{w(t)} \frac{1}{(\_a^2 - 2)\arctan(\_a)} d\_a\right) + c_1 = 0$$

✓ Solution by Mathematica

Time used: 0.909 (sec). Leaf size: 62

```
DSolve[w'[t]==(w[t]^2-2)*Arctan[ w[t]],w[t],t,IncludeSingularSolutions -> True]
```

$$w(t) \to \text{InverseFunction}\left[\int_1^{\#1} \frac{1}{\text{Arctan}(K[1])\,(K[1]^2 - 2)} dK[1]\&\right][t + c_1]$$

$$w(t) \to -\sqrt{2}$$

$$w(t) \to \sqrt{2}$$

$$w(t) \to \text{Arctan}^{(-1)}(0)$$

5.26 problem 22

Internal problem ID [12656]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 22.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 24

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

$$y(t) = 2 - \sqrt{2}\,\tanh\left(\sqrt{2}\,t + \operatorname{arctanh}\left(\frac{3\sqrt{2}}{2}\right)\right)$$

✓ Solution by Mathematica

Time used: 0.083 (sec). Leaf size: 59

```
DSolve[{y'[t]==y[t]^2-4*y[t]+2,{y[0]==-1}},y[t],t,IncludeSingularSolutions -> True]
```

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

5.27 problem 23

Internal problem ID [12657]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 23.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 17

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

$$y(t) = 2 - \sqrt{2}\tanh\left(\sqrt{2}\,t\right)$$

✓ Solution by Mathematica

Time used: 0.042 (sec). Leaf size: 46

```
DSolve[{y'[t]==y[t]^2-4*y[t]+2,{y[0]==2}},y[t],t,IncludeSingularSolutions -> True]
```

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

5.28 problem 24

Internal problem ID [12658]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 24.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.032 (sec). Leaf size: 24

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

$$y(t) = 2 - \sqrt{2}\, \tanh\left(\sqrt{2}\, t + \operatorname{arctanh}\left(2\sqrt{2}\right)\right)$$

✓ Solution by Mathematica

Time used: 0.07 (sec). Leaf size: 59

```
DSolve[{y'[t]==y[t]^2-4*y[t]+2,{y[0]==-2}},y[t],t,IncludeSingularSolutions -> True]
```

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

5.29 problem 25

Internal problem ID [12659]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 25.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

With initial conditions

$$[y(0) = -4]$$

✓ Solution by Maple

Time used: 0.032 (sec). Leaf size: 24

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

$$y(t) = 2 - \sqrt{2}\,\tanh\left(\sqrt{2}\,t + \operatorname{arctanh}\left(3\sqrt{2}\right)\right)$$

✓ Solution by Mathematica

Time used: 0.069 (sec). Leaf size: 63

```
DSolve[{y'[t]==y[t]^2-4*y[t]+2,{y[0]==-4}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to -\frac{2\left(\left(2\sqrt{2}-5\right)e^{2\sqrt{2}t} + 5 + 2\sqrt{2}\right)}{\left(6+\sqrt{2}\right)e^{2\sqrt{2}t} - 6 + \sqrt{2}}$$

5.30 problem 26

Internal problem ID [12660]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 26.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type **[_quadrature]**

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 24

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

$$y(t) = 2 - \sqrt{2}\,\tanh\left(\sqrt{2}\,t - \operatorname{arctanh}\left(\sqrt{2}\right)\right)$$

✓ Solution by Mathematica

Time used: 0.068 (sec). Leaf size: 62

```
DSolve[{y'[t]==y[t]^2-4*y[t]+2,{y[0]==4}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{(4\sqrt{2} - 6)\,e^{2\sqrt{2}t} + 6 + 4\sqrt{2}}{(\sqrt{2} - 2)\,e^{2\sqrt{2}t} + 2 + \sqrt{2}}$$

5.31 problem 27

Internal problem ID [12661]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 27.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

With initial conditions

$$[y(3) = 1]$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 32

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

$$y(t) = 2 - \sqrt{2}\tanh\left(\frac{\left(-6 + \sqrt{2}\operatorname{arctanh}\left(\frac{\sqrt{2}}{2}\right) + 2t\right)\sqrt{2}}{2}\right)$$

✓ Solution by Mathematica

Time used: 0.098 (sec). Leaf size: 69

```
DSolve[{y'[t]==y[t]^2-4*y[t]+2,{y[3]==1}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{\sqrt{2}\left(e^{2\sqrt{2}t} + e^{6\sqrt{2}}\right)}{\left(1 + \sqrt{2}\right)e^{2\sqrt{2}t} + \left(\sqrt{2} - 1\right)e^{6\sqrt{2}}}$$

5.32 problem 37 (i)

Internal problem ID [12662]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 37 (i).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - y\cos\left(\frac{\pi y}{2}\right) = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 24

```
dsolve(diff(y(t),t)=y(t)*cos(Pi/2*y(t)),y(t), singsol=all)
```

$$t - \left(\int^{y(t)} \frac{1}{\_a\cos\left(\frac{\pi\_a}{2}\right)}d\_a\right) + c_1 = 0$$

✓ Solution by Mathematica

Time used: 4.801 (sec). Leaf size: 47

```
DSolve[y'[t]==y[t]*Cos[Pi/2*y[t]],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \text{InverseFunction}\left[\int_1^{\#1} \frac{\sec\left(\frac{1}{2}\pi K[1]\right)}{K[1]}dK[1]\&\right][t + c_1]$$
$$y(t) \to -1$$
$$y(t) \to 0$$
$$y(t) \to 1$$

5.33 problem 37 (ii)

Internal problem ID [12663]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 37 (ii).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)=y(t)-y(t)^2,y(t), singsol=all)
```

$$y(t) = \frac{1}{1 + c_1 e^{-t}}$$

✓ Solution by Mathematica

Time used: 0.42 (sec). Leaf size: 29

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

$$y(t) \rightarrow \frac{e^t}{e^t + e^{c_1}}$$
$$y(t) \rightarrow 0$$
$$y(t) \rightarrow 1$$

5.34 problem 37 (iii)

Internal problem ID [12664]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 37 (iii).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - y\sin\left(\frac{\pi y}{2}\right) = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 24

```
dsolve(diff(y(t),t)=y(t)*sin(Pi/2*y(t)),y(t), singsol=all)
```

$$t - \left(\int^{y(t)} \frac{1}{\_a \sin\left(\frac{\pi\_a}{2}\right)} d\_a\right) + c_1 = 0$$

✓ Solution by Mathematica

Time used: 7.222 (sec). Leaf size: 37

```
DSolve[y'[t]==y[t]*Sin[Pi/2*y[t]],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \text{InverseFunction}\left[\int_1^{\#1} \frac{\csc\left(\frac{1}{2}\pi K[1]\right)}{K[1]} dK[1]\&\right][t + c_1]$$

$$y(t) \to 0$$

5.35 problem 37 (iv)

Internal problem ID [12665]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 37 (iv).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

Time used: 0.078 (sec). Leaf size: 16

```
dsolve(diff(y(t),t)=y(t)^3-y(t)^2,y(t), singsol=all)
```

$$y(t) = \frac{1}{\text{LambertW}\left(-c_1 e^{t-1}\right) + 1}$$

✓ Solution by Mathematica

Time used: 0.374 (sec). Leaf size: 38

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

$$y(t) \rightarrow \text{InverseFunction}\left[\frac{1}{\#1} + \log(1 - \#1) - \log(\#1)\&\right][t + c_1]$$
$$y(t) \rightarrow 0$$
$$y(t) \rightarrow 1$$

5.36 problem 37 (v)

Internal problem ID [12666]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 37 (v).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - \cos\left(\frac{\pi y}{2}\right) = 0}$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 57

```
dsolve(diff(y(t),t)=cos(Pi/2*y(t)),y(t), singsol=all)
```

$$y(t) = \frac{2\arctan\left(\frac{e^{c_1\pi+\pi t}-1}{e^{c_1\pi+\pi t}+1}, \frac{2\,e^{\frac{1}{2}c_1\pi+\frac{1}{2}\pi t}}{e^{c_1\pi+\pi t}+1}\right)}{\pi}$$

✓ Solution by Mathematica

Time used: 0.846 (sec). Leaf size: 31

```
DSolve[y'[t]==Cos[Pi/2*y[t]],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{2\arcsin\left(\coth\left(\frac{1}{2}\pi(t+c_1)\right)\right)}{\pi}$$

$$y(t) \to -1$$

$$y(t) \to 1$$

5.37 problem 37 (vi)

Internal problem ID [12667]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 37 (vi).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type **[_quadrature]**

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

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)=y(t)^2-y(t),y(t), singsol=all)
```

$$y(t) = \frac{1}{1 + c_1 e^t}$$

✓ Solution by Mathematica

Time used: 0.336 (sec). Leaf size: 25

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

$$y(t) \to \frac{1}{1 + e^{t+c_1}}$$
$$y(t) \to 0$$
$$y(t) \to 1$$

5.38 problem 37 (vii)

Internal problem ID [12668]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 37 (vii).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - y \sin\left(\frac{\pi y}{2}\right) = 0}$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 24

```
dsolve(diff(y(t),t)=y(t)*sin(Pi/2*y(t)),y(t), singsol=all)
```

$$t - \left(\int^{y(t)} \frac{1}{\_a \sin\left(\frac{\pi\_a}{2}\right)} d\_a\right) + c_1 = 0$$

✓ Solution by Mathematica

Time used: 0.786 (sec). Leaf size: 37

```
DSolve[y'[t]==y[t]*Sin[Pi/2*y[t]],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \text{InverseFunction}\left[\int_1^{\#1} \frac{\csc\left(\frac{1}{2}\pi K[1]\right)}{K[1]} dK[1]\&\right][t + c_1]$$

$$y(t) \to 0$$

5.39 problem 37 (viii)

Internal problem ID [12669]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.6 page 89
Problem number: 37 (viii).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

Time used: 0.062 (sec). Leaf size: 20

```
dsolve(diff(y(t),t)=y(t)^2-y(t)^3,y(t), singsol=all)
```

$$y(t) = \frac{1}{\operatorname{LambertW}\left(-\frac{e^{-t-1}}{c_1}\right) + 1}$$

✓ Solution by Mathematica

Time used: 0.408 (sec). Leaf size: 40

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

$$y(t) \to \text{InverseFunction}\left[\frac{1}{\#1} + \log(1 - \#1) - \log(\#1)\&\right][-t + c_1]$$
$$y(t) \to 0$$
$$y(t) \to 1$$

6 Chapter 1. First-Order Differential Equations. Exercises section 1.8 page 121

6.1 problem 1

Internal problem ID [12670]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.8 page 121
Problem number: 1.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{y' + 4y = 9\,\mathrm{e}^{-t}}$$

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)=-4*y(t)+9*exp(-t),y(t), singsol=all)
```

$$y(t) = \left(3\,\mathrm{e}^{3t} + c_1\right)\mathrm{e}^{-4t}$$

✓ Solution by Mathematica

Time used: 0.088 (sec). Leaf size: 21

```
DSolve[y'[t]==-4*y[t]+9*Exp[-t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to e^{-4t}\left(3e^{3t} + c_1\right)$$

6.2 problem 2

Internal problem ID [12671]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.8 page 121
Problem number: 2.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{y' + 4y = 3\,\mathrm{e}^{-t}}$$

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)=-4*y(t)+3*exp(-t),y(t), singsol=all)
```

$$y(t) = \left(\mathrm{e}^{3t} + c_1\right)\mathrm{e}^{-4t}$$

✓ Solution by Mathematica

Time used: 0.087 (sec). Leaf size: 19

```
DSolve[y'[t]==-4*y[t]+3*Exp[-t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to e^{-4t}\left(e^{3t} + c_1\right)$$

6.3 problem 3

Internal problem ID [12672]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.8 page 121
Problem number: 3.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{y' + 3y = 4\cos(2t)}$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 23

```
dsolve(diff(y(t),t)=-3*y(t)+4*cos(2*t),y(t), singsol=all)
```

$$y(t) = \frac{8\sin(2t)}{13} + \frac{12\cos(2t)}{13} + c_1 \mathrm{e}^{-3t}$$

✓ Solution by Mathematica

Time used: 0.155 (sec). Leaf size: 31

```
DSolve[y'[t]==-3*y[t]+4*Cos[2*t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{4}{13}(2\sin(2t) + 3\cos(2t)) + c_1 e^{-3t}$$

6.4 problem 4

Internal problem ID [12673]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.8 page 121
Problem number: 4.
ODE order: 1.
ODE degree: 1.

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

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

✓ Solution by Maple

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

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

$$y(t) = c_1 \mathrm{e}^{2t} - \frac{\sin(2t)}{4} - \frac{\cos(2t)}{4}$$

✓ Solution by Mathematica

Time used: 0.15 (sec). Leaf size: 30

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

$$y(t) \to -\frac{1}{4}\sin(2t) - \frac{1}{4}\cos(2t) + c_1 e^{2t}$$

6.5 problem 5

Internal problem ID [12674]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.8 page 121
Problem number: 5.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{y' - 3y = -4\,e^{3t}}$$

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)=3*y(t)-4*exp(3*t),y(t), singsol=all)
```

$$y(t) = e^{3t}(-4t + c_1)$$

✓ Solution by Mathematica

Time used: 0.072 (sec). Leaf size: 17

```
DSolve[y'[t]==3*y[t]-4*Exp[3*t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to e^{3t}(-4t + c_1)$$

6.6 problem 6

Internal problem ID [12675]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.8 page 121
Problem number: 6.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{y' - \frac{y}{2} = 4\,\mathrm{e}^{\frac{t}{2}}}$$

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)=y(t)/2+4*exp(t/2),y(t), singsol=all)
```

$$y(t) = \mathrm{e}^{\frac{t}{2}}(4t + c_1)$$

✓ Solution by Mathematica

Time used: 0.074 (sec). Leaf size: 19

```
DSolve[y'[t]==y[t]/2+4*Exp[t/2],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to e^{t/2}(4t + c_1)$$

6.7 problem 7

Internal problem ID [12676]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.8 page 121
Problem number: 7.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{y' + 2y = e^{\frac{t}{3}}}$$

With initial conditions

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

✓ Solution by Maple

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

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

$$y(t) = \frac{\left(3\,e^{\frac{7t}{3}} + 4\right) e^{-2t}}{7}$$

✓ Solution by Mathematica

Time used: 0.096 (sec). Leaf size: 25

```
DSolve[{y'[t]+2*y[t]==Exp[t/3],{y[0]==1}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{7}e^{-2t}\left(3e^{7t/3} + 4\right)$$

6.8 problem 8

Internal problem ID [12677]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.8 page 121
Problem number: 8.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{y' - 2y = 3\,e^{-2t}}$$

With initial conditions

$$[y(0) = 10]$$

✓ Solution by Maple

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

```
dsolve([diff(y(t),t)-2*y(t)=3*exp(-2*t),y(0) = 10],y(t), singsol=all)
```

$$y(t) = -\frac{3\,e^{-2t}}{4} + \frac{43\,e^{2t}}{4}$$

✓ Solution by Mathematica

Time used: 0.096 (sec). Leaf size: 23

```
DSolve[{y'[t]-2*y[t]==3*Exp[-2*t],{y[0]==10}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{4}e^{-2t}\left(43e^{4t} - 3\right)$$

6.9 problem 9

Internal problem ID [12678]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.8 page 121
Problem number: 9.
ODE order: 1.
ODE degree: 1.

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

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

With initial conditions

$$[y(0) = 5]$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 23

```
dsolve([diff(y(t),t)+y(t)=cos(2*t),y(0) = 5],y(t), singsol=all)
```

$$y(t) = \frac{2\sin(2t)}{5} + \frac{\cos(2t)}{5} + \frac{24\,\mathrm{e}^{-t}}{5}$$

✓ Solution by Mathematica

Time used: 0.144 (sec). Leaf size: 27

```
DSolve[{y'[t]+y[t]==Cos[2*t],{y[0]==5}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{5}\left(24e^{-t} + 2\sin(2t) + \cos(2t)\right)$$

6.10 problem 10

Internal problem ID [12679]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.8 page 121
Problem number: 10.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{y' + 3y = \cos(2t)}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 23

```
dsolve([diff(y(t),t)+3*y(t)=cos(2*t),y(0) = -1],y(t), singsol=all)
```

$$y(t) = \frac{2\sin(2t)}{13} + \frac{3\cos(2t)}{13} - \frac{16\,\mathrm{e}^{-3t}}{13}$$

✓ Solution by Mathematica

Time used: 0.067 (sec). Leaf size: 30

```
DSolve[{y'[t]+3*y[t]==Cos[2*t],{y[0]==-1}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{13}\left(2\left(\sin(2t) - 8e^{-3t}\right) + 3\cos(2t)\right)$$

6.11 problem 11

Internal problem ID [12680]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.8 page 121
Problem number: 11.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{y' - 2y = 7\,\mathrm{e}^{2t}}$$

With initial conditions

$$[y(0) = 3]$$

✓ Solution by Maple

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

```
dsolve([diff(y(t),t)-2*y(t)=7*exp(2*t),y(0) = 3],y(t), singsol=all)
```

$$y(t) = \mathrm{e}^{2t}(7t + 3)$$

✓ Solution by Mathematica

Time used: 0.073 (sec). Leaf size: 16

```
DSolve[{y'[t]-2*y[t]==7*Exp[2*t],{y[0]==3}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to e^{2t}(7t + 3)$$

6.12 problem 20

Internal problem ID [12681]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.8 page 121
Problem number: 20.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{y' + 2y = 3t^2 + 2t - 1}$$

✓ Solution by Maple

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

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

$$y(t) = \frac{3t^2}{2} - \frac{t}{2} - \frac{1}{4} + c_1 \mathrm{e}^{-2t}$$

✓ Solution by Mathematica

Time used: 0.193 (sec). Leaf size: 28

```
DSolve[y'[t]+2*y[t]==3*t^2+2*t-1,y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{4}\left(6t^2 - 2t - 1\right) + c_1 e^{-2t}$$

6.13 problem 21

Internal problem ID [12682]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.8 page 121
Problem number: 21.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{y' + 2y = t^2 + 2t + 1 + e^{4t}}$$

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)+2*y(t)=t^2+2*t+1+exp(4*t),y(t), singsol=all)
```

$$y(t) = \frac{1}{4} + \frac{e^{4t}}{6} + \frac{t^2}{2} + \frac{t}{2} + c_1 e^{-2t}$$

✓ Solution by Mathematica

Time used: 0.557 (sec). Leaf size: 35

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

$$y(t) \to \frac{1}{12}\left(6t^2 + 6t + 2e^{4t} + 3\right) + c_1 e^{-2t}$$

6.14 problem 22

Internal problem ID [12683]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.8 page 121
Problem number: 22.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{y' + y = t^3 + \sin(3t)}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 35

```
dsolve(diff(y(t),t)+y(t)=t^3+sin(3*t),y(t), singsol=all)
```

$$y(t) = t^3 - 3t^2 + 6t + \frac{\sin(3t)}{10} - \frac{3\cos(3t)}{10} + c_1 e^{-t} - 6$$

✓ Solution by Mathematica

Time used: 0.19 (sec). Leaf size: 42

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

$$y(t) \to t^3 - 3t^2 + 6t + \frac{1}{10}\sin(3t) - \frac{3}{10}\cos(3t) + c_1 e^{-t} - 6$$

6.15 problem 23

Internal problem ID [12684]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.8 page 121
Problem number: 23.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{y' - 3y = 2t - e^{4t}}$$

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)-3*y(t)=2*t-exp(4*t),y(t), singsol=all)
```

$$y(t) = -\frac{2t}{3} - \frac{2}{9} - e^{4t} + c_1 e^{3t}$$

✓ Solution by Mathematica

Time used: 0.146 (sec). Leaf size: 30

```
DSolve[y'[t]-3*y[t]==2*t-Exp[4*t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to -\frac{2}{9}(3t+1) - e^{4t} + c_1 e^{3t}$$

6.16 problem 24

Internal problem ID [12685]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.8 page 121
Problem number: 24.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{y' + y = \cos(2t) + 3\sin(2t) + e^{-t}}$$

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)+y(t)=cos(2*t)+3*sin(2*t)+exp(-t),y(t), singsol=all)
```

$$y(t) = \sin(2t) - \cos(2t) + c_1 e^{-t} + t\,e^{-t}$$

✓ Solution by Mathematica

Time used: 0.239 (sec). Leaf size: 32

```
DSolve[y'[t]+y[t]==Cos[2*t]+3*Sin[2*t]+Exp[-t],y[t],t,IncludeSingularSolutions -> True]
```

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

7 Chapter 1. First-Order Differential Equations. Exercises section 1.9 page 133

7.1 problem 1

Internal problem ID [12686]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.9 page 133
Problem number: 1.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

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

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)=-y(t)/t+2,y(t), singsol=all)
```

$$y(t) = t + \frac{c_1}{t}$$

✓ Solution by Mathematica

Time used: 0.041 (sec). Leaf size: 13

```
DSolve[y'[t]==-y[t]/t+2,y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to t + \frac{c_1}{t}$$

7.2 problem 2

Internal problem ID [12687]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.9 page 133
Problem number: 2.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y' - \frac{3y}{t} = t^5}$$

✓ Solution by Maple

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

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

$$y(t) = \left(\frac{t^3}{3} + c_1\right) t^3$$

✓ Solution by Mathematica

Time used: 0.044 (sec). Leaf size: 19

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

$$y(t) \to \frac{t^6}{3} + c_1 t^3$$

7.3 problem 3

Internal problem ID [12688]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.9 page 133
Problem number: 3.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

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

✓ Solution by Maple

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

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

$$y(t) = \frac{\frac{1}{4}t^4 + \frac{1}{3}t^3 + c_1}{1+t}$$

✓ Solution by Mathematica

Time used: 0.051 (sec). Leaf size: 28

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

$$y(t) \to \frac{3t^4 + 4t^3 + 12c_1}{12t + 12}$$

7.4 problem 4

Internal problem ID [12689]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.9 page 133
Problem number: 4.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y' + 2yt = 4\,\mathrm{e}^{-t^2}}$$

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)=-2*t*y(t)+4*exp(-t^2),y(t), singsol=all)
```

$$y(t) = \mathrm{e}^{-t^2}(4t + c_1)$$

✓ Solution by Mathematica

Time used: 0.098 (sec). Leaf size: 19

```
DSolve[y'[t]==-2*t*y[t]+4*Exp[-t^2],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to e^{-t^2}(4t + c_1)$$

7.5 problem 5

Internal problem ID [12690]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.9 page 133
Problem number: 5.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y' - \frac{2ty}{t^2+1} = 3}$$

✓ Solution by Maple

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

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

$$y(t) = \left(t^2+1\right)\left(3\arctan\left(t\right)+c_1\right)$$

✓ Solution by Mathematica

Time used: 0.059 (sec). Leaf size: 18

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

$$y(t) \to \left(t^2+1\right)\left(3\arctan(t)+c_1\right)$$

7.6 problem 6

Internal problem ID [12691]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.9 page 133
Problem number: 6.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y' - \frac{2y}{t} = \mathrm{e}^t t^3}$$

✓ Solution by Maple

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

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

$$y(t) = \left((t-1)\,\mathrm{e}^t + c_1\right) t^2$$

✓ Solution by Mathematica

Time used: 0.082 (sec). Leaf size: 19

```
DSolve[y'[t]-2/t*y[t]==t^3*Exp[t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to t^2\left(e^t(t-1) + c_1\right)$$

7.7 problem 7

Internal problem ID [12692]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.9 page 133
Problem number: 7.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

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

With initial conditions

$$[y(0) = 3]$$

✓ Solution by Maple

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

```
dsolve([diff(y(t),t)=-y(t)/(1+t)+2,y(0) = 3],y(t), singsol=all)
```

$$y(t) = \frac{t^2 + 2t + 3}{1 + t}$$

✓ Solution by Mathematica

Time used: 0.047 (sec). Leaf size: 19

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

$$y(t) \to \frac{t^2 + 2t + 3}{t + 1}$$

7.8 problem 8

Internal problem ID [12693]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.9 page 133
Problem number: 8.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y' - \frac{y}{t+1} = 4t^2 + 4t}$$

With initial conditions

$$[y(1) = 10]$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 15

```
dsolve([diff(y(t),t)=y(t)/(1+t)+4*t^2+4*t,y(1) = 10],y(t), singsol=all)
```

$$y(t) = 2t^3 + 2t^2 + 3t + 3$$

✓ Solution by Mathematica

Time used: 0.052 (sec). Leaf size: 20

```
DSolve[{y'[t]==y[t]/(1+t)+4*t^2+4*t,{y[1]==10}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to 2t^3 + 2t^2 + 3t + 3$$

7.9 problem 9

Internal problem ID [12694]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.9 page 133
Problem number: 9.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

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

With initial conditions

$$[y(1) = 3]$$

✓ Solution by Maple

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

```
dsolve([diff(y(t),t)=-y(t)/t+2,y(1) = 3],y(t), singsol=all)
```

$$y(t) = t + \frac{2}{t}$$

✓ Solution by Mathematica

Time used: 0.041 (sec). Leaf size: 12

```
DSolve[{y'[t]==-y[t]/t+2,{y[1]==3}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to t + \frac{2}{t}$$

7.10 problem 10

Internal problem ID [12695]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.9 page 133
Problem number: 10.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y' + 2yt = 4\,\mathrm{e}^{-t^2}}$$

With initial conditions

$$[y(0) = 3]$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 16

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

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

✓ Solution by Mathematica

Time used: 0.09 (sec). Leaf size: 18

```
DSolve[{y'[t]==-2*t*y[t]+4*Exp[-t^2],{y[0]==3}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to e^{-t^2}(4t + 3)$$

7.11 problem 11

Internal problem ID [12696]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.9 page 133
Problem number: 11.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

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

With initial conditions

$$[y(-2) = 4]$$

✓ Solution by Maple

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

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

$$y(t) = 2t^3 + 5t^2$$

✓ Solution by Mathematica

Time used: 0.046 (sec). Leaf size: 14

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

$$y(t) \to t^2(2t + 5)$$

7.12 problem 12

Internal problem ID [12697]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.9 page 133
Problem number: 12.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y' - \frac{3y}{t} = 2\,\mathrm{e}^{2t}t^3}$$

With initial conditions

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

✓ Solution by Maple

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

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

$$y(t) = -t^3\left(-\mathrm{e}^{2t} + \mathrm{e}^2\right)$$

✓ Solution by Mathematica

Time used: 0.083 (sec). Leaf size: 20

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

$$y(t) \to \left(e^{2t} - e^2\right) t^3$$

7.13 problem 13

Internal problem ID [12698]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.9 page 133
Problem number: 13.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y' - \sin(t)\, y = 4}$$

✓ Solution by Maple

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

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

$$y(t) = \left(\int 4\,\mathrm{e}^{\cos(t)}dt + c_1\right)\mathrm{e}^{-\cos(t)}$$

✓ Solution by Mathematica

Time used: 0.486 (sec). Leaf size: 29

```
DSolve[y'[t]==Sin[t]*y[t]+4,y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to e^{-\cos(t)}\left(\int_1^t 4e^{\cos(K[1])}dK[1] + c_1\right)$$

7.14 problem 14

Internal problem ID [12699]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.9 page 133
Problem number: 14.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

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

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 55

```
dsolve(diff(y(t),t)=t^2*y(t)+4,y(t), singsol=all)
```

$$y(t) = c_1 \mathrm{e}^{\frac{t^3}{3}} + \frac{\mathrm{e}^{\frac{t^3}{6}} 243^{\frac{5}{6}} \left(t^3 \,\mathrm{WhittakerM}\left(\frac{1}{6}, \frac{2}{3}, \frac{t^3}{3}\right) + 4 \,\mathrm{WhittakerM}\left(\frac{7}{6}, \frac{2}{3}, \frac{t^3}{3}\right)\right)}{27 t^2 \left(t^3\right)^{\frac{1}{6}}}$$

✓ Solution by Mathematica

Time used: 0.102 (sec). Leaf size: 49

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

$$y(t) \to \frac{1}{3} e^{\frac{t^3}{3}} \left(-\frac{4\sqrt[3]{3}\, t\, \Gamma\left(\frac{1}{3}, \frac{t^3}{3}\right)}{\sqrt[3]{t^3}} + 3c_1 \right)$$

7.15 problem 15

Internal problem ID [12700]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.9 page 133
Problem number: 15.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y' - \frac{y}{t^2} = 4\cos(t)}$$

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)=y(t)/t^2+4*cos(t),y(t), singsol=all)
```

$$y(t) = \left(\int 4\,\mathrm{e}^{\frac{1}{t}}\cos(t)\,dt + c_1\right)\mathrm{e}^{-\frac{1}{t}}$$

✓ Solution by Mathematica

Time used: 3.836 (sec). Leaf size: 34

```
DSolve[y'[t]==y[t]/t^2+4*Cos[t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to e^{-1/t}\left(\int_1^t 4e^{\frac{1}{K[1]}}\cos(K[1])dK[1] + c_1\right)$$

7.16 problem 16

Internal problem ID [12701]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.9 page 133
Problem number: 16.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{y' - y = 4\cos\left(t^2\right)}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 57

```
dsolve(diff(y(t),t)=y(t)+4*cos(t^2),y(t), singsol=all)
```

$$y(t) = \left(\frac{\sqrt{\pi}\,\mathrm{e}^{\frac{i}{4}}\,\mathrm{erf}\left(\sqrt{-i}\,t + \frac{1}{2\sqrt{-i}}\right)}{\sqrt{-i}} - \sqrt{\pi}\,\mathrm{e}^{-\frac{i}{4}}(-1)^{\frac{3}{4}}\,\mathrm{erf}\left((-1)^{\frac{1}{4}}\,t - \frac{(-1)^{\frac{3}{4}}}{2}\right) + c_1\right)\mathrm{e}^{t}$$

✓ Solution by Mathematica

Time used: 0.137 (sec). Leaf size: 77

```
DSolve[y'[t]==y[t]+4*Cos[t^2],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to e^t\left(c_1 - \sqrt[4]{-1}e^{-\frac{i}{4}}\sqrt{\pi}\left(\mathrm{erfi}\left(\frac{1}{2}(-1)^{3/4}(2t-i)\right) + ie^{\frac{i}{2}}\mathrm{erfi}\left(\frac{1}{2}\sqrt[4]{-1}(2t+i)\right)\right)\right)$$

7.17 problem 17

Internal problem ID [12702]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.9 page 133
Problem number: 17.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y' + e^{-t^2} y = \cos(t)}$$

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)=-y(t)/exp(t^2)+cos(t),y(t), singsol=all)
```

$$y(t) = \left(\int e^{\frac{\sqrt{\pi}\,\mathrm{erf}(t)}{2}} \cos(t)\,dt + c_1\right) e^{-\frac{\sqrt{\pi}\,\mathrm{erf}(t)}{2}}$$

✓ Solution by Mathematica

Time used: 1.093 (sec). Leaf size: 47

```
DSolve[y'[t]==-y[t]/Exp[t^2]+Cos[t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to e^{-\frac{1}{2}\sqrt{\pi}\mathrm{erf}(t)} \left(\int_1^t e^{\frac{1}{2}\sqrt{\pi}\mathrm{erf}(K[1])} \cos(K[1]) dK[1] + c_1\right)$$

7.18 problem 18

Internal problem ID [12703]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.9 page 133
Problem number: 18.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y' - \frac{y}{\sqrt{t^3-3}} = t}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 33

```
dsolve(diff(y(t),t)=y(t)/sqrt(t^3-3)+t,y(t), singsol=all)
```

$$y(t) = \left(\int t\,\mathrm{e}^{-\left(\int \frac{1}{\sqrt{t^3-3}}dt\right)}dt + c_1\right)\mathrm{e}^{\int \frac{1}{\sqrt{t^3-3}}dt}$$

✓ Solution by Mathematica

Time used: 20.591 (sec). Leaf size: 110

```
DSolve[y'[t]==y[t]/Sqrt[t^3-3]+t,y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to e^{\frac{t\sqrt{1-\frac{t^3}{3}}\,\text{Hypergeometric2F1}\left(\frac{1}{3},\frac{1}{2},\frac{4}{3},\frac{t^3}{3}\right)}{\sqrt{t^3-3}}}\left(\int_1^t \exp\left(-\frac{\text{Hypergeometric2F1}\left(\frac{1}{3},\frac{1}{2},\frac{4}{3},\frac{K[1]^3}{3}\right)K[1]\sqrt{1-\frac{K[1]^3}{3}}}{\sqrt{K[1]^3-3}}\right)K[1]d\right.$$

$$\left. + c_1\right)$$

7.19 problem 19

Internal problem ID [12704]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.9 page 133
Problem number: 19.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y' - aty = 4\,\mathrm{e}^{-t^2}}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 37

```
dsolve(diff(y(t),t)=a*t*y(t)+4*exp(-t^2),y(t), singsol=all)
```

$$y(t) = \left(\frac{4\sqrt{\pi}\,\operatorname{erf}\left(\frac{\sqrt{4+2a}\,t}{2}\right)}{\sqrt{4+2a}} + c_1\right)\mathrm{e}^{\frac{a\,t^2}{2}}$$

✓ Solution by Mathematica

Time used: 0.213 (sec). Leaf size: 58

```
DSolve[y'[t]==a*t*y[t]+4*Exp[-t^2],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{e^{\frac{at^2}{2}}\left(2\sqrt{2\pi}\operatorname{erf}\left(\frac{\sqrt{a+2}t}{\sqrt{2}}\right) + \sqrt{a+2}c_1\right)}{\sqrt{a+2}}$$

7.20 problem 20

Internal problem ID [12705]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.9 page 133
Problem number: 20.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y' - t^r y = 4}$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 331

```
dsolve(diff(y(t),t)=t^r*y(t)+4,y(t), singsol=all)
```

$$y(t) = \left(\frac{4\left(\frac{1}{r+1}\right)^{-\frac{1}{r+1}} \left(\frac{(r+1)^2 t^{\frac{r}{r+1}+\frac{1}{r+1}-1-r} \left(\frac{1}{r+1}\right)^{\frac{1}{r+1}} \left(\frac{t^{r+1} r^2}{r+1} + \frac{2t^{r+1} r}{r+1} + r^2 + \frac{t^{r+1}}{r+1} + 3r+2\right) \left(\frac{t^{r+1}}{r+1}\right)^{-\frac{r+2}{2(r+1)}} \mathrm{e}^{-\frac{t^{r+1}}{2(r+1)}} \operatorname{WhittakerM}\left(\frac{1}{r+1} - 2 \cdots\right.}{(r+2)(2r+3)} \cdots \right.}{r \cdots} + c_1 \right) \mathrm{e}^{\frac{t^{r+1}}{r+1}}$$

✓ Solution by Mathematica

Time used: 0.12 (sec). Leaf size: 66

```
DSolve[y'[t]==t^r*y[t]+4,y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to e^{\frac{t^{r+1}}{r+1}} \left(-\frac{4t\left(\frac{t^{r+1}}{r+1}\right)^{-\frac{1}{r+1}} \Gamma\left(\frac{1}{r+1}, \frac{t^{r+1}}{r+1}\right)}{r+1} + c_1 \right)$$

7.21 problem 21

Internal problem ID [12706]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.9 page 133
Problem number: 21.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{v' + \frac{2v}{5} = 3\cos(2t)}$$

✓ Solution by Maple

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

```
dsolve(diff(v(t),t)+4/10*v(t)=3*cos(2*t),v(t), singsol=all)
```

$$v(t) = \frac{75\sin(2t)}{52} + \frac{15\cos(2t)}{52} + c_1 e^{-\frac{2t}{5}}$$

✓ Solution by Mathematica

Time used: 0.152 (sec). Leaf size: 31

```
DSolve[v'[t]+4/10*v[t]==3*Cos[2*t],v[t],t,IncludeSingularSolutions -> True]
```

$$v(t) \to \frac{15}{52}(5\sin(2t) + \cos(2t)) + c_1 e^{-2t/5}$$

7.22 problem 22 (f)

Internal problem ID [12707]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.9 page 133
Problem number: 22 (f).
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y' + 2yt = 4\,\mathrm{e}^{-t^2}}$$

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)=-2*t*y(t)+4*exp(-t^2),y(t), singsol=all)
```

$$y(t) = \mathrm{e}^{-t^2}(4t + c_1)$$

✓ Solution by Mathematica

Time used: 0.095 (sec). Leaf size: 19

```
DSolve[y'[t]==-2*t*y[t]+4*Exp[-t^2],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to e^{-t^2}(4t + c_1)$$

7.23 problem 23

Internal problem ID [12708]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Exercises section 1.9 page 133
Problem number: 23.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{y' + 2y = 3\,\mathrm{e}^{-2t}}$$

✓ Solution by Maple

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

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

$$y(t) = \mathrm{e}^{-2t}(3t + c_1)$$

✓ Solution by Mathematica

Time used: 0.084 (sec). Leaf size: 17

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

$$y(t) \to e^{-2t}(3t + c_1)$$

8 Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136

8.1 problem 2

Internal problem ID [12709]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 2.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' - 3y = 0}$$

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)=3*y(t),y(t), singsol=all)
```

$$y(t) = c_1 \mathrm{e}^{3t}$$

✓ Solution by Mathematica

Time used: 0.037 (sec). Leaf size: 18

```
DSolve[y'[t]==3*y[t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to c_1 e^{3t}$$
$$y(t) \to 0$$

8.2 problem 3

Internal problem ID [12710]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 3.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

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

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

$$y(t) = \frac{1}{3}t^3 + \frac{1}{5}t^5 + c_1$$

✓ Solution by Mathematica

Time used: 0.004 (sec). Leaf size: 22

```
DSolve[y'[t]==t^2*(t^2+1),y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{t^5}{5} + \frac{t^3}{3} + c_1$$

8.3 problem 4

Internal problem ID [12711]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 4.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' + \sin(y)^5 = 0}$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 189

```
dsolve(diff(y(t),t)=-sin(y(t))^5,y(t), singsol=all)
```

$$y(t) = \arctan\left(\frac{2\,e^{\mathrm{RootOf}\left(e^{8\_Z}+8\,e^{6\_Z}+64c_1e^{4\_Z}+24\_Z\,e^{4\_Z}+64t\,e^{4\_Z}-8\,e^{2\_Z}-1\right)}}{e^{2\,\mathrm{RootOf}\left(e^{8\_Z}+8\,e^{6\_Z}+64c_1e^{4\_Z}+24\_Z\,e^{4\_Z}+64t\,e^{4\_Z}-8\,e^{2\_Z}-1\right)}+1}, -\frac{e^{2\,\mathrm{RootOf}\left(e^{8\_Z}+8\,e^{6\_Z}+64c_1e^{4\_Z}+24\_Z\,e^{4\_Z}+64t\,e^{4\_Z}-8\,e^{2\_Z}-1\right)}-1}{e^{2\,\mathrm{RootOf}\left(e^{8\_Z}+8\,e^{6\_Z}+64c_1e^{4\_Z}+24\_Z\,e^{4\_Z}+64t\,e^{4\_Z}-8\,e^{2\_Z}-1\right)}+1}\right)$$

✓ Solution by Mathematica

Time used: 1.165 (sec). Leaf size: 101

```
DSolve[y'[t]==-Sin[y[t]]^5,y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \text{InverseFunction}\left[\frac{1}{16}\left(-\frac{1}{64}\csc^4\left(\frac{\#1}{2}\right)-\frac{3}{32}\csc^2\left(\frac{\#1}{2}\right)+\frac{1}{64}\sec^4\left(\frac{\#1}{2}\right)+\frac{3}{32}\sec^2\left(\frac{\#1}{2}\right)+\frac{3}{8}\log\left(\sin\left(\frac{\#1}{2}\right)\right)-\frac{3}{8}\log\left(\cos\left(\frac{\#1}{2}\right)\right)\right)\&\right]\left[-\frac{t}{16}+c_1\right]$$

$$y(t) \to 0$$

8.4 problem 5

Internal problem ID [12712]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 5.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - \frac{(t^2-4)(y+1)\,\mathrm{e}^{y}}{(t-1)(3-y)} = 0}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 38

```
dsolve(diff(y(t),t)=(  (t^2-4)*(1+y(t))*exp(y(t)))/(   (t-1)*(3-y(t))),y(t), singsol=all)
```

$$y(t) = -\operatorname{RootOf}\left(8\,\mathrm{e}\,\mathrm{Ei}_1(1-\_Z) + t^2 - 6\ln(t-1) - 2\,\mathrm{e}^{-\_Z} + 2c_1 + 2t\right)$$

✓ Solution by Mathematica

Time used: 1.486 (sec). Leaf size: 53

```
DSolve[y'[t]==(  (t^2-4)*(1+y[t])*Exp[y[t]])/(   (t-1)*(3-y[t])),y[t],t,IncludeSingularSolut
```

$$y(t) \to \text{InverseFunction}\left[-4e\,\text{ExpIntegralEi}(-\#1-1) - e^{-\#1}\&\right]\left[-\frac{t^2}{2} - t + 3\log(t-1) + \frac{3}{2} + c_1\right]$$

$$y(t) \to -1$$

8.5 problem 6

Internal problem ID [12713]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 6.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

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

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

$$y(t) = \pi - \operatorname{arccot}(t + c_1)$$

✓ Solution by Mathematica

Time used: 0.319 (sec). Leaf size: 19

```
DSolve[y'[t]==Sin[y[t]]^2,y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to -\cot^{-1}(t - 2c_1)$$
$$y(t) \to 0$$

8.6 problem 17

Internal problem ID [12714]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 17.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{y' - (y-3)(\sin(y)\sin(t)+\cos(t)+1) = 0}$$

With initial conditions

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

✗ Solution by Maple

```
dsolve([diff(y(t),t)= (y(t)-3)*( sin(y(t))*sin(t)+cos(t)+1),y(0) = 4],y(t), singsol=all)
```

No solution found

✗ Solution by Mathematica

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

```
DSolve[{y'[t]==(y[t]-3)*( Sin[y[t]]*Sin[t]+Cos[t]+1),{y[0]==4}},y[t],t,IncludeSingularSoluti
```

Not solved

8.7 problem 20

Internal problem ID [12715]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 20.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{y' - y = \mathrm{e}^{-t}}$$

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)= y(t)+exp(-t),y(t), singsol=all)
```

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

✓ Solution by Mathematica

Time used: 0.079 (sec). Leaf size: 21

```
DSolve[y'[t]==y[t]+Exp[-t],y[t],t,IncludeSingularSolutions -> True]
```

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

8.8 problem 21

Internal problem ID [12716]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 21.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' + 2y = 3}$$

✓ Solution by Maple

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

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

$$y(t) = \frac{3}{2} + c_1 \mathrm{e}^{-2t}$$

✓ Solution by Mathematica

Time used: 0.041 (sec). Leaf size: 24

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

$$y(t) \to \frac{3}{2} + c_1 e^{-2t}$$
$$y(t) \to \frac{3}{2}$$

8.9 problem 22

Internal problem ID [12717]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 22.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

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

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)= t*y(t),y(t), singsol=all)
```

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

✓ Solution by Mathematica

Time used: 0.037 (sec). Leaf size: 22

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

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

8.10 problem 23

Internal problem ID [12718]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 23.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{y' - 3y = e^{7t}}$$

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)= 3*y(t)+exp(7*t),y(t), singsol=all)
```

$$y(t) = \left(\frac{e^{4t}}{4} + c_1\right) e^{3t}$$

✓ Solution by Mathematica

Time used: 0.068 (sec). Leaf size: 23

```
DSolve[y'[t]==3*y[t]+Exp[7*t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{e^{7t}}{4} + c_1 e^{3t}$$

8.11 problem 24

Internal problem ID [12719]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 24.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - \frac{ty}{t^2+1} = 0}$$

✓ Solution by Maple

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

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

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

✓ Solution by Mathematica

Time used: 0.048 (sec). Leaf size: 22

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

$$y(t) \to c_1\sqrt{t^2+1}$$
$$y(t) \to 0$$

8.12 problem 25

Internal problem ID [12720]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 25.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{y' + 5y = \sin(3t)}$$

✓ Solution by Maple

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

```
dsolve(diff(y(t),t)= -5*y(t)+sin(3*t),y(t), singsol=all)
```

$$y(t) = \frac{5\sin(3t)}{34} - \frac{3\cos(3t)}{34} + c_1 e^{-5t}$$

✓ Solution by Mathematica

Time used: 0.165 (sec). Leaf size: 30

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

$$y(t) \to \frac{5}{34}\sin(3t) - \frac{3}{34}\cos(3t) + c_1 e^{-5t}$$

8.13 problem 26

Internal problem ID [12721]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 26.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

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

✓ Solution by Maple

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

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

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

✓ Solution by Mathematica

Time used: 0.054 (sec). Leaf size: 23

```
DSolve[y'[t]==t+2*y[t]/(1+t),y[t],t,IncludeSingularSolutions -> True]
```

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

8.14 problem 27

Internal problem ID [12722]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 27.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

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

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

$$y(t) = \sqrt{3}\,\tan\left((t + c_1)\sqrt{3}\right)$$

✓ Solution by Mathematica

Time used: 0.256 (sec). Leaf size: 48

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

$$y(t) \to \sqrt{3}\tan\left(\sqrt{3}(t + c_1)\right)$$
$$y(t) \to -i\sqrt{3}$$
$$y(t) \to i\sqrt{3}$$

8.15 problem 28

Internal problem ID [12723]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 28.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

✓ Solution by Maple

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

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

$$y(t) = \frac{2}{2c_1 e^{-2t} + 1}$$

✓ Solution by Mathematica

Time used: 0.447 (sec). Leaf size: 36

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

$$y(t) \to \frac{2e^{2t}}{e^{2t} + e^{2c_1}}$$
$$y(t) \to 0$$
$$y(t) \to 2$$

8.16 problem 29

Internal problem ID [12724]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 29.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{y' + 3y = \mathrm{e}^{-2t} + t^2}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 24

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

$$y(t) = \frac{t^2}{3} - \frac{2t}{9} + \frac{2}{27} + \mathrm{e}^{-2t} + c_1\mathrm{e}^{-3t}$$

✓ Solution by Mathematica

Time used: 0.147 (sec). Leaf size: 33

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

$$y(t) \to \frac{1}{27}(9t^2 - 6t + 2) + e^{-2t} + c_1 e^{-3t}$$

8.17 problem 30

Internal problem ID [12725]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 30.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{x' + tx = 0}$$

With initial conditions

$$[x(0) = \mathrm{e}]$$

✓ Solution by Maple

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

```
dsolve([diff(x(t),t)= -t*x(t),x(0) = exp(1)],x(t), singsol=all)
```

$$x(t) = \mathrm{e}^{1-\frac{t^2}{2}}$$

✓ Solution by Mathematica

Time used: 0.038 (sec). Leaf size: 16

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

$$x(t) \to e^{1-\frac{t^2}{2}}$$

8.18 problem 31

Internal problem ID [12726]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 31.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{y' - 2y = \cos(4t)}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 23

```
dsolve([diff(y(t),t)= 2*y(t)+cos(4*t),y(0) = 1],y(t), singsol=all)
```

$$y(t) = \frac{11\,e^{2t}}{10} + \frac{\sin(4t)}{5} - \frac{\cos(4t)}{10}$$

✓ Solution by Mathematica

Time used: 0.159 (sec). Leaf size: 29

```
DSolve[{y'[t]==2*y[t]+Cos[4*t],{y[0]==1}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{10}\left(11e^{2t} + 2\sin(4t) - \cos(4t)\right)$$

8.19 problem 32

Internal problem ID [12727]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 32.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{y' - 3y = 2\,e^{3t}}$$

With initial conditions

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

✓ Solution by Maple

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

```
dsolve([diff(y(t),t)= 3*y(t)+2*exp(3*t),y(0) = -1],y(t), singsol=all)
```

$$y(t) = e^{3t}(2t - 1)$$

✓ Solution by Mathematica

Time used: 0.07 (sec). Leaf size: 16

```
DSolve[{y'[t]==3*y[t]+2*Exp[3*t],{y[0]==-1}},y[t],t,IncludeSingularSolutions -> True]
```

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

8.20 problem 33

Internal problem ID [12728]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 33.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type **[_separable]**

$$\boxed{y' - t^2y^3 - y^3 = 0}$$

With initial conditions

$$\left[y(0) = -\frac{1}{2}\right]$$

✓ Solution by Maple

Time used: 0.078 (sec). Leaf size: 18

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

$$y(t) = -\frac{3}{\sqrt{-6t^3 - 18t + 36}}$$

✓ Solution by Mathematica

Time used: 0.319 (sec). Leaf size: 28

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

$$y(t) \to -\frac{\sqrt{\frac{3}{2}}}{\sqrt{-t^3 - 3t + 6}}$$

8.21 problem 34

Internal problem ID [12729]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 34.
ODE order: 1.
ODE degree: 1.

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

$$\boxed{y' + 5y = 3\,\mathrm{e}^{-5t}}$$

With initial conditions

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

✓ Solution by Maple

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

```
dsolve([diff(y(t),t)+5*y(t)= 3*exp(-5*t),y(0) = -2],y(t), singsol=all)
```

$$y(t) = \mathrm{e}^{-5t}(3t - 2)$$

✓ Solution by Mathematica

Time used: 0.085 (sec). Leaf size: 16

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

$$y(t) \to e^{-5t}(3t - 2)$$

8.22 problem 35

Internal problem ID [12730]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 35.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_linear]`

$$\boxed{y' - 2yt = 3t\,\mathrm{e}^{t^2}}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 16

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

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

✓ Solution by Mathematica

Time used: 0.082 (sec). Leaf size: 21

```
DSolve[{y'[t]== 2*t*y[t]+3*t*Exp[t^2],{y[0]==1}},y[t],t,IncludeSingularSolutions -> True]
```

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

8.23 problem 36

Internal problem ID [12731]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 36.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - \frac{(t+1)^2}{(y+1)^2} = 0}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.062 (sec). Leaf size: 5

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

$$y(t) = t$$

✓ Solution by Mathematica

Time used: 0.805 (sec). Leaf size: 16

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

$$y(t) \to \sqrt[3]{(t+1)^3} - 1$$

8.24 problem 37

Internal problem ID [12732]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 37.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type **[_separable]**

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.032 (sec). Leaf size: 16

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

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

✓ Solution by Mathematica

Time used: 0.222 (sec). Leaf size: 17

```
DSolve[{y'[t]== 2*t*y[t]^2+3*t^2*y[t]^2,{y[1]==-1}},y[t],t,IncludeSingularSolutions -> True]
```

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

8.25 problem 38

Internal problem ID [12733]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 38.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

$$\boxed{y' + y^2 = 1}$$

With initial conditions

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

✓ Solution by Maple

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

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

$$y(t) = 1$$

✓ Solution by Mathematica

Time used: 0.002 (sec). Leaf size: 6

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

$$y(t) \to 1$$

8.26 problem 39

Internal problem ID [12734]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 39.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - \frac{t^2}{y + y t^3} = 0}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 18

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

$$y(t) = -\frac{\sqrt{6 \ln(t^3 + 1) + 36}}{3}$$

✓ Solution by Mathematica

Time used: 0.195 (sec). Leaf size: 26

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

$$y(t) \to -\sqrt{\frac{2}{3}} \sqrt{\log(t^3 + 1) + 6}$$

8.27 problem 40

Internal problem ID [12735]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 40.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

With initial conditions

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

✓ Solution by Maple

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

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

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

✓ Solution by Mathematica

Time used: 0.006 (sec). Leaf size: 14

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

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

8.28 problem 43

Internal problem ID [12736]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 43.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_Riccati]`

$$\boxed{y' - (-2 + y)(y + 1 - \cos(t)) = 0}$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 118

```
dsolve(diff(y(t),t)=(y(t)-2)*(y(t)+1-cos(t)),y(t), singsol=all)
```

$$y(t) = -\frac{i c_1 \mathrm{e}^{t-\frac{3\pi}{2}-\sin(t)}}{c_1 \mathrm{e}^{-2t}\left(\int i \mathrm{e}^{-\frac{3\pi}{2}+3t-\sin(t)}dt\right) + \mathrm{e}^{\pi-2t}} - \frac{-2c_1 \mathrm{e}^{-2t}\left(\int i \mathrm{e}^{-\frac{3\pi}{2}+3t-\sin(t)}dt\right) - 2\,\mathrm{e}^{\pi-2t}}{c_1 \mathrm{e}^{-2t}\left(\int i \mathrm{e}^{-\frac{3\pi}{2}+3t-\sin(t)}dt\right) + \mathrm{e}^{\pi-2t}}$$

✓ Solution by Mathematica

Time used: 3.379 (sec). Leaf size: 224

```
DSolve[y'[t]==(y[t]-2)*(y[t]+1-Cos[t]),y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to -\frac{-2\int_1^{e^{it}} e^{\frac{i\left(K[1]^2-1\right)}{2K[1]}} K[1]^{-1-3i} dK[1] + i e^{\frac{1}{2}ie^{-it}\left(-1+e^{2it}\right)}\left(e^{it}\right)^{-3i} - 2c_1}{\int_1^{e^{it}} e^{\frac{i\left(K[1]^2-1\right)}{2K[1]}} K[1]^{-1-3i} dK[1] + c_1}$$

$$y(t) \to 2$$

$$y(t) \to 2 - \frac{i e^{\frac{1}{2}ie^{-it}\left(-1+e^{2it}\right)}\left(e^{it}\right)^{-3i}}{\int_1^{e^{it}} e^{\frac{i\left(K[1]^2-1\right)}{2K[1]}} K[1]^{-1-3i} dK[1]}$$

8.29 problem 44

Internal problem ID [12737]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 44.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_Abel]`

$$\boxed{y' - (y-1)(-2+y)\left(y - e^{\frac{t}{2}}\right) = 0}$$

✗ Solution by Maple

```
dsolve(diff(y(t),t)=(y(t)-1)*(y(t)-2)*(y(t)-exp(t/2)),y(t), singsol=all)
```

No solution found

✗ Solution by Mathematica

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

```
DSolve[y'[t]==(y[t]-1)*(y[t]-2)*(y[t]-Exp[t/2]),y[t],t,IncludeSingularSolutions -> True]
```

Timed out

8.30 problem 45

Internal problem ID [12738]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 45.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

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

✓ Solution by Maple

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

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

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

✓ Solution by Mathematica

Time used: 0.188 (sec). Leaf size: 26

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

$$y(t) \to -1 + c_1 e^{\frac{t^3}{3}+t}$$
$$y(t) \to -1$$

8.31 problem 46

Internal problem ID [12739]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 46.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_separable]`

$$\boxed{y' - \frac{2y+1}{t} = 0}$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 11

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

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

✓ Solution by Mathematica

Time used: 0.036 (sec). Leaf size: 22

```
DSolve[y'[t]==(2*y[t]+1)/t,y[t],t,IncludeSingularSolutions -> True]
```

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

8.32 problem 47

Internal problem ID [12740]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 1. First-Order Differential Equations. Review Exercises for chapter 1. page 136
Problem number: 47.
ODE order: 1.
ODE degree: 1.

CAS Maple gives this as type `[_quadrature]`

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 14

```
dsolve([diff(y(t),t)=3-y(t)^2,y(0) = 0],y(t), singsol=all)
```

$$y(t) = \sqrt{3}\,\tanh\left(\sqrt{3}\,t\right)$$

✓ Solution by Mathematica

Time used: 0.047 (sec). Leaf size: 37

```
DSolve[{y'[t]==3-y[t]^2,{y[0]==0}},y[t],t,IncludeSingularSolutions -> True]
```

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

9 Chapter 3. Linear Systems. Exercises section 3.1. page 258

9.1 problem 1

Internal problem ID [12741]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.1. page 258
Problem number: 1.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= x(t) - y \\
y' &= x(t) - y
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.047 (sec). Leaf size: 19

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

$$x(t) = c_1t + c_1 + c_2$$

$$y(t) = c_1t + c_2$$

✓ Solution by Mathematica

Time used: 0.003 (sec). Leaf size: 32

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

$$
\begin{aligned}
x(t) &\to c_1(t+1) - c_2t \\
y(t) &\to (c_1 - c_2)t + c_2
\end{aligned}
$$

9.2 problem 2

Internal problem ID [12742]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.1. page 258
Problem number: 2.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= 2x(t) - y \\
y' &= 0
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.047 (sec). Leaf size: 19

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

$$x(t) = \frac{c_2}{2} + c_1 e^{2t}$$

$$y(t) = c_2$$

✓ Solution by Mathematica

Time used: 0.004 (sec). Leaf size: 32

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

$$
\begin{aligned}
x(t) &\to \left(c_1 - \frac{c_2}{2}\right) e^{2t} + \frac{c_2}{2} \\
y(t) &\to c_2
\end{aligned}
$$

9.3 problem 3

Internal problem ID [12743]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.1. page 258
Problem number: 3.
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = x(t)$$
$$y' = 2x(t) + y$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 21

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

$$x(t) = \frac{c_2 e^t}{2}$$

$$y(t) = e^t (c_2 t + c_1)$$

✓ Solution by Mathematica

Time used: 0.003 (sec). Leaf size: 26

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

$$x(t) \to c_1 e^t$$
$$y(t) \to e^t (2c_1 t + c_2)$$

9.4 problem 4

Internal problem ID [12744]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.1. page 258
Problem number: 4.
ODE order: 1.
ODE degree: 1.

Solve

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 31

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

$$x(t) = c_1 \mathrm{e}^t - c_2 \mathrm{e}^{-3t}$$

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

✓ Solution by Mathematica

Time used: 0.01 (sec). Leaf size: 68

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

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

9.5 problem 5

Internal problem ID [12745]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.1. page 258
Problem number: 5.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= 2x(t) + y \\
y' &= x(t) + y
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.063 (sec). Leaf size: 86

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

$$
\begin{aligned}
x(t) &= \frac{c_1 e^{\frac{(3+\sqrt{5})t}{2}} \sqrt{5}}{2} - \frac{c_2 e^{-\frac{(\sqrt{5}-3)t}{2}} \sqrt{5}}{2} + \frac{c_1 e^{\frac{(3+\sqrt{5})t}{2}}}{2} + \frac{c_2 e^{-\frac{(\sqrt{5}-3)t}{2}}}{2} \\
y(t) &= c_1 e^{\frac{(3+\sqrt{5})t}{2}} + c_2 e^{-\frac{(\sqrt{5}-3)t}{2}}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.014 (sec). Leaf size: 145

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

$$
\begin{aligned}
x(t) &\to \frac{1}{10} e^{-\frac{1}{2}(\sqrt{5}-3)t} \left(c_1 \left(\left(5+\sqrt{5}\right) e^{\sqrt{5}t} + 5 - \sqrt{5}\right) + 2\sqrt{5} c_2 \left(e^{\sqrt{5}t} - 1\right)\right) \\
y(t) &\to \frac{1}{10} e^{-\frac{1}{2}(\sqrt{5}-3)t} \left(2\sqrt{5} c_1 \left(e^{\sqrt{5}t} - 1\right) - c_2 \left(\left(\sqrt{5} - 5\right) e^{\sqrt{5}t} - 5 - \sqrt{5}\right)\right)
\end{aligned}
$$

9.6 problem 6

Internal problem ID [12746]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.1. page 258
Problem number: 6.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= 3y \\
y' &= 3\pi y - \frac{x(t)}{3}
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 148

```
dsolve([diff(x(t),t)=3*y(t),diff(y(t),t)=3*Pi*y(t)-1/3*x(t)],[x(t), y(t)], singsol=all)
```

$$
\begin{aligned}
x(t) &= \frac{3c_1 e^{-\frac{\left(-3\pi+\sqrt{9\pi^2-4}\right)t}{2}}\sqrt{9\pi^2-4}}{2} + \frac{9c_1 e^{-\frac{\left(-3\pi+\sqrt{9\pi^2-4}\right)t}{2}}\pi}{2} \\
&\quad - \frac{3c_2 e^{\frac{\left(3\pi+\sqrt{9\pi^2-4}\right)t}{2}}\sqrt{9\pi^2-4}}{2} + \frac{9c_2 e^{\frac{\left(3\pi+\sqrt{9\pi^2-4}\right)t}{2}}\pi}{2} \\
y(t) &= c_1 e^{-\frac{\left(-3\pi+\sqrt{9\pi^2-4}\right)t}{2}} + c_2 e^{\frac{\left(3\pi+\sqrt{9\pi^2-4}\right)t}{2}}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.016 (sec). Leaf size: 233

```
DSolve[{x'[t]==3*y[t],y'[t]==3*Pi*y[t]-1/3*x[t]},{x[t],y[t]},t,IncludeSingularSolutions -> T
```

$$x(t) \to \frac{e^{-\frac{1}{2}\left(\sqrt{9\pi^2-4}-3\pi\right)t}\left(\sqrt{9\pi^2-4}c_1\left(e^{\sqrt{9\pi^2-4}t}+1\right)-3\pi c_1\left(e^{\sqrt{9\pi^2-4}t}-1\right)+6c_2\left(e^{\sqrt{9\pi^2-4}t}-1\right)\right)}{2\sqrt{9\pi^2-4}}$$

$$y(t) \to \frac{e^{-\frac{1}{2}\left(\sqrt{9\pi^2-4}-3\pi\right)t}\left(3c_2\left(3\pi\left(e^{\sqrt{9\pi^2-4}t}-1\right)+\sqrt{9\pi^2-4}\left(e^{\sqrt{9\pi^2-4}t}+1\right)\right)-2c_1\left(e^{\sqrt{9\pi^2-4}t}-1\right)\right)}{6\sqrt{9\pi^2-4}}$$

9.7 problem 7

Internal problem ID [12747]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.1. page 258
Problem number: 7.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
p'(t) &= 3p(t) - 2q(t) - 7r(t) \\
q'(t) &= -2p(t) + 6r(t) \\
r'(t) &= \frac{73q(t)}{100} + 2r(t)
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.141 (sec). Leaf size: 910

```
dsolve([diff(p(t),t)=3*p(t)-2*q(t)-7*r(t),diff(q(t),t)=-2*p(t)+6*r(t),diff(r(t),t)=73/100*q(
```

$$p(t) =$$

$$-\frac{\left(i\sqrt{3}\left(31130+6i\sqrt{895302429}\right)^{\frac{4}{3}}-\left(31130+6i\sqrt{895302429}\right)^{\frac{4}{3}}+128560i\sqrt{3}\left(31130+6i\sqrt{895302429}\right.\right.}{}$$

$$+\frac{\left(i\sqrt{3}\left(31130+6i\sqrt{895302429}\right)^{\frac{4}{3}}+\left(31130+6i\sqrt{895302429}\right)^{\frac{4}{3}}+128560i\sqrt{3}\left(31130+6i\sqrt{895302429}\right.\right.}{}$$

$$-\frac{\left(\left(31130+6i\sqrt{895302429}\right)^{\frac{4}{3}}+1986\left(31130+6i\sqrt{895302429}\right)^{\frac{2}{3}}+240i\sqrt{895302429}+128560\left(31130\right.\right.}{1314\left(31130+6i\sqrt{8953024\right.}}$$

$$q(t) =$$

$$-\frac{5\left(i\sqrt{3}\left(31130+6i\sqrt{895302429}\right)^{\frac{2}{3}}-3214i\sqrt{3}+\left(31130+6i\sqrt{895302429}\right)^{\frac{2}{3}}+20\left(31130+6i\sqrt{895302\right.\right.}{219\left(31130+6i\sqrt{89\right.}}$$

$$+\frac{5\left(i\sqrt{3}\left(31130+6i\sqrt{895302429}\right)^{\frac{2}{3}}-3214i\sqrt{3}-\left(31130+6i\sqrt{895302429}\right)^{\frac{2}{3}}-20\left(31130+6i\sqrt{895302\right.\right.}{219\left(31130+6i\sqrt{895\right.}}$$

$$+\frac{10\left(\left(31130+6i\sqrt{895302429}\right)^{\frac{2}{3}}-10\left(31130+6i\sqrt{895302429}\right)^{\frac{1}{3}}+3214\right)c_3\mathrm{e}^{\frac{\left(\left(31130+6i\sqrt{895302429}\right)^{\frac{2}{3}}+50\left(31130\right.\right.}{30\left(31130+6i\sqrt{89530\right.}}}}{219\left(31130+6i\sqrt{895302429}\right)^{\frac{1}{3}}}$$

$$r(t) = c_1\mathrm{e}^{-\frac{\left(i\sqrt{3}\left(31130+6i\sqrt{895302429}\right)^{\frac{2}{3}}-3214i\sqrt{3}+\left(31130+6i\sqrt{895302429}\right)^{\frac{2}{3}}-100\left(31130+6i\sqrt{895302429}\right)^{\frac{1}{3}}+3214\right)t}{60\left(31130+6i\sqrt{895302429}\right)^{\frac{1}{3}}}}$$
$$+ c_2\mathrm{e}^{\frac{\left(i\sqrt{3}\left(31130+6i\sqrt{895302429}\right)^{\frac{2}{3}}-3214i\sqrt{3}-\left(31130+6i\sqrt{895302429}\right)^{\frac{2}{3}}+100\left(31130+6i\sqrt{895302429}\right)^{\frac{1}{3}}-3214\right)t}{60\left(31130+6i\sqrt{895302429}\right)^{\frac{1}{3}}}}$$
$$+ c_3\mathrm{e}^{\frac{\left(\left(31130+6i\sqrt{895302429}\right)^{\frac{2}{3}}+50\left(31130+6i\sqrt{895302429}\right)^{\frac{1}{3}}+3214\right)t}{30\left(31130+6i\sqrt{895302429}\right)^{\frac{1}{3}}}}$$

✓ Solution by Mathematica

Time used: 0.051 (sec). Leaf size: 602

```
DSolve[{p'[t]==3*p[t]-2*q[t]-7*r[t],q'[t]==-2*p[t]+6*r[t],r'[t]==73/100*q[t]+2*r[t]},{p[t],q
```

$$
\begin{aligned}
p(t) \to & -100c_2\text{RootSum}\left[\#1^3-500\#1^2-23800\#1 + 10920000\&,\frac{2\#1e^{\frac{\#1t}{100}}+111e^{\frac{\#1t}{100}}}{3\#1^2-1000\#1-23800}\&\right] - 100c_3\text{RootSum}\left[\#1^3-500\#1^2 - 23800\#1+10920000\&,\frac{7\#1e^{\frac{\#1t}{100}}+1200e^{\frac{\#1t}{100}}}{3\#1^2-1000\#1-23800}\&\right] + c_1\text{RootSum}\left[\#1^3 - 500\#1^2-23800\#1+10920000\&,\frac{\#1^2e^{\frac{\#1t}{100}}-200\#1e^{\frac{\#1t}{100}}-43800e^{\frac{\#1t}{100}}}{3\#1^2-1000\#1-23800}\&\right] \\
q(t) \to & -200c_1\text{RootSum}\left[\#1^3-500\#1^2-23800\#1 + 10920000\&,\frac{\#1e^{\frac{\#1t}{100}}-200e^{\frac{\#1t}{100}}}{3\#1^2-1000\#1-23800}\&\right] + 200c_3\text{RootSum}\left[\#1^3-500\#1^2 - 23800\#1+10920000\&,\frac{3\#1e^{\frac{\#1t}{100}}-200e^{\frac{\#1t}{100}}}{3\#1^2-1000\#1-23800}\&\right] + c_2\text{RootSum}\left[\#1^3 - 500\#1^2-23800\#1+10920000\&,\frac{\#1^2e^{\frac{\#1t}{100}}-500\#1e^{\frac{\#1t}{100}}+60000e^{\frac{\#1t}{100}}}{3\#1^2-1000\#1-23800}\&\right] \\
r(t) \to & -14600c_1\text{RootSum}\left[\#1^3-500\#1^2-23800\#1 + 10920000\&,\frac{e^{\frac{\#1t}{100}}}{3\#1^2-1000\#1-23800}\&\right] + 73c_2\text{RootSum}\left[\#1^3-500\#1^2 - 23800\#1+10920000\&,\frac{\#1e^{\frac{\#1t}{100}}-300e^{\frac{\#1t}{100}}}{3\#1^2-1000\#1-23800}\&\right] + c_3\text{RootSum}\left[\#1^3 - 500\#1^2-23800\#1+10920000\&,\frac{\#1^2e^{\frac{\#1t}{100}}-300\#1e^{\frac{\#1t}{100}}-40000e^{\frac{\#1t}{100}}}{3\#1^2-1000\#1-23800}\&\right]
\end{aligned}
$$

9.8 problem 8

Internal problem ID [12748]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.1. page 258
Problem number: 8.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= -3x(t) + 2\pi y \\
y' &= 4x(t) - y
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 115

```
dsolve([diff(x(t),t)=-3*x(t)+2*Pi*y(t),diff(y(t),t)=4*x(t)-y(t)],[x(t), y(t)], singsol=all)
```

$$
\begin{aligned}
x(t) &= -\frac{c_1 \mathrm{e}^{-\left(2+\sqrt{1+8\pi}\right)t}\sqrt{1+8\pi}}{4} + \frac{c_2 \mathrm{e}^{\left(-2+\sqrt{1+8\pi}\right)t}\sqrt{1+8\pi}}{4} \\
&\quad - \frac{c_1 \mathrm{e}^{-\left(2+\sqrt{1+8\pi}\right)t}}{4} - \frac{c_2 \mathrm{e}^{\left(-2+\sqrt{1+8\pi}\right)t}}{4} \\
y(t) &= c_1 \mathrm{e}^{-\left(2+\sqrt{1+8\pi}\right)t} + c_2 \mathrm{e}^{\left(-2+\sqrt{1+8\pi}\right)t}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.014 (sec). Leaf size: 189

```
DSolve[{x'[t]==-3*x[t]+2*Pi*y[t],y'[t]==4*x[t]-y[t]},{x[t],y[t]},t,IncludeSingularSolutions
```

$$x(t) \to \frac{e^{-\left(\left(2+\sqrt{1+8\pi}\right)t\right)}\left(c_1\left(\left(\sqrt{1+8\pi}-1\right)e^{2\sqrt{1+8\pi}t}+1+\sqrt{1+8\pi}\right)+2\pi c_2\left(e^{2\sqrt{1+8\pi}t}-1\right)\right)}{2\sqrt{1+8\pi}}$$

$$y(t) \to \frac{e^{-\left(\left(2+\sqrt{1+8\pi}\right)t\right)}\left(4c_1\left(e^{2\sqrt{1+8\pi}t}-1\right)+c_2\left(\left(1+\sqrt{1+8\pi}\right)e^{2\sqrt{1+8\pi}t}-1+\sqrt{1+8\pi}\right)\right)}{2\sqrt{1+8\pi}}$$

9.9 problem 9

Internal problem ID [12749]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.1. page 258
Problem number: 9.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= \beta y \\
y' &= \gamma x(t) - y
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.032 (sec). Leaf size: 128

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

$$
x(t) = \frac{c_1 e^{\frac{\left(-1+\sqrt{4\gamma\beta+1}\right)t}{2}}\sqrt{4\gamma\beta+1} - c_2 e^{-\frac{\left(1+\sqrt{4\gamma\beta+1}\right)t}{2}}\sqrt{4\gamma\beta+1} + c_1 e^{\frac{\left(-1+\sqrt{4\gamma\beta+1}\right)t}{2}} + c_2 e^{-\frac{\left(1+\sqrt{4\gamma\beta+1}\right)t}{2}}}{2\gamma}
$$

$$
y(t) = c_1 e^{\frac{\left(-1+\sqrt{4\gamma\beta+1}\right)t}{2}} + c_2 e^{-\frac{\left(1+\sqrt{4\gamma\beta+1}\right)t}{2}}
$$

✓ Solution by Mathematica

Time used: 0.019 (sec). Leaf size: 202

```
DSolve[{x'[t]==\[Beta]*y[t],y'[t]==\[Gamma]*x[t]-y[t]},{x[t],y[t]},t,IncludeSingularSolution
```

$$x(t) \to \frac{e^{-\frac{1}{2}t\left(\sqrt{4\beta\gamma+1}+1\right)}\left(c_1\left(\sqrt{4\beta\gamma+1}+\left(\sqrt{4\beta\gamma+1}+1\right)e^{t\sqrt{4\beta\gamma+1}}-1\right)+2\beta c_2\left(e^{t\sqrt{4\beta\gamma+1}}-1\right)\right)}{2\sqrt{4\beta\gamma+1}}$$

$$y(t) \to \frac{e^{-\frac{1}{2}t\left(\sqrt{4\beta\gamma+1}+1\right)}\left(2\gamma c_1\left(e^{t\sqrt{4\beta\gamma+1}}-1\right)+c_2\left(\sqrt{4\beta\gamma+1}+\left(\sqrt{4\beta\gamma+1}-1\right)e^{t\sqrt{4\beta\gamma+1}}+1\right)\right)}{2\sqrt{4\beta\gamma+1}}$$

9.10 problem 24

Internal problem ID [12750]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.1. page 258
Problem number: 24.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= 2y \\
y' &= x(t) + y
\end{aligned}
$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 34

```
dsolve([diff(x(t),t) = 2*y(t), diff(y(t),t) = x(t)+y(t), x(0) = -2, y(0) = -1],[x(t), y(t)],
```

$$
\begin{aligned}
x(t) &= -\frac{4\,\mathrm{e}^{2t}}{3} - \frac{2\,\mathrm{e}^{-t}}{3} \\
y(t) &= -\frac{4\,\mathrm{e}^{2t}}{3} + \frac{\mathrm{e}^{-t}}{3}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.005 (sec). Leaf size: 44

```
DSolve[{x'[t]==2*y[t],y'[t]==x[t]+y[t]},{x[0]==-2,y[0]==-1},{x[t],y[t]},t,IncludeSingularSol
```

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

9.11 problem 25

Internal problem ID [12751]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.1. page 258
Problem number: 25.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= x(t) - y \\
y' &= x(t) + 3y
\end{aligned}
$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 25

```
dsolve([diff(x(t),t) = x(t)-y(t), diff(y(t),t) = x(t)+3*y(t), x(0) = 0, y(0) = 2],[x(t), y(t
```

$$
\begin{aligned}
x(t) &= -2\,\mathrm{e}^{2t} t \\
y(t) &= \mathrm{e}^{2t}(2t + 2)
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.005 (sec). Leaf size: 26

```
DSolve[{x'[t]==x[t]-y[t],y'[t]==x[t]+3*y[t]},{x[0]==0,y[0]==2},{x[t],y[t]},t,IncludeSingular
```

$$
\begin{aligned}
x(t) &\to -2e^{2t} t \\
y(t) &\to 2e^{2t}(t + 1)
\end{aligned}
$$

9.12 problem 26

Internal problem ID [12752]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.1. page 258
Problem number: 26.
ODE order: 1.
ODE degree: 1.

Solve

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

With initial conditions

$$[x(0) = 2, y(0) = 3]$$

✓ Solution by Maple

Time used: 0.078 (sec). Leaf size: 28

```
dsolve([diff(x(t),t) = -2*x(t)-y(t), diff(y(t),t) = 2*x(t)-5*y(t), x(0) = 2, y(0) = 3],[x(t)
```

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

✓ Solution by Mathematica

Time used: 0.006 (sec). Leaf size: 30

```
DSolve[{x'[t]==-2*x[t]-y[t],y'[t]==2*x[t]-5*y[t]},{x[0]==2,y[0]==3},{x[t],y[t]},t,IncludeSin
```

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

9.13 problem 28

Internal problem ID [12753]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.1. page 258
Problem number: 28.
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = -2x(t) - 3y$$
$$y' = 3x(t) - 2y$$

With initial conditions

$$[x(0) = 2, y(0) = 3]$$

✓ Solution by Maple

Time used: 0.032 (sec). Leaf size: 44

```
dsolve([diff(x(t),t) = -2*x(t)-3*y(t), diff(y(t),t) = 3*x(t)-2*y(t), x(0) = 2, y(0) = 3],[x(
```

$$x(t) = e^{-2t}(2\cos(3t) - 3\sin(3t))$$
$$y(t) = e^{-2t}(3\cos(3t) + 2\sin(3t))$$

✓ Solution by Mathematica

Time used: 0.005 (sec). Leaf size: 46

```
DSolve[{x'[t]==-2*x[t]-3*y[t],y'[t]==3*x[t]-2*y[t]},{x[0]==2,y[0]==3},{x[t],y[t]},t,IncludeS
```

$$x(t) \to e^{-2t}(2\cos(3t) - 3\sin(3t))$$
$$y(t) \to e^{-2t}(2\sin(3t) + 3\cos(3t))$$

9.14 problem 29

Internal problem ID [12754]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.1. page 258
Problem number: 29.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= 2x(t) + 3y \\
y' &= x(t)
\end{aligned}
$$

With initial conditions

$$[x(0) = 2, y(0) = 3]$$

✓ Solution by Maple

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

```
dsolve([diff(x(t),t) = 2*x(t)+3*y(t), diff(y(t),t) = x(t), x(0) = 2, y(0) = 3],[x(t), y(t)],
```

$$
\begin{aligned}
x(t) &= \frac{15\,\mathrm{e}^{3t}}{4} - \frac{7\,\mathrm{e}^{-t}}{4} \\
y(t) &= \frac{5\,\mathrm{e}^{3t}}{4} + \frac{7\,\mathrm{e}^{-t}}{4}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.006 (sec). Leaf size: 44

```
DSolve[{x'[t]==2*x[t]+3*y[t],y'[t]==x[t]},{x[0]==2,y[0]==3},{x[t],y[t]},t,IncludeSingularSol
```

$$
\begin{aligned}
x(t) &\to \frac{1}{4}e^{-t}\left(15e^{4t} - 7\right) \\
y(t) &\to \frac{1}{4}e^{-t}\left(5e^{4t} + 7\right)
\end{aligned}
$$

9.15 problem 34

Internal problem ID [12755]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.1. page 258
Problem number: 34.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= 1 \\
y' &= x(t)
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 21

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

$$
\begin{aligned}
x(t) &= t + c_1 \\
y(t) &= \frac{1}{2}t^2 + c_1 t + c_2
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.009 (sec). Leaf size: 26

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

$$
\begin{aligned}
x(t) &\to t + c_1 \\
y(t) &\to \frac{t^2}{2} + c_1 t + c_2
\end{aligned}
$$

10 Chapter 3. Linear Systems. Exercises section 3.2. page 277

10.1 problem 1

Internal problem ID [12756]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.2. page 277
Problem number: 1.
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = 3x(t)$$
$$y' = -2y$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 20

```
dsolve([diff(x(t),t)=3*x(t),diff(y(t),t)=-2*y(t)],[x(t), y(t)], singsol=all)
```

$$x(t) = c_1 e^{3t}$$
$$y(t) = c_2 e^{-2t}$$

✓ Solution by Mathematica

Time used: 0.004 (sec). Leaf size: 32

```
DSolve[{x'[t]==3*x[t],y'[t]==-2*x[t]},{x[t],y[t]},t,IncludeSingularSolutions -> True]
```

$$x(t) \to c_1 e^{3t}$$
$$y(t) \to c_2 - \frac{2}{3} c_1 \left(e^{3t} - 1\right)$$

10.2 problem 2

Internal problem ID [12757]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.2. page 277
Problem number: 2.
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = -4x(t) - 2y$$
$$y' = -x(t) - 3y$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 36

```
dsolve([diff(x(t),t)=-4*x(t)-2*y(t),diff(y(t),t)=-x(t)-3*y(t)],[x(t), y(t)], singsol=all)
```

$$x(t) = 2c_1 e^{-5t} - c_2 e^{-2t}$$
$$y(t) = c_1 e^{-5t} + c_2 e^{-2t}$$

✓ Solution by Mathematica

Time used: 0.009 (sec). Leaf size: 71

```
DSolve[{x'[t]==-4*x[t]-2*y[t],y'[t]==-x[t]-3*y[t]},{x[t],y[t]},t,IncludeSingularSolutions ->
```

$$x(t) \to \frac{1}{3}e^{-5t}\left(c_1\left(e^{3t} + 2\right) - 2c_2\left(e^{3t} - 1\right)\right)$$
$$y(t) \to \frac{1}{3}e^{-5t}\left(c_1\left(-e^{3t}\right) + 2c_2 e^{3t} + c_1 + c_2\right)$$

10.3 problem 3

Internal problem ID [12758]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.2. page 277
Problem number: 3.
ODE order: 1.
ODE degree: 1.

Solve

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

✓ Solution by Maple

Time used: 0.032 (sec). Leaf size: 36

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

$$x(t) = -c_1 e^{-3t} + 2c_2 e^{-6t}$$
$$y(t) = c_1 e^{-3t} + c_2 e^{-6t}$$

✓ Solution by Mathematica

Time used: 0.005 (sec). Leaf size: 71

```
DSolve[{x'[t]==-5*x[t]-2*y[t],y'[t]==-x[t]-4*y[t]},{x[t],y[t]},t,IncludeSingularSolutions ->
```

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

10.4 problem 4

Internal problem ID [12759]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.2. page 277
Problem number: 4.
ODE order: 1.
ODE degree: 1.

Solve

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 31

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

$$x(t) = e^{3t}(c_2t + c_1 - c_2)$$
$$y(t) = e^{3t}(c_2t + c_1)$$

✓ Solution by Mathematica

Time used: 0.004 (sec). Leaf size: 44

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

$$x(t) \to e^{3t}(c_1(-t) + c_2t + c_1)$$
$$y(t) \to e^{3t}((c_2 - c_1)t + c_2)$$

10.5 problem 5

Internal problem ID [12760]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.2. page 277
Problem number: 5.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= -\frac{x(t)}{2} \\
y' &= x(t) - \frac{y}{2}
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 24

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

$$
\begin{aligned}
x(t) &= c_2 e^{-\frac{t}{2}} \\
y(t) &= e^{-\frac{t}{2}}(c_2 t + c_1)
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.009 (sec). Leaf size: 33

```
DSolve[{x'[t]==-1/2*x[t],y'[t]==x[t]-1/2*y[t]},{x[t],y[t]},t,IncludeSingularSolutions -> Tru
```

$$
\begin{aligned}
x(t) &\to c_1 e^{-t/2} \\
y(t) &\to e^{-t/2}(c_1 t + c_2)
\end{aligned}
$$

10.6 problem 6

Internal problem ID [12761]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.2. page 277
Problem number: 6.
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = 5x(t) + 4y$$
$$y' = 9x(t)$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 35

```
dsolve([diff(x(t),t)=5*x(t)+4*y(t),diff(y(t),t)=9*x(t)],[x(t), y(t)], singsol=all)
```

$$x(t) = c_1 \mathrm{e}^{9t} - \frac{4c_2 \mathrm{e}^{-4t}}{9}$$
$$y(t) = c_1 \mathrm{e}^{9t} + c_2 \mathrm{e}^{-4t}$$

✓ Solution by Mathematica

Time used: 0.009 (sec). Leaf size: 74

```
DSolve[{x'[t]==5*x[t]+4*y[t],y'[t]==9*x[t]},{x[t],y[t]},t,IncludeSingularSolutions -> True]
```

$$x(t) \to \frac{1}{13} e^{-4t} \left(c_1 \left(9e^{13t} + 4\right) + 4c_2 \left(e^{13t} - 1\right)\right)$$
$$y(t) \to \frac{1}{13} e^{-4t} \left(9c_1 \left(e^{13t} - 1\right) + c_2 \left(4e^{13t} + 9\right)\right)$$

10.7 problem 7

Internal problem ID [12762]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.2. page 277
Problem number: 7.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= 3x(t) + 4y \\
y' &= x(t)
\end{aligned}
$$

✓ Solution by Maple

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

```
dsolve([diff(x(t),t)=3*x(t)+4*y(t),diff(y(t),t)=1*x(t)],[x(t), y(t)], singsol=all)
```

$$
\begin{aligned}
x(t) &= -c_1 \mathrm{e}^{-t} + 4c_2 \mathrm{e}^{4t} \\
y(t) &= c_1 \mathrm{e}^{-t} + c_2 \mathrm{e}^{4t}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.004 (sec). Leaf size: 71

```
DSolve[{x'[t]==3*x[t]+4*y[t],y'[t]==1*x[t]},{x[t],y[t]},t,IncludeSingularSolutions -> True]
```

$$
\begin{aligned}
x(t) &\to \frac{1}{5} e^{-t} \left(c_1 \left(4e^{5t} + 1 \right) + 4c_2 \left(e^{5t} - 1 \right) \right) \\
y(t) &\to \frac{1}{5} e^{-t} \left(c_1 \left(e^{5t} - 1 \right) + c_2 \left(e^{5t} + 4 \right) \right)
\end{aligned}
$$

10.8 problem 8

Internal problem ID [12763]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.2. page 277
Problem number: 8.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= 2x(t) - y \\
y' &= -x(t) + y
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 86

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

$$
\begin{aligned}
x(t) &= -\frac{c_1 \mathrm{e}^{\frac{(3+\sqrt{5})t}{2}}\sqrt{5}}{2} + \frac{c_2 \mathrm{e}^{-\frac{(\sqrt{5}-3)t}{2}}\sqrt{5}}{2} - \frac{c_1 \mathrm{e}^{\frac{(3+\sqrt{5})t}{2}}}{2} - \frac{c_2 \mathrm{e}^{-\frac{(\sqrt{5}-3)t}{2}}}{2} \\
y(t) &= c_1 \mathrm{e}^{\frac{(3+\sqrt{5})t}{2}} + c_2 \mathrm{e}^{-\frac{(\sqrt{5}-3)t}{2}}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.015 (sec). Leaf size: 144

```
DSolve[{x'[t]==2*x[t]-y[t],y'[t]==-1*x[t]+y[t]},{x[t],y[t]},t,IncludeSingularSolutions -> Tr
```

$$
\begin{aligned}
x(t) &\to \frac{1}{10} e^{-\frac{1}{2}(\sqrt{5}-3)t}\left(c_1\left(\left(5+\sqrt{5}\right)e^{\sqrt{5}t} + 5 - \sqrt{5}\right) - 2\sqrt{5}c_2\left(e^{\sqrt{5}t} - 1\right)\right) \\
y(t) &\to -\frac{1}{10} e^{-\frac{1}{2}(\sqrt{5}-3)t}\left(2\sqrt{5}c_1\left(e^{\sqrt{5}t} - 1\right) + c_2\left(\left(\sqrt{5}-5\right)e^{\sqrt{5}t} - 5 - \sqrt{5}\right)\right)
\end{aligned}
$$

10.9 problem 9

Internal problem ID [12764]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.2. page 277
Problem number: 9.
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = 2x(t) + y$$
$$y' = x(t) + y$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 86

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

$$x(t) = \frac{c_1 e^{\frac{(3+\sqrt{5})t}{2}} \sqrt{5}}{2} - \frac{c_2 e^{-\frac{(\sqrt{5}-3)t}{2}} \sqrt{5}}{2} + \frac{c_1 e^{\frac{(3+\sqrt{5})t}{2}}}{2} + \frac{c_2 e^{-\frac{(\sqrt{5}-3)t}{2}}}{2}$$
$$y(t) = c_1 e^{\frac{(3+\sqrt{5})t}{2}} + c_2 e^{-\frac{(\sqrt{5}-3)t}{2}}$$

✓ Solution by Mathematica

Time used: 0.014 (sec). Leaf size: 145

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

$$x(t) \to \frac{1}{10} e^{-\frac{1}{2}(\sqrt{5}-3)t} \left(c_1 \left(\left(5+\sqrt{5}\right) e^{\sqrt{5}t} + 5 - \sqrt{5}\right) + 2\sqrt{5} c_2 \left(e^{\sqrt{5}t} - 1\right)\right)$$
$$y(t) \to \frac{1}{10} e^{-\frac{1}{2}(\sqrt{5}-3)t} \left(2\sqrt{5} c_1 \left(e^{\sqrt{5}t} - 1\right) - c_2 \left(\left(\sqrt{5}-5\right) e^{\sqrt{5}t} - 5 - \sqrt{5}\right)\right)$$

10.10 problem 10

Internal problem ID [12765]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.2. page 277
Problem number: 10.
ODE order: 1.
ODE degree: 1.

Solve

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 35

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

$$x(t) = c_1 e^{-3t} + 2c_2 e^{-2t}$$
$$y(t) = c_1 e^{-3t} + c_2 e^{-2t}$$

✓ Solution by Mathematica

Time used: 0.005 (sec). Leaf size: 58

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

$$x(t) \to e^{-3t}\left(c_1\left(2e^t - 1\right) - 2c_2\left(e^t - 1\right)\right)$$
$$y(t) \to e^{-3t}\left(c_1\left(e^t - 1\right) - c_2\left(e^t - 2\right)\right)$$

10.11 problem 11 (a)

Internal problem ID [12766]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.2. page 277
Problem number: 11 (a).
ODE order: 1.
ODE degree: 1.

Solve

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

With initial conditions

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

✓ Solution by Maple

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

```
dsolve([diff(x(t),t) = -2*x(t)-2*y(t), diff(y(t),t) = -2*x(t)+y(t), x(0) = 1, y(0) = 0],[x(t
```

$$x(t) = \frac{e^{2t}}{5} + \frac{4\,e^{-3t}}{5}$$
$$y(t) = -\frac{2\,e^{2t}}{5} + \frac{2\,e^{-3t}}{5}$$

✓ Solution by Mathematica

Time used: 0.006 (sec). Leaf size: 40

```
DSolve[{x'[t]==-2*x[t]-2*y[t],y'[t]==-2*x[t]+y[t]},{x[0]==1,y[0]==0},{x[t],y[t]},t,IncludeSi
```

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

10.12 problem 11 (b)

Internal problem ID [12767]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.2. page 277
Problem number: 11 (b).
ODE order: 1.
ODE degree: 1.

Solve

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 34

```
dsolve([diff(x(t),t) = -2*x(t)-2*y(t), diff(y(t),t) = -2*x(t)+y(t), x(0) = 0, y(0) = 1],[x(t
```

$$x(t) = -\frac{2\,\mathrm{e}^{2t}}{5} + \frac{2\,\mathrm{e}^{-3t}}{5}$$
$$y(t) = \frac{4\,\mathrm{e}^{2t}}{5} + \frac{\mathrm{e}^{-3t}}{5}$$

✓ Solution by Mathematica

Time used: 0.006 (sec). Leaf size: 42

```
DSolve[{x'[t]==-2*x[t]-2*y[t],y'[t]==-2*x[t]+y[t]},{x[0]==0,y[0]==1},{x[t],y[t]},t,IncludeSi
```

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

10.13 problem 11 (c)

Internal problem ID [12768]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.2. page 277
Problem number: 11 (c).
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= -2x(t) - 2y \\
y' &= -2x(t) + y
\end{aligned}
$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 18

```
dsolve([diff(x(t),t) = -2*x(t)-2*y(t), diff(y(t),t) = -2*x(t)+y(t), x(0) = 1, y(0) = -2],[x(
```

$$
\begin{aligned}
x(t) &= \mathrm{e}^{2t} \\
y(t) &= -2\,\mathrm{e}^{2t}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.006 (sec). Leaf size: 20

```
DSolve[{x'[t]==-2*x[t]-2*y[t],y'[t]==-2*x[t]+y[t]},{x[0]==1,y[0]==-2},{x[t],y[t]},t,IncludeS
```

$$
\begin{aligned}
x(t) &\to e^{2t} \\
y(t) &\to -2e^{2t}
\end{aligned}
$$

10.14 problem 12 (a)

Internal problem ID [12769]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.2. page 277
Problem number: 12 (a).
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = 3x(t)$$
$$y' = x(t) - 2y$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 25

```
dsolve([diff(x(t),t) = 3*x(t), diff(y(t),t) = x(t)-2*y(t), x(0) = 1, y(0) = 0],[x(t), y(t)],
```

$$x(t) = e^{3t}$$
$$y(t) = \frac{e^{3t}}{5} - \frac{e^{-2t}}{5}$$

✓ Solution by Mathematica

Time used: 0.011 (sec). Leaf size: 29

```
DSolve[{x'[t]==3*x[t],y'[t]==x[t]-2*y[t]},{x[0]==1,y[0]==0},{x[t],y[t]},t,IncludeSingularSol
```

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

10.15 problem 12 (b)

Internal problem ID [12770]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.2. page 277
Problem number: 12 (b).
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= 3x(t) \\
y' &= x(t) - 2y
\end{aligned}
$$

With initial conditions

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

✓ Solution by Maple

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

```
dsolve([diff(x(t),t) = 3*x(t), diff(y(t),t) = x(t)-2*y(t), x(0) = 0, y(0) = 1],[x(t), y(t)],
```

$$
\begin{aligned}
x(t) &= 0 \\
y(t) &= \mathrm{e}^{-2t}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.005 (sec). Leaf size: 14

```
DSolve[{x'[t]==3*x[t],y'[t]==x[t]-2*y[t]},{x[0]==0,y[0]==1},{x[t],y[t]},t,IncludeSingularSol
```

$$
\begin{aligned}
x(t) &\to 0 \\
y(t) &\to e^{-2t}
\end{aligned}
$$

10.16 problem 12 (c)

Internal problem ID [12771]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.2. page 277
Problem number: 12 (c).
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = 3x(t)$$
$$y' = x(t) - 2y$$

With initial conditions

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

✓ Solution by Maple

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

```
dsolve([diff(x(t),t) = 3*x(t), diff(y(t),t) = x(t)-2*y(t), x(0) = 2, y(0) = 2],[x(t), y(t)],
```

$$x(t) = 2\,\mathrm{e}^{3t}$$
$$y(t) = \frac{2\,\mathrm{e}^{3t}}{5} + \frac{8\,\mathrm{e}^{-2t}}{5}$$

✓ Solution by Mathematica

Time used: 0.005 (sec). Leaf size: 31

```
DSolve[{x'[t]==3*x[t],y'[t]==x[t]-2*y[t]},{x[0]==2,y[0]==2},{x[t],y[t]},t,IncludeSingularSol
```

$$x(t) \to 2e^{3t}$$
$$y(t) \to \frac{2}{5}e^{-2t}(e^{5t} + 4)$$

10.17 problem 13 (a)

Internal problem ID [12772]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.2. page 277
Problem number: 13 (a).
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= -4x(t) + y \\
y' &= 2x(t) - 3y
\end{aligned}
$$

With initial conditions

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

✓ Solution by Maple

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

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

$$
\begin{aligned}
x(t) &= \frac{2\,\mathrm{e}^{-5t}}{3} + \frac{\mathrm{e}^{-2t}}{3} \\
y(t) &= -\frac{2\,\mathrm{e}^{-5t}}{3} + \frac{2\,\mathrm{e}^{-2t}}{3}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.011 (sec). Leaf size: 40

```
DSolve[{x'[t]==-4*x[t]+y[t],y'[t]==2*x[t]-3*y[t]},{x[0]==1,y[0]==0},{x[t],y[t]},t,IncludeSin
```

$$
\begin{aligned}
x(t) &\to \frac{1}{3}e^{-5t}(e^{3t} + 2) \\
y(t) &\to \frac{2}{3}e^{-5t}(e^{3t} - 1)
\end{aligned}
$$

10.18 problem 13 (b)

Internal problem ID [12773]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.2. page 277
Problem number: 13 (b).
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = -4x(t) + y$$
$$y' = 2x(t) - 3y$$

With initial conditions

$$[x(0) = 2, y(0) = 1]$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 30

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

$$x(t) = e^{-5t} + e^{-2t}$$
$$y(t) = -e^{-5t} + 2e^{-2t}$$

✓ Solution by Mathematica

Time used: 0.006 (sec). Leaf size: 34

```
DSolve[{x'[t]==-4*x[t]+y[t],y'[t]==2*x[t]-3*y[t]},{x[0]==2,y[0]==1},{x[t],y[t]},t,IncludeSin
```

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

10.19 problem 13 (c)

Internal problem ID [12774]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.2. page 277
Problem number: 13 (c).
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = -4x(t) + y$$
$$y' = 2x(t) - 3y$$

With initial conditions

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

✓ Solution by Maple

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

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

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

✓ Solution by Mathematica

Time used: 0.006 (sec). Leaf size: 22

```
DSolve[{x'[t]==-4*x[t]+y[t],y'[t]==2*x[t]-3*y[t]},{x[0]==-1,y[0]==-2},{x[t],y[t]},t,IncludeS
```

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

10.20 problem 14 (a)

Internal problem ID [12775]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.2. page 277
Problem number: 14 (a).
ODE order: 1.
ODE degree: 1.

Solve

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

With initial conditions

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

✓ Solution by Maple

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

```
dsolve([diff(x(t),t) = 4*x(t)-2*y(t), diff(y(t),t) = x(t)+y(t), x(0) = 1, y(0) = 0],[x(t), y
```

$$x(t) = 2\,e^{3t} - e^{2t}$$
$$y(t) = e^{3t} - e^{2t}$$

✓ Solution by Mathematica

Time used: 0.006 (sec). Leaf size: 32

```
DSolve[{x'[t]==4*x[t]-2*y[t],y'[t]==x[t]+y[t]},{x[0]==1,y[0]==0},{x[t],y[t]},t,IncludeSingul
```

$$x(t) \to e^{2t}(2e^t - 1)$$
$$y(t) \to e^{2t}(e^t - 1)$$

10.21 problem 14 (b)

Internal problem ID [12776]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.2. page 277
Problem number: 14 (b).
ODE order: 1.
ODE degree: 1.

Solve

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

With initial conditions

$$[x(0) = 2, y(0) = 1]$$

✓ Solution by Maple

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

```
dsolve([diff(x(t),t) = 4*x(t)-2*y(t), diff(y(t),t) = x(t)+y(t), x(0) = 2, y(0) = 1],[x(t), y
```

$$x(t) = 2\,\mathrm{e}^{3t}$$
$$y(t) = \mathrm{e}^{3t}$$

✓ Solution by Mathematica

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

```
DSolve[{x'[t]==4*x[t]-2*y[t],y'[t]==x[t]+y[t]},{x[0]==2,y[0]==1},{x[t],y[t]},t,IncludeSingul
```

$$x(t) \to 2e^{3t}$$
$$y(t) \to e^{3t}$$

10.22 problem 14 (c)

Internal problem ID [12777]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.2. page 277
Problem number: 14 (c).
ODE order: 1.
ODE degree: 1.

Solve

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 32

```
dsolve([diff(x(t),t) = 4*x(t)-2*y(t), diff(y(t),t) = x(t)+y(t), x(0) = -1, y(0) = -2],[x(t),
```

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

✓ Solution by Mathematica

Time used: 0.006 (sec). Leaf size: 32

```
DSolve[{x'[t]==4*x[t]-2*y[t],y'[t]==x[t]+y[t]},{x[0]==-1,y[0]==-2},{x[t],y[t]},t,IncludeSing
```

$$x(t) \to e^{2t}(2e^t - 3)$$
$$y(t) \to e^{2t}(e^t - 3)$$

11 Chapter 3. Linear Systems. Exercises section 3.4 page 310

11.1 problem 3

Internal problem ID [12778]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.4 page 310
Problem number: 3.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= 2y \\
y' &= -2x(t)
\end{aligned}
$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 18

```
dsolve([diff(x(t),t) = 2*y(t), diff(y(t),t) = -2*x(t), x(0) = 1, y(0) = 0],[x(t), y(t)], sin
```

$$
\begin{aligned}
x(t) &= \cos(2t) \\
y(t) &= -\sin(2t)
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.004 (sec). Leaf size: 18

```
DSolve[{x'[t]==2*y[t],y'[t]==-2*x[t]},{x[0]==1,y[0]==0},{x[t],y[t]},t,IncludeSingularSolutio
```

$$
\begin{aligned}
x(t) &\to \cos(2t) \\
y(t) &\to -\sin(2t)
\end{aligned}
$$

11.2 problem 4

Internal problem ID [12779]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.4 page 310
Problem number: 4.
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = 2x(t) + 2y$$
$$y' = -4x(t) + 6y$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 33

```
dsolve([diff(x(t),t) = 2*x(t)+2*y(t), diff(y(t),t) = -4*x(t)+6*y(t), x(0) = 1, y(0) = 1],[x(
```

$$x(t) = e^{4t} \cos(2t)$$
$$y(t) = e^{4t}(-\sin(2t) + \cos(2t))$$

✓ Solution by Mathematica

Time used: 0.01 (sec). Leaf size: 35

```
DSolve[{x'[t]==2*x[t]+2*y[t],y'[t]==-4*x[t]+6*y[t]},{x[0]==1,y[0]==1},{x[t],y[t]},t,IncludeS
```

$$x(t) \to e^{4t} \cos(2t)$$
$$y(t) \to e^{4t}(\cos(2t) - \sin(2t))$$

11.3 problem 5

Internal problem ID [12780]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.4 page 310
Problem number: 5.
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = -3x(t) - 5y$$
$$y' = 3x(t) + y$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 49

```
dsolve([diff(x(t),t) = -3*x(t)-5*y(t), diff(y(t),t) = 3*x(t)+y(t), x(0) = 4, y(0) = 0],[x(t)
```

$$x(t) = -\frac{e^{-t}\left(-12\cos\left(\sqrt{11}\,t\right) + \frac{24\sqrt{11}\sin\left(\sqrt{11}\,t\right)}{11}\right)}{3}$$
$$y(t) = \frac{12\,e^{-t}\sqrt{11}\sin\left(\sqrt{11}\,t\right)}{11}$$

✓ Solution by Mathematica

Time used: 0.028 (sec). Leaf size: 63

```
DSolve[{x'[t]==-3*x[t]-5*y[t],y'[t]==3*x[t]+y[t]},{x[0]==4,y[0]==0},{x[t],y[t]},t,IncludeSin
```

$$x(t) \to \frac{4}{11}e^{-t}\left(11\cos\left(\sqrt{11}t\right) - 2\sqrt{11}\sin\left(\sqrt{11}t\right)\right)$$
$$y(t) \to \frac{12e^{-t}\sin\left(\sqrt{11}t\right)}{\sqrt{11}}$$

11.4 problem 6

Internal problem ID [12781]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.4 page 310
Problem number: 6.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= 2y \\
y' &= -2x(t) - y
\end{aligned}
$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.125 (sec). Leaf size: 61

```
dsolve([diff(x(t),t) = 2*y(t), diff(y(t),t) = -2*x(t)-y(t), x(0) = -1, y(0) = 1],[x(t), y(t)
```

$$
\begin{aligned}
x(t) &= -\frac{\mathrm{e}^{-\frac{t}{2}}\left(4\cos\left(\frac{\sqrt{15}\,t}{2}\right) - \frac{4\sqrt{15}\,\sin\left(\frac{\sqrt{15}\,t}{2}\right)}{5}\right)}{4} \\
y(t) &= \mathrm{e}^{-\frac{t}{2}}\left(\cos\left(\frac{\sqrt{15}\,t}{2}\right) + \frac{\sqrt{15}\,\sin\left(\frac{\sqrt{15}\,t}{2}\right)}{5}\right)
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.036 (sec). Leaf size: 92

```
DSolve[{x'[t]==0*x[t]+2*y[t],y'[t]==-2*x[t]-y[t]},{x[0]==-1,y[0]==1},{x[t],y[t]},t,IncludeSi
```

$$x(t) \to \frac{1}{5}e^{-t/2}\left(\sqrt{15}\sin\left(\frac{\sqrt{15}t}{2}\right) - 5\cos\left(\frac{\sqrt{15}t}{2}\right)\right)$$

$$y(t) \to \frac{1}{5}e^{-t/2}\left(\sqrt{15}\sin\left(\frac{\sqrt{15}t}{2}\right) + 5\cos\left(\frac{\sqrt{15}t}{2}\right)\right)$$

11.5 problem 7

Internal problem ID [12782]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.4 page 310
Problem number: 7.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= 2x(t) - 6y \\
y' &= 2x(t) + y
\end{aligned}
$$

With initial conditions

$$
[x(0) = 2, y(0) = 1]
$$

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 61

```
dsolve([diff(x(t),t) = 2*x(t)-6*y(t), diff(y(t),t) = 2*x(t)+y(t), x(0) = 2, y(0) = 1],[x(t),
```

$$
\begin{aligned}
x(t) &= -\frac{e^{\frac{3t}{2}}\left(\frac{40\sqrt{47}\,\sin\left(\frac{\sqrt{47}\,t}{2}\right)}{47} - 8\cos\left(\frac{\sqrt{47}\,t}{2}\right)\right)}{4} \\
y(t) &= e^{\frac{3t}{2}}\left(\frac{7\sqrt{47}\,\sin\left(\frac{\sqrt{47}\,t}{2}\right)}{47} + \cos\left(\frac{\sqrt{47}\,t}{2}\right)\right)
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.03 (sec). Leaf size: 94

```
DSolve[{x'[t]==2*x[t]-6*y[t],y'[t]==2*x[t]+y[t]},{x[0]==2,y[0]==1},{x[t],y[t]},t,IncludeSing
```

$$x(t) \to \frac{2}{47}e^{3t/2}\left(47\cos\left(\frac{\sqrt{47}t}{2}\right) - 5\sqrt{47}\sin\left(\frac{\sqrt{47}t}{2}\right)\right)$$
$$y(t) \to \frac{1}{47}e^{3t/2}\left(7\sqrt{47}\sin\left(\frac{\sqrt{47}t}{2}\right) + 47\cos\left(\frac{\sqrt{47}t}{2}\right)\right)$$

11.6 problem 8

Internal problem ID [12783]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.4 page 310
Problem number: 8.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= x(t) + 4y \\
y' &= -3x(t) + 2y
\end{aligned}
$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 63

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

$$
\begin{aligned}
x(t) &= \frac{\mathrm{e}^{\frac{3t}{2}} \left(-\frac{54\sqrt{47}\,\sin\left(\frac{\sqrt{47}\,t}{2}\right)}{47} + 6\cos\left(\frac{\sqrt{47}\,t}{2}\right)\right)}{6} \\
y(t) &= \mathrm{e}^{\frac{3t}{2}} \left(-\frac{7\sqrt{47}\,\sin\left(\frac{\sqrt{47}\,t}{2}\right)}{47} - \cos\left(\frac{\sqrt{47}\,t}{2}\right)\right)
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.03 (sec). Leaf size: 94

```
DSolve[{x'[t]==1*x[t]+4*y[t],y'[t]==-3*x[t]+2*y[t]},{x[0]==1,y[0]==-1},{x[t],y[t]},t,Include
```

$$x(t) \to \frac{1}{47}e^{3t/2}\left(47\cos\left(\frac{\sqrt{47}t}{2}\right) - 9\sqrt{47}\sin\left(\frac{\sqrt{47}t}{2}\right)\right)$$
$$y(t) \to -\frac{1}{47}e^{3t/2}\left(7\sqrt{47}\sin\left(\frac{\sqrt{47}t}{2}\right) + 47\cos\left(\frac{\sqrt{47}t}{2}\right)\right)$$

11.7 problem 9

Internal problem ID [12784]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.4 page 310
Problem number: 9.
ODE order: 1.
ODE degree: 1.

Solve

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 18

```
dsolve([diff(x(t),t) = 2*y(t), diff(y(t),t) = -2*x(t), x(0) = 1, y(0) = 0],[x(t), y(t)], sin
```

$$x(t) = \cos(2t)$$
$$y(t) = -\sin(2t)$$

✓ Solution by Mathematica

Time used: 0.004 (sec). Leaf size: 18

```
DSolve[{x'[t]==0*x[t]+2*y[t],y'[t]==-2*x[t]+0*y[t]},{x[0]==1,y[0]==0},{x[t],y[t]},t,IncludeS
```

$$x(t) \to \cos(2t)$$
$$y(t) \to -\sin(2t)$$

11.8 problem 10

Internal problem ID [12785]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.4 page 310
Problem number: 10.
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = 2x(t) + 2y$$
$$y' = -4x(t) + 6y$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 33

```
dsolve([diff(x(t),t) = 2*x(t)+2*y(t), diff(y(t),t) = -4*x(t)+6*y(t), x(0) = 1, y(0) = 1],[x(
```

$$x(t) = e^{4t} \cos(2t)$$
$$y(t) = e^{4t}(-\sin(2t) + \cos(2t))$$

✓ Solution by Mathematica

Time used: 0.01 (sec). Leaf size: 35

```
DSolve[{x'[t]==2*x[t]+2*y[t],y'[t]==-4*x[t]+6*y[t]},{x[0]==1,y[0]==1},{x[t],y[t]},t,IncludeS
```

$$x(t) \to e^{4t} \cos(2t)$$
$$y(t) \to e^{4t}(\cos(2t) - \sin(2t))$$

11.9 problem 11

Internal problem ID [12786]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.4 page 310
Problem number: 11.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= -3x(t) - 5y \\
y' &= 3x(t) + y
\end{aligned}
$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 49

```
dsolve([diff(x(t),t) = -3*x(t)-5*y(t), diff(y(t),t) = 3*x(t)+y(t), x(0) = 4, y(0) = 0],[x(t)
```

$$
\begin{aligned}
x(t) &= -\frac{e^{-t}\left(-12\cos\left(\sqrt{11}\,t\right) + \frac{24\sqrt{11}\,\sin\left(\sqrt{11}\,t\right)}{11}\right)}{3} \\
y(t) &= \frac{12\,e^{-t}\sqrt{11}\,\sin\left(\sqrt{11}\,t\right)}{11}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.028 (sec). Leaf size: 63

```
DSolve[{x'[t]==-3*x[t]-5*y[t],y'[t]==3*x[t]+1*y[t]},{x[0]==4,y[0]==0},{x[t],y[t]},t,IncludeS
```

$$
\begin{aligned}
x(t) &\to \frac{4}{11}e^{-t}\left(11\cos\left(\sqrt{11}t\right) - 2\sqrt{11}\sin\left(\sqrt{11}t\right)\right) \\
y(t) &\to \frac{12e^{-t}\sin\left(\sqrt{11}t\right)}{\sqrt{11}}
\end{aligned}
$$

11.10 problem 12

Internal problem ID [12787]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.4 page 310
Problem number: 12.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= 2y \\
y' &= -2x(t) - y
\end{aligned}
$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 61

```
dsolve([diff(x(t),t) = 2*y(t), diff(y(t),t) = -2*x(t)-y(t), x(0) = -1, y(0) = 1],[x(t), y(t)
```

$$
\begin{aligned}
x(t) &= -\frac{e^{-\frac{t}{2}}\left(4\cos\left(\frac{\sqrt{15}\,t}{2}\right) - \frac{4\sqrt{15}\,\sin\left(\frac{\sqrt{15}\,t}{2}\right)}{5}\right)}{4} \\
y(t) &= e^{-\frac{t}{2}}\left(\cos\left(\frac{\sqrt{15}\,t}{2}\right) + \frac{\sqrt{15}\,\sin\left(\frac{\sqrt{15}\,t}{2}\right)}{5}\right)
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.037 (sec). Leaf size: 92

```
DSolve[{x'[t]==2*y[t],y'[t]==-2*x[t]-1*y[t]},{x[0]==-1,y[0]==1},{x[t],y[t]},t,IncludeSingula
```

$$x(t) \to \frac{1}{5}e^{-t/2}\left(\sqrt{15}\sin\left(\frac{\sqrt{15}t}{2}\right) - 5\cos\left(\frac{\sqrt{15}t}{2}\right)\right)$$
$$y(t) \to \frac{1}{5}e^{-t/2}\left(\sqrt{15}\sin\left(\frac{\sqrt{15}t}{2}\right) + 5\cos\left(\frac{\sqrt{15}t}{2}\right)\right)$$

11.11 problem 13

Internal problem ID [12788]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.4 page 310
Problem number: 13.
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = 2x(t) - 6y$$
$$y' = 2x(t) + y$$

With initial conditions

$$[x(0) = 2, y(0) = 1]$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 61

```
dsolve([diff(x(t),t) = 2*x(t)-6*y(t), diff(y(t),t) = 2*x(t)+y(t), x(0) = 2, y(0) = 1],[x(t),
```

$$x(t) = -\frac{e^{\frac{3t}{2}}\left(\frac{40\sqrt{47}\sin\left(\frac{\sqrt{47}\,t}{2}\right)}{47} - 8\cos\left(\frac{\sqrt{47}\,t}{2}\right)\right)}{4}$$
$$y(t) = e^{\frac{3t}{2}}\left(\frac{7\sqrt{47}\sin\left(\frac{\sqrt{47}\,t}{2}\right)}{47} + \cos\left(\frac{\sqrt{47}\,t}{2}\right)\right)$$

✓ Solution by Mathematica

Time used: 0.031 (sec). Leaf size: 94

```
DSolve[{x'[t]==2*x[t]-6*y[t],y'[t]==2*x[t]+1*y[t]},{x[0]==2,y[0]==1},{x[t],y[t]},t,IncludeSi
```

$$x(t) \to \frac{2}{47}e^{3t/2}\left(47\cos\left(\frac{\sqrt{47}t}{2}\right) - 5\sqrt{47}\sin\left(\frac{\sqrt{47}t}{2}\right)\right)$$

$$y(t) \to \frac{1}{47}e^{3t/2}\left(7\sqrt{47}\sin\left(\frac{\sqrt{47}t}{2}\right) + 47\cos\left(\frac{\sqrt{47}t}{2}\right)\right)$$

11.12 problem 14

Internal problem ID [12789]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.4 page 310
Problem number: 14.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= x(t) + 4y \\
y' &= -3x(t) + 2y
\end{aligned}
$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 63

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

$$
\begin{aligned}
x(t) &= \frac{e^{\frac{3t}{2}}\left(-\frac{54\sqrt{47}\sin\left(\frac{\sqrt{47}\,t}{2}\right)}{47} + 6\cos\left(\frac{\sqrt{47}\,t}{2}\right)\right)}{6} \\
y(t) &= e^{\frac{3t}{2}}\left(-\frac{7\sqrt{47}\sin\left(\frac{\sqrt{47}\,t}{2}\right)}{47} - \cos\left(\frac{\sqrt{47}\,t}{2}\right)\right)
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.03 (sec). Leaf size: 94

```
DSolve[{x'[t]==1*x[t]+4*y[t],y'[t]==-3*x[t]+2*y[t]},{x[0]==1,y[0]==-1},{x[t],y[t]},t,Include
```

$$x(t) \to \frac{1}{47}e^{3t/2}\left(47\cos\left(\frac{\sqrt{47}t}{2}\right) - 9\sqrt{47}\sin\left(\frac{\sqrt{47}t}{2}\right)\right)$$
$$y(t) \to -\frac{1}{47}e^{3t/2}\left(7\sqrt{47}\sin\left(\frac{\sqrt{47}t}{2}\right) + 47\cos\left(\frac{\sqrt{47}t}{2}\right)\right)$$

11.13 problem 24

Internal problem ID [12790]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.4 page 310
Problem number: 24.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= -\frac{9x(t)}{10} - 2y \\
y' &= x(t) + \frac{11y}{10}
\end{aligned}
$$

With initial conditions

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

✓ Solution by Maple

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

```
dsolve([diff(x(t),t) = -9/10*x(t)-2*y(t), diff(y(t),t) = x(t)+11/10*y(t), x(0) = 1, y(0) = 1
```

$$
\begin{aligned}
x(t) &= -\mathrm{e}^{\frac{t}{10}}(3\sin(t) - \cos(t)) \\
y(t) &= \mathrm{e}^{\frac{t}{10}}(2\sin(t) + \cos(t))
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.01 (sec). Leaf size: 38

```
DSolve[{x'[t]==-9/10*x[t]-2*y[t],y'[t]==x[t]+11/10*y[t]},{x[0]==1,y[0]==1},{x[t],y[t]},t,Inc
```

$$
\begin{aligned}
x(t) &\to e^{t/10}(\cos(t) - 3\sin(t)) \\
y(t) &\to e^{t/10}(2\sin(t) + \cos(t))
\end{aligned}
$$

11.14 problem 26

Internal problem ID [12791]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.4 page 310
Problem number: 26.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= -3x(t) + 10y \\
y' &= -x(t) + 3y
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 37

```
dsolve([diff(x(t),t)=-3*x(t)+10*y(t),diff(y(t),t)=-x(t)+3*y(t)],[x(t), y(t)], singsol=all)
```

$$
\begin{aligned}
x(t) &= -\cos(t)\, c_1 + \sin(t)\, c_2 + 3\sin(t)\, c_1 + 3\cos(t)\, c_2 \\
y(t) &= \sin(t)\, c_1 + \cos(t)\, c_2
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.007 (sec). Leaf size: 42

```
DSolve[{x'[t]==-3*x[t]+10*y[t],y'[t]==-x[t]+3*y[t]},{x[t],y[t]},t,IncludeSingularSolutions -
```

$$
\begin{aligned}
x(t) &\to 10c_2 \sin(t) + c_1(\cos(t) - 3\sin(t)) \\
y(t) &\to c_2(3\sin(t) + \cos(t)) - c_1 \sin(t)
\end{aligned}
$$

12 Chapter 3. Linear Systems. Exercises section 3.5 page 327

12.1 problem 1

Internal problem ID [12792]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.5 page 327
Problem number: 1.
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = -3x(t)$$
$$y' = x(t) - 3y$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 18

```
dsolve([diff(x(t),t) = -3*x(t), diff(y(t),t) = x(t)-3*y(t), x(0) = 1, y(0) = 0],[x(t), y(t)]
```

$$x(t) = \mathrm{e}^{-3t}$$
$$y(t) = \mathrm{e}^{-3t}t$$

✓ Solution by Mathematica

Time used: 0.01 (sec). Leaf size: 20

```
DSolve[{x'[t]==-3*x[t],y'[t]==x[t]-3*y[t]},{x[0]==1,y[0]==0},{x[t],y[t]},t,IncludeSingularSo
```

$$x(t) \to e^{-3t}$$
$$y(t) \to e^{-3t}t$$

12.2 problem 2

Internal problem ID [12793]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.5 page 327
Problem number: 2.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= 2x(t) + y \\
y' &= -x(t) - 2y
\end{aligned}
$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 73

```
dsolve([diff(x(t),t) = 2*x(t)+y(t), diff(y(t),t) = -x(t)-2*y(t), x(0) = 1, y(0) = 0],[x(t),
```

$$
\begin{aligned}
x(t) &= \frac{e^{\sqrt{3}\,t}}{2} + \frac{e^{-\sqrt{3}\,t}}{2} + \frac{\sqrt{3}\,e^{\sqrt{3}\,t}}{3} - \frac{\sqrt{3}\,e^{-\sqrt{3}\,t}}{3} \\
y(t) &= -\frac{\sqrt{3}\,e^{\sqrt{3}\,t}}{6} + \frac{\sqrt{3}\,e^{-\sqrt{3}\,t}}{6}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.018 (sec). Leaf size: 82

```
DSolve[{x'[t]==2*x[t]+1*y[t],y'[t]==-1*x[t]-2*y[t]},{x[0]==1,y[0]==0},{x[t],y[t]},t,IncludeS
```

$$
\begin{aligned}
x(t) &\to \frac{1}{6}e^{-\sqrt{3}t}\left(\left(3+2\sqrt{3}\right)e^{2\sqrt{3}t} + 3 - 2\sqrt{3}\right) \\
y(t) &\to -\frac{e^{-\sqrt{3}t}\left(e^{2\sqrt{3}t} - 1\right)}{2\sqrt{3}}
\end{aligned}
$$

12.3 problem 3

Internal problem ID [12794]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.5 page 327
Problem number: 3.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= -2x(t) - y \\
y' &= x(t) - 4y
\end{aligned}
$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 22

```
dsolve([diff(x(t),t) = -2*x(t)-y(t), diff(y(t),t) = x(t)-4*y(t), x(0) = 1, y(0) = 0],[x(t),
```

$$
\begin{aligned}
x(t) &= e^{-3t}(t+1) \\
y(t) &= e^{-3t}t
\end{aligned}
$$

✓ Solution by Mathematica

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

```
DSolve[{x'[t]==-2*x[t]-1*y[t],y'[t]==1*x[t]-4*y[t]},{x[0]==1,y[0]==0},{x[t],y[t]},t,IncludeS
```

$$
\begin{aligned}
x(t) &\to e^{-3t}(t+1) \\
y(t) &\to e^{-3t}t
\end{aligned}
$$

12.4 problem 4

Internal problem ID [12795]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.5 page 327
Problem number: 4.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= y \\
y' &= -x(t) - 2y
\end{aligned}
$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 26

```
dsolve([diff(x(t),t) = y(t), diff(y(t),t) = -x(t)-2*y(t), x(0) = 1, y(0) = 0],[x(t), y(t)],
```

$$
\begin{aligned}
x(t) &= -\mathrm{e}^{-t}(-t-1) \\
y(t) &= -\mathrm{e}^{-t}t
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.004 (sec). Leaf size: 25

```
DSolve[{x'[t]==1*y[t],y'[t]==-1*x[t]-2*y[t]},{x[0]==1,y[0]==0},{x[t],y[t]},t,IncludeSingular
```

$$
\begin{aligned}
x(t) &\to e^{-t}(t+1) \\
y(t) &\to -e^{-t}t
\end{aligned}
$$

12.5 problem 5

Internal problem ID [12796]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.5 page 327
Problem number: 5.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= -3x(t) \\
y' &= x(t) - 3y
\end{aligned}
$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 18

```
dsolve([diff(x(t),t) = -3*x(t), diff(y(t),t) = x(t)-3*y(t), x(0) = 1, y(0) = 0],[x(t), y(t)]
```

$$
\begin{aligned}
x(t) &= \mathrm{e}^{-3t} \\
y(t) &= \mathrm{e}^{-3t} t
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.01 (sec). Leaf size: 20

```
DSolve[{x'[t]==-3*x[t]+0*y[t],y'[t]==1*x[t]-3*y[t]},{x[0]==1,y[0]==0},{x[t],y[t]},t,IncludeS
```

$$
\begin{aligned}
x(t) &\to e^{-3t} \\
y(t) &\to e^{-3t} t
\end{aligned}
$$

12.6 problem 6

Internal problem ID [12797]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.5 page 327
Problem number: 6.
ODE order: 1.
ODE degree: 1.

Solve

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 25

```
dsolve([diff(x(t),t) = 2*x(t)+y(t), diff(y(t),t) = -x(t)+4*y(t), x(0) = 1, y(0) = 0],[x(t),
```

$$x(t) = e^{3t}(-t + 1)$$
$$y(t) = -e^{3t}t$$

✓ Solution by Mathematica

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

```
DSolve[{x'[t]==2*x[t]+1*y[t],y'[t]==-1*x[t]+4*y[t]},{x[0]==1,y[0]==0},{x[t],y[t]},t,IncludeS
```

$$x(t) \to -e^{3t}(t - 1)$$
$$y(t) \to -e^{3t}t$$

12.7 problem 7

Internal problem ID [12798]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.5 page 327
Problem number: 7.
ODE order: 1.
ODE degree: 1.

Solve

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

With initial conditions

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

✓ Solution by Maple

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

```
dsolve([diff(x(t),t) = -2*x(t)-y(t), diff(y(t),t) = x(t)-4*y(t), x(0) = 1, y(0) = 0],[x(t),
```

$$x(t) = e^{-3t}(t+1)$$
$$y(t) = e^{-3t}t$$

✓ Solution by Mathematica

Time used: 0.005 (sec). Leaf size: 24

```
DSolve[{x'[t]==-2*x[t]-1*y[t],y'[t]==1*x[t]-4*y[t]},{x[0]==1,y[0]==0},{x[t],y[t]},t,IncludeS
```

$$x(t) \to e^{-3t}(t+1)$$
$$y(t) \to e^{-3t}t$$

12.8 problem 8

Internal problem ID [12799]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.5 page 327
Problem number: 8.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= y \\
y' &= -x(t) - 2y
\end{aligned}
$$

With initial conditions

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

✓ Solution by Maple

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

```
dsolve([diff(x(t),t) = y(t), diff(y(t),t) = -x(t)-2*y(t), x(0) = 1, y(0) = 0],[x(t), y(t)],
```

$$
\begin{aligned}
x(t) &= -\mathrm{e}^{-t}(-t-1) \\
y(t) &= -\mathrm{e}^{-t}t
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.004 (sec). Leaf size: 25

```
DSolve[{x'[t]==1*y[t],y'[t]==-1*x[t]-2*y[t]},{x[0]==1,y[0]==0},{x[t],y[t]},t,IncludeSingular
```

$$
\begin{aligned}
x(t) &\to e^{-t}(t+1) \\
y(t) &\to -e^{-t}t
\end{aligned}
$$

12.9 problem 17

Internal problem ID [12800]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.5 page 327
Problem number: 17.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= 2y \\
y' &= -y
\end{aligned}
$$

With initial conditions

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

✓ Solution by Maple

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

```
dsolve([diff(x(t),t) = 2*y(t), diff(y(t),t) = -y(t), x(0) = 1, y(0) = 0],[x(t), y(t)], sings
```

$$
\begin{aligned}
x(t) &= 1 \\
y(t) &= 0
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.004 (sec). Leaf size: 10

```
DSolve[{x'[t]==2*y[t],y'[t]==0*x[t]-1*y[t]},{x[0]==1,y[0]==0},{x[t],y[t]},t,IncludeSingularS
```

$$
\begin{aligned}
x(t) &\to 1 \\
y(t) &\to 0
\end{aligned}
$$

12.10 problem 18

Internal problem ID [12801]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.5 page 327
Problem number: 18.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= 2x(t) + 4y \\
y' &= 3x(t) + 6y
\end{aligned}
$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 24

```
dsolve([diff(x(t),t) = 2*x(t)+4*y(t), diff(y(t),t) = 3*x(t)+6*y(t), x(0) = 1, y(0) = 0],[x(t
```

$$
\begin{aligned}
x(t) &= \frac{e^{8t}}{4} + \frac{3}{4} \\
y(t) &= -\frac{3}{8} + \frac{3\,e^{8t}}{8}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.01 (sec). Leaf size: 30

```
DSolve[{x'[t]==2*x[t]+4*y[t],y'[t]==3*x[t]+6*y[t]},{x[0]==1,y[0]==0},{x[t],y[t]},t,IncludeSi
```

$$
\begin{aligned}
x(t) &\to \frac{1}{4}\left(e^{8t} + 3\right) \\
y(t) &\to \frac{3}{8}\left(e^{8t} - 1\right)
\end{aligned}
$$

12.11 problem 19

Internal problem ID [12802]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.5 page 327
Problem number: 19.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= 4x(t) + 2y \\
y' &= 2x(t) + y
\end{aligned}
$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 24

```
dsolve([diff(x(t),t) = 4*x(t)+2*y(t), diff(y(t),t) = 2*x(t)+y(t), x(0) = 1, y(0) = 0],[x(t),
```

$$
\begin{aligned}
x(t) &= \frac{4\,e^{5t}}{5} + \frac{1}{5} \\
y(t) &= -\frac{2}{5} + \frac{2\,e^{5t}}{5}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.005 (sec). Leaf size: 32

```
DSolve[{x'[t]==4*x[t]+2*y[t],y'[t]==2*x[t]+1*y[t]},{x[0]==1,y[0]==0},{x[t],y[t]},t,IncludeSi
```

$$
\begin{aligned}
x(t) &\to \frac{1}{5}\left(4e^{5t} + 1\right) \\
y(t) &\to \frac{2}{5}\left(e^{5t} - 1\right)
\end{aligned}
$$

12.12 problem 21(a)

Internal problem ID [12803]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.5 page 327
Problem number: 21(a).
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = 2y$$
$$y' = 0$$

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 15

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

$$x(t) = 2c_2t + c_1$$
$$y(t) = c_2$$

✓ Solution by Mathematica

Time used: 0.008 (sec). Leaf size: 18

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

$$x(t) \to 2c_2t + c_1$$
$$y(t) \to c_2$$

12.13 problem 21(b)

Internal problem ID [12804]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.5 page 327
Problem number: 21(b).
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = -2y$$
$$y' = 0$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 15

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

$$x(t) = -2c_2t + c_1$$
$$y(t) = c_2$$

✓ Solution by Mathematica

Time used: 0.003 (sec). Leaf size: 18

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

$$x(t) \to c_1 - 2c_2t$$
$$y(t) \to c_2$$

12.14 problem 24

Internal problem ID [12805]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.5 page 327
Problem number: 24.
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = -3x(t) - y$$
$$y' = 4x(t) + y$$

With initial conditions

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

✓ Solution by Maple

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

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

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

✓ Solution by Mathematica

Time used: 0.005 (sec). Leaf size: 22

```
DSolve[{x'[t]==-3*x[t]-y[t],y'[t]==4*x[t]+y[t]},{x[0]==-1,y[0]==2},{x[t],y[t]},t,IncludeSing
```

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

13 Chapter 3. Linear Systems. Exercises section 3.6 page 342

13.1 problem 1

Internal problem ID [12806]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.6 page 342
Problem number: 1.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' - 6y' - 7y = 0}$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 17

```
dsolve(diff(y(t),t$2)-6*diff(y(t),t)-7*y(t)=0,y(t), singsol=all)
```

$$y(t) = c_1 e^{7t} + c_2 e^{-t}$$

✓ Solution by Mathematica

Time used: 0.019 (sec). Leaf size: 22

```
DSolve[y''[t]-6*y'[t]-7*y[t]==0,y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to e^{-t}\left(c_2 e^{8t} + c_1\right)$$

13.2 problem 2

Internal problem ID [12807]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.6 page 342
Problem number: 2.
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)
```

$$y(t) = c_1 e^{-3t} + c_2 e^{4t}$$

✓ Solution by Mathematica

Time used: 0.02 (sec). Leaf size: 22

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

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

14 Chapter 3. Linear Systems. Exercises section 3.8 page 371

14.1 problem 1

Internal problem ID [12808]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.8 page 371
Problem number: 1.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= \frac{y}{10} \\
y' &= \frac{z(t)}{5} \\
z'(t) &= \frac{2x(t)}{5}
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.125 (sec). Leaf size: 183

```
dsolve([diff(x(t),t)=0*x(t)+1/10*y(t)+0*z(t),diff(y(t),t)=0*x(t)+0*y(t)+2/10*z(t),diff(z(t),
```

$$
\begin{aligned}
x(t) &= \frac{c_1 e^{\frac{t}{5}}}{2} - \frac{c_2 e^{-\frac{t}{10}} \sin\left(\frac{\sqrt{3}\,t}{10}\right)}{4} + \frac{c_2 e^{-\frac{t}{10}} \sqrt{3}\cos\left(\frac{\sqrt{3}\,t}{10}\right)}{4} \\
&\quad - \frac{c_3 e^{-\frac{t}{10}} \cos\left(\frac{\sqrt{3}\,t}{10}\right)}{4} - \frac{c_3 e^{-\frac{t}{10}} \sqrt{3}\sin\left(\frac{\sqrt{3}\,t}{10}\right)}{4} \\
y(t) &= c_1 e^{\frac{t}{5}} - \frac{c_2 e^{-\frac{t}{10}} \sin\left(\frac{\sqrt{3}\,t}{10}\right)}{2} - \frac{c_2 e^{-\frac{t}{10}} \sqrt{3}\cos\left(\frac{\sqrt{3}\,t}{10}\right)}{2} \\
&\quad - \frac{c_3 e^{-\frac{t}{10}} \cos\left(\frac{\sqrt{3}\,t}{10}\right)}{2} + \frac{c_3 e^{-\frac{t}{10}} \sqrt{3}\sin\left(\frac{\sqrt{3}\,t}{10}\right)}{2} \\
z(t) &= c_1 e^{\frac{t}{5}} + c_2 e^{-\frac{t}{10}} \sin\left(\frac{\sqrt{3}\,t}{10}\right) + c_3 e^{-\frac{t}{10}} \cos\left(\frac{\sqrt{3}\,t}{10}\right)
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.059 (sec). Leaf size: 269

```
DSolve[{x'[t]==0*x[t]+1/10*y[t]+0*z[t],y'[t]==0*x[t]+0*y[t]+2/10*z[t],z'[t]==4/10*x[t]+0*y[t
```

$$x(t) \to \frac{1}{6}e^{-t/10}\left((2c_1+c_2+c_3)e^{t/10}\sqrt[5]{e^t} + (4c_1-c_2-c_3)\cos\left(\frac{\sqrt{3}t}{10}\right)+\sqrt{3}(c_2-c_3)\sin\left(\frac{\sqrt{3}t}{10}\right)\right)$$

$$y(t) \to \frac{1}{3}e^{-t/10}\left((2c_1+c_2+c_3)e^{t/10}\sqrt[5]{e^t} - (2c_1-2c_2+c_3)\cos\left(\frac{\sqrt{3}t}{10}\right)-\sqrt{3}(2c_1-c_3)\sin\left(\frac{\sqrt{3}t}{10}\right)\right)$$

$$z(t) \to \frac{1}{3}e^{-t/10}\left((2c_1+c_2+c_3)e^{t/10}\sqrt[5]{e^t} - (2c_1+c_2-2c_3)\cos\left(\frac{\sqrt{3}t}{10}\right)+\sqrt{3}(2c_1-c_2)\sin\left(\frac{\sqrt{3}t}{10}\right)\right)$$

14.2 problem 4

Internal problem ID [12809]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.8 page 371
Problem number: 4.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= y \\
y' &= -x(t) \\
z'(t) &= 2z(t)
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 36

```
dsolve([diff(x(t),t)=0*x(t)+1*y(t)+0*z(t),diff(y(t),t)=-1*x(t)+0*y(t)+0*z(t),diff(z(t),t)=0*
```

$$
\begin{aligned}
x(t) &= -\cos(t)\, c_1 + \sin(t)\, c_2 \\
y(t) &= \sin(t)\, c_1 + \cos(t)\, c_2 \\
z(t) &= c_3 e^{2t}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.035 (sec). Leaf size: 76

```
DSolve[{x'[t]==0*x[t]+1*y[t]+0*z[t],y'[t]==-1*x[t]+0*y[t]+0*z[t],z'[t]==0*x[t]+0*y[t]+2*z[t]
```

$$x(t) \to c_1 \cos(t) + c_2 \sin(t)$$
$$y(t) \to c_2 \cos(t) - c_1 \sin(t)$$
$$z(t) \to c_3 e^{2t}$$
$$x(t) \to c_1 \cos(t) + c_2 \sin(t)$$
$$y(t) \to c_2 \cos(t) - c_1 \sin(t)$$
$$z(t) \to 0$$

14.3 problem 5

Internal problem ID [12810]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.8 page 371
Problem number: 5.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= -2x(t) + 3y \\
y' &= 3x(t) - 2y \\
z'(t) &= -z(t)
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 40

```
dsolve([diff(x(t),t)=-2*x(t)+3*y(t)+0*z(t),diff(y(t),t)=3*x(t)-2*y(t)+0*z(t),diff(z(t),t)=0*
```

$$
\begin{aligned}
x(t) &= c_1 e^t - c_2 e^{-5t} \\
y(t) &= c_1 e^t + c_2 e^{-5t} \\
z(t) &= c_3 e^{-t}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.032 (sec). Leaf size: 150

```
DSolve[{x'[t]==-2*x[t]+3*y[t]+0*z[t],y'[t]==3*x[t]-2*y[t]+0*z[t],z'[t]==0*x[t]+0*y[t]-1*z[t]
```

$$x(t) \to \frac{1}{2}e^{-5t}\left(c_1\left(e^{6t}+1\right)+c_2\left(e^{6t}-1\right)\right)$$

$$y(t) \to \frac{1}{2}e^{-5t}\left(c_1\left(e^{6t}-1\right)+c_2\left(e^{6t}+1\right)\right)$$

$$z(t) \to c_3e^{-t}$$

$$x(t) \to \frac{1}{2}e^{-5t}\left(c_1\left(e^{6t}+1\right)+c_2\left(e^{6t}-1\right)\right)$$

$$y(t) \to \frac{1}{2}e^{-5t}\left(c_1\left(e^{6t}-1\right)+c_2\left(e^{6t}+1\right)\right)$$

$$z(t) \to 0$$

14.4 problem 6

Internal problem ID [12811]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.8 page 371
Problem number: 6.
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = x(t) + 3z(t)$$
$$y' = -y$$
$$z'(t) = -3x(t) + z(t)$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 51

```
dsolve([diff(x(t),t)=1*x(t)+0*y(t)+3*z(t),diff(y(t),t)=0*x(t)-1*y(t)+0*z(t),diff(z(t),t)=-3*
```

$$x(t) = -e^{t}(c_2 \cos(3t) - \sin(3t) c_3)$$
$$y(t) = c_1 e^{-t}$$
$$z(t) = e^{t}(c_3 \cos(3t) + \sin(3t) c_2)$$

✓ Solution by Mathematica

Time used: 0.032 (sec). Leaf size: 108

```
DSolve[{x'[t]==1*x[t]+0*y[t]+3*z[t],y'[t]==0*x[t]-1*y[t]+0*z[t],z'[t]==-3*x[t]+0*y[t]+1*z[t]
```

$$x(t) \to e^t(c_1 \cos(3t) + c_2 \sin(3t))$$
$$z(t) \to e^t(c_2 \cos(3t) - c_1 \sin(3t))$$
$$y(t) \to c_3 e^{-t}$$
$$x(t) \to e^t(c_1 \cos(3t) + c_2 \sin(3t))$$
$$z(t) \to e^t(c_2 \cos(3t) - c_1 \sin(3t))$$
$$y(t) \to 0$$

14.5 problem 7

Internal problem ID [12812]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.8 page 371
Problem number: 7.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= x(t) \\
y' &= 2y - z(t) \\
z'(t) &= -y + 2z(t)
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 38

```
dsolve([diff(x(t),t)=1*x(t)+0*y(t)+0*z(t),diff(y(t),t)=0*x(t)+2*y(t)-1*z(t),diff(z(t),t)=0*x
```

$$
\begin{aligned}
x(t) &= c_1 e^{t} \\
y(t) &= -c_2 e^{3t} + c_3 e^{t} \\
z(t) &= c_2 e^{3t} + c_3 e^{t}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.034 (sec). Leaf size: 144

```
DSolve[{x'[t]==1*x[t]+0*y[t]+0*z[t],y'[t]==0*x[t]+2*y[t]-1*z[t],z'[t]==0*x[t]-1*y[t]+2*z[t]}
```

$$x(t) \to c_1 e^t$$

$$y(t) \to \frac{1}{2} e^t \left(c_2 e^{2t} - c_3 e^{2t} + c_2 + c_3\right)$$

$$z(t) \to \frac{1}{2} e^t \left(c_2 \left(-e^{2t}\right) + c_3 e^{2t} + c_2 + c_3\right)$$

$$x(t) \to 0$$

$$y(t) \to \frac{1}{2} e^t \left(c_2 e^{2t} - c_3 e^{2t} + c_2 + c_3\right)$$

$$z(t) \to \frac{1}{2} e^t \left(c_2 \left(-e^{2t}\right) + c_3 e^{2t} + c_2 + c_3\right)$$

14.6 problem 10

Internal problem ID [12813]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.8 page 371
Problem number: 10.
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = -2x(t) + y$$
$$y' = -2y$$
$$z'(t) = -z(t)$$

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 33

```
dsolve([diff(x(t),t)=-2*x(t)+1*y(t)+0*z(t),diff(y(t),t)=0*x(t)-2*y(t)+0*z(t),diff(z(t),t)=0*
```

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

✓ Solution by Mathematica

Time used: 0.038 (sec). Leaf size: 72

```
DSolve[{x'[t]==-2*x[t]+1*y[t]+0*z[t],y'[t]==0*x[t]-2*y[t]+0*z[t],z'[t]==0*x[t]+0*y[t]-1*z[t]
```

$$x(t) \to e^{-2t}(c_2t + c_1)$$
$$y(t) \to c_2e^{-2t}$$
$$z(t) \to c_3e^{-t}$$
$$x(t) \to e^{-2t}(c_2t + c_1)$$
$$y(t) \to c_2e^{-2t}$$
$$z(t) \to 0$$

14.7 problem 11

Internal problem ID [12814]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.8 page 371
Problem number: 11.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= -2x(t) + y \\
y' &= -2y \\
z'(t) &= z(t)
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 31

```
dsolve([diff(x(t),t)=-2*x(t)+1*y(t)+0*z(t),diff(y(t),t)=0*x(t)-2*y(t)+0*z(t),diff(z(t),t)=0*
```

$$
\begin{aligned}
x(t) &= (c_2 t + c_1)\,e^{-2t} \\
y(t) &= c_2 e^{-2t} \\
z(t) &= c_3 e^{t}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.033 (sec). Leaf size: 70

```
DSolve[{x'[t]==-2*x[t]+1*y[t]+0*z[t],y'[t]==0*x[t]-2*y[t]+0*z[t],z'[t]==0*x[t]+0*y[t]+1*z[t]
```

$$x(t) \to e^{-2t}(c_2 t + c_1)$$
$$y(t) \to c_2 e^{-2t}$$
$$z(t) \to c_3 e^t$$
$$x(t) \to e^{-2t}(c_2 t + c_1)$$
$$y(t) \to c_2 e^{-2t}$$
$$z(t) \to 0$$

14.8 problem 12

Internal problem ID [12815]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.8 page 371
Problem number: 12.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= -x(t) + 2y \\
y' &= 2x(t) - 4y \\
z'(t) &= -z(t)
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 36

```
dsolve([diff(x(t),t)=-1*x(t)+2*y(t)+0*z(t),diff(y(t),t)=2*x(t)-4*y(t)+0*z(t),diff(z(t),t)=0*
```

$$
\begin{aligned}
x(t) &= -\frac{c_2 \mathrm{e}^{-5t}}{2} + 2c_1 \\
y(t) &= c_1 + c_2 \mathrm{e}^{-5t} \\
z(t) &= c_3 \mathrm{e}^{-t}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.037 (sec). Leaf size: 158

```
DSolve[{x'[t]==-1*x[t]+2*y[t]+0*z[t],y'[t]==2*x[t]-4*y[t]+0*z[t],z'[t]==0*x[t]+0*y[t]-1*z[t]
```

$$x(t) \to \frac{1}{5}e^{-5t}\left(c_1\left(4e^{5t}+1\right)+2c_2\left(e^{5t}-1\right)\right)$$
$$y(t) \to \frac{1}{5}e^{-5t}\left(2c_1\left(e^{5t}-1\right)+c_2\left(e^{5t}+4\right)\right)$$
$$z(t) \to c_3e^{-t}$$
$$x(t) \to \frac{1}{5}e^{-5t}\left(c_1\left(4e^{5t}+1\right)+2c_2\left(e^{5t}-1\right)\right)$$
$$y(t) \to \frac{1}{5}e^{-5t}\left(2c_1\left(e^{5t}-1\right)+c_2\left(e^{5t}+4\right)\right)$$
$$z(t) \to 0$$

14.9 problem 13

Internal problem ID [12816]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.8 page 371
Problem number: 13.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= -x(t) + 2y \\
y' &= 2x(t) - 4y \\
z'(t) &= 0
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 31

```
dsolve([diff(x(t),t)=-1*x(t)+2*y(t)+0*z(t),diff(y(t),t)=2*x(t)-4*y(t)+0*z(t),diff(z(t),t)=0*
```

$$
\begin{aligned}
x(t) &= -\frac{c_2 e^{-5t}}{2} + 2c_1 \\
y(t) &= c_1 + c_2 e^{-5t} \\
z(t) &= c_3
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.005 (sec). Leaf size: 77

```
DSolve[{x'[t]==-1*x[t]+2*y[t]+0*z[t],y'[t]==2*x[t]-4*y[t]+0*z[t],z'[t]==0*x[t]+0*y[t]+0*z[t]
```

$$
\begin{aligned}
x(t) &\to \frac{1}{5} e^{-5t} \left(c_1 \left(4e^{5t} + 1\right) + 2c_2 \left(e^{5t} - 1\right)\right) \\
y(t) &\to \frac{1}{5} e^{-5t} \left(2c_1 \left(e^{5t} - 1\right) + c_2 \left(e^{5t} + 4\right)\right) \\
z(t) &\to c_3
\end{aligned}
$$

14.10 problem 14

Internal problem ID [12817]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.8 page 371
Problem number: 14.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= -2x(t) + y \\
y' &= -2y + z(t) \\
z'(t) &= -2z(t)
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.032 (sec). Leaf size: 46

```
dsolve([diff(x(t),t)=-2*x(t)+1*y(t)+0*z(t),diff(y(t),t)=0*x(t)-2*y(t)+1*z(t),diff(z(t),t)=0*
```

$$
\begin{aligned}
x(t) &= \frac{(c_3 t^2 + 2c_2 t + 2c_1)\, \mathrm{e}^{-2t}}{2} \\
y(t) &= (c_3 t + c_2)\, \mathrm{e}^{-2t} \\
z(t) &= c_3 \mathrm{e}^{-2t}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.005 (sec). Leaf size: 57

```
DSolve[{x'[t]==-2*x[t]+1*y[t]+0*z[t],y'[t]==0*x[t]-2*y[t]+1*z[t],z'[t]==0*x[t]+0*y[t]-2*z[t]
```

$$
\begin{aligned}
x(t) &\to \frac{1}{2} e^{-2t} (t(c_3 t + 2c_2) + 2c_1) \\
y(t) &\to e^{-2t} (c_3 t + c_2) \\
z(t) &\to c_3 e^{-2t}
\end{aligned}
$$

14.11 problem 15

Internal problem ID [12818]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.8 page 371
Problem number: 15.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= y \\
y' &= z(t) \\
z'(t) &= 0
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 28

```
dsolve([diff(x(t),t)=0*x(t)+1*y(t)+0*z(t),diff(y(t),t)=0*x(t)+0*y(t)+1*z(t),diff(z(t),t)=0*x
```

$$
\begin{aligned}
x(t) &= \frac{1}{2}c_3t^2 + c_2t + c_1 \\
y(t) &= c_3t + c_2 \\
z(t) &= c_3
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.003 (sec). Leaf size: 36

```
DSolve[{x'[t]==0*x[t]+1*y[t]+0*z[t],y'[t]==0*x[t]+0*y[t]+1*z[t],z'[t]==0*x[t]+0*y[t]+0*z[t]}
```

$$
\begin{aligned}
x(t) &\to \frac{c_3t^2}{2} + c_2t + c_1 \\
y(t) &\to c_3t + c_2 \\
z(t) &\to c_3
\end{aligned}
$$

14.12 problem 16

Internal problem ID [12819]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.8 page 371
Problem number: 16.
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = 2x(t) - y$$
$$y' = -2y + 3z(t)$$
$$z'(t) = -x(t) + 3y - z(t)$$

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 171

```
dsolve([diff(x(t),t)=2*x(t)-1*y(t)+0*z(t),diff(y(t),t)=0*x(t)-2*y(t)+3*z(t),diff(z(t),t)=-1*
```

$$x(t) = -\frac{9c_2\mathrm{e}^{\left(-1+2\sqrt{3}\right)t}}{11} - \frac{9c_3\mathrm{e}^{-\left(1+2\sqrt{3}\right)t}}{11} - \frac{4c_2\mathrm{e}^{\left(-1+2\sqrt{3}\right)t}\sqrt{3}}{11} + \frac{4c_3\mathrm{e}^{-\left(1+2\sqrt{3}\right)t}\sqrt{3}}{11} + c_1\mathrm{e}^t$$
$$y(t) = \frac{6c_2\mathrm{e}^{\left(-1+2\sqrt{3}\right)t}\sqrt{3}}{11} - \frac{6c_3\mathrm{e}^{-\left(1+2\sqrt{3}\right)t}\sqrt{3}}{11} - \frac{3c_2\mathrm{e}^{\left(-1+2\sqrt{3}\right)t}}{11} - \frac{3c_3\mathrm{e}^{-\left(1+2\sqrt{3}\right)t}}{11} + c_1\mathrm{e}^t$$
$$z(t) = c_1\mathrm{e}^t + c_2\mathrm{e}^{\left(-1+2\sqrt{3}\right)t} + c_3\mathrm{e}^{-\left(1+2\sqrt{3}\right)t}$$

✓ Solution by Mathematica

Time used: 0.054 (sec). Leaf size: 474

```
DSolve[{x'[t]==2*x[t]-1*y[t]+0*z[t],y'[t]==0*x[t]-2*y[t]+3*z[t],z'[t]==-1*x[t]+3*y[t]-1*z[t]
```

$$
\begin{aligned}
x(t) \to \frac{1}{16}e^{-\left(\left(1+2\sqrt{3}\right)t\right)}\Bigg(c_1\left(\left(5+3\sqrt{3}\right)e^{4\sqrt{3}t}+6e^{2\left(1+\sqrt{3}\right)t}+5-3\sqrt{3}\right)\\
-2c_2\left(\left(1+\sqrt{3}\right)e^{4\sqrt{3}t}-2e^{2\left(1+\sqrt{3}\right)t}+1-\sqrt{3}\right)\\
-c_3\left(\left(3+\sqrt{3}\right)e^{4\sqrt{3}t}-6e^{2\left(1+\sqrt{3}\right)t}+3-\sqrt{3}\right)\Bigg)
\end{aligned}
$$

$$
\begin{aligned}
y(t) \to \frac{1}{16}e^{-\left(\left(1+2\sqrt{3}\right)t\right)}\Bigg(c_1\left(-\left(3+\sqrt{3}\right)e^{4\sqrt{3}t}+6e^{2\left(1+\sqrt{3}\right)t}-3+\sqrt{3}\right)\\
+2c_2\left(-\left(\sqrt{3}-3\right)e^{4\sqrt{3}t}+2e^{2\left(1+\sqrt{3}\right)t}+3+\sqrt{3}\right)\\
+3c_3\left(\left(\sqrt{3}-1\right)e^{4\sqrt{3}t}+2e^{2\left(1+\sqrt{3}\right)t}-1-\sqrt{3}\right)\Bigg)
\end{aligned}
$$

$$
\begin{aligned}
z(t) \to -\frac{1}{48}e^{-\left(\left(1+2\sqrt{3}\right)t\right)}\Bigg(c_1\left(\left(9+7\sqrt{3}\right)e^{4\sqrt{3}t}-18e^{2\left(1+\sqrt{3}\right)t}+9-7\sqrt{3}\right)\\
-2c_2\left(\left(5\sqrt{3}-3\right)e^{4\sqrt{3}t}+6e^{2\left(1+\sqrt{3}\right)t}-3-5\sqrt{3}\right)\\
+3c_3\left(\left(\sqrt{3}-5\right)e^{4\sqrt{3}t}-6e^{2\left(1+\sqrt{3}\right)t}-5-\sqrt{3}\right)\Bigg)
\end{aligned}
$$

14.13 problem 17

Internal problem ID [12820]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.8 page 371
Problem number: 17.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= -4x(t) + 3y \\
y' &= -y + z(t) \\
z'(t) &= 5x(t) - 5y
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.078 (sec). Leaf size: 111

```
dsolve([diff(x(t),t)=-4*x(t)+3*y(t)+0*z(t),diff(y(t),t)=0*x(t)-1*y(t)+1*z(t),diff(z(t),t)=5*
```

$$
\begin{aligned}
x(t) &= -\frac{9c_2 e^{-2t}\sin(t)}{10} - \frac{3c_2 e^{-2t}\cos(t)}{10} - \frac{9c_3 e^{-2t}\cos(t)}{10} + \frac{3c_3 e^{-2t}\sin(t)}{10} + c_1 e^{-t} \\
y(t) &= -\frac{c_2 e^{-2t}\cos(t)}{2} - \frac{c_2 e^{-2t}\sin(t)}{2} - \frac{c_3 e^{-2t}\cos(t)}{2} + \frac{c_3 e^{-2t}\sin(t)}{2} + c_1 e^{-t} \\
z(t) &= e^{-2t}(\sin(t)\, c_2 + \cos(t)\, c_3)
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.027 (sec). Leaf size: 152

```
DSolve[{x'[t]==-4*x[t]+3*y[t]+0*z[t],y'[t]==0*x[t]-1*y[t]+1*z[t],z'[t]==5*x[t]-5*y[t]+0*z[t]
```

$$
\begin{aligned}
x(t) &\to \frac{1}{2}e^{-2t}\left((5c_1 - 3c_2 + 3c_3)e^t - 3(c_1 - c_2 + c_3)\cos(t) - 3(3c_1 - 3c_2 + c_3)\sin(t)\right) \\
y(t) &\to \frac{1}{2}e^{-2t}\left((5c_1 - 3c_2 + 3c_3)e^t + (-5c_1 + 5c_2 - 3c_3)\cos(t) - (5c_1 - 5c_2 + c_3)\sin(t)\right) \\
z(t) &\to e^{-2t}(c_3\cos(t) + (5c_1 - 5c_2 + 2c_3)\sin(t))
\end{aligned}
$$

14.14 problem 18

Internal problem ID [12821]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.8 page 371
Problem number: 18.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= -10x(t) + 10y \\
y' &= 28x(t) - y \\
z'(t) &= -\frac{8z(t)}{3}
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.032 (sec). Leaf size: 95

```
dsolve([diff(x(t),t)=-10*x(t)+10*y(t)+0*z(t),diff(y(t),t)=28*x(t)-1*y(t)+0*z(t),diff(z(t),t)
```

$$
\begin{aligned}
x(t) &= \frac{c_1 e^{\frac{\left(-11+\sqrt{1201}\right)t}{2}} \sqrt{1201}}{56} - \frac{c_2 e^{-\frac{\left(11+\sqrt{1201}\right)t}{2}} \sqrt{1201}}{56} - \frac{9c_1 e^{\frac{\left(-11+\sqrt{1201}\right)t}{2}}}{56} - \frac{9c_2 e^{-\frac{\left(11+\sqrt{1201}\right)t}{2}}}{56} \\
y(t) &= c_1 e^{\frac{\left(-11+\sqrt{1201}\right)t}{2}} + c_2 e^{-\frac{\left(11+\sqrt{1201}\right)t}{2}} \\
z(t) &= c_3 e^{-\frac{8t}{3}}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.047 (sec). Leaf size: 312

```
DSolve[{x'[t]==-10*x[t]+10*y[t]+0*z[t],y'[t]==28*x[t]-1*y[t]+0*z[t],z'[t]==0*x[t]+0*y[t]-8/3
```

$$x(t) \to \frac{e^{-\frac{1}{2}\left(11+\sqrt{1201}\right)t}\left(c_1\left(\left(1201-9\sqrt{1201}\right)e^{\sqrt{1201}t}+1201+9\sqrt{1201}\right)+20\sqrt{1201}c_2\left(e^{\sqrt{1201}t}-1\right)\right)}{2402}$$

$$y(t) \to \frac{e^{-\frac{1}{2}\left(11+\sqrt{1201}\right)t}\left(56\sqrt{1201}c_1\left(e^{\sqrt{1201}t}-1\right)+c_2\left(\left(1201+9\sqrt{1201}\right)e^{\sqrt{1201}t}+1201-9\sqrt{1201}\right)\right)}{2402}$$

$$z(t) \to c_3e^{-8t/3}$$

$$x(t) \to \frac{e^{-\frac{1}{2}\left(11+\sqrt{1201}\right)t}\left(c_1\left(\left(1201-9\sqrt{1201}\right)e^{\sqrt{1201}t}+1201+9\sqrt{1201}\right)+20\sqrt{1201}c_2\left(e^{\sqrt{1201}t}-1\right)\right)}{2402}$$

$$y(t) \to \frac{e^{-\frac{1}{2}\left(11+\sqrt{1201}\right)t}\left(56\sqrt{1201}c_1\left(e^{\sqrt{1201}t}-1\right)+c_2\left(\left(1201+9\sqrt{1201}\right)e^{\sqrt{1201}t}+1201-9\sqrt{1201}\right)\right)}{2402}$$

$$z(t) \to 0$$

14.15 problem 20

Internal problem ID [12822]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Exercises section 3.8 page 371
Problem number: 20.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= -y + z(t)\\
y' &= -x(t) + z(t)\\
z'(t) &= z(t)
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 42

```
dsolve([diff(x(t),t)=-y(t)+z(t),diff(y(t),t)=-x(t)+z(t),diff(z(t),t)=z(t)],[x(t), y(t), z(t)
```

$$
\begin{aligned}
x(t) &= -c_1 e^{t} + c_2 e^{-t} + c_3 e^{t}\\
y(t) &= c_1 e^{t} + c_2 e^{-t}\\
z(t) &= c_3 e^{t}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.013 (sec). Leaf size: 94

```
DSolve[{x'[t]==-y[t]+z[t],y'[t]==-x[t]+z[t],z'[t]==z[t]},{x[t],y[t],z[t]},t,IncludeSingularS
```

$$
\begin{aligned}
x(t) &\to \frac{1}{2}e^{-t}\left(c_1\left(e^{2t}+1\right) - (c_2 - c_3)\left(e^{2t}-1\right)\right)\\
y(t) &\to \frac{1}{2}e^{-t}\left(-\left(c_1\left(e^{2t}-1\right)\right) + c_2\left(e^{2t}+1\right) + c_3\left(e^{2t}-1\right)\right)\\
z(t) &\to c_3 e^{t}
\end{aligned}
$$

15 Chapter 3. Linear Systems. Review Exercises for chapter 3. page 376

15.1 problem 3

Internal problem ID [12825]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Review Exercises for chapter 3. page 376
Problem number: 3.
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = 3x(t)$$
$$y' = -2y$$

✓ Solution by Maple

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

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

$$x(t) = c_1 e^{3t}$$
$$y(t) = c_2 e^{-2t}$$

✓ Solution by Mathematica

Time used: 0.064 (sec). Leaf size: 65

```
DSolve[{x'[t]==3*x[t]+0*y[t],y'[t]==0*x[t]-2*y[t]},{x[t],y[t]},t,IncludeSingularSolutions ->
```

$$x(t) \to c_1 e^{3t}$$
$$y(t) \to c_2 e^{-2t}$$
$$x(t) \to c_1 e^{3t}$$
$$y(t) \to 0$$
$$x(t) \to 0$$
$$y(t) \to c_2 e^{-2t}$$
$$x(t) \to 0$$
$$y(t) \to 0$$

15.2 problem 6

Internal problem ID [12827]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Review Exercises for chapter 3. page 376
Problem number: 6.
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= 0 \\
y' &= x(t) - y
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 17

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

$$
\begin{aligned}
x(t) &= c_1 \\
y(t) &= c_1 + c_2 \mathrm{e}^{-t}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.004 (sec). Leaf size: 27

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

$$
\begin{aligned}
x(t) &\to c_1 \\
y(t) &\to e^{-t}\left(c_1\left(e^t - 1\right) + c_2\right)
\end{aligned}
$$

15.3 problem 7

Internal problem ID [12828]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Review Exercises for chapter 3. page 376
Problem number: 7.
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = \pi^2 x(t) + \frac{187y}{5}$$
$$y' = \sqrt{555}\, x(t) + \frac{400617y}{5000}$$

With initial conditions

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

✓ Solution by Maple

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

```
dsolve([diff(x(t),t) = Pi^2*x(t)+187/5*y(t), diff(y(t),t) = 555^(1/2)*x(t)+400617/5000*y(t),
```

$$x(t) = 0$$
$$y(t) = 0$$

✓ Solution by Mathematica

Time used: 0.038 (sec). Leaf size: 10

```
DSolve[{x'[t]==Pi^2*x[t]+374/10*y[t],y'[t]==Sqrt[555]*x[t]+801234/10000*y[t]},{x[0]==0,y[0]=
```

$$x(t) \to 0$$
$$y(t) \to 0$$

15.4 problem 19(i)

Internal problem ID [12829]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Review Exercises for chapter 3. page 376
Problem number: 19(i).
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= x(t) + y \\
y' &= -2x(t) - y
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 38

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

$$
\begin{aligned}
x(t) &= -\frac{\cos(t)\, c_1}{2} + \frac{\sin(t)\, c_2}{2} - \frac{\sin(t)\, c_1}{2} - \frac{\cos(t)\, c_2}{2} \\
y(t) &= \sin(t)\, c_1 + \cos(t)\, c_2
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.012 (sec). Leaf size: 39

```
DSolve[{x'[t]==1*x[t]+1*y[t],y'[t]==-2*x[t]-y[t]},{x[t],y[t]},t,IncludeSingularSolutions ->
```

$$
\begin{aligned}
x(t) &\to c_1 \cos(t) + (c_1 + c_2) \sin(t) \\
y(t) &\to c_2 \cos(t) - (2c_1 + c_2) \sin(t)
\end{aligned}
$$

15.5 problem 19 (ii)

Internal problem ID [12830]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Review Exercises for chapter 3. page 376
Problem number: 19 (ii).
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= -3x(t) + y \\
y' &= -x(t) + y
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 82

```
dsolve([diff(x(t),t)=-3*x(t)+1*y(t),diff(y(t),t)=-1*x(t)+1*y(t)],[x(t), y(t)], singsol=all)
```

$$
\begin{aligned}
x(t) &= -c_1 \mathrm{e}^{\left(\sqrt{3}-1\right)t}\sqrt{3} + c_2 \mathrm{e}^{-\left(1+\sqrt{3}\right)t}\sqrt{3} + 2c_1 \mathrm{e}^{\left(\sqrt{3}-1\right)t} + 2c_2 \mathrm{e}^{-\left(1+\sqrt{3}\right)t} \\
y(t) &= c_1 \mathrm{e}^{\left(\sqrt{3}-1\right)t} + c_2 \mathrm{e}^{-\left(1+\sqrt{3}\right)t}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.014 (sec). Leaf size: 147

```
DSolve[{x'[t]==-3*x[t]+1*y[t],y'[t]==-1*x[t]+1*y[t]},{x[t],y[t]},t,IncludeSingularSolutions
```

$$
\begin{aligned}
x(t) &\to \frac{1}{6} e^{-\left(\left(1+\sqrt{3}\right)t\right)} \left(c_1\left(\left(3-2\sqrt{3}\right)e^{2\sqrt{3}t} + 3 + 2\sqrt{3}\right) + \sqrt{3}c_2\left(e^{2\sqrt{3}t} - 1\right)\right) \\
y(t) &\to \frac{1}{6} e^{-\left(\left(1+\sqrt{3}\right)t\right)} \left(c_2\left(\left(3+2\sqrt{3}\right)e^{2\sqrt{3}t} + 3 - 2\sqrt{3}\right) - \sqrt{3}c_1\left(e^{2\sqrt{3}t} - 1\right)\right)
\end{aligned}
$$

15.6 problem 19 (iii)

Internal problem ID [12831]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Review Exercises for chapter 3. page 376
Problem number: 19 (iii).
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= -3x(t) + y \\
y' &= -x(t)
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 68

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

$$
\begin{aligned}
x(t) &= \left(-\frac{\sqrt{5}}{2} + \frac{3}{2}\right) c_1 \mathrm{e}^{\frac{(\sqrt{5}-3)t}{2}} + \left(\frac{3}{2} + \frac{\sqrt{5}}{2}\right) c_2 \mathrm{e}^{-\frac{(3+\sqrt{5})t}{2}} \\
y(t) &= c_1 \mathrm{e}^{\frac{(\sqrt{5}-3)t}{2}} + c_2 \mathrm{e}^{-\frac{(3+\sqrt{5})t}{2}}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.015 (sec). Leaf size: 148

```
DSolve[{x'[t]==-3*x[t]+1*y[t],y'[t]==-1*x[t]+0*y[t]},{x[t],y[t]},t,IncludeSingularSolutions
```

$$
\begin{aligned}
x(t) &\to \frac{1}{10} e^{-\frac{1}{2}(3+\sqrt{5})t} \left(c_1 \left(\left(5-3\sqrt{5}\right) e^{\sqrt{5}t} + 5 + 3\sqrt{5}\right) + 2\sqrt{5} c_2 \left(e^{\sqrt{5}t} - 1\right)\right) \\
y(t) &\to \frac{1}{10} e^{-\frac{1}{2}(3+\sqrt{5})t} \left(c_2 \left(\left(5+3\sqrt{5}\right) e^{\sqrt{5}t} + 5 - 3\sqrt{5}\right) - 2\sqrt{5} c_1 \left(e^{\sqrt{5}t} - 1\right)\right)
\end{aligned}
$$

15.7 problem 19 (iv)

Internal problem ID [12832]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Review Exercises for chapter 3. page 376
Problem number: 19 (iv).
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= -x(t) + y \\
y' &= -2x(t) + y
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 38

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

$$
\begin{aligned}
x(t) &= -\frac{\cos(t)\, c_1}{2} + \frac{\sin(t)\, c_2}{2} + \frac{\sin(t)\, c_1}{2} + \frac{\cos(t)\, c_2}{2} \\
y(t) &= \sin(t)\, c_1 + \cos(t)\, c_2
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.007 (sec). Leaf size: 39

```
DSolve[{x'[t]==-1*x[t]+1*y[t],y'[t]==-2*x[t]+1*y[t]},{x[t],y[t]},t,IncludeSingularSolutions
```

$$
\begin{aligned}
x(t) &\to c_1 \cos(t) + (c_2 - c_1)\sin(t) \\
y(t) &\to c_2(\sin(t) + \cos(t)) - 2c_1 \sin(t)
\end{aligned}
$$

15.8 problem 19 (v)

Internal problem ID [12833]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Review Exercises for chapter 3. page 376
Problem number: 19 (v).
ODE order: 1.
ODE degree: 1.

Solve

$$
\begin{aligned}
x'(t) &= 2x(t) \\
y' &= x(t) - y
\end{aligned}
$$

✓ Solution by Maple

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

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

$$
\begin{aligned}
x(t) &= 3c_1 e^{2t} \\
y(t) &= c_1 e^{2t} + c_2 e^{-t}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.009 (sec). Leaf size: 40

```
DSolve[{x'[t]==2*x[t]+0*y[t],y'[t]==1*x[t]-1*y[t]},{x[t],y[t]},t,IncludeSingularSolutions ->
```

$$
\begin{aligned}
x(t) &\to c_1 e^{2t} \\
y(t) &\to \frac{1}{3} e^{-t} \left(c_1 \left(e^{3t} - 1\right) + 3c_2\right)
\end{aligned}
$$

15.9 problem 19 (vi)

Internal problem ID [12834]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Review Exercises for chapter 3. page 376
Problem number: 19 (vi).
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = 3x(t) + y$$
$$y' = -x(t)$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 68

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

$$x(t) = \left(\frac{\sqrt{5}}{2} - \frac{3}{2}\right) c_2 e^{-\frac{\left(\sqrt{5}-3\right)t}{2}} + \left(-\frac{3}{2} - \frac{\sqrt{5}}{2}\right) c_1 e^{\frac{\left(3+\sqrt{5}\right)t}{2}}$$
$$y(t) = c_1 e^{\frac{\left(3+\sqrt{5}\right)t}{2}} + c_2 e^{-\frac{\left(\sqrt{5}-3\right)t}{2}}$$

✓ Solution by Mathematica

Time used: 0.018 (sec). Leaf size: 148

```
DSolve[{x'[t]==3*x[t]+1*y[t],y'[t]==-1*x[t]+0*y[t]},{x[t],y[t]},t,IncludeSingularSolutions -
```

$$x(t) \to \frac{1}{10} e^{-\frac{1}{2}\left(\sqrt{5}-3\right)t}\left(c_1\left(\left(5+3\sqrt{5}\right)e^{\sqrt{5}t} + 5 - 3\sqrt{5}\right) + 2\sqrt{5}c_2\left(e^{\sqrt{5}t} - 1\right)\right)$$
$$y(t) \to -\frac{1}{10} e^{-\frac{1}{2}\left(\sqrt{5}-3\right)t}\left(2\sqrt{5}c_1\left(e^{\sqrt{5}t} - 1\right) + c_2\left(\left(3\sqrt{5}-5\right)e^{\sqrt{5}t} - 5 - 3\sqrt{5}\right)\right)$$

15.10 problem 19 (vii)

Internal problem ID [12835]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Review Exercises for chapter 3. page 376
Problem number: 19 (vii).
ODE order: 1.
ODE degree: 1.

Solve

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

✓ Solution by Maple

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

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

$$x(t) = -\frac{\mathrm{e}^{-2t}(2c_2t + 2c_1 + c_2)}{4}$$
$$y(t) = (c_2t + c_1)\,\mathrm{e}^{-2t}$$

✓ Solution by Mathematica

Time used: 0.003 (sec). Leaf size: 45

```
DSolve[{x'[t]==0*x[t]+1*y[t],y'[t]==-4*x[t]-4*y[t]},{x[t],y[t]},t,IncludeSingularSolutions -
```

$$x(t) \to e^{-2t}(2c_1t + c_2t + c_1)$$
$$y(t) \to e^{-2t}(c_2 - 2(2c_1 + c_2)t)$$

15.11 problem 19 (viii)

Internal problem ID [12836]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Review Exercises for chapter 3. page 376
Problem number: 19 (viii).
ODE order: 1.
ODE degree: 1.

Solve

$$x'(t) = -3x(t) - 3y$$
$$y' = 2x(t) + y$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 78

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

$$x(t) = -\frac{e^{-t}\left(\sqrt{2}\,\sin\left(\sqrt{2}\,t\right) c_2 - \sqrt{2}\,\cos\left(\sqrt{2}\,t\right) c_1 + 2\sin\left(\sqrt{2}\,t\right) c_1 + 2\cos\left(\sqrt{2}\,t\right) c_2\right)}{2}$$
$$y(t) = e^{-t}\left(\sin\left(\sqrt{2}\,t\right) c_1 + \cos\left(\sqrt{2}\,t\right) c_2\right)$$

✓ Solution by Mathematica

Time used: 0.026 (sec). Leaf size: 91

```
DSolve[{x'[t]==-3*x[t]-3*y[t],y'[t]==2*x[t]+1*y[t]},{x[t],y[t]},t,IncludeSingularSolutions -
```

$$x(t) \to \frac{1}{2}e^{-t}\left(2c_1\cos\left(\sqrt{2}t\right) - \sqrt{2}(2c_1 + 3c_2)\sin\left(\sqrt{2}t\right)\right)$$
$$y(t) \to e^{-t}\left(c_2\cos\left(\sqrt{2}t\right) + \sqrt{2}(c_1 + c_2)\sin\left(\sqrt{2}t\right)\right)$$

15.12 problem 23

Internal problem ID [12837]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Review Exercises for chapter 3. page 376
Problem number: 23.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 5y' + 6y = 0}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 17

```
dsolve([diff(y(t),t$2)+5*diff(y(t),t)+6*y(t)=0,y(0) = 0, D(y)(0) = 2],y(t), singsol=all)
```

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

✓ Solution by Mathematica

Time used: 0.021 (sec). Leaf size: 17

```
DSolve[{y''[t]+5*y'[t]+6*y[t]==0,{y[0]==0,y'[0]==2}},y[t],t,IncludeSingularSolutions -> True
```

$$y(t) \to 2e^{-3t}\left(e^t - 1\right)$$

15.13 problem 24

Internal problem ID [12838]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Review Exercises for chapter 3. page 376
Problem number: 24.
ODE order: 2.
ODE degree: 1.

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

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

With initial conditions

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

✓ Solution by Maple

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

```
dsolve([diff(y(t),t$2)+2*diff(y(t),t)+5*y(t)=0,y(0) = 3, D(y)(0) = -1],y(t), singsol=all)
```

$$y(t) = \mathrm{e}^{-t}(\sin(2t) + 3\cos(2t))$$

✓ Solution by Mathematica

Time used: 0.031 (sec). Leaf size: 22

```
DSolve[{y''[t]+2*y'[t]+5*y[t]==0,{y[0]==3,y'[0]==-1}},y[t],t,IncludeSingularSolutions -> Tru
```

$$y(t) \to e^{-t}(\sin(2t) + 3\cos(2t))$$

15.14 problem 25

Internal problem ID [12839]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Review Exercises for chapter 3. page 376
Problem number: 25.
ODE order: 2.
ODE degree: 1.

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

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

With initial conditions

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

✓ Solution by Maple

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

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

$$y(t) = e^{-t}(1 + 2t)$$

✓ Solution by Mathematica

Time used: 0.022 (sec). Leaf size: 16

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

$$y(t) \to e^{-t}(2t + 1)$$

15.15 problem 26

Internal problem ID [12840]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 3. Linear Systems. Review Exercises for chapter 3. page 376
Problem number: 26.
ODE order: 2.
ODE degree: 1.

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

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

With initial conditions

$$\left[y(0) = 3, y'(0) = -\sqrt{2}\right]$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 21

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

$$y(t) = -\sin\left(\sqrt{2}\,t\right) + 3\cos\left(\sqrt{2}\,t\right)$$

✓ Solution by Mathematica

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

```
DSolve[{y''[t]+2*y[t]==0,{y[0]==3,y'[0]==-Sqrt[2]}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to 3\cos\left(\sqrt{2}t\right) - \sin\left(\sqrt{2}t\right)$$

16 Chapter 4. Forcing and Resonance. Section 4.1 page 399

16.1 problem 1

Internal problem ID [12841]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 1.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' - y' - 6y = e^{4t}}$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 23

```
dsolve(diff(y(t),t$2)-diff(y(t),t)-6*y(t)=exp(4*t),y(t), singsol=all)
```

$$y(t) = c_2 e^{3t} + c_1 e^{-2t} + \frac{e^{4t}}{6}$$

✓ Solution by Mathematica

Time used: 0.044 (sec). Leaf size: 31

```
DSolve[y''[t]-y'[t]-6*y[t]==Exp[4*t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{e^{4t}}{6} + c_1 e^{-2t} + c_2 e^{3t}$$

16.2 problem 2

Internal problem ID [12842]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 2.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 6y' + 8y = 2\,\mathrm{e}^{-3t}}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 24

```
dsolve(diff(y(t),t$2)+6*diff(y(t),t)+8*y(t)=2*exp(-3*t),y(t), singsol=all)
```

$$y(t) = \left(-\frac{c_1 \mathrm{e}^{-2t}}{2} - 2\,\mathrm{e}^{-t} + c_2\right) \mathrm{e}^{-2t}$$

✓ Solution by Mathematica

Time used: 0.032 (sec). Leaf size: 27

```
DSolve[y''[t]+6*y'[t]+8*y[t]==2*Exp[-3*t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to e^{-4t}\left(-2e^t + c_2 e^{2t} + c_1\right)$$

16.3 problem 3

Internal problem ID [12843]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 3.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' - y' - 2y = 5\,e^{3t}}$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 23

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

$$y(t) = c_2 e^{2t} + c_1 e^{-t} + \frac{5\,e^{3t}}{4}$$

✓ Solution by Mathematica

Time used: 0.027 (sec). Leaf size: 31

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

$$y(t) \to \frac{5e^{3t}}{4} + c_1 e^{-t} + c_2 e^{2t}$$

16.4 problem 4

Internal problem ID [12844]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 4.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y' + 13y = \mathrm{e}^{-t}}$$

✓ Solution by Maple

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

```
dsolve(diff(y(t),t$2)+4*diff(y(t),t)+13*y(t)=exp(-t),y(t), singsol=all)
```

$$y(t) = c_2 \mathrm{e}^{-2t} \sin(3t) + c_1 \mathrm{e}^{-2t} \cos(3t) + \frac{\mathrm{e}^{-t}}{10}$$

✓ Solution by Mathematica

Time used: 0.115 (sec). Leaf size: 34

```
DSolve[y''[t]+4*y'[t]+13*y[t]==Exp[-t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{10} e^{-2t} \left(e^t + 10c_2 \cos(3t) + 10c_1 \sin(3t)\right)$$

16.5 problem 5

Internal problem ID [12845]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 5.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y' + 13y = -3\,\mathrm{e}^{-2t}}$$

✓ Solution by Maple

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

```
dsolve(diff(y(t),t$2)+4*diff(y(t),t)+13*y(t)=-3*exp(-2*t),y(t), singsol=all)
```

$$y(t) = c_2\mathrm{e}^{-2t}\sin(3t) + c_1\mathrm{e}^{-2t}\cos(3t) - \frac{\mathrm{e}^{-2t}}{3}$$

✓ Solution by Mathematica

Time used: 0.038 (sec). Leaf size: 32

```
DSolve[y''[t]+4*y'[t]+13*y[t]==-3*Exp[-2*t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{3}e^{-2t}(3c_2\cos(3t) + 3c_1\sin(3t) - 1)$$

16.6 problem 6

Internal problem ID [12846]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 6.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 7y' + 10y = \mathrm{e}^{-2t}}$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 24

```
dsolve(diff(y(t),t$2)+7*diff(y(t),t)+10*y(t)=exp(-2*t),y(t), singsol=all)
```

$$y(t) = c_2\mathrm{e}^{-5t} + c_1\mathrm{e}^{-2t} + \frac{t\,\mathrm{e}^{-2t}}{3}$$

✓ Solution by Mathematica

Time used: 0.054 (sec). Leaf size: 31

```
DSolve[y''[t]+7*y'[t]+10*y[t]==Exp[-2*t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to e^{-5t}\left(e^{3t}\left(\frac{t}{3} - \frac{1}{9} + c_2\right) + c_1\right)$$

16.7 problem 7

Internal problem ID [12847]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 7.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' - 5y' + 4y = e^{4t}}$$

✓ Solution by Maple

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

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

$$y(t) = e^{t} c_2 + c_1 e^{4t} + \frac{t\,e^{4t}}{3}$$

✓ Solution by Mathematica

Time used: 0.038 (sec). Leaf size: 29

```
DSolve[y''[t]-5*y'[t]+4*y[t]==Exp[4*t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to c_1 e^{t} + e^{4t}\left(\frac{t}{3} - \frac{1}{9} + c_2\right)$$

16.8 problem 8

Internal problem ID [12848]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 8.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + y' - 6y = 4\,\mathrm{e}^{-3t}}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 24

```
dsolve(diff(y(t),t$2)+diff(y(t),t)-6*y(t)=4*exp(-3*t),y(t), singsol=all)
```

$$y(t) = c_2\mathrm{e}^{2t} + c_1\mathrm{e}^{-3t} - \frac{4\,\mathrm{e}^{-3t}t}{5}$$

✓ Solution by Mathematica

Time used: 0.048 (sec). Leaf size: 32

```
DSolve[y''[t]+y'[t]-6*y[t]==4*Exp[-3*t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{25}e^{-3t}\left(-20t + 25c_2e^{5t} - 4 + 25c_1\right)$$

16.9 problem 9

Internal problem ID [12849]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 9.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 6y' + 8y = \mathrm{e}^{-t}}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 24

```
dsolve([diff(y(t),t$2)+6*diff(y(t),t)+8*y(t)=exp(-t),y(0) = 0, D(y)(0) = 0],y(t), singsol=al
```

$$y(t) = \frac{(2\,\mathrm{e}^{3t} - 3\,\mathrm{e}^{2t} + 1)\,\mathrm{e}^{-4t}}{6}$$

✓ Solution by Mathematica

Time used: 0.054 (sec). Leaf size: 28

```
DSolve[{y''[t]+6*y'[t]+8*y[t]==Exp[-t],{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolutions -
```

$$y(t) \to \frac{1}{6}e^{-4t}\left(e^t - 1\right)^2\left(2e^t + 1\right)$$

16.10 problem 10

Internal problem ID [12850]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 10.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 7y' + 12y = 3\,\mathrm{e}^{-t}}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 23

```
dsolve([diff(y(t),t$2)+7*diff(y(t),t)+12*y(t)=3*exp(-t),y(0) = 2, D(y)(0) = 1],y(t), singsol
```

$$y(t) = \frac{15\,\mathrm{e}^{-3t}}{2} - 6\,\mathrm{e}^{-4t} + \frac{\mathrm{e}^{-t}}{2}$$

✓ Solution by Mathematica

Time used: 0.031 (sec). Leaf size: 26

```
DSolve[{y''[t]+7*y'[t]+12*y[t]==3*Exp[-t],{y[0]==2,y'[0]==1}},y[t],t,IncludeSingularSolution
```

$$y(t) \to \frac{1}{2}e^{-4t}\left(15e^t + e^{3t} - 12\right)$$

16.11 problem 11

Internal problem ID [12851]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 11.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y' + 13y = -3\,\mathrm{e}^{-2t}}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 16

```
dsolve([diff(y(t),t$2)+4*diff(y(t),t)+13*y(t)=-3*exp(-2*t),y(0) = 0, D(y)(0) = 0],y(t), sing
```

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

✓ Solution by Mathematica

Time used: 0.038 (sec). Leaf size: 20

```
DSolve[{y''[t]+4*y'[t]+13*y[t]==-3*Exp[-2*t],{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolut
```

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

16.12 problem 12

Internal problem ID [12852]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 12.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 7y' + 10y = \mathrm{e}^{-2t}}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 22

```
dsolve([diff(y(t),t$2)+7*diff(y(t),t)+10*y(t)=exp(-2*t),y(0) = 0, D(y)(0) = 0],y(t), singsol
```

$$y(t) = \frac{(3t-1)\,\mathrm{e}^{-2t}}{9} + \frac{\mathrm{e}^{-5t}}{9}$$

✓ Solution by Mathematica

Time used: 0.043 (sec). Leaf size: 27

```
DSolve[{y''[t]+7*y'[t]+10*y[t]==Exp[-2*t],{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolution
```

$$y(t) \to \frac{1}{9}e^{-5t}\left(e^{3t}(3t-1)+1\right)$$

16.13 problem 13

Internal problem ID [12853]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 13.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y' + 3y = \mathrm{e}^{-\frac{t}{2}}}$$

With initial conditions

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

✓ Solution by Maple

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

```
dsolve([diff(y(t),t$2)+4*diff(y(t),t)+3*y(t)=exp(-t/2),y(0) = 0, D(y)(0) = 0],y(t), singsol=
```

$$y(t) = \frac{\mathrm{e}^{-3t}}{5} - \mathrm{e}^{-t} + \frac{4\,\mathrm{e}^{-\frac{t}{2}}}{5}$$

✓ Solution by Mathematica

Time used: 0.083 (sec). Leaf size: 32

```
DSolve[{y''[t]+4*y'[t]+3*y[t]==Exp[-t/2],{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolutions
```

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

16.14 problem 14

Internal problem ID [12854]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 14.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y' + 3y = \mathrm{e}^{-2t}}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 23

```
dsolve([diff(y(t),t$2)+4*diff(y(t),t)+3*y(t)=exp(-2*t),y(0) = 0, D(y)(0) = 0],y(t), singsol=
```

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

✓ Solution by Mathematica

Time used: 0.043 (sec). Leaf size: 21

```
DSolve[{y''[t]+4*y'[t]+3*y[t]==Exp[-2*t],{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolutions
```

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

16.15 problem 15

Internal problem ID [12855]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 15.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y' + 3y = e^{-4t}}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 23

```
dsolve([diff(y(t),t$2)+4*diff(y(t),t)+3*y(t)=exp(-4*t),y(0) = 0, D(y)(0) = 0],y(t), singsol=
```

$$y(t) = -\frac{e^{-3t}}{2} + \frac{e^{-t}}{6} + \frac{e^{-4t}}{3}$$

✓ Solution by Mathematica

Time used: 0.045 (sec). Leaf size: 26

```
DSolve[{y''[t]+4*y'[t]+3*y[t]==Exp[-4*t],{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolutions
```

$$y(t) \to \frac{1}{6}e^{-4t}(e^t - 1)^2 (e^t + 2)$$

16.16 problem 16

Internal problem ID [12856]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 16.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y' + 20y = e^{-\frac{t}{2}}}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 31

```
dsolve([diff(y(t),t$2)+4*diff(y(t),t)+20*y(t)=exp(-t/2),y(0) = 0, D(y)(0) = 0],y(t), singsol
```

$$y(t) = \frac{4\,e^{-\frac{t}{2}}}{73} + \frac{(-8\cos(4t) - 3\sin(4t))\,e^{-2t}}{146}$$

✓ Solution by Mathematica

Time used: 0.259 (sec). Leaf size: 36

```
DSolve[{y''[t]+4*y'[t]+20*y[t]==Exp[-t/2],{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolution
```

$$y(t) \to \frac{1}{146}e^{-2t}\left(8e^{3t/2} - 3\sin(4t) - 8\cos(4t)\right)$$

16.17 problem 17

Internal problem ID [12857]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 17.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y' + 20y = e^{-2t}}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 16

```
dsolve([diff(y(t),t$2)+4*diff(y(t),t)+20*y(t)=exp(-2*t),y(0) = 0, D(y)(0) = 0],y(t), singsol
```

$$y(t) = -\frac{e^{-2t}(\cos(4t) - 1)}{16}$$

✓ Solution by Mathematica

Time used: 0.086 (sec). Leaf size: 20

```
DSolve[{y''[t]+4*y'[t]+20*y[t]==Exp[-2*t],{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolution
```

$$y(t) \to \frac{1}{8}e^{-2t}\sin^2(2t)$$

16.18 problem 18

Internal problem ID [12858]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 18.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y' + 20y = \mathrm{e}^{-4t}}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 28

```
dsolve([diff(y(t),t$2)+4*diff(y(t),t)+20*y(t)=exp(-4*t),y(0) = 0, D(y)(0) = 0],y(t), singsol
```

$$y(t) = \frac{(-2\cos(4t) + \sin(4t))\,\mathrm{e}^{-2t}}{40} + \frac{\mathrm{e}^{-4t}}{20}$$

✓ Solution by Mathematica

Time used: 0.18 (sec). Leaf size: 37

```
DSolve[{y''[t]+4*y'[t]+20*y[t]==Exp[-4*t],{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolution
```

$$y(t) \to \frac{1}{40} e^{-4t} \left(e^{2t} \sin(4t) - 2e^{2t} \cos(4t) + 2\right)$$

16.19 problem 19

Internal problem ID [12859]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 19.
ODE order: 2.
ODE degree: 1.

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

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

✓ Solution by Maple

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

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

$$y(t) = c_2 \mathrm{e}^{-t} + \mathrm{e}^{-t} t c_1 + \frac{t^2 \mathrm{e}^{-t}}{2}$$

✓ Solution by Mathematica

Time used: 0.037 (sec). Leaf size: 27

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

$$y(t) \to \frac{1}{2} e^{-t} \left(t^2 + 2c_2 t + 2c_1\right)$$

16.20 problem 21

Internal problem ID [12860]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 21.
ODE order: 2.
ODE degree: 1.

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

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 16

```
dsolve([diff(y(t),t$2)-5*diff(y(t),t)+4*y(t)=5,y(0) = 0, D(y)(0) = 0],y(t), singsol=all)
```

$$y(t) = -\frac{5\,\mathrm{e}^{t}}{3} + \frac{5\,\mathrm{e}^{4t}}{12} + \frac{5}{4}$$

✓ Solution by Mathematica

Time used: 0.02 (sec). Leaf size: 21

```
DSolve[{y''[t]-5*y'[t]+4*y[t]==5,{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolutions -> True
```

$$y(t) \to \frac{5}{12}\left(-4e^{t} + e^{4t} + 3\right)$$

16.21 problem 22

Internal problem ID [12861]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 22.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 5y' + 6y = 2}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 18

```
dsolve([diff(y(t),t$2)+5*diff(y(t),t)+6*y(t)=2,y(0) = 0, D(y)(0) = 0],y(t), singsol=all)
```

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

✓ Solution by Mathematica

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

```
DSolve[{y''[t]+5*y'[t]+6*y[t]==2,{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolutions -> True
```

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

16.22 problem 23

Internal problem ID [12862]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 23.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 2y' + 10y = 10}$$

With initial conditions

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

✓ Solution by Maple

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

```
dsolve([diff(y(t),t$2)+2*diff(y(t),t)+10*y(t)=10,y(0) = 0, D(y)(0) = 0],y(t), singsol=all)
```

$$y(t) = 1 + \frac{(-3\cos(3t) - \sin(3t))\,\mathrm{e}^{-t}}{3}$$

✓ Solution by Mathematica

Time used: 0.029 (sec). Leaf size: 32

```
DSolve[{y''[t]+2*y'[t]+10*y[t]==10,{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolutions -> Tr
```

$$y(t) \to \frac{1}{3}e^{-t}(3e^t - \sin(3t) - 3\cos(3t))$$

16.23 problem 24

Internal problem ID [12863]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 24.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y' + 6y = -8}$$

With initial conditions

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

✓ Solution by Maple

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

```
dsolve([diff(y(t),t$2)+4*diff(y(t),t)+6*y(t)=-8,y(0) = 0, D(y)(0) = 0],y(t), singsol=all)
```

$$y(t) = \frac{4\,\mathrm{e}^{-2t}\sin\left(\sqrt{2}\,t\right)\sqrt{2}}{3} + \frac{4\,\mathrm{e}^{-2t}\cos\left(\sqrt{2}\,t\right)}{3} - \frac{4}{3}$$

✓ Solution by Mathematica

Time used: 0.035 (sec). Leaf size: 44

```
DSolve[{y''[t]+4*y'[t]+6*y[t]==-8,{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolutions -> Tru
```

$$y(t) \to \frac{4}{3}e^{-2t}\left(-e^{2t} + \sqrt{2}\sin\left(\sqrt{2}t\right) + \cos\left(\sqrt{2}t\right)\right)$$

16.24 problem 25

Internal problem ID [12864]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 25.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 9y = e^{-t}}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 23

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

$$y(t) = \frac{\sin(3t)}{30} - \frac{\cos(3t)}{10} + \frac{e^{-t}}{10}$$

✓ Solution by Mathematica

Time used: 0.121 (sec). Leaf size: 33

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

$$y(t) \to \frac{1}{30}e^{-t}\left(e^t \sin(3t) - 3e^t \cos(3t) + 3\right)$$

16.25 problem 26

Internal problem ID [12865]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 26.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y = 2\,\mathrm{e}^{-2t}}$$

With initial conditions

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

✓ Solution by Maple

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

```
dsolve([diff(y(t),t$2)+4*y(t)=2*exp(-2*t),y(0) = 0, D(y)(0) = 0],y(t), singsol=all)
```

$$y(t) = \frac{\sin(2t)}{4} - \frac{\cos(2t)}{4} + \frac{\mathrm{e}^{-2t}}{4}$$

✓ Solution by Mathematica

Time used: 0.033 (sec). Leaf size: 25

```
DSolve[{y''[t]+4*y[t]==2*Exp[-2*t],{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolutions -> Tr
```

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

16.26 problem 27

Internal problem ID [12866]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 27.
ODE order: 2.
ODE degree: 1.

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

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

With initial conditions

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

✓ Solution by Maple

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

```
dsolve([diff(y(t),t$2)+2*y(t)=-3,y(0) = 0, D(y)(0) = 0],y(t), singsol=all)
```

$$y(t) = -\frac{3}{2} + \frac{3\cos\left(\sqrt{2}\, t\right)}{2}$$

✓ Solution by Mathematica

Time used: 0.023 (sec). Leaf size: 17

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

$$y(t) \to -3\sin^2\left(\frac{t}{\sqrt{2}}\right)$$

16.27 problem 28

Internal problem ID [12867]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 28.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y = \mathrm{e}^t}$$

With initial conditions

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

✓ Solution by Maple

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

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

$$y(t) = -\frac{\sin(2t)}{10} - \frac{\cos(2t)}{5} + \frac{\mathrm{e}^t}{5}$$

✓ Solution by Mathematica

Time used: 0.082 (sec). Leaf size: 27

```
DSolve[{y''[t]+4*y[t]==Exp[t],{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{10}\left(2e^t - \sin(2t) - 2\cos(2t)\right)$$

16.28 problem 29

Internal problem ID [12868]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 29.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 9y = 6}$$

With initial conditions

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

✓ Solution by Maple

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

```
dsolve([diff(y(t),t$2)+9*y(t)=6,y(0) = 0, D(y)(0) = 0],y(t), singsol=all)
```

$$y(t) = \frac{2}{3} - \frac{2\cos(3t)}{3}$$

✓ Solution by Mathematica

Time used: 0.021 (sec). Leaf size: 17

```
DSolve[{y''[t]+9*y[t]==6,{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{4}{3}\sin^2\left(\frac{3t}{2}\right)$$

16.29 problem 30

Internal problem ID [12869]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 30.
ODE order: 2.
ODE degree: 1.

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

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 28

```
dsolve([diff(y(t),t$2)+2*y(t)=-exp(t),y(0) = 0, D(y)(0) = 0],y(t), singsol=all)
```

$$y(t) = \frac{\sqrt{2}\,\sin\left(\sqrt{2}\,t\right)}{6} + \frac{\cos\left(\sqrt{2}\,t\right)}{3} - \frac{\mathrm{e}^{t}}{3}$$

✓ Solution by Mathematica

Time used: 0.028 (sec). Leaf size: 39

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

$$y(t) \to \frac{1}{6}\left(-2e^{t} + \sqrt{2}\sin\left(\sqrt{2}t\right) + 2\cos\left(\sqrt{2}t\right)\right)$$

16.30 problem 31

Internal problem ID [12870]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 31.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y = -3t^2 + 2t + 3}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 26

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

$$y(t) = -\frac{\sin(2t)}{4} + \frac{7\cos(2t)}{8} - \frac{3t^2}{4} + \frac{t}{2} + \frac{9}{8}$$

✓ Solution by Mathematica

Time used: 0.024 (sec). Leaf size: 31

```
DSolve[{y''[t]+4*y[t]==-3*t^2+2*t+3,{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolutions -> T
```

$$y(t) \to \frac{1}{8}(-6t^2 + 4t - 2\sin(2t) - 9\cos(2t) + 9)$$

16.31 problem 32

Internal problem ID [12871]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 32.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 2y' = 3t + 2}$$

With initial conditions

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

✓ Solution by Maple

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

```
dsolve([diff(y(t),t$2)+2*diff(y(t),t)=3*t+2,y(0) = 0, D(y)(0) = 0],y(t), singsol=all)
```

$$y(t) = \frac{3t^2}{4} + \frac{e^{-2t}}{8} + \frac{t}{4} - \frac{1}{8}$$

✓ Solution by Mathematica

Time used: 0.131 (sec). Leaf size: 24

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

$$y(t) \to \frac{1}{8}\left(6t^2 + 2t + e^{-2t} - 1\right)$$

16.32 problem 33

Internal problem ID [12872]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 33.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y' = 3t + 2}$$

With initial conditions

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

✓ Solution by Maple

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

```
dsolve([diff(y(t),t$2)+4*diff(y(t),t)=3*t+2,y(0) = 0, D(y)(0) = 0],y(t), singsol=all)
```

$$y(t) = \frac{3t^2}{8} + \frac{5\,\mathrm{e}^{-4t}}{64} + \frac{5t}{16} - \frac{5}{64}$$

✓ Solution by Mathematica

Time used: 0.136 (sec). Leaf size: 26

```
DSolve[{y''[t]+4*y'[t]==3*t+2,{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{64}\left(24t^2 + 20t + 5e^{-4t} - 5\right)$$

16.33 problem 34

Internal problem ID [12873]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 34.
ODE order: 2.
ODE degree: 1.

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

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 26

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

$$y(t) = \frac{7}{4} - \frac{3t}{2} + \frac{t^2}{2} + \frac{e^{-2t}}{4} - 2\,e^{-t}$$

✓ Solution by Mathematica

Time used: 0.03 (sec). Leaf size: 37

```
DSolve[{y''[t]+3*y'[t]+2*y[t]==t^2,{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolutions -> Tr
```

$$y(t) \to \frac{1}{4}e^{-2t}\left(e^{2t}\left(2t^2 - 6t + 7\right) - 8e^t + 1\right)$$

16.34 problem 35

Internal problem ID [12874]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 35.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y = t - \frac{1}{20}t^2}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 26

```
dsolve([diff(y(t),t$2)+4*y(t)=t-t^2/20,y(0) = 0, D(y)(0) = 0],y(t), singsol=all)
```

$$y(t) = -\frac{\sin(2t)}{8} - \frac{\cos(2t)}{160} - \frac{t^2}{80} + \frac{t}{4} + \frac{1}{160}$$

✓ Solution by Mathematica

Time used: 0.024 (sec). Leaf size: 31

```
DSolve[{y''[t]+4*y[t]==t-t^2/20,{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{160}\left(-2t^2 + 40t - 20\sin(2t) - \cos(2t) + 1\right)$$

16.35 problem 37

Internal problem ID [12875]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 37.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 5y' + 6y = 4 + e^{-t}}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 24

```
dsolve([diff(y(t),t$2)+5*diff(y(t),t)+6*y(t)=4+exp(-t),y(0) = 0, D(y)(0) = 0],y(t), singsol=
```

$$y(t) = \frac{11\,e^{-3t}}{6} - 3\,e^{-2t} + \frac{e^{-t}}{2} + \frac{2}{3}$$

✓ Solution by Mathematica

Time used: 0.106 (sec). Leaf size: 28

```
DSolve[{y''[t]+5*y'[t]+6*y[t]==4+Exp[-t],{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolutions
```

$$y(t) \to \frac{1}{6}e^{-3t}\left(e^t - 1\right)^2\left(4e^t + 11\right)$$

16.36 problem 38

Internal problem ID [12876]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 38.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 3y' + 2y = \mathrm{e}^{-t} - 4}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 30

```
dsolve([diff(y(t),t$2)+3*diff(y(t),t)+2*y(t)=exp(-t)-4,y(0) = 0, D(y)(0) = 0],y(t), singsol=
```

$$y(t) = -\left(2\,\mathrm{e}^{2t} + \ln\left(\mathrm{e}^{-t}\right)\mathrm{e}^{t} - 3\,\mathrm{e}^{t} + 1\right)\mathrm{e}^{-2t}$$

✓ Solution by Mathematica

Time used: 0.077 (sec). Leaf size: 23

```
DSolve[{y''[t]+3*y'[t]+2*y[t]==Exp[-t]-4,{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolutions
```

$$y(t) \to e^{-t}(t+3) - e^{-2t} - 2$$

16.37 problem 39

Internal problem ID [12877]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 39.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 6y' + 8y = 2t + \mathrm{e}^{-t}}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 27

```
dsolve([diff(y(t),t$2)+6*diff(y(t),t)+8*y(t)=2*t+exp(-t),y(0) = 0, D(y)(0) = 0],y(t), singso
```

$$y(t) = \frac{5\,\mathrm{e}^{-4t}}{48} - \frac{3}{16} + \frac{t}{4} + \frac{\mathrm{e}^{-t}}{3} - \frac{\mathrm{e}^{-2t}}{4}$$

✓ Solution by Mathematica

Time used: 0.223 (sec). Leaf size: 42

```
DSolve[{y''[t]+6*y'[t]+8*y[t]==2*t+Exp[-t],{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolutio
```

$$y(t) \to \frac{1}{48}e^{-4t}\left(3e^{4t}(4t-3) - 12e^{2t} + 16e^{3t} + 5\right)$$

16.38 problem 40

Internal problem ID [12878]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 40.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 6y' + 8y = 2t + e^t}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 25

```
dsolve([diff(y(t),t$2)+6*diff(y(t),t)+8*y(t)=2*t+exp(t),y(0) = 0, D(y)(0) = 0],y(t), singsol
```

$$y(t) = \frac{(16\,e^{5t} + 60t\,e^{4t} - 45\,e^{4t} + 20\,e^{2t} + 9)\,e^{-4t}}{240}$$

✓ Solution by Mathematica

Time used: 0.2 (sec). Leaf size: 33

```
DSolve[{y''[t]+6*y'[t]+8*y[t]==2*t+Exp[t],{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolution
```

$$y(t) \to \frac{1}{240}\left(60t + 9e^{-4t} + 20e^{-2t} + 16e^t - 45\right)$$

16.39 problem 41

Internal problem ID [12879]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 41.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y = t + e^{-t}}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 26

```
dsolve([diff(y(t),t$2)+4*y(t)=t+exp(-t),y(0) = 0, D(y)(0) = 0],y(t), singsol=all)
```

$$y(t) = -\frac{\sin(2t)}{40} - \frac{\cos(2t)}{5} + \frac{t}{4} + \frac{e^{-t}}{5}$$

✓ Solution by Mathematica

Time used: 0.794 (sec). Leaf size: 32

```
DSolve[{y''[t]+4*y[t]==t+Exp[-t],{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolutions -> True
```

$$y(t) \to \frac{1}{40}\left(10t + 8e^{-t} - \sin(2t) - 8\cos(2t)\right)$$

16.40 problem 42

Internal problem ID [12880]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.1 page 399
Problem number: 42.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y = 6 + t^2 + \mathrm{e}^t}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 27

```
dsolve([diff(y(t),t$2)+4*y(t)=6+t^2+exp(t),y(0) = 0, D(y)(0) = 0],y(t), singsol=all)
```

$$y(t) = -\frac{\sin(2t)}{10} - \frac{63\cos(2t)}{40} + \frac{11}{8} + \frac{t^2}{4} + \frac{\mathrm{e}^t}{5}$$

✓ Solution by Mathematica

Time used: 0.352 (sec). Leaf size: 33

```
DSolve[{y''[t]+4*y[t]==6+t^2+Exp[t],{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolutions -> T
```

$$y(t) \to \frac{1}{40}\left(10t^2 + 8e^t - 4\sin(2t) - 63\cos(2t) + 55\right)$$

17 Chapter 4. Forcing and Resonance. Section 4.2 page 412

17.1 problem 1

Internal problem ID [12881]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.2 page 412
Problem number: 1.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 3y' + 2y = \cos(t)}$$

✓ Solution by Maple

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

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

$$y(t) = -c_1 e^{-2t} + \frac{\cos(t)}{10} + \frac{3\sin(t)}{10} + c_2 e^{-t}$$

✓ Solution by Mathematica

Time used: 0.07 (sec). Leaf size: 32

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

$$y(t) \to \frac{1}{10}\left(3\sin(t) + \cos(t) + 10e^{-2t}\left(c_2 e^t + c_1\right)\right)$$

17.2 problem 2

Internal problem ID [12882]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.2 page 412
Problem number: 2.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 3y' + 2y = 5\cos(t)}$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 26

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

$$y(t) = -c_1 \mathrm{e}^{-2t} + \frac{\cos(t)}{2} + \frac{3\sin(t)}{2} + c_2 \mathrm{e}^{-t}$$

✓ Solution by Mathematica

Time used: 0.034 (sec). Leaf size: 32

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

$$y(t) \to \frac{1}{2}\left(3\sin(t) + \cos(t) + 2e^{-2t}\left(c_2 e^t + c_1\right)\right)$$

17.3 problem 3

Internal problem ID [12883]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.2 page 412
Problem number: 3.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 3y' + 2y = \sin(t)}$$

✓ Solution by Maple

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

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

$$y(t) = -c_1 \mathrm{e}^{-2t} - \frac{3\cos(t)}{10} + \frac{\sin(t)}{10} + c_2 \mathrm{e}^{-t}$$

✓ Solution by Mathematica

Time used: 0.098 (sec). Leaf size: 32

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

$$y(t) \to \frac{1}{10}\left(\sin(t) - 3\cos(t) + 10e^{-2t}\left(c_2 e^t + c_1\right)\right)$$

17.4 problem 4

Internal problem ID [12884]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.2 page 412
Problem number: 4.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 3y' + 2y = 2\sin(t)}$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 26

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

$$y(t) = -c_1 \mathrm{e}^{-2t} - \frac{3\cos(t)}{5} + \frac{\sin(t)}{5} + c_2 \mathrm{e}^{-t}$$

✓ Solution by Mathematica

Time used: 0.033 (sec). Leaf size: 32

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

$$y(t) \to \frac{1}{5}\left(\sin(t) - 3\cos(t) + 5e^{-2t}\left(c_2 e^t + c_1\right)\right)$$

17.5 problem 5

Internal problem ID [12885]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.2 page 412
Problem number: 5.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 6y' + 8y = \cos(t)}$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 26

```
dsolve(diff(y(t),t$2)+6*diff(y(t),t)+8*y(t)=cos(t),y(t), singsol=all)
```

$$y(t) = -\frac{c_1 e^{-4t}}{2} + \frac{7\cos(t)}{85} + \frac{6\sin(t)}{85} + c_2 e^{-2t}$$

✓ Solution by Mathematica

Time used: 0.09 (sec). Leaf size: 35

```
DSolve[y''[t]+6*y'[t]+8*y[t]==Cos[t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{6\sin(t)}{85} + \frac{7\cos(t)}{85} + e^{-4t}\left(c_2 e^{2t} + c_1\right)$$

17.6 problem 6

Internal problem ID [12886]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.2 page 412
Problem number: 6.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 6y' + 8y = -4\cos(3t)}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 30

```
dsolve(diff(y(t),t$2)+6*diff(y(t),t)+8*y(t)=-4*cos(3*t),y(t), singsol=all)
```

$$y(t) = -\frac{c_1 e^{-4t}}{2} + c_2 e^{-2t} + \frac{4\cos(3t)}{325} - \frac{72\sin(3t)}{325}$$

✓ Solution by Mathematica

Time used: 0.034 (sec). Leaf size: 37

```
DSolve[y''[t]+6*y'[t]+8*y[t]==-4*Cos[3*t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to c_1 e^{-4t} + c_2 e^{-2t} + \frac{4}{325}(\cos(3t) - 18\sin(3t))$$

17.7 problem 7

Internal problem ID [12887]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.2 page 412
Problem number: 7.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y' + 13y = 3\cos(2t)}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 37

```
dsolve(diff(y(t),t$2)+4*diff(y(t),t)+13*y(t)=3*cos(2*t),y(t), singsol=all)
```

$$y(t) = c_2 e^{-2t} \sin(3t) + c_1 e^{-2t} \cos(3t) + \frac{24\sin(2t)}{145} + \frac{27\cos(2t)}{145}$$

✓ Solution by Mathematica

Time used: 0.042 (sec). Leaf size: 47

```
DSolve[y''[t]+4*y'[t]+13*y[t]==3*Cos[2*t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{3}{145}(8\sin(2t) + 9\cos(2t)) + c_2 e^{-2t} \cos(3t) + c_1 e^{-2t} \sin(3t)$$

17.8 problem 8

Internal problem ID [12888]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.2 page 412
Problem number: 8.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y' + 20y = -\cos(5t)}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 37

```
dsolve(diff(y(t),t$2)+4*diff(y(t),t)+20*y(t)=-cos(5*t),y(t), singsol=all)
```

$$y(t) = \mathrm{e}^{-2t} \sin(4t)\, c_2 + \mathrm{e}^{-2t} \cos(4t)\, c_1 + \frac{\cos(5t)}{85} - \frac{4\sin(5t)}{85}$$

✓ Solution by Mathematica

Time used: 0.043 (sec). Leaf size: 45

```
DSolve[y''[t]+4*y'[t]+20*y[t]==-Cos[5*t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{85}(\cos(5t) - 4\sin(5t)) + c_2 e^{-2t} \cos(4t) + c_1 e^{-2t} \sin(4t)$$

17.9 problem 9

Internal problem ID [12889]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.2 page 412
Problem number: 9.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y' + 20y = -3\sin(2t)}$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 37

```
dsolve(diff(y(t),t$2)+4*diff(y(t),t)+20*y(t)=-3*sin(2*t),y(t), singsol=all)
```

$$y(t) = \mathrm{e}^{-2t}\sin(4t)\, c_2 + \mathrm{e}^{-2t}\cos(4t)\, c_1 - \frac{3\sin(2t)}{20} + \frac{3\cos(2t)}{40}$$

✓ Solution by Mathematica

Time used: 0.04 (sec). Leaf size: 45

```
DSolve[y''[t]+4*y'[t]+20*y[t]==-3*Sin[2*t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{3}{40}(\cos(2t) - 2\sin(2t)) + c_2 e^{-2t}\cos(4t) + c_1 e^{-2t}\sin(4t)$$

17.10 problem 10

Internal problem ID [12890]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.2 page 412
Problem number: 10.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 2y' + y = \cos(3t)}$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 30

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

$$y(t) = c_2 e^{-t} + e^{-t} t c_1 - \frac{2\cos(3t)}{25} + \frac{3\sin(3t)}{50}$$

✓ Solution by Mathematica

Time used: 0.22 (sec). Leaf size: 35

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

$$y(t) \to \frac{3}{50}\sin(3t) - \frac{2}{25}\cos(3t) + e^{-t}(c_2 t + c_1)$$

17.11 problem 11

Internal problem ID [12891]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.2 page 412
Problem number: 11.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 6y' + 8y = \cos(t)}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 25

```
dsolve([diff(y(t),t$2)+6*diff(y(t),t)+8*y(t)=cos(t),y(0) = 0, D(y)(0) = 0],y(t), singsol=all
```

$$y(t) = \frac{2\,\mathrm{e}^{-4t}}{17} + \frac{7\cos(t)}{85} + \frac{6\sin(t)}{85} - \frac{\mathrm{e}^{-2t}}{5}$$

✓ Solution by Mathematica

Time used: 2.147 (sec). Leaf size: 63

```
DSolve[{y''[t]+5*y'[t]+8*y[t]==Cos[t],{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolutions ->
```

$$y(t) \to \frac{1}{518}\left(35\sin(t) - 45\sqrt{7}e^{-5t/2}\sin\left(\frac{\sqrt{7}t}{2}\right) + 49\cos(t) - 49e^{-5t/2}\cos\left(\frac{\sqrt{7}t}{2}\right)\right)$$

17.12 problem 12

Internal problem ID [12892]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.2 page 412
Problem number: 12.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 6y' + 8y = 2\cos(3t)}$$

With initial conditions

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

✓ Solution by Maple

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

```
dsolve([diff(y(t),t$2)+6*diff(y(t),t)+8*y(t)=2*cos(3*t),y(0) = 0, D(y)(0) = 0],y(t), singsol
```

$$y(t) = \frac{4\,e^{-4t}}{25} - \frac{2\,e^{-2t}}{13} - \frac{2\cos(3t)}{325} + \frac{36\sin(3t)}{325}$$

✓ Solution by Mathematica

Time used: 0.047 (sec). Leaf size: 74

```
DSolve[{y''[t]+5*y'[t]+8*y[t]==2*Cos[3*t],{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolution
```

$$y(t) \to \frac{1}{791}e^{-5t/2}\left(105e^{5t/2}\sin(3t) - 85\sqrt{7}\sin\left(\frac{\sqrt{7}t}{2}\right) - 7e^{5t/2}\cos(3t) + 7\cos\left(\frac{\sqrt{7}t}{2}\right)\right)$$

17.13 problem 13

Internal problem ID [12893]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.2 page 412
Problem number: 13.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 6y' + 20y = -3\sin(2t)}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 44

```
dsolve([diff(y(t),t$2)+6*diff(y(t),t)+20*y(t)=-3*sin(2*t),y(0) = 0, D(y)(0) = 0],y(t), sings
```

$$y(t) = -\frac{3\,\mathrm{e}^{-3t}\sqrt{11}\,\sin\left(\sqrt{11}\,t\right)}{1100} - \frac{9\,\mathrm{e}^{-3t}\cos\left(\sqrt{11}\,t\right)}{100} - \frac{3\sin(2t)}{25} + \frac{9\cos(2t)}{100}$$

✓ Solution by Mathematica

Time used: 0.052 (sec). Leaf size: 61

```
DSolve[{y''[t]+6*y'[t]+20*y[t]==-3*Sin[2*t],{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSoluti
```

$$y(t) \to -\frac{3e^{-3t}\left(44e^{3t}\sin(2t) + \sqrt{11}\sin\left(\sqrt{11}t\right) - 33e^{3t}\cos(2t) + 33\cos\left(\sqrt{11}t\right)\right)}{1100}$$

17.14 problem 14

Internal problem ID [12894]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.2 page 412
Problem number: 14.
ODE order: 2.
ODE degree: 1.

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

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 28

```
dsolve([diff(y(t),t$2)+2*diff(y(t),t)+y(t)=2*cos(2*t),y(0) = 0, D(y)(0) = 0],y(t), singsol=a
```

$$y(t) = \frac{2(3-5t)\,\mathrm{e}^{-t}}{25} - \frac{6\cos(2t)}{25} + \frac{8\sin(2t)}{25}$$

✓ Solution by Mathematica

Time used: 0.036 (sec). Leaf size: 37

```
DSolve[{y''[t]+2*y'[t]+y[t]==2*Cos[2*t],{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolutions
```

$$y(t) \to -\frac{2}{25}e^{-t}\left(5t - 4e^t\sin(2t) + 3e^t\cos(2t) - 3\right)$$

17.15 problem 15

Internal problem ID [12895]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.2 page 412
Problem number: 15.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 3y' + y = \cos(3t)}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 39

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

$$y(t) = \mathrm{e}^{\frac{(\sqrt{5}-3)t}{2}} c_2 + \mathrm{e}^{-\frac{(3+\sqrt{5})t}{2}} c_1 - \frac{8\cos(3t)}{145} + \frac{9\sin(3t)}{145}$$

✓ Solution by Mathematica

Time used: 0.674 (sec). Leaf size: 52

```
DSolve[y''[t]+3*y'[t]+y[t]==Cos[3*t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{9}{145}\sin(3t) - \frac{8}{145}\cos(3t) + e^{-\frac{1}{2}(3+\sqrt{5})t}\left(c_2 e^{\sqrt{5}t} + c_1\right)$$

17.16 problem 18

Internal problem ID [12896]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.2 page 412
Problem number: 18.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y' + 20y = 3 + 2\cos(2t)}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 38

```
dsolve(diff(y(t),t$2)+4*diff(y(t),t)+20*y(t)=3+2*cos(2*t),y(t), singsol=all)
```

$$y(t) = e^{-2t}\sin(4t)\, c_2 + e^{-2t}\cos(4t)\, c_1 + \frac{\sin(2t)}{20} + \frac{\cos(2t)}{10} + \frac{3}{20}$$

✓ Solution by Mathematica

Time used: 1.265 (sec). Leaf size: 47

```
DSolve[y''[t]+4*y'[t]+20*y[t]==3+2*Cos[2*t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{20}\left(\sin(2t) + 2\cos(2t) + 20c_2e^{-2t}\cos(4t) + 20c_1e^{-2t}\sin(4t) + 3\right)$$

17.17 problem 19

Internal problem ID [12897]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.2 page 412
Problem number: 19.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y' + 20y = e^{-t} \cos(t)}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 38

```
dsolve(diff(y(t),t$2)+4*diff(y(t),t)+20*y(t)=exp(-t)*cos(t),y(t), singsol=all)
```

$$y(t) = e^{-2t} \sin(4t)\, c_2 + e^{-2t} \cos(4t)\, c_1 + \frac{e^{-t}(\sin(t) + 8\cos(t))}{130}$$

✓ Solution by Mathematica

Time used: 0.457 (sec). Leaf size: 44

```
DSolve[y''[t]+4*y'[t]+20*y[t]==Exp[-t]*Cos[t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{130} e^{-2t} \left(e^t \sin(t) + 8e^t \cos(t) + 130 c_2 \cos(4t) + 130 c_1 \sin(4t)\right)$$

18 Chapter 4. Forcing and Resonance. Section 4.3 page 424

18.1 problem 1

Internal problem ID [12898]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.3 page 424
Problem number: 1.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 9y = \cos(t)}$$

✓ Solution by Maple

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

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

$$y(t) = \sin(3t)\, c_2 + \cos(3t)\, c_1 + \frac{\cos(t)}{8}$$

✓ Solution by Mathematica

Time used: 0.064 (sec). Leaf size: 30

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

$$y(t) \to \frac{\cos(t)}{8} + \left(\frac{1}{12} + c_1\right)\cos(3t) + c_2 \sin(3t)$$

18.2 problem 2

Internal problem ID [12899]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.3 page 424
Problem number: 2.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 9y = 5\sin(2t)}$$

✓ Solution by Maple

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

```
dsolve(diff(y(t),t$2)+9*y(t)=5*sin(2*t),y(t), singsol=all)
```

$$y(t) = \sin(3t)\, c_2 + \cos(3t)\, c_1 + \sin(2t)$$

✓ Solution by Mathematica

Time used: 0.031 (sec). Leaf size: 24

```
DSolve[y''[t]+9*y[t]==5*Sin[2*t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \sin(2t) + c_1 \cos(3t) + c_2 \sin(3t)$$

18.3 problem 3

Internal problem ID [12900]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.3 page 424
Problem number: 3.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y = -\cos\left(\frac{t}{2}\right)}$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 23

```
dsolve(diff(y(t),t$2)+4*y(t)=-cos(t/2),y(t), singsol=all)
```

$$y(t) = c_2 \sin(2t) + c_1 \cos(2t) - \frac{4\cos\left(\frac{t}{2}\right)}{15}$$

✓ Solution by Mathematica

Time used: 0.031 (sec). Leaf size: 30

```
DSolve[y''[t]+4*y[t]==-Cos[t/2],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to -\frac{4}{15}\cos\left(\frac{t}{2}\right) + c_1\cos(2t) + c_2\sin(2t)$$

18.4 problem 4

Internal problem ID [12901]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.3 page 424
Problem number: 4.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y = 3\cos(2t)}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 30

```
dsolve(diff(y(t),t$2)+4*y(t)=3*cos(2*t),y(t), singsol=all)
```

$$y(t) = c_2 \sin(2t) + c_1 \cos(2t) + \frac{3\cos(2t)}{8} + \frac{3\sin(2t)\,t}{4}$$

✓ Solution by Mathematica

Time used: 0.049 (sec). Leaf size: 33

```
DSolve[y''[t]+4*y[t]==3*Cos[2*t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \left(\frac{3}{16} + c_1\right)\cos(2t) + \frac{1}{4}(3t + 4c_2)\sin(2t)$$

18.5 problem 5

Internal problem ID [12902]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 4. Forcing and Resonance. Section 4.3 page 424
Problem number: 5.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 9y = 2\cos(3t)}$$

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 30

```
dsolve(diff(y(t),t$2)+9*y(t)=2*cos(3*t),y(t), singsol=all)
```

$$y(t) = \sin(3t)\, c_2 + \cos(3t)\, c_1 + \frac{\cos(3t)}{9} + \frac{\sin(3t)\, t}{3}$$

✓ Solution by Mathematica

Time used: 0.054 (sec). Leaf size: 31

```
DSolve[y''[t]+9*y[t]==2*Cos[3*t],y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \left(\frac{1}{18} + c_1\right)\cos(3t) + \frac{1}{3}(t + 3c_2)\sin(3t)$$

19 Chapter 6. Laplace transform. Section 6.3 page 600

19.1 problem 27

Internal problem ID [12903]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 6. Laplace transform. Section 6.3 page 600
Problem number: 27.
ODE order: 2.
ODE degree: 1.

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

$$\boxed{y'' + 4y = 8}$$

With initial conditions

$$[y(0) = 11, y'(0) = 5]$$

✓ Solution by Maple

Time used: 0.218 (sec). Leaf size: 18

```
dsolve([diff(y(t),t$2)+4*y(t)=8,y(0) = 11, D(y)(0) = 5],y(t), singsol=all)
```

$$y(t) = 2 + 9\cos(2t) + \frac{5\sin(2t)}{2}$$

✓ Solution by Mathematica

Time used: 0.021 (sec). Leaf size: 19

```
DSolve[{y''[t]+4*y[t]==8,{y[0]==11,y'[0]==5}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to 9\cos(2t) + 5\sin(t)\cos(t) + 2$$

19.2 problem 28

Internal problem ID [12904]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 6. Laplace transform. Section 6.3 page 600
Problem number: 28.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _with_linear_symmetries]]`

$$\boxed{y'' - 4y = \mathrm{e}^{2t}}$$

With initial conditions

$$[y(0) = 1, y'(0) = -1]$$

✓ Solution by Maple

Time used: 0.094 (sec). Leaf size: 22

```
dsolve([diff(y(t),t$2)-4*y(t)=exp(2*t),y(0) = 1, D(y)(0) = -1],y(t), singsol=all)
```

$$y = \frac{13\,\mathrm{e}^{-2t}}{16} + \frac{\mathrm{e}^{2t}(3 + 4t)}{16}$$

✓ Solution by Mathematica

Time used: 0.031 (sec). Leaf size: 27

```
DSolve[{y''[t]-4*y[t]==Exp[2*t],{y[0]==1,y'[0]==-1}},y[t],t,IncludeSingularSolutions -> True
```

$$y(t) \to \frac{1}{16} e^{-2t} \left(e^{4t}(4t + 3) + 13\right)$$

19.3 problem 29

Internal problem ID [12905]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 6. Laplace transform. Section 6.3 page 600
Problem number: 29.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _with_linear_symmetries]]`

$$\boxed{y'' - 4y' + 5y = 2\,e^{t}}$$

With initial conditions

$$[y(0) = 3, y'(0) = 1]$$

✓ Solution by Maple

Time used: 0.078 (sec). Leaf size: 20

```
dsolve([diff(y(t),t$2)-4*diff(y(t),t)+5*y(t)=2*exp(t),y(0) = 3, D(y)(0) = 1],y(t), singsol=a
```

$$y = (2\cos(t) - 4\sin(t))\,e^{2t} + e^{t}$$

✓ Solution by Mathematica

Time used: 0.029 (sec). Leaf size: 25

```
DSolve[{y''[t]-4*y'[t]+5*y[t]==2*Exp[t],{y[0]==3,y'[0]==1}},y[t],t,IncludeSingularSolutions
```

$$y(t) \to e^{t}\left(-4e^{t}\sin(t) + 2e^{t}\cos(t) + 1\right)$$

19.4 problem 30

Internal problem ID [12906]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 6. Laplace transform. Section 6.3 page 600
Problem number: 30.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _linear, _nonhomogeneous]]`

$$\boxed{y'' + 6y' + 13y = 13\,\text{Heaviside}\,(t-4)}$$

With initial conditions

$$[y(0) = 3, y'(0) = 1]$$

✓ Solution by Maple

Time used: 0.109 (sec). Leaf size: 57

```
dsolve([diff(y(t),t$2)+6*diff(y(t),t)+13*y(t)=13*Heaviside(t-4),y(0) = 3, D(y)(0) = 1],y(t),
```

$$y = \left(-\frac{1}{2} - \frac{3i}{4}\right)\text{Heaviside}\,(t-4)\,\mathrm{e}^{(-3-2i)(t-4)} + \left(-\frac{1}{2} + \frac{3i}{4}\right)\text{Heaviside}\,(t-4)\,\mathrm{e}^{(-3+2i)(t-4)} + \text{Heaviside}\,(t-4) + \mathrm{e}^{-3t}(3\cos(2t) + 5\sin(2t))$$

✓ Solution by Mathematica

Time used: 0.057 (sec). Leaf size: 82

```
DSolve[{y''[t]-4*y'[t]+5*y[t]==UnitStep[t-4],{y[0]==3,y'[0]==1}},y[t],t,IncludeSingularSolut
```

$$y(t) \to \begin{cases} e^{2t}(3\cos(t) - 5\sin(t)) & t \leq 4 \\ -\frac{1}{5}e^{2t-8}\cos(4-t) + 3e^{2t}\cos(t) - \frac{2}{5}e^{2t-8}\sin(4-t) - 5e^{2t}\sin(t) + \frac{1}{5} & \text{True} \end{cases}$$

19.5 problem 31

Internal problem ID [12907]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 6. Laplace transform. Section 6.3 page 600
Problem number: 31.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _linear, _nonhomogeneous]]`

$$\boxed{y'' + 4y = \cos(2t)}$$

With initial conditions

$$[y(0) = -2, y'(0) = 0]$$

✓ Solution by Maple

Time used: 0.093 (sec). Leaf size: 18

```
dsolve([diff(y(t),t$2)+4*y(t)=cos(2*t),y(0) = -2, D(y)(0) = 0],y(t), singsol=all)
```

$$y = \frac{t\sin(2t)}{4} - 2\cos(2t)$$

✓ Solution by Mathematica

Time used: 0.049 (sec). Leaf size: 21

```
DSolve[{y''[t]+4*y[t]==Cos[2*t],{y[0]==-2,y'[0]==0}},y[t],t,IncludeSingularSolutions -> True
```

$$y(t) \to \frac{1}{4}t\sin(2t) - 2\cos(2t)$$

19.6 problem 32

Internal problem ID [12908]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 6. Laplace transform. Section 6.3 page 600
Problem number: 32.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _linear, _nonhomogeneous]]`

$$\boxed{y'' + 3y = \text{Heaviside}\,(t-4)\cos\,(5t-20)}$$

With initial conditions

$$[y(0) = 0, y'(0) = -2]$$

✓ Solution by Maple

Time used: 0.125 (sec). Leaf size: 39

```
dsolve([diff(y(t),t$2)+3*y(t)=Heaviside(t-4)*cos(5*(t-4)),y(0) = 0, D(y)(0) = -2],y(t), sing
```

$$y = -\frac{2\sqrt{3}\,\sin\left(\sqrt{3}\,t\right)}{3} - \frac{\text{Heaviside}\,(t-4)\cos\,(5t-20)}{22} + \frac{\text{Heaviside}\,(t-4)\cos\left(\sqrt{3}\,(t-4)\right)}{22}$$

✓ Solution by Mathematica

Time used: 0.797 (sec). Leaf size: 66

```
DSolve[{y''[t]+3*y[t]==UnitStep[t-4]*Cos[5*(t-4)],{y[0]==0,y'[0]==-2}},y[t],t,IncludeSingula
```

$$y(t) \to \begin{cases} -\frac{2\sin\left(\sqrt{3}t\right)}{\sqrt{3}} & t \leq 4 \\ \frac{1}{66}\left(-3\cos(5(t-4)) + 3\cos\left(\sqrt{3}(t-4)\right) - 44\sqrt{3}\sin\left(\sqrt{3}t\right)\right) & \text{True} \end{cases}$$

19.7 problem 33

Internal problem ID [12909]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 6. Laplace transform. Section 6.3 page 600
Problem number: 33.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _linear, _nonhomogeneous]]`

$$\boxed{y'' + 4y' + 9y = 20 \operatorname{Heaviside}(-2+t)\sin(-2+t)}$$

With initial conditions

$$[y(0) = 1, y'(0) = 2]$$

✓ Solution by Maple

Time used: 0.125 (sec). Leaf size: 64

```
dsolve([diff(y(t),t$2)+4*diff(y(t),t)+9*y(t)=20*Heaviside(t-2)*sin(t-2),y(0) = 1, D(y)(0) =
```

$$y = \mathrm{e}^{4-2t}\cos\left(\sqrt{5}\,(-2+t)\right)\operatorname{Heaviside}(-2+t) + \mathrm{e}^{-2t}\cos\left(\sqrt{5}\,t\right) + \frac{4\sqrt{5}\,\mathrm{e}^{-2t}\sin\left(\sqrt{5}\,t\right)}{5} - \operatorname{Heaviside}(-2+t)\left(\cos(-2+t) - 2\sin(-2+t)\right)$$

✓ Solution by Mathematica

Time used: 2.391 (sec). Leaf size: 115

```
DSolve[{y''[t]+4*y'[t]+9*y[t]==20*UnitStep[t-2]*Sin[t-2],{y[0]==1,y'[0]==2}},y[t],t,IncludeS
```

$y(t)$

$$\to \begin{cases} -\cos(2-t) + e^{4-2t}\cos\left(\sqrt{5}(t-2)\right) + e^{-2t}\cos\left(\sqrt{5}t\right) - 2\sin(2-t) + \frac{4e^{-2t}\sin\left(\sqrt{5}t\right)}{\sqrt{5}} & t > 2 \\ \frac{1}{5}e^{-2t}\left(5\cos\left(\sqrt{5}t\right) + 4\sqrt{5}\sin\left(\sqrt{5}t\right)\right) & \text{True} \end{cases}$$

19.8 problem 34

Internal problem ID [12910]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 6. Laplace transform. Section 6.3 page 600
Problem number: 34.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _linear, _nonhomogeneous]]`

$$\boxed{y'' + 3y = \begin{cases} t & 0 \le t < 1 \\ 1 & 1 \le t \end{cases}}$$

With initial conditions

$$[y(0) = 2, y'(0) = 0]$$

✓ Solution by Maple

Time used: 0.125 (sec). Leaf size: 83

```
dsolve([diff(y(t),t$2)+3*y(t)=piecewise(0<=t and t<1,t,t>=1,1),y(0) = 2, D(y)(0) = 0],y(t),
```

$$y = 2\cos\left(\sqrt{3}\,t\right) - \frac{\sqrt{3}\,\sin\left(\sqrt{3}\,t\right)}{9} + \frac{\left(\begin{cases} t & t < 1 \\ 1 + \frac{\sqrt{3}\,\sin\left(\sqrt{3}\,(-1+t)\right)}{3} & 1 \le t \end{cases}\right)}{3}$$

✓ Solution by Mathematica

Time used: 0.079 (sec). Leaf size: 108

```
DSolve[{y''[t]+3*y[t]==Piecewise[{{t,0<=t<1},{1,t>=1}}],{y[0]==2,y'[0]==0}},y[t],t,IncludeSi
```

$$y(t) \to \begin{cases} 2\cos\left(\sqrt{3}t\right) & t \leq 0 \\ \frac{1}{9}\left(3t + 18\cos\left(\sqrt{3}t\right) - \sqrt{3}\sin\left(\sqrt{3}t\right)\right) & 0 < t \leq 1 \\ \frac{1}{9}\left(18\cos\left(\sqrt{3}t\right) + \sqrt{3}\sin\left(\sqrt{3}(t-1)\right) - \sqrt{3}\sin\left(\sqrt{3}t\right) + 3\right) & \text{True} \end{cases}$$

20 Chapter 6. Laplace transform. Section 6.4. page 608

20.1 problem 2

Internal problem ID [12911]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 6. Laplace transform. Section 6.4. page 608
Problem number: 2.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _linear, _nonhomogeneous]]`

$$\boxed{y'' + 3y = 5(\delta(-2 + t))}$$

With initial conditions

$$[y(0) = 0, y'(0) = 0]$$

✓ Solution by Maple

Time used: 0.094 (sec). Leaf size: 21

```
dsolve([diff(y(t),t$2)+3*y(t)=5*Dirac(t-2),y(0) = 0, D(y)(0) = 0],y(t), singsol=all)
```

$$y = \frac{5 \operatorname{Heaviside}(-2 + t) \sin\left(\sqrt{3}\,(-2 + t)\right) \sqrt{3}}{3}$$

✓ Solution by Mathematica

Time used: 0.288 (sec). Leaf size: 36

```
DSolve[{y''[t]+3*y[t]==DiracDelta[t-2],{y[0]==2,y'[0]==0}},y[t],t,IncludeSingularSolutions -
```

$$y(t) \to \frac{\theta(t-2) \sin\left(\sqrt{3}(t-2)\right)}{\sqrt{3}} + 2\cos\left(\sqrt{3}t\right)$$

20.2 problem 3

Internal problem ID [12912]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 6. Laplace transform. Section 6.4. page 608
Problem number: 3.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _linear, _nonhomogeneous]]`

$$\boxed{y'' + 2y' + 5y = \delta(-3 + t)}$$

With initial conditions

$$[y(0) = 1, y'(0) = 1]$$

✓ Solution by Maple

Time used: 0.11 (sec). Leaf size: 37

```
dsolve([diff(y(t),t$2)+2*diff(y(t),t)+5*y(t)=Dirac(t-3),y(0) = 1, D(y)(0) = 1],y(t), singsol
```

$$y = \mathrm{e}^{-t}(\cos(2t) + \sin(2t)) + \frac{\mathrm{Heaviside}(t-3)\,\mathrm{e}^{-t+3}\sin(2t-6)}{2}$$

✓ Solution by Mathematica

Time used: 0.179 (sec). Leaf size: 41

```
DSolve[{y''[t]+2*y'[t]+5*y[t]==DiracDelta[t-3],{y[0]==1,y'[0]==1}},y[t],t,IncludeSingularSol
```

$$y(t) \to \frac{1}{2}e^{-t}\left(2(\sin(2t) + \cos(2t)) - e^3\theta(t-3)\sin(6-2t)\right)$$

20.3 problem 4

Internal problem ID [12913]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 6. Laplace transform. Section 6.4. page 608
Problem number: 4.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _linear, _nonhomogeneous]]`

$$\boxed{y'' + 2y' + 2y = -2(\delta(-2 + t))}$$

With initial conditions

$$[y(0) = 2, y'(0) = 0]$$

✓ Solution by Maple

Time used: 0.219 (sec). Leaf size: 32

```
dsolve([diff(y(t),t$2)+2*diff(y(t),t)+2*y(t)=-2*Dirac(t-2),y(0) = 2, D(y)(0) = 0],y(t), sing
```

$$y = -2\,\text{Heaviside}\,(-2 + t)\,\mathrm{e}^{2-t}\sin\,(-2 + t) + 2\,\mathrm{e}^{-t}(\cos\,(t) + \sin\,(t))$$

✓ Solution by Mathematica

Time used: 0.3 (sec). Leaf size: 31

```
DSolve[{y''[t]+2*y'[t]+2*y[t]==-2*DiracDelta[t-2],{y[0]==2,y'[0]==0}},y[t],t,IncludeSingular
```

$$y(t) \to 2e^{-t}\left(e^2\theta(t-2)\sin(2-t) + \sin(t) + \cos(t)\right)$$

20.4 problem 5

Internal problem ID [12914]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 6. Laplace transform. Section 6.4. page 608
Problem number: 5.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _linear, _nonhomogeneous]]`

$$\boxed{y'' + 2y' + 3y = \delta(t-1) - 3(\delta(t-4))}$$

With initial conditions

$$[y(0) = 0, y'(0) = 0]$$

✓ Solution by Maple

Time used: 0.109 (sec). Leaf size: 51

```
dsolve([diff(y(t),t$2)+2*diff(y(t),t)+3*y(t)=Dirac(t-1)-3*Dirac(t-4),y(0) = 0, D(y)(0) = 0],
```

$$y = \frac{\sqrt{2}\left(-3\,\mathrm{Heaviside}\,(t-4)\,\mathrm{e}^{4-t}\sin\left(\sqrt{2}\,(t-4)\right) + \mathrm{Heaviside}\,(-1+t)\,\mathrm{e}^{1-t}\sin\left(\sqrt{2}\,(-1+t)\right)\right)}{2}$$

✓ Solution by Mathematica

Time used: 0.371 (sec). Leaf size: 53

```
DSolve[{y''[t]+2*y'[t]+3*y[t]==DiracDelta[t-1]-3*DiracDelta[t-4],{y[0]==0,y'[0]==0}},y[t],t,
```

$$y(t) \to \frac{e^{1-t}\left(\theta(t-1)\sin\left(\sqrt{2}(t-1)\right) - 3e^3\theta(t-4)\sin\left(\sqrt{2}(t-4)\right)\right)}{\sqrt{2}}$$

21 Chapter 6. Laplace transform. Section 6.6. page 624

21.1 problem 1

Internal problem ID [12915]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 6. Laplace transform. Section 6.6. page 624
Problem number: 1.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _linear, _nonhomogeneous]]`

$$\boxed{y'' + 2y' + 2y = \mathrm{e}^{-2t} \sin(4t)}$$

With initial conditions

$$[y(0) = 2, y'(0) = -2]$$

✓ Solution by Maple

Time used: 0.125 (sec). Leaf size: 37

```
dsolve([diff(y(t),t$2)+2*diff(y(t),t)+2*y(t)=exp(-2*t)*sin(4*t),y(0) = 2, D(y)(0) = -2],y(t)
```

$$y = \frac{(4\cos(4t) - 7\sin(4t))\,\mathrm{e}^{-2t}}{130} + \frac{128\left(\cos(t) + \frac{\sin(t)}{8}\right)\mathrm{e}^{-t}}{65}$$

✓ Solution by Mathematica

Time used: 0.379 (sec). Leaf size: 41

```
DSolve[{y''[t]+2*y'[t]+2*y[t]==Exp[-2*t]*Sin[4*t],{y[0]==2,y'[0]==-2}},y[t],t,IncludeSingula
```

$$y(t) \to \frac{1}{130} e^{-2t}(32e^t \sin(t) - 7\sin(4t) + 256e^t \cos(t) + 4\cos(4t))$$

21.2 problem 2

Internal problem ID [12916]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 6. Laplace transform. Section 6.6. page 624
Problem number: 2.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _linear, _nonhomogeneous]]`

$$\boxed{y'' + y' + 5y = \text{Heaviside}\,(-2+t)\sin(-8+4t)}$$

With initial conditions

$$[y(0) = -2, y'(0) = 0]$$

✓ Solution by Maple

Time used: 0.156 (sec). Leaf size: 89

```
dsolve([diff(y(t),t$2)+diff(y(t),t)+5*y(t)=Heaviside(t-2)*sin(4*(t-2)),y(0) = -2, D(y)(0) =
```

$$\begin{aligned} y = {} & \frac{4\,\mathrm{e}^{1-\frac{t}{2}}\cos\left(\frac{\sqrt{19}\,(-2+t)}{2}\right)\text{Heaviside}\,(-2+t)}{137} \\ & + \frac{92\,\mathrm{e}^{1-\frac{t}{2}}\sin\left(\frac{\sqrt{19}\,(-2+t)}{2}\right)\text{Heaviside}\,(-2+t)\sqrt{19}}{2603} - 2\,\mathrm{e}^{-\frac{t}{2}}\cos\left(\frac{\sqrt{19}\,t}{2}\right) \\ & - \frac{2\,\mathrm{e}^{-\frac{t}{2}}\sqrt{19}\sin\left(\frac{\sqrt{19}\,t}{2}\right)}{19} - \frac{4\left(\cos(-8+4t) + \frac{11\sin(-8+4t)}{4}\right)\text{Heaviside}\,(-2+t)}{137} \end{aligned}$$

✓ Solution by Mathematica

Time used: 6.103 (sec). Leaf size: 163

```
DSolve[{y''[t]+y'[t]+5*y[t]==UnitStep[t-2]*Sin[4*(t-2)],{y[0]==-2,y'[0]==0}},y[t],t,IncludeS
```

$y(t)$

$$\rightarrow \left\{ \begin{array}{c} -\frac{2}{19}e^{-t/2}\left(19\cos\left(\frac{\sqrt{19}t}{2}\right)+\sqrt{19}\sin\left(\frac{\sqrt{19}t}{2}\right)\right) \\ \frac{e^{-t/2}\left(-76e^{t/2}\cos(8-4t)+76e\cos\left(\frac{1}{2}\sqrt{19}(t-2)\right)-5206\cos\left(\frac{\sqrt{19}t}{2}\right)+209e^{t/2}\sin(8-4t)+92\sqrt{19}e\sin\left(\frac{1}{2}\sqrt{19}(t-2)\right)-274\sqrt{19}\sin\left(\frac{\sqrt{19}t}{2}\right)\right.}{2603} \end{array} \right.$$

21.3 problem 3

Internal problem ID [12917]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 6. Laplace transform. Section 6.6. page 624
Problem number: 3.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _linear, _nonhomogeneous]]`

$$\boxed{y'' + y' + 8y = (1 - \text{Heaviside}\,(t-4))\cos\,(t-4)}$$

With initial conditions

$$[y(0) = 0, y'(0) = 0]$$

✓ Solution by Maple

Time used: 0.156 (sec). Leaf size: 128

```
dsolve([diff(y(t),t$2)+diff(y(t),t)+8*y(t)=(1-Heaviside(t-4))*cos(t-4),y(0) = 0, D(y)(0) = 0
```

$$y = -\frac{9\,\text{Heaviside}\,(t-4)\left(\left(\sin\left(2\sqrt{31}\right)\sqrt{31} - \frac{217\cos\left(2\sqrt{31}\right)}{9}\right)\cos\left(\frac{\sqrt{31}\,t}{2}\right) - \frac{217\sin\left(\frac{\sqrt{31}\,t}{2}\right)\left(\frac{9\cos\left(2\sqrt{31}\right)\sqrt{31}}{217} + \sin\left(2\sqrt{3\right.\right.}{9}\right.}{1550}$$
$$- \frac{7\left(\cos\,(4) - \frac{\sin(4)}{7}\right)\mathrm{e}^{-\frac{t}{2}}\cos\left(\frac{\sqrt{31}\,t}{2}\right)}{50} - \frac{9\left(\cos\,(4) + \frac{13\sin(4)}{9}\right)\sqrt{31}\,\mathrm{e}^{-\frac{t}{2}}\sin\left(\frac{\sqrt{31}\,t}{2}\right)}{1550}$$
$$- \frac{7(-1 + \text{Heaviside}\,(t-4))\left(\left(\cos\,(t) + \frac{\sin(t)}{7}\right)\cos\,(4) - \frac{\sin(4)(\cos(t) - 7\sin(t))}{7}\right)}{50}$$

✓ Solution by Mathematica

Time used: 4.688 (sec). Leaf size: 207

```
DSolve[{y''[t]+y'[t]+8*y[t]==(1-UnitStep[t-4])*Cos[t-4],{y[0]==0,y'[0]==0}},y[t],t,IncludeSi
```

$y(t)$

$$\rightarrow \frac{e^{-t/2}\Big(\theta(4-t)\left(-31e^{t/2}\sin(4-t)-9\sqrt{31}e^2\sin\left(\frac{1}{2}\sqrt{31}(t-4)\right)+217e^{t/2}\cos(4-t)-217e^2\cos\left(\frac{1}{2}\sqrt{31}(\right.\right.}{}$$

21.4 problem 4

Internal problem ID [12918]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 6. Laplace transform. Section 6.6. page 624
Problem number: 4.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _linear, _nonhomogeneous]]`

$$\boxed{y''+y'+3y=(1-\text{Heaviside}\left(-2+t\right))\,\mathrm{e}^{\frac{1}{5}-\frac{t}{10}}\sin\left(-2+t\right)}$$

With initial conditions

$$[y(0)=1, y'(0)=2]$$

✓ Solution by Maple

Time used: 0.25 (sec). Leaf size: 178

```
dsolve([diff(y(t),t$2)+diff(y(t),t)+3*y(t)=(1-Heaviside(t-2))*exp(-(t-2)/10)*sin(t-2),y(0) =
```

$$
\begin{aligned}
y &= \frac{8000\,\text{Heaviside}\left(-2+t\right)\left(\left(\cos\left(t\right)-\frac{191\sin(t)}{80}\right)\cos\left(2\right)+\frac{191\left(\cos(t)+\frac{80\sin(t)}{191}\right)\sin(2)}{80}\right)\mathrm{e}^{\frac{1}{5}-\frac{t}{10}}}{42881} \\
&+ \frac{100\left(11(80\cos\left(2\right)+191\sin\left(2\right))\cos\left(\frac{\sqrt{11}\,t}{2}\right)-318\sqrt{11}\,\sin\left(\frac{\sqrt{11}\,t}{2}\right)\left(\cos\left(2\right)-\frac{782\sin(2)}{795}\right)\right)\mathrm{e}^{\frac{1}{5}-\frac{t}{2}}}{471691} \\
&+ \left(-\frac{4000}{42881}+\frac{9550i}{42881}\right)\mathrm{e}^{\left(-\frac{1}{10}-i\right)(-2+t)}+\left(-\frac{4000}{42881}-\frac{9550i}{42881}\right)\mathrm{e}^{\left(-\frac{1}{10}+i\right)(-2+t)} \\
&+ \frac{200\,\text{Heaviside}\left(-2+t\right)\left(\left(-159\sin\left(\sqrt{11}\right)\sqrt{11}-440\cos\left(\sqrt{11}\right)\right)\cos\left(\frac{\sqrt{11}\,t}{2}\right)+\left(159\cos\left(\sqrt{11}\right)\sqrt{11}-\right.}{471691} \\
&+ \frac{5\,\mathrm{e}^{-\frac{t}{2}}\sqrt{11}\,\sin\left(\frac{\sqrt{11}\,t}{2}\right)}{11}+\mathrm{e}^{-\frac{t}{2}}\cos\left(\frac{\sqrt{11}\,t}{2}\right)
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 6.103 (sec). Leaf size: 243

```
DSolve[{y''[t]+y'[t]+8*y[t]==(1-UnitStep[t-2])*Exp[-(t-2)/10]*Sin[t-2],{y[0]==1,y'[0]==2}},y
```

$y(t)$

$$\rightarrow \{ \frac{e^{-t/2}\left(-248000e^{\frac{2t}{5}+\frac{1}{5}}\cos(2-t)+5\left(\sqrt{31}\left(483881-8\sqrt[5]{e}(3295\cos(2)-1782\sin(2))\right)\sin\left(\frac{\sqrt{31}t}{2}\right)-428420e^{\frac{2t}{5}+\frac{1}{5}}\sin(2-t)\right)+31\cos\left(\right.}{15000311}$$

$$\frac{e^{-t/2}\left(-248000e\cos\left(\frac{1}{2}\sqrt{31}(t-2)\right)+5\sqrt{31}\left(26360e\sin\left(\frac{1}{2}\sqrt{31}(t-2)\right)+\left(483881-8\sqrt[5]{e}(3295\cos(2)-1782\sin(2))\right)\sin\left(\frac{\sqrt{31}t}{2}\right)\right)+31\cos\right.}{15000311}$$

21.5 problem 5

Internal problem ID [12919]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 6. Laplace transform. Section 6.6. page 624
Problem number: 5.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _missing_x]]`

$$\boxed{y'' + 16y = 0}$$

With initial conditions

$$[y(0) = 1, y'(0) = 1]$$

✓ Solution by Maple

Time used: 0.078 (sec). Leaf size: 15

```
dsolve([diff(y(t),t$2)+16*y(t)=0,y(0) = 1, D(y)(0) = 1],y(t), singsol=all)
```

$$y = \cos(4t) + \frac{\sin(4t)}{4}$$

✓ Solution by Mathematica

Time used: 0.021 (sec). Leaf size: 18

```
DSolve[{y''[t]+16*y[t]==0,{y[0]==1,y'[0]==1}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{4}\sin(4t) + \cos(4t)$$

21.6 problem 6

Internal problem ID [12920]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 6. Laplace transform. Section 6.6. page 624
Problem number: 6.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _linear, _nonhomogeneous]]`

$$\boxed{y'' + 4y = \sin(2t)}$$

With initial conditions

$$[y(0) = 0, y'(0) = 0]$$

✓ Solution by Maple

Time used: 0.094 (sec). Leaf size: 18

```
dsolve([diff(y(t),t$2)+4*y(t)=sin(2*t),y(0) = 0, D(y)(0) = 0],y(t), singsol=all)
```

$$y = \frac{\sin(2t)}{8} - \frac{t\cos(2t)}{4}$$

✓ Solution by Mathematica

Time used: 0.055 (sec). Leaf size: 21

```
DSolve[{y''[t]+4*y[t]==Sin[2*t],{y[0]==0,y'[0]==0}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{8}(\sin(2t) - 2t\cos(2t))$$

21.7 problem 7

Internal problem ID [12921]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 6. Laplace transform. Section 6.6. page 624
Problem number: 7.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _missing_x]]`

$$\boxed{y'' + 2y' + y = 0}$$

With initial conditions

$$[y(0) = 1, y'(0) = 2]$$

✓ Solution by Maple

Time used: 0.078 (sec). Leaf size: 14

```
dsolve([diff(y(t),t$2)+2*diff(y(t),t)+y(t)=0,y(0) = 1, D(y)(0) = 2],y(t), singsol=all)
```

$$y = (3t + 1)\,\mathrm{e}^{-t}$$

✓ Solution by Mathematica

Time used: 0.024 (sec). Leaf size: 16

```
DSolve[{y''[t]+2*y'[t]+y[t]==0,{y[0]==1,y'[0]==2}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to e^{-t}(3t + 1)$$

21.8 problem 8

Internal problem ID [12922]

Book: DIFFERENTIAL EQUATIONS by Paul Blanchard, Robert L. Devaney, Glen R. Hall. 4th edition. Brooks/Cole. Boston, USA. 2012
Section: Chapter 6. Laplace transform. Section 6.6. page 624
Problem number: 8.
ODE order: 2.
ODE degree: 1.

CAS Maple gives this as type `[[_2nd_order, _with_linear_symmetries]]`

$$\boxed{y'' + 16y = t}$$

With initial conditions

$$[y(0) = 1, y'(0) = 1]$$

✓ Solution by Maple

Time used: 0.079 (sec). Leaf size: 18

```
dsolve([diff(y(t),t$2)+16*y(t)=t,y(0) = 1, D(y)(0) = 1],y(t), singsol=all)
```

$$y = \frac{t}{16} + \cos(4t) + \frac{15\sin(4t)}{64}$$

✓ Solution by Mathematica

Time used: 0.022 (sec). Leaf size: 24

```
DSolve[{y''[t]+16*y[t]==t,{y[0]==1,y'[0]==1}},y[t],t,IncludeSingularSolutions -> True]
```

$$y(t) \to \frac{1}{64}(4t + 15\sin(4t)) + \cos(4t)$$