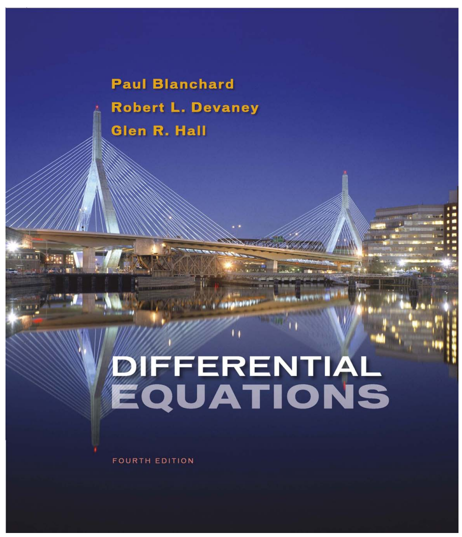
A Solution Manual For

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



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

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1.1 problem 1

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 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]`

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

✓ Solution by Maple
Time used: 0.0 (sec). Leaf size: 10

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

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

✓ 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 [12866]

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]`

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

✓ Solution by Maple
Time used: 0.0 (sec). Leaf size: 15

```
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 [12867]

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 [12868]

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 [12869]

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)
```

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

✓ 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 [12870]

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: 0.016 (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 [12871]

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 [12872]

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: 0.0 (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 [12873]

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 [12874]

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: 0.015 (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 [12875]

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]`

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

✓ Solution by Maple
Time used: 0.0 (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 [12876]

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: 0.016 (sec). Leaf size: 35

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

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

✓ 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 [12877]

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)
```

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

✓ 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 [12878]

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]`

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

✓ 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)
```

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

✓ 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 [12879]

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: 0.016 (sec). Leaf size: 282

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

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

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

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

✓ 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 [12880]

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)
```

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

✓ 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 [12881]

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]`

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

✓ Solution by Maple
Time used: 0.016 (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]
```

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

1.18 problem 21

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 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: 0.046 (sec). Leaf size: 34

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

$$y(t) = \frac{e^{e^t + c_1}}{\sqrt{\frac{e^{2c_1 + 2e^t}}{\text{LambertW}\left(e^{2c_1 + 2e^t}\right)}}}$$

✓ 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 [12883]

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: 0.031 (sec). Leaf size: 24

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

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

✓ 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 [12884]

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 [12885]

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: 0.0 (sec). Leaf size: 8

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

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

✓ 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 [12886]

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]`

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

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 [12887]

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]`

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

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]
```

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

1.24 problem 27

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 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: 0.016 (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 [12889]

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]`

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

With initial conditions

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

✓ Solution by Maple
Time used: 0.109 (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 [12890]

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 [12891]

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: 0.328 (sec). Leaf size: 24

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

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

✓ 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 [12892]

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: 0.016 (sec). Leaf size: 12

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

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

✓ 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]
```

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

1.29 problem 32

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 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]`

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

With initial conditions

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

✓ Solution by Maple
Time used: 0.094 (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 [12894]

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: 0.063 (sec). Leaf size: 18

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

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

✓ 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 [12895]

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: 0.094 (sec). Leaf size: 16

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

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

✓ 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 [12896]

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: 0.047 (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 [12897]

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: 0.015 (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 [12898]

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]`

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

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]
```

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

1.35 problem 38

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 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: 0.078 (sec). Leaf size: 16

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

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

✓ 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]
```

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

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2.1 problem 1

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 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: 0.0 (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 [12901]

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 [12902]

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: 0.0 (sec). Leaf size: 12

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

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

✓ Solution by Mathematica

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

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

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

2.4 problem 4

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 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: 0.0 (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 [12904]

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]`

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

✓ 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)
```

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

✓ 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 [12905]

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']]`

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

✓ 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 [12906]

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]`

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

With initial conditions

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

✓ Solution by Maple
Time used: 0.016 (sec). Leaf size: 12

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

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

✓ 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 [12907]

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: 0.015 (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 [12908]

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]`

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.188 (sec). Leaf size: 65

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

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

✓ 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]
```

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

2.10 problem 10

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 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]`

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

With initial conditions

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

✓ Solution by Maple
Time used: 0.0 (sec). Leaf size: 13

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

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

✓ 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 [12910]

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: 1.39 (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)
```

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

✗ 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 [12911]

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: 0.735 (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 [12912]

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 [12913]

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: 11.64 (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)
```

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

✓ 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 [12914]

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: 0.61 (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 [12915]

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: 0.016 (sec). Leaf size: 14

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

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

✓ 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 [12916]

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: 0.0 (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: 0.294 (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 [12917]

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: 0.172 (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 [12918]

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 [12919]

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]`

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

✓ 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]
```

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

2.21 problem 16 (vi)

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 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)
```

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

✓ 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 [12921]

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]`

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

✓ Solution by Maple
Time used: 0.0 (sec). Leaf size: 14

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

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

✓ 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 [12922]

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 [12923]

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: 0.0 (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 [12924]

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: 0.0 (sec). Leaf size: 9

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

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

✓ 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 [12925]

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: 0.0 (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 [12926]

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 [12927]

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 [12928]

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: 0.0 (sec). Leaf size: 22

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

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

✓ 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

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3.2 problem 2 73
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3.1 problem 1

Internal problem ID [12929]

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: 0.015 (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 [12930]

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]
```

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

3.3 problem 3

Internal problem ID [12931]

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: 0.109 (sec). Leaf size: 115

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

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

✓ 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 [12932]

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: 1.594 (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 [12933]

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: 0.11 (sec). Leaf size: 23

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

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

✓ 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 [12934]

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: 0.094 (sec). Leaf size: 21

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

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

✓ 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 [12935]

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: 0.281 (sec). Leaf size: 37

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

$$y(t) = -\frac{2}{\mathrm{RootOf}\left(2\_Z\,\mathrm{expIntegral}_1(1) - 2\_Z\,\mathrm{expIntegral}_1(-\_Z) - 2\_Z\,e^{-1} - t\_Z - 2\,e^{-\_Z}\right)}$$

✗ 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 [12936]

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: 0.172 (sec). Leaf size: 38

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

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

✗ 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 [12937]

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: 1.594 (sec). Leaf size: 21

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

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

✓ 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 [12938]

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 [12939]

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: 0.031 (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 [12940]

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: 0.016 (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 [12941]

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: 0.344 (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
```

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

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4.4 problem 8 89
4.5 problem 12 90
4.6 problem 13 91
4.7 problem 14 92
4.8 problem 15 93
4.9 problem 16 94

4.1 problem 5

Internal problem ID [12942]

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: 1.828 (sec). Leaf size: 133

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

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

✓ 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 [12943]

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 [12944]

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: 4.344 (sec). Leaf size: 147

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

$$y(t) = \frac{(16\,e^{6t}+9)\left(1+8\,e^{6t}+4\sqrt{e^{6t}+4\,e^{12t}}\right)^{\frac{2}{3}} + \left(24\,e^{6t}+12\sqrt{e^{6t}+4\,e^{12t}}+9\right)\left(1+8\,e^{6t}+4\sqrt{e^{6t}+4\,e^{12t}}\right)^{\frac{1}{3}} +}{(16\,e^{6t}+3)\left(1+8\,e^{6t}+4\sqrt{e^{6t}+4\,e^{12t}}\right)^{\frac{2}{3}} + \left(8\,e^{6t}+4\sqrt{e^{6t}+4\,e^{12t}}+3\right)\left(1+8\,e^{6t}+4\sqrt{e^{6t}+4\,e^{12t}}\right)^{\frac{1}{3}} +}$$

✓ 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]
```

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

4.4 problem 8

Internal problem ID [12945]

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: 1.703 (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]
```

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

4.5 problem 12

Internal problem ID [12946]

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: 0.016 (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 [12947]

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: 0.016 (sec). Leaf size: 11

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

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

✓ 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 [12948]

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: 0.172 (sec). Leaf size: 24

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

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

✓ 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 [12949]

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)
```

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

✓ 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 [12950]

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]`

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

With initial conditions

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

✓ Solution by Maple
Time used: 0.031 (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]
```

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

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5.1 problem 1 and 13 (i)

Internal problem ID [12951]

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]`

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

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)
```

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

✓ 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 [12952]

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]`

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

With initial conditions

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

✓ Solution by Maple
Time used: 0.032 (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 [12953]

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]`

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

With initial conditions

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

✓ Solution by Maple
Time used: 0.0 (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 [12954]

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]`

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

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 [12955]

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: 0.094 (sec). Leaf size: 23

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

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

✓ 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 [12956]

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: 0.125 (sec). Leaf size: 26

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

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

✓ 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 [12957]

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: 0.016 (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 [12958]

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: 0.109 (sec). Leaf size: 20

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

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

✓ 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 [12959]

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: 0.093 (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 [12960]

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: 1.672 (sec). Leaf size: 79

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

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

✓ 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 [12961]

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: 0.016 (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 [12962]

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 [12963]

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: 0.016 (sec). Leaf size: 19

```
dsolve(diff(w(t),t)=w(t)*cos( w(t)),w(t), singsol=all)
```

$$t - \left(\int^{w(t)} \frac{\sec(\_a)}{\_a} d\_a\right) + c_1 = 0$$

✓ Solution by Mathematica
Time used: 7.857 (sec). Leaf size: 50

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

$$\begin{aligned}
w(t) &\to \text{InverseFunction}\left[\int_1^{\#1} \frac{\sec(K[1])}{K[1]} dK[1]\&\right][t + c_1] \\
w(t) &\to 0 \\
w(t) &\to -\frac{\pi}{2} \\
w(t) &\to \frac{\pi}{2}
\end{aligned}$$

5.14 problem 4 and 16(i)

Internal problem ID [12964]

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 [12965]

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: 0.407 (sec). Leaf size: 20

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

$$w(t) = \operatorname{RootOf}\left(\int_{\_Z}^{1} \frac{\sec(\_a)}{\_a} d\_a + t - 3\right)$$

✗ 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 [12966]

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: 0.11 (sec). Leaf size: 19

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

$$w(t) = \mathrm{RootOf}\left(\int_{\_Z}^{2} \frac{\sec(\_a)}{\_a} d\_a + t\right)$$

✗ 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 [12967]

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: 0.109 (sec). Leaf size: 19

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

$$w(t) = \mathrm{RootOf}\left(\int_{\_Z}^{-1} \frac{\sec(\_a)}{\_a} d\_a + t\right)$$

✗ 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 [12968]

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: 0.0 (sec). Leaf size: 19

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

$$t + \int^{w(t)} \frac{\csc(\_a)}{\_a - 1} d\_a + c_1 = 0$$

✓ 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 [12969]

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]`

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

✓ Solution by Maple
Time used: 0.016 (sec). Leaf size: 33

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

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

✓ 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 [12970]

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 [12971]

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: 0.094 (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 [12972]

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: 0.016 (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 [12973]

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: 0.016 (sec). Leaf size: 9

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

$$y(t) = \arcsin\left(c_1 e^t\right)$$

✓ 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 [12974]

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: 0.125 (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 [12975]

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: 0.0 (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 [12976]

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: 0.125 (sec). Leaf size: 24

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

$$y(t) = -\sqrt{2}\,\tanh\left(\operatorname{arctanh}\left(\frac{3\sqrt{2}}{2}\right) + \sqrt{2}\,t\right) + 2$$

✓ 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]
```

$$y(t) \to -\frac{(\sqrt{2}-4)\,e^{2\sqrt{2}t} + 4 + \sqrt{2}}{(3+\sqrt{2})\,e^{2\sqrt{2}t} - 3 + \sqrt{2}}$$

5.27 problem 23

Internal problem ID [12977]

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: 0.031 (sec). Leaf size: 17

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

$$y(t) = -\sqrt{2}\tanh\left(\sqrt{2}\,t\right) + 2$$

✓ 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 [12978]

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: 0.109 (sec). Leaf size: 24

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

$$y(t) = -\sqrt{2}\tanh\left(\operatorname{arctanh}\left(2\sqrt{2}\right) + \sqrt{2}\,t\right) + 2$$

✓ 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 [12979]

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: 0.125 (sec). Leaf size: 24

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

$$y(t) = -\sqrt{2}\tanh\left(\operatorname{arctanh}\left(3\sqrt{2}\right) + \sqrt{2}\,t\right) + 2$$

✓ 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 [12980]

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: 0.11 (sec). Leaf size: 24

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

$$y(t) = -\sqrt{2}\tanh\left(-\operatorname{arctanh}\left(\sqrt{2}\right) + \sqrt{2}\,t\right) + 2$$

✓ 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]
```

$$y(t) \to \frac{\left(4\sqrt{2} - 6\right)e^{2\sqrt{2}t} + 6 + 4\sqrt{2}}{\left(\sqrt{2} - 2\right)e^{2\sqrt{2}t} + 2 + \sqrt{2}}$$

5.31 problem 27

Internal problem ID [12981]

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: 0.094 (sec). Leaf size: 32

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

$$y(t) = -\sqrt{2}\tanh\left(\frac{\left(\sqrt{2}\,\operatorname{arctanh}\left(\frac{\sqrt{2}}{2}\right) + 2t - 6\right)\sqrt{2}}{2}\right) + 2$$

✓ 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 [12982]

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: 0.016 (sec). Leaf size: 22

```
dsolve(diff(y(t),t)=y(t)*cos(Pi/2*y(t)),y(t), singsol=all)
```

$$t - \left(\int^{y(t)} \frac{\sec\left(\frac{\pi\_a}{2}\right)}{\_a} d\_a\right) + c_1 = 0$$

✓ 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 [12983]

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]`

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

✓ Solution by Maple
Time used: 0.016 (sec). Leaf size: 14

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

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

✓ Solution by Mathematica
Time used: 0.42 (sec). Leaf size: 29

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

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

5.34 problem 37 (iii)

Internal problem ID [12984]

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: 22

```
dsolve(diff(y(t),t)=y(t)*sin(Pi/2*y(t)),y(t), singsol=all)
```

$$t - \left(\int^{y(t)} \frac{\csc\left(\frac{\pi\_a}{2}\right)}{\_a} d\_a\right) + c_1 = 0$$

✓ 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 [12985]

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: 0.172 (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]
```

$$y(t) \to \text{InverseFunction}\left[\frac{1}{\#1} + \log(1 - \#1) - \log(\#1)\&\right][t + c_1]$$
$$y(t) \to 0$$
$$y(t) \to 1$$

5.36 problem 37 (v)

Internal problem ID [12986]

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: 0.031 (sec). Leaf size: 48

```
dsolve(diff(y(t),t)=cos(Pi/2*y(t)),y(t), singsol=all)
```

$$y(t) = \frac{2\arctan\left(\frac{e^{\pi(t+c_1)}-1}{e^{\pi(t+c_1)}+1}, \frac{2\,e^{\frac{\pi(t+c_1)}{2}}}{e^{\pi(t+c_1)}+1}\right)}{\pi}$$

✓ 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 [12987]

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 [12988]

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: 0.0 (sec). Leaf size: 22

```
dsolve(diff(y(t),t)=y(t)*sin(Pi/2*y(t)),y(t), singsol=all)
```

$$t - \left(\int^{y(t)} \frac{\csc\left(\frac{\pi\_a}{2}\right)}{\_a} d\_a\right) + c_1 = 0$$

✓ 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 [12989]

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: 0.109 (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]
```

$$y(t) \rightarrow \text{InverseFunction}\left[\frac{1}{\#1} + \log(1 - \#1) - \log(\#1)\&\right][-t + c_1]$$
$$y(t) \rightarrow 0$$
$$y(t) \rightarrow 1$$

6 Chapter 1. First-Order Differential Equations. Exercises section 1.8 page 121

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6.1 problem 1

Internal problem ID [12990]

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']]`

$$\boxed{y' + 4y = 9\,e^{-t}}$$

✓ 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)
```

$$y(t) = \left(3\,e^{3t} + c_1\right) e^{-4t}$$

✓ 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 [12991]

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 [12992]

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: 0.0 (sec). Leaf size: 23

```
dsolve(diff(y(t),t)=-3*y(t)+4*cos(2*t),y(t), singsol=all)
```

$$y(t) = \frac{12\cos(2t)}{13} + \frac{8\sin(2t)}{13} + c_1 \mathrm{e}^{-3t}$$

✓ 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 [12993]

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)
```

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

✓ 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 [12994]

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)
```

$$y(t) = (-4t + c_1)\,e^{3t}$$

✓ 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 [12995]

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)
```

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

✓ 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 [12996]

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: 0.016 (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 [12997]

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']]`

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

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)
```

$$y(t) = \frac{43\,\mathrm{e}^{2t}}{4} - \frac{3\,\mathrm{e}^{-2t}}{4}$$

✓ 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 [12998]

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: 0.016 (sec). Leaf size: 23

```
dsolve([diff(y(t),t)+y(t)=cos(2*t),y(0) = 5],y(t), singsol=all)
```

$$y(t) = \frac{\cos(2t)}{5} + \frac{2\sin(2t)}{5} + \frac{24\,e^{-t}}{5}$$

✓ 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 [12999]

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)
```

$$y(t) = \frac{3\cos(2t)}{13} + \frac{2\sin(2t)}{13} - \frac{16\,\mathrm{e}^{-3t}}{13}$$

✓ 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 [13000]

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)
```

$$y(t) = (7t + 3)\,\mathrm{e}^{2t}$$

✓ 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 [13001]

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: 0.016 (sec). Leaf size: 20

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

$$y(t) = \frac{3t^2}{2} - \frac{t}{2} - \frac{1}{4} + \mathrm{e}^{-2t} c_1$$

✓ 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]
```

$$y(t) \to \frac{1}{4}(6t^2 - 2t - 1) + c_1 e^{-2t}$$

6.13 problem 21

Internal problem ID [13002]

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)
```

$$y(t) = \frac{t^2}{2} + \frac{t}{2} + \frac{1}{4} + \frac{e^{4t}}{6} + e^{-2t}c_1$$

✓ 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]
```

$$y(t) \to \frac{1}{12}\left(6t^2 + 6t + 2e^{4t} + 3\right) + c_1e^{-2t}$$

6.14 problem 22

Internal problem ID [13003]

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)
```

$$y(t) = t^3 - 3t^2 + 6t - 6 - \frac{3\cos(3t)}{10} + \frac{\sin(3t)}{10} + \mathrm{e}^{-t}c_1$$

✓ 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]
```

$$y(t) \to t^3 - 3t^2 + 6t + \frac{1}{10}\sin(3t) - \frac{3}{10}\cos(3t) + c_1e^{-t} - 6$$

6.15 problem 23

Internal problem ID [13004]

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 [13005]

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: 23

```
dsolve(diff(y(t),t)+y(t)=cos(2*t)+3*sin(2*t)+exp(-t),y(t), singsol=all)
```

$$y(t) = (t + c_1)\, e^{-t} - \cos(2t) + \sin(2t)$$

✓ 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]
```

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

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7.1 problem 1

Internal problem ID [13006]

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 [13007]

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: 16

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

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

✓ 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 [13008]

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]`

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

✓ Solution by Maple
Time used: 0.0 (sec). Leaf size: 26

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

$$y(t) = \frac{3t^4 + 4t^3 + 12c_1}{12t + 12}$$

✓ 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 [13009]

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]`

$$\boxed{y' + 2ty = 4\,\mathrm{e}^{-t^2}}$$

✓ 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)
```

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

✓ 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 [13010]

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)
```

$$y(t) = (3\arctan(t) + c_1)\left(t^2+1\right)$$

✓ 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]
```

$$y(t) \to \left(t^2+1\right)(3\arctan(t) + c_1)$$

7.6 problem 6

Internal problem ID [13011]

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)
```

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

✓ 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 [13012]

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]`

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

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)
```

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

✓ 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 [13013]

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]`

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

With initial conditions

$$[y(1) = 10]$$

✓ Solution by Maple
Time used: 0.016 (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 [13014]

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: 0.016 (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 [13015]

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]`

$$\boxed{y' + 2ty = 4\,\mathrm{e}^{-t^2}}$$

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)
```

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

✓ 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 [13016]

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 [13017]

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: 0.016 (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)
```

$$y(t) = -\left(-\mathrm{e}^{2t} + \mathrm{e}^{2}\right) t^3$$

✓ 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 [13018]

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)
```

$$y(t) = \left(4\left(\int \mathrm{e}^{\cos(t)}dt\right) + c_1\right)\mathrm{e}^{-\cos(t)}$$

✓ 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 [13019]

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: 41

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

$$y(t) = \frac{3\, 3^{\frac{1}{6}} t \,\mathrm{WhittakerM}\left(\frac{1}{6}, \frac{2}{3}, \frac{t^3}{3}\right) \mathrm{e}^{\frac{t^3}{6}}}{(t^3)^{\frac{1}{6}}} + c_1 \mathrm{e}^{\frac{t^3}{3}} + 4t$$

✓ 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 [13020]

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: 24

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

$$y(t) = \left(4\left(\int \cos(t)\,\mathrm{e}^{\frac{1}{t}}dt\right) + c_1\right)\mathrm{e}^{-\frac{1}{t}}$$

✓ 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 [13021]

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']]`

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

✓ Solution by Maple
Time used: 0.0 (sec). Leaf size: 68

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

$$y(t) = \left(\frac{1}{4} - \frac{i}{4}\right)\sqrt{2}\,e^{t}\left(2\,e^{-\frac{i}{4}}\operatorname{erf}\left(\frac{(1-i+(2+2i)\,t)\sqrt{2}}{4}\right)\sqrt{\pi} + 2i\sqrt{\pi}\,e^{\frac{i}{4}}\operatorname{erf}\left(\left(\frac{1}{4} - \frac{i}{4}\right)\sqrt{2}\,(2t+i)\right) + (1+i)\sqrt{2}\,c_1\right)$$

✓ 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]
```

$$y(t) \to e^{t}\left(c_1 - \sqrt[4]{-1}e^{-\frac{i}{4}}\sqrt{\pi}\left(\operatorname{erfi}\left(\frac{1}{2}(-1)^{3/4}(2t-i)\right) + ie^{\frac{i}{2}}\operatorname{erfi}\left(\frac{1}{2}\sqrt[4]{-1}(2t+i)\right)\right)\right)$$

7.17 problem 17

Internal problem ID [13022]

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)
```

$$y(t) = \left(\int \cos(t)\, e^{\frac{\sqrt{\pi}\,\mathrm{erf}(t)}{2}} dt + c_1\right) e^{-\frac{\sqrt{\pi}\,\mathrm{erf}(t)}{2}}$$

✓ 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 [13023]

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]`

$$y' - \frac{y}{\sqrt{t^3-3}} = t$$

✓ 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 [13024]

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: 45

```
dsolve(diff(y(t),t)=a*t*y(t)+4*exp(-t^2),y(t), singsol=all)
```

$$y(t) = \frac{\left(c_1\sqrt{2a+4} + 4\sqrt{\pi}\ \mathrm{erf}\left(\frac{\sqrt{2a+4}\,t}{2}\right)\right)\mathrm{e}^{\frac{a\,t^2}{2}}}{\sqrt{2a+4}}$$

✓ 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]
```

$$y(t) \to \frac{e^{\frac{at^2}{2}}\left(2\sqrt{2\pi}\mathrm{erf}\left(\frac{\sqrt{a+2}t}{\sqrt{2}}\right) + \sqrt{a+2}c_1\right)}{\sqrt{a+2}}$$

7.20 problem 20

Internal problem ID [13025]

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: 0.0 (sec). Leaf size: 202

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

$$y(t) = \frac{4\,\mathrm{e}^{\frac{t^r t}{2r+2}}\left(t^{-r}\left(\frac{t\,t^r}{r+1}\right)^{\frac{-r-2}{2r+2}}(r+1)\,(r+2)^2\,\mathrm{WhittakerM}\left(\frac{r+2}{2r+2}, \frac{2r+3}{2r+2}, \frac{t\,t^r}{r+1}\right) + (r+1)^2\left((r+2)\,t^{-r} + t\right)\left(\frac{t\,t^r}{r+1}\right)^{\frac{-r-}{2r+}}\right.}{2r^2 + 7r + 6}$$

✓ 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 [13026]

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)
```

$$v(t) = \frac{15\cos(2t)}{52} + \frac{75\sin(2t)}{52} + \mathrm{e}^{-\frac{2t}{5}} c_1$$

✓ 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 [13027]

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]`

$$\boxed{y' + 2ty = 4\,\mathrm{e}^{-t^2}}$$

✓ 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)
```

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

✓ 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 [13028]

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)
```

$$y(t) = (c_1 + 3t)\,\mathrm{e}^{-2t}$$

✓ 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]
```

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

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8.1 problem 2

Internal problem ID [13029]

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)
```

$$y(t) = c_1 e^{3t}$$

✓ 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 [13030]

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: 0.015 (sec). Leaf size: 16

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

$$y(t) = \frac{1}{5}t^5 + \frac{1}{3}t^3 + c_1$$

✓ 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 [13031]

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: 0.047 (sec). Leaf size: 190

```
dsolve(diff(y(t),t)=-sin(y(t))^5,y(t), singsol=all)
```

$$y(t) = \arctan\left(\frac{2\,\mathrm{e}^{\mathrm{RootOf}\left(\mathrm{e}^{8\_Z}+8\,\mathrm{e}^{6\_Z}+64c_1\mathrm{e}^{4\_Z}+24\_Z\mathrm{e}^{4\_Z}+64t\,\mathrm{e}^{4\_Z}-8\,\mathrm{e}^{2\_Z}-1\right)}}{\mathrm{e}^{2\,\mathrm{RootOf}\left(\mathrm{e}^{8\_Z}+8\,\mathrm{e}^{6\_Z}+64c_1\mathrm{e}^{4\_Z}+24\_Z\mathrm{e}^{4\_Z}+64t\,\mathrm{e}^{4\_Z}-8\,\mathrm{e}^{2\_Z}-1\right)}+1}, \frac{-\mathrm{e}^{2\,\mathrm{RootOf}\left(\mathrm{e}^{8\_Z}+8\,\mathrm{e}^{6\_Z}+64c_1\mathrm{e}^{4\_Z}+24\_Z\mathrm{e}^{4\_Z}\right.}}{\mathrm{e}^{2\,\mathrm{RootOf}\left(\mathrm{e}^{8\_Z}+8\,\mathrm{e}^{6\_Z}+64c_1\mathrm{e}^{4\_Z}+24\_Z\mathrm{e}^{4\_Z}+\right.}}$$

✓ 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 [13032]

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]`

$$y' - \frac{(t^2-4)(y+1)\,\mathrm{e}^y}{(t-1)(3-y)} = 0$$

✓ Solution by Maple
Time used: 0.062 (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)
```

$$y(t) = -\operatorname{RootOf}\left(8\,\mathrm{e}\,\operatorname{expIntegral}_1(1-\_Z) + t^2 - 2\,\mathrm{e}^{-\_Z} - 6\ln(t-1) + 2c_1 + 2t\right)$$

✓ 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 [13033]

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: 0.015 (sec). Leaf size: 12

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

$$y(t) = \frac{\pi}{2} + \arctan(t + c_1)$$

✓ 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 [13034]

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 [13035]

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)
```

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

✓ 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 [13036]

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)
```

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

✓ 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 [13037]

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]`

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

✓ Solution by Maple
Time used: 0.0 (sec). Leaf size: 12

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

$$y(t) = e^{\frac{t^2}{2}} c_1$$

✓ 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 [13038]

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']]`

$$\boxed{y' - 3y = \mathrm{e}^{7t}}$$

✓ Solution by Maple
Time used: 0.0 (sec). Leaf size: 18

```
dsolve(diff(y(t),t)= 3*y(t)+exp(7*t),y(t), singsol=all)
```

$$y(t) = \frac{(\mathrm{e}^{4t} + 4c_1)\,\mathrm{e}^{3t}}{4}$$

✓ 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 [13039]

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 [13040]

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)
```

$$y(t) = -\frac{3\cos(3t)}{34} + \frac{5\sin(3t)}{34} + e^{-5t}c_1$$

✓ 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 [13041]

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]`

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

✓ Solution by Maple
Time used: 0.016 (sec). Leaf size: 22

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

$$y(t) = (t+1)\left((t+1)\ln(t+1) + c_1 t + c_1 + 1\right)$$

✓ 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 [13042]

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 [13043]

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)
```

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

✓ 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 [13044]

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']]`

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

✓ 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)
```

$$y(t) = \frac{t^2}{3} - \frac{2t}{9} + \frac{2}{27} + e^{-2t} + c_1 e^{-3t}$$

✓ 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 [13045]

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]**

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

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 [13046]

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: 0.0 (sec). Leaf size: 23

```
dsolve([diff(y(t),t)= 2*y(t)+cos(4*t),y(0) = 1],y(t), singsol=all)
```

$$y(t) = -\frac{\cos(4t)}{10} + \frac{\sin(4t)}{5} + \frac{11\,e^{2t}}{10}$$

✓ 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 [13047]

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‘]]`

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

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)
```

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

✓ 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 [13048]

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: 0.14 (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 [13049]

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: 0.0 (sec). Leaf size: 14

```
dsolve([diff(y(t),t)+5*y(t)= 3*exp(-5*t),y(0) = -2],y(t), singsol=all)
```

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

✓ 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 [13050]

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]`

$$\boxed{y' - 2ty = 3t\,\mathrm{e}^{t^2}}$$

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)
```

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

✓ 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]
```

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

8.23 problem 36

Internal problem ID [13051]

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]`

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.094 (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 [13052]

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]`

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

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]
```

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

8.25 problem 38

Internal problem ID [13053]

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 [13054]

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: 0.016 (sec). Leaf size: 18

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

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

✓ 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 [13055]

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: 0.016 (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 [13056]

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]`

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

✓ Solution by Maple

Time used: 0.0 (sec). Leaf size: 81

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

$$y(t) = \frac{-2c_1 e^{-2t}\left(\int e^{-\frac{3\pi}{2}+3t-\sin(t)}dt\right) + c_1 e^{t-\frac{3\pi}{2}-\sin(t)} + 2i e^{-2t+\pi}}{-c_1 e^{-2t}\left(\int e^{-\frac{3\pi}{2}+3t-\sin(t)}dt\right) + i e^{-2t+\pi}}$$

✓ 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]
```

$$y(t) \to -\frac{-2\int_1^{e^{it}} e^{\frac{i(K[1]^2-1)}{2K[1]}} K[1]^{-1-3i} dK[1] + i e^{\frac{1}{2}ie^{-it}(-1+e^{2it})}\left(e^{it}\right)^{-3i} - 2c_1}{\int_1^{e^{it}} e^{\frac{i(K[1]^2-1)}{2K[1]}} K[1]^{-1-3i} dK[1] + c_1}$$

$$y(t) \to 2$$

$$y(t) \to 2 - \frac{i e^{\frac{1}{2}ie^{-it}(-1+e^{2it})}\left(e^{it}\right)^{-3i}}{\int_1^{e^{it}} e^{\frac{i(K[1]^2-1)}{2K[1]}} K[1]^{-1-3i} dK[1]}$$

8.29 problem 44

Internal problem ID [13057]

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]`

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

✗ 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 [13058]

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)
```

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

✓ 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 [13059]

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: 0.0 (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: 0.036 (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 [13060]

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: 0.032 (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

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9.1 problem 1

Internal problem ID [13061]

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: 0.016 (sec). Leaf size: 21

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

$$\begin{aligned} x(t) &= c_1 t + c_2 \\ y(t) &= c_1 t - c_1 + c_2 \end{aligned}$$

✓ 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]
```

$$\begin{aligned} x(t) &\to c_1(t+1) - c_2 t \\ y(t) &\to (c_1 - c_2)t + c_2 \end{aligned}$$

9.2 problem 2

Internal problem ID [13062]

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

$$x'(t) = 2x(t) - y$$
$$y' = 0$$

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 19

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

$$x(t) \to \left(c_1 - \frac{c_2}{2}\right) e^{2t} + \frac{c_2}{2}$$
$$y(t) \to c_2$$

9.3 problem 3

Internal problem ID [13063]

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: 0.032 (sec). Leaf size: 21

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

$$x(t) = c_2 e^t$$
$$y(t) = (2c_2 t + c_1) e^t$$

✓ 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 [13064]

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

$$
\begin{aligned}
x'(t) &= -x(t) + 2y \\
y' &= 2x(t) - y
\end{aligned}
$$

✓ 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)],singsol=all)
```

$$
\begin{aligned}
x(t) &= c_1 e^t + c_2 e^{-3t} \\
y(t) &= c_1 e^t - c_2 e^{-3t}
\end{aligned}
$$

✓ 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
```

$$
\begin{aligned}
x(t) &\to \frac{1}{2}e^{-3t}\left(c_1\left(e^{4t}+1\right)+c_2\left(e^{4t}-1\right)\right) \\
y(t) &\to \frac{1}{2}e^{-3t}\left(c_1\left(e^{4t}-1\right)+c_2\left(e^{4t}+1\right)\right)
\end{aligned}
$$

9.5 problem 5

Internal problem ID [13065]

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

$$x'(t) = 2x(t) + y$$
$$y' = x(t) + y$$

✓ 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)=x(t)+y(t)],singsol=all)
```

$$x(t) = c_1 e^{\frac{(3+\sqrt{5})t}{2}} + c_2 e^{-\frac{(\sqrt{5}-3)t}{2}}$$
$$y(t) = \frac{c_1 e^{\frac{(3+\sqrt{5})t}{2}}\sqrt{5}}{2} - \frac{c_2 e^{-\frac{(\sqrt{5}-3)t}{2}}\sqrt{5}}{2} - \frac{c_1 e^{\frac{(3+\sqrt{5})t}{2}}}{2} - \frac{c_2 e^{-\frac{(\sqrt{5}-3)t}{2}}}{2}$$

✓ 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]
```

$$x(t) \to \frac{1}{10}e^{-\frac{1}{2}(\sqrt{5}-3)t}\left(c_1\left(\left(5+\sqrt{5}\right)e^{\sqrt{5}t} + 5 - \sqrt{5}\right) + 2\sqrt{5}c_2\left(e^{\sqrt{5}t} - 1\right)\right)$$
$$y(t) \to \frac{1}{10}e^{-\frac{1}{2}(\sqrt{5}-3)t}\left(2\sqrt{5}c_1\left(e^{\sqrt{5}t} - 1\right) - c_2\left(\left(\sqrt{5}-5\right)e^{\sqrt{5}t} - 5 - \sqrt{5}\right)\right)$$

9.6 problem 6

Internal problem ID [13066]

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: 120

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

$$
\begin{aligned}
x(t) &= c_1 \mathrm{e}^{\frac{\left(3\pi-\sqrt{9\pi^2-4}\right)t}{2}} + c_2 \mathrm{e}^{\frac{\left(3\pi+\sqrt{9\pi^2-4}\right)t}{2}} \\
y(t) &= \left(\frac{\pi}{2} + \frac{\sqrt{9\pi^2-4}}{6}\right) c_2 \mathrm{e}^{\frac{\left(3\pi+\sqrt{9\pi^2-4}\right)t}{2}} + \left(\frac{\pi}{2} - \frac{\sqrt{9\pi^2-4}}{6}\right) c_1 \mathrm{e}^{\frac{\left(3\pi-\sqrt{9\pi^2-4}\right)t}{2}}
\end{aligned}
$$

✓ 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 [13067]

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

$$
\begin{aligned}
p'(t) &= 3p(t) - 2q(t) - 7r(t) \\
q'(t) &= -2p(t) + 6r(t) \\
r'(t) &= \frac{73q(t)}{100} + 2r(t)
\end{aligned}
$$

✓ <u>Solution by Maple</u>

Time used: 0.157 (sec). Leaf size: 1006

```
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(
```

$p(t) =$

$$-\frac{\left(-i\sqrt{3}\left(31130+6i\sqrt{895302429}\right)^{\frac{4}{3}}+\left(31130+6i\sqrt{895302429}\right)^{\frac{4}{3}}+96420i\sqrt{3}\left(31130+6i\sqrt{89530242}\right.\right.}{}$$

$$+\frac{\left(-i\sqrt{3}\left(31130+6i\sqrt{895302429}\right)^{\frac{4}{3}}-\left(31130+6i\sqrt{895302429}\right)^{\frac{4}{3}}+96420i\sqrt{3}\left(31130+6i\sqrt{89530242}\right.\right.}{}$$

$$+\frac{\left(\left(31130+6i\sqrt{895302429}\right)^{\frac{4}{3}}-5114\left(31130+6i\sqrt{895302429}\right)^{\frac{2}{3}}-180i\sqrt{895302429}-96420\left(31130+\right.\right.}{2400\left(31130+6i\sqrt{89530242}\right.}$$

$$q(t) = c_1 \mathrm{e}^{-\frac{\left(i\sqrt{3}\left(31130+6i\sqrt{895302429}\right)^{\frac{2}{3}}-3214i\sqrt{3}+\left(31130+6i\sqrt{895302429}\right)^{\frac{2}{3}}-100\left(31130+6i\sqrt{895302429}\right)^{\frac{1}{3}}+3214\right)t}{60\left(31130+6i\sqrt{895302429}\right)^{\frac{1}{3}}}}$$

$$+ c_2 \mathrm{e}^{\frac{\left(i\sqrt{3}\left(31130+6i\sqrt{895302429}\right)^{\frac{2}{3}}-3214i\sqrt{3}-\left(31130+6i\sqrt{895302429}\right)^{\frac{2}{3}}+100\left(31130+6i\sqrt{895302429}\right)^{\frac{1}{3}}-3214\right)t}{60\left(31130+6i\sqrt{895302429}\right)^{\frac{1}{3}}}}$$

$$+ c_3 \mathrm{e}^{\frac{\left(\left(31130+6i\sqrt{895302429}\right)^{\frac{2}{3}}+50\left(31130+6i\sqrt{895302429}\right)^{\frac{1}{3}}+3214\right)t}{30\left(31130+6i\sqrt{895302429}\right)^{\frac{1}{3}}}}$$

$r(t)$

$$=\frac{\left(i\sqrt{3}\left(31130+6i\sqrt{895302429}\right)^{\frac{4}{3}}-\left(31130+6i\sqrt{895302429}\right)^{\frac{4}{3}}+32140i\sqrt{3}\left(31130+6i\sqrt{895302429}\right)^{\frac{1}{3}}\right.}{}$$

$$-\frac{\left(i\sqrt{3}\left(31130+6i\sqrt{895302429}\right)^{\frac{4}{3}}+\left(31130+6i\sqrt{895302429}\right)^{\frac{4}{3}}+32140i\sqrt{3}\left(31130+6i\sqrt{895302429}\right)\right.}{}$$

$$+\frac{\left(\left(31130+6i\sqrt{895302429}\right)^{\frac{4}{3}}-3114\left(31130+6i\sqrt{895302429}\right)^{\frac{2}{3}}+60i\sqrt{895302429}+32140\left(31130+6\right.\right.}{7200\left(31130+6i\sqrt{89530242}\right.}$$

✓ 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
```

$$p(t) \to -100c_2\text{RootSum}\left[\#1^3 - 500\#1^2 - 23800\#1 + 10920000\&, \frac{2\#1e^{\frac{\#1t}{100}} + 111e^{\frac{\#1t}{100}}}{3\#1^2 - 1000\#1 - 23800}\&\right] - 100c_3\text{RootSum}\left[\#1^3 - 500\#1^2 - 23800\#1 + 10920000\&, \frac{7\#1e^{\frac{\#1t}{100}} + 1200e^{\frac{\#1t}{100}}}{3\#1^2 - 1000\#1 - 23800}\&\right] + c_1\text{RootSum}\left[\#1^3 - 500\#1^2 - 23800\#1 + 10920000\&, \frac{\#1^2e^{\frac{\#1t}{100}} - 200\#1e^{\frac{\#1t}{100}} - 43800e^{\frac{\#1t}{100}}}{3\#1^2 - 1000\#1 - 23800}\&\right]$$

$$q(t) \to -200c_1\text{RootSum}\left[\#1^3 - 500\#1^2 - 23800\#1 + 10920000\&, \frac{\#1e^{\frac{\#1t}{100}} - 200e^{\frac{\#1t}{100}}}{3\#1^2 - 1000\#1 - 23800}\&\right] + 200c_3\text{RootSum}\left[\#1^3 - 500\#1^2 - 23800\#1 + 10920000\&, \frac{3\#1e^{\frac{\#1t}{100}} - 200e^{\frac{\#1t}{100}}}{3\#1^2 - 1000\#1 - 23800}\&\right] + c_2\text{RootSum}\left[\#1^3 - 500\#1^2 - 23800\#1 + 10920000\&, \frac{\#1^2e^{\frac{\#1t}{100}} - 500\#1e^{\frac{\#1t}{100}} + 60000e^{\frac{\#1t}{100}}}{3\#1^2 - 1000\#1 - 23800}\&\right]$$

$$r(t) \to -14600c_1\text{RootSum}\left[\#1^3 - 500\#1^2 - 23800\#1 + 10920000\&, \frac{e^{\frac{\#1t}{100}}}{3\#1^2 - 1000\#1 - 23800}\&\right] + 73c_2\text{RootSum}\left[\#1^3 - 500\#1^2 - 23800\#1 + 10920000\&, \frac{\#1e^{\frac{\#1t}{100}} - 300e^{\frac{\#1t}{100}}}{3\#1^2 - 1000\#1 - 23800}\&\right] + c_3\text{RootSum}\left[\#1^3 - 500\#1^2 - 23800\#1 + 10920000\&, \frac{\#1^2e^{\frac{\#1t}{100}} - 300\#1e^{\frac{\#1t}{100}} - 40000e^{\frac{\#1t}{100}}}{3\#1^2 - 1000\#1 - 23800}\&\right]$$

9.8 problem 8

Internal problem ID [13068]

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

$$x'(t) = -3x(t) + 2\pi y$$
$$y' = 4x(t) - y$$

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 119

```
dsolve([diff(x(t),t)=-3*x(t)+2*Pi*y(t),diff(y(t),t)=4*x(t)-y(t)],singsol=all)
```

$$x(t) = c_1 e^{-\left(2+\sqrt{1+8\pi}\right)t} + c_2 e^{\left(-2+\sqrt{1+8\pi}\right)t}$$
$$y(t) = -\frac{c_1 e^{-\left(2+\sqrt{1+8\pi}\right)t}\sqrt{1+8\pi} - c_2 e^{\left(-2+\sqrt{1+8\pi}\right)t}\sqrt{1+8\pi} - c_1 e^{-\left(2+\sqrt{1+8\pi}\right)t} - c_2 e^{\left(-2+\sqrt{1+8\pi}\right)t}}{2\pi}$$

✓ 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 [13069]

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: 0.046 (sec). Leaf size: 119

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

$$
\begin{aligned}
x(t) &= c_1 \mathrm{e}^{\frac{\left(-1+\sqrt{4\beta\gamma+1}\right)t}{2}} + c_2 \mathrm{e}^{-\frac{\left(1+\sqrt{4\beta\gamma+1}\right)t}{2}} \\
y(t) &= \frac{\left(-\frac{1}{2}+\frac{\sqrt{4\beta\gamma+1}}{2}\right) c_1 \mathrm{e}^{\frac{\left(-1+\sqrt{4\beta\gamma+1}\right)t}{2}}}{\beta} + \frac{\left(-\frac{\mathrm{e}^{-\frac{\left(1+\sqrt{4\beta\gamma+1}\right)t}{2}}\sqrt{4\beta\gamma+1}}{2} - \frac{\mathrm{e}^{-\frac{\left(1+\sqrt{4\beta\gamma+1}\right)t}{2}}}{2}\right) c_2}{\beta}
\end{aligned}
$$

✓ 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
```

$$
\begin{aligned}
&x(t) \\
&\to \frac{e^{-\frac{1}{2}t\left(\sqrt{4\beta\gamma+1}+1\right)}\left(c_1\left(\sqrt{4\beta\gamma+1}+\left(\sqrt{4\beta\gamma+1}+1\right)e^{t\sqrt{4\beta\gamma+1}}-1\right)+2\beta c_2\left(e^{t\sqrt{4\beta\gamma+1}}-1\right)\right)}{2\sqrt{4\beta\gamma+1}} \\
&y(t) \\
&\to \frac{e^{-\frac{1}{2}t\left(\sqrt{4\beta\gamma+1}+1\right)}\left(2\gamma c_1\left(e^{t\sqrt{4\beta\gamma+1}}-1\right)+c_2\left(\sqrt{4\beta\gamma+1}+\left(\sqrt{4\beta\gamma+1}-1\right)e^{t\sqrt{4\beta\gamma+1}}+1\right)\right)}{2\sqrt{4\beta\gamma+1}}
\end{aligned}
$$

9.10 problem 24

Internal problem ID [13070]

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: 0.016 (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], singsol=all)
```

$$
\begin{aligned}
x(t) &= -\frac{2\,\mathrm{e}^{-t}}{3} - \frac{4\,\mathrm{e}^{2t}}{3} \\
y(t) &= \frac{\mathrm{e}^{-t}}{3} - \frac{4\,\mathrm{e}^{2t}}{3}
\end{aligned}
$$

✓ 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 [13071]

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: 26

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

$$
\begin{aligned}
x(t) &= -2\,\mathrm{e}^{2t} t \\
y(t) &= -\mathrm{e}^{2t}(-2t - 2)
\end{aligned}
$$

✓ 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 [13072]

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

$$
\begin{aligned}
x'(t) &= -2x(t) - y \\
y' &= 2x(t) - 5y
\end{aligned}
$$

With initial conditions

$$[x(0) = 2, y(0) = 3]$$

✓ Solution by Maple
Time used: 0.031 (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], sing
```

$$
\begin{aligned}
x(t) &= e^{-4t} + e^{-3t} \\
y(t) &= 2\,e^{-4t} + e^{-3t}
\end{aligned}
$$

✓ 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
```

$$
\begin{aligned}
x(t) &\to e^{-4t}(e^t + 1) \\
y(t) &\to e^{-4t}(e^t + 2)
\end{aligned}
$$

9.13 problem 28

Internal problem ID [13073]

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: 0.031 (sec). Leaf size: 45

```
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], si
```

$$x(t) = e^{-2t}(-3\sin(3t) + 2\cos(3t))$$
$$y(t) = -e^{-2t}(-3\cos(3t) - 2\sin(3t))$$

✓ 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 [13074]

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

$$x'(t) = 2x(t) + 3y$$
$$y' = x(t)$$

With initial conditions

$$[x(0) = 2, y(0) = 3]$$

✓ Solution by Maple
Time used: 0.031 (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], singsol=all)
```

$$x(t) = \frac{15\,e^{3t}}{4} - \frac{7\,e^{-t}}{4}$$
$$y(t) = \frac{5\,e^{3t}}{4} + \frac{7\,e^{-t}}{4}$$

✓ 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
```

$$x(t) \to \frac{1}{4}e^{-t}\left(15e^{4t} - 7\right)$$
$$y(t) \to \frac{1}{4}e^{-t}\left(5e^{4t} + 7\right)$$

9.15 problem 34

Internal problem ID [13075]

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)],singsol=all)
```

$$\begin{aligned} x(t) &= c_2 + t \\ y(t) &= c_2 t + \frac{1}{2}t^2 + c_1 \end{aligned}$$

✓ 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

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10.1 problem 1

Internal problem ID [13076]

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)],singsol=all)
```

$$x(t) = c_2 e^{3t}$$
$$y(t) = c_1 e^{-2t}$$

✓ 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 [13077]

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)],singsol=all)
```

$$x(t) = c_1 e^{-5t} + c_2 e^{-2t}$$
$$y(t) = \frac{c_1 e^{-5t}}{2} - c_2 e^{-2t}$$

✓ 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 ->
```

$$x(t) \to \frac{1}{3}e^{-5t}\left(c_1\left(e^{3t}+2\right) - 2c_2\left(e^{3t}-1\right)\right)$$
$$y(t) \to \frac{1}{3}e^{-5t}\left(c_1\left(-e^{3t}\right) + 2c_2e^{3t} + c_1 + c_2\right)$$

10.3 problem 3

Internal problem ID [13078]

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

$$
\begin{aligned}
x'(t) &= -5x(t) - 2y \\
y' &= -x(t) - 4y
\end{aligned}
$$

✓ 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)],singsol=all)
```

$$
\begin{aligned}
x(t) &= \mathrm{e}^{-6t}c_1 + c_2\mathrm{e}^{-3t} \\
y(t) &= \frac{\mathrm{e}^{-6t}c_1}{2} - c_2\mathrm{e}^{-3t}
\end{aligned}
$$

✓ 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 ->
```

$$
\begin{aligned}
x(t) &\to \frac{1}{3}e^{-6t}\left(c_1\left(e^{3t}+2\right) - 2c_2\left(e^{3t}-1\right)\right) \\
y(t) &\to \frac{1}{3}e^{-6t}\left(c_1\left(-e^{3t}\right) + 2c_2e^{3t} + c_1 + c_2\right)
\end{aligned}
$$

10.4 problem 4

Internal problem ID [13079]

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

$$
\begin{aligned}
x'(t) &= 2x(t) + y \\
y' &= -x(t) + 4y
\end{aligned}
$$

✓ Solution by Maple
Time used: 0.0 (sec). Leaf size: 29

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

$$
\begin{aligned}
x(t) &= e^{3t}(c_2 t + c_1) \\
y(t) &= e^{3t}(c_2 t + c_1 + c_2)
\end{aligned}
$$

✓ 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 ->
```

$$
\begin{aligned}
x(t) &\to e^{3t}(c_1(-t) + c_2 t + c_1) \\
y(t) &\to e^{3t}((c_2 - c_1)t + c_2)
\end{aligned}
$$

10.5 problem 5

Internal problem ID [13080]

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

$$x'(t) = -\frac{x(t)}{2}$$
$$y' = x(t) - \frac{y}{2}$$

✓ Solution by Maple

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

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

$$x(t) = c_2 e^{-\frac{t}{2}}$$
$$y(t) = (c_2 t + c_1) e^{-\frac{t}{2}}$$

✓ 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
```

$$x(t) \to c_1 e^{-t/2}$$
$$y(t) \to e^{-t/2}(c_1 t + c_2)$$

10.6 problem 6

Internal problem ID [13081]

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)],singsol=all)
```

$$x(t) = -\frac{4\,\mathrm{e}^{-4t}c_1}{9} + c_2\mathrm{e}^{9t}$$
$$y(t) = \mathrm{e}^{-4t}c_1 + c_2\mathrm{e}^{9t}$$

✓ 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 [13082]

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: 0.015 (sec). Leaf size: 36

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

$$
\begin{aligned}
x(t) &= 4c_1 e^{4t} - c_2 e^{-t} \\
y(t) &= c_1 e^{4t} + c_2 e^{-t}
\end{aligned}
$$

✓ 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 [13083]

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: 0.016 (sec). Leaf size: 86

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

$$
\begin{aligned}
x(t) &= c_1 \mathrm{e}^{\frac{(3+\sqrt{5})t}{2}} + c_2 \mathrm{e}^{-\frac{(\sqrt{5}-3)t}{2}} \\
y(t) &= -\frac{c_1 \mathrm{e}^{\frac{(3+\sqrt{5})t}{2}} \sqrt{5}}{2} + \frac{c_2 \mathrm{e}^{-\frac{(\sqrt{5}-3)t}{2}} \sqrt{5}}{2} + \frac{c_1 \mathrm{e}^{\frac{(3+\sqrt{5})t}{2}}}{2} + \frac{c_2 \mathrm{e}^{-\frac{(\sqrt{5}-3)t}{2}}}{2}
\end{aligned}
$$

✓ 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 [13084]

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

$$
\begin{aligned}
x'(t) &= 2x(t) + y \\
y' &= x(t) + y
\end{aligned}
$$

✓ 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)],singsol=all)
```

$$
\begin{aligned}
x(t) &= c_1 e^{\frac{(3+\sqrt{5})t}{2}} + c_2 e^{-\frac{(\sqrt{5}-3)t}{2}} \\
y(t) &= \frac{c_1 e^{\frac{(3+\sqrt{5})t}{2}} \sqrt{5}}{2} - \frac{c_2 e^{-\frac{(\sqrt{5}-3)t}{2}} \sqrt{5}}{2} - \frac{c_1 e^{\frac{(3+\sqrt{5})t}{2}}}{2} - \frac{c_2 e^{-\frac{(\sqrt{5}-3)t}{2}}}{2}
\end{aligned}
$$

✓ 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]
```

$$
\begin{aligned}
x(t) &\to \frac{1}{10} e^{-\frac{1}{2}(\sqrt{5}-3)t} \left(c_1 \left(\left(5+\sqrt{5}\right) e^{\sqrt{5}t} + 5 - \sqrt{5} \right) + 2\sqrt{5} c_2 \left(e^{\sqrt{5}t} - 1 \right) \right) \\
y(t) &\to \frac{1}{10} e^{-\frac{1}{2}(\sqrt{5}-3)t} \left(2\sqrt{5} c_1 \left(e^{\sqrt{5}t} - 1 \right) - c_2 \left(\left(\sqrt{5}-5\right) e^{\sqrt{5}t} - 5 - \sqrt{5} \right) \right)
\end{aligned}
$$

10.10 problem 10

Internal problem ID [13085]

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: 0.031 (sec). Leaf size: 35

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

$$x(t) = c_1 \mathrm{e}^{-2t} + c_2 \mathrm{e}^{-3t}$$
$$y(t) = \frac{c_1 \mathrm{e}^{-2t}}{2} + c_2 \mathrm{e}^{-3t}$$

✓ 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 [13086]

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], sin
```

$$x(t) = \frac{e^{2t}}{5} + \frac{4\,e^{-3t}}{5}$$
$$y(t) = -\frac{2\,e^{2t}}{5} + \frac{2\,e^{-3t}}{5}$$

✓ 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 [13087]

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: 0.016 (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) = 0, y(0) = 1], sin
```

$$x(t) = -\frac{2\,e^{2t}}{5} + \frac{2\,e^{-3t}}{5}$$
$$y(t) = \frac{4\,e^{2t}}{5} + \frac{e^{-3t}}{5}$$

✓ 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 [13088]

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

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.0 (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], si
```

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

✓ 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
```

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

10.14 problem 12 (a)

Internal problem ID [13089]

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], singsol=all)
```

$$x(t) = e^{3t}$$
$$y(t) = \frac{e^{3t}}{5} - \frac{e^{-2t}}{5}$$

✓ 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 [13090]

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

$$x'(t) = 3x(t)$$
$$y' = x(t) - 2y$$

With initial conditions

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

✓ Solution by Maple
Time used: 0.0 (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], singsol=all)
```

$$x(t) = 0$$
$$y(t) = \mathrm{e}^{-2t}$$

✓ 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
```

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

10.16 problem 12 (c)

Internal problem ID [13091]

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

$$\begin{aligned} x'(t) &= 3x(t) \\ y' &= x(t) - 2y \end{aligned}$$

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], singsol=all)
```

$$\begin{aligned} x(t) &= 2\,\mathrm{e}^{3t} \\ y(t) &= \frac{2\,\mathrm{e}^{3t}}{5} + \frac{8\,\mathrm{e}^{-2t}}{5} \end{aligned}$$

✓ 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
```

$$\begin{aligned} x(t) &\rightarrow 2e^{3t} \\ y(t) &\rightarrow \frac{2}{5}e^{-2t}\left(e^{5t} + 4\right) \end{aligned}$$

10.17 problem 13 (a)

Internal problem ID [13092]

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], sing
```

$$
\begin{aligned}
x(t) &= \frac{2\,\mathrm{e}^{-5t}}{3} + \frac{\mathrm{e}^{-2t}}{3} \\
y(t) &= -\frac{2\,\mathrm{e}^{-5t}}{3} + \frac{2\,\mathrm{e}^{-2t}}{3}
\end{aligned}
$$

✓ 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
```

$$
\begin{aligned}
x(t) &\to \frac{1}{3}e^{-5t}\left(e^{3t} + 2\right) \\
y(t) &\to \frac{2}{3}e^{-5t}\left(e^{3t} - 1\right)
\end{aligned}
$$

10.18 problem 13 (b)

Internal problem ID [13093]

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: 0.016 (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], sing
```

$$x(t) = e^{-5t} + e^{-2t}$$
$$y(t) = -e^{-5t} + 2e^{-2t}$$

✓ 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
```

$$x(t) \to e^{-5t} + e^{-2t}$$
$$y(t) \to e^{-5t}(2e^{3t} - 1)$$

10.19 problem 13 (c)

Internal problem ID [13094]

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], si
```

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

✓ 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 [13095]

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: 0.032 (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], singsol
```

$$x(t) = 2\,e^{3t} - e^{2t}$$
$$y(t) = e^{3t} - e^{2t}$$

✓ 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 [13096]

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], singsol
```

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

✓ 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 [13097]

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: 0.016 (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) = -2], sings
```

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

✓ 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
```

$$x(t) \to e^{2t}(2e^t - 3)$$
$$y(t) \to e^{2t}(e^t - 3)$$

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11.1 problem 3

Internal problem ID [13098]

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

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

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], singsol=all)
```

$$x(t) = \cos(2t)$$
$$y(t) = -\sin(2t)$$

✓ 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
```

$$x(t) \to \cos(2t)$$
$$y(t) \to -\sin(2t)$$

11.2 problem 4

Internal problem ID [13099]

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], si
```

$$x(t) = e^{4t} \cos(2t)$$
$$y(t) = e^{4t}(\cos(2t) - \sin(2t))$$

✓ 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 [13100]

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: 0.047 (sec). Leaf size: 48

```
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], sing
```

$$x(t) = e^{-t}\left(-\frac{8\sqrt{11}\,\sin\left(\sqrt{11}\,t\right)}{11} + 4\cos\left(\sqrt{11}\,t\right)\right)$$
$$y(t) = \frac{12\,e^{-t}\sqrt{11}\,\sin\left(\sqrt{11}\,t\right)}{11}$$

✓ 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 [13101]

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

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

With initial conditions

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

✓ Solution by Maple

Time used: 0.032 (sec). Leaf size: 63

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

$$x(t) = e^{-\frac{t}{2}} \left(\frac{\sqrt{15}\, \sin\left(\frac{t\sqrt{15}}{2}\right)}{5} - \cos\left(\frac{t\sqrt{15}}{2}\right) \right)$$
$$y(t) = -\frac{e^{-\frac{t}{2}} \left(-\frac{4\sqrt{15}\, \sin\left(\frac{t\sqrt{15}}{2}\right)}{5} - 4\cos\left(\frac{t\sqrt{15}}{2}\right) \right)}{4}$$

✓ 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 [13102]

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

$$x'(t) = 2x(t) - 6y$$
$$y' = 2x(t) + y$$

With initial conditions

$$[x(0) = 2, y(0) = 1]$$

✓ Solution by Maple

Time used: 0.032 (sec). Leaf size: 63

```
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], sings
```

$$x(t) = e^{\frac{3t}{2}} \left(-\frac{10\sqrt{47}\, \sin\left(\frac{\sqrt{47}\, t}{2}\right)}{47} + 2\cos\left(\frac{\sqrt{47}\, t}{2}\right)\right)$$

$$y(t) = \frac{e^{\frac{3t}{2}} \left(\frac{84\sqrt{47}\, \sin\left(\frac{\sqrt{47}\, t}{2}\right)}{47} + 12\cos\left(\frac{\sqrt{47}\, t}{2}\right)\right)}{12}$$

✓ 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 [13103]

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

$$x'(t) = x(t) + 4y$$
$$y' = -3x(t) + 2y$$

With initial conditions

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

✓ Solution by Maple
Time used: 0.031 (sec). Leaf size: 61

```
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], sin
```

$$x(t) = \mathrm{e}^{\frac{3t}{2}} \left(-\frac{9\sqrt{47}\,\sin\left(\frac{\sqrt{47}\,t}{2}\right)}{47} + \cos\left(\frac{\sqrt{47}\,t}{2}\right)\right)$$
$$y(t) = -\frac{\mathrm{e}^{\frac{3t}{2}} \left(\frac{56\sqrt{47}\,\sin\left(\frac{\sqrt{47}\,t}{2}\right)}{47} + 8\cos\left(\frac{\sqrt{47}\,t}{2}\right)\right)}{8}$$

✓ 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 [13104]

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: 0.0 (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], singsol=all)
```

$$x(t) = \cos(2t)$$
$$y(t) = -\sin(2t)$$

✓ 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 [13105]

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

$$
\begin{aligned}
x'(t) &= 2x(t) + 2y \\
y' &= -4x(t) + 6y
\end{aligned}
$$

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], si
```

$$
\begin{aligned}
x(t) &= e^{4t} \cos(2t) \\
y(t) &= e^{4t}(\cos(2t) - \sin(2t))
\end{aligned}
$$

✓ 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
```

$$
\begin{aligned}
x(t) &\to e^{4t} \cos(2t) \\
y(t) &\to e^{4t}(\cos(2t) - \sin(2t))
\end{aligned}
$$

11.9 problem 11

Internal problem ID [13106]

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

$$x'(t) = -3x(t) - 5y$$
$$y' = 3x(t) + y$$

With initial conditions

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

✓ Solution by Maple
Time used: 0.016 (sec). Leaf size: 48

```
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], sing
```

$$x(t) = e^{-t}\left(-\frac{8\sqrt{11}\,\sin\left(\sqrt{11}\,t\right)}{11} + 4\cos\left(\sqrt{11}\,t\right)\right)$$
$$y(t) = \frac{12\,e^{-t}\sqrt{11}\,\sin\left(\sqrt{11}\,t\right)}{11}$$

✓ 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]+1*y[t]},{x[0]==4,y[0]==0},{x[t],y[t]},t,IncludeS
```

$$x(t) \to \frac{4}{11}e^{-t}\left(11\cos\left(\sqrt{11}t\right) - 2\sqrt{11}\sin\left(\sqrt{11}t\right)\right)$$
$$y(t) \to \frac{12e^{-t}\sin\left(\sqrt{11}t\right)}{\sqrt{11}}$$

11.10 problem 12

Internal problem ID [13107]

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: 0.015 (sec). Leaf size: 63

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

$$
\begin{aligned}
x(t) &= \mathrm{e}^{-\frac{t}{2}} \left(\frac{\sqrt{15}\, \sin\left(\frac{t\sqrt{15}}{2}\right)}{5} - \cos\left(\frac{t\sqrt{15}}{2}\right) \right) \\
y(t) &= -\frac{\mathrm{e}^{-\frac{t}{2}} \left(-\frac{4\sqrt{15}\, \sin\left(\frac{t\sqrt{15}}{2}\right)}{5} - 4\cos\left(\frac{t\sqrt{15}}{2}\right) \right)}{4}
\end{aligned}
$$

✓ 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
```

$$
\begin{aligned}
x(t) &\to \frac{1}{5} e^{-t/2} \left(\sqrt{15} \sin\left(\frac{\sqrt{15}t}{2}\right) - 5\cos\left(\frac{\sqrt{15}t}{2}\right) \right) \\
y(t) &\to \frac{1}{5} e^{-t/2} \left(\sqrt{15} \sin\left(\frac{\sqrt{15}t}{2}\right) + 5\cos\left(\frac{\sqrt{15}t}{2}\right) \right)
\end{aligned}
$$

11.11 problem 13

Internal problem ID [13108]

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: 0.0 (sec). Leaf size: 63

```
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], sings
```

$$x(t) = \mathrm{e}^{\frac{3t}{2}} \left(-\frac{10\sqrt{47}\,\sin\left(\frac{\sqrt{47}\,t}{2}\right)}{47} + 2\cos\left(\frac{\sqrt{47}\,t}{2}\right) \right)$$
$$y(t) = \frac{\mathrm{e}^{\frac{3t}{2}} \left(\frac{84\sqrt{47}\,\sin\left(\frac{\sqrt{47}\,t}{2}\right)}{47} + 12\cos\left(\frac{\sqrt{47}\,t}{2}\right) \right)}{12}$$

✓ 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 [13109]

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: 61

```
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], sin
```

$$x(t) = e^{\frac{3t}{2}} \left(-\frac{9\sqrt{47}\sin\left(\frac{\sqrt{47}\,t}{2}\right)}{47} + \cos\left(\frac{\sqrt{47}\,t}{2}\right) \right)$$

$$y(t) = -\frac{e^{\frac{3t}{2}} \left(\frac{56\sqrt{47}\sin\left(\frac{\sqrt{47}\,t}{2}\right)}{47} + 8\cos\left(\frac{\sqrt{47}\,t}{2}\right) \right)}{8}$$

✓ 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 [13110]

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

$$x'(t) = -\frac{9x(t)}{10} - 2y$$
$$y' = x(t) + \frac{11y}{10}$$

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
```

$$x(t) = e^{\frac{t}{10}}(-3\sin(t) + \cos(t))$$
$$y(t) = -\frac{e^{\frac{t}{10}}(-4\sin(t) - 2\cos(t))}{2}$$

✓ 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
```

$$x(t) \to e^{t/10}(\cos(t) - 3\sin(t))$$
$$y(t) \to e^{t/10}(2\sin(t) + \cos(t))$$

11.14 problem 26

Internal problem ID [13111]

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

$$x'(t) = -3x(t) + 10y$$
$$y' = -x(t) + 3y$$

✓ Solution by Maple

Time used: 0.015 (sec). Leaf size: 38

```
dsolve([diff(x(t),t)=-3*x(t)+10*y(t),diff(y(t),t)=-x(t)+3*y(t)],singsol=all)
```

$$x(t) = c_1 \sin(t) + c_2 \cos(t)$$
$$y(t) = \frac{c_1 \cos(t)}{10} - \frac{c_2 \sin(t)}{10} + \frac{3c_1 \sin(t)}{10} + \frac{3c_2 \cos(t)}{10}$$

✓ 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 -
```

$$x(t) \to 10c_2 \sin(t) + c_1(\cos(t) - 3\sin(t))$$
$$y(t) \to c_2(3\sin(t) + \cos(t)) - c_1 \sin(t)$$

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12.1 problem 1

Internal problem ID [13112]

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: 0.032 (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], singsol=all
```

$$x(t) = \mathrm{e}^{-3t}$$
$$y(t) = t\,\mathrm{e}^{-3t}$$

✓ 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 [13113]

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: 0.032 (sec). Leaf size: 106

```
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], singso
```

$$
\begin{aligned}
x(t) &= \left(\frac{1}{2}+\frac{\sqrt{3}}{3}\right) \mathrm{e}^{\sqrt{3}\, t}+\left(\frac{1}{2}-\frac{\sqrt{3}}{3}\right) \mathrm{e}^{-\sqrt{3}\, t} \\
y(t) &= \left(\frac{1}{2}+\frac{\sqrt{3}}{3}\right) \sqrt{3}\, \mathrm{e}^{\sqrt{3}\, t}-\left(\frac{1}{2}-\frac{\sqrt{3}}{3}\right) \sqrt{3}\, \mathrm{e}^{-\sqrt{3}\, t} \\
&\quad -2\left(\frac{1}{2}+\frac{\sqrt{3}}{3}\right) \mathrm{e}^{\sqrt{3}\, t}-2\left(\frac{1}{2}-\frac{\sqrt{3}}{3}\right) \mathrm{e}^{-\sqrt{3}\, t}
\end{aligned}
$$

✓ 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
```

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

12.3 problem 3

Internal problem ID [13114]

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

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

With initial conditions

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

✓ Solution by Maple
Time used: 0.031 (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], singso
```

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

✓ 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
```

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

12.4 problem 4

Internal problem ID [13115]

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: 23

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

$$
\begin{aligned}
x(t) &= \mathrm{e}^{-t}(t+1) \\
y(t) &= -t\,\mathrm{e}^{-t}
\end{aligned}
$$

✓ 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 [13116]

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

$$x'(t) = -3x(t)$$
$$y' = x(t) - 3y$$

With initial conditions

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

✓ Solution by Maple
Time used: 0.015 (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], singsol=all
```

$$x(t) = e^{-3t}$$
$$y(t) = t\,e^{-3t}$$

✓ 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
```

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

12.6 problem 6

Internal problem ID [13117]

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

$$
\begin{aligned}
x'(t) &= 2x(t) + y \\
y' &= -x(t) + 4y
\end{aligned}
$$

With initial conditions

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

✓ Solution by Maple
Time used: 0.016 (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], singso
```

$$
\begin{aligned}
x(t) &= e^{3t}(-t + 1) \\
y(t) &= -e^{3t}t
\end{aligned}
$$

✓ Solution by Mathematica
Time used: 0.004 (sec). Leaf size: 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
```

$$
\begin{aligned}
x(t) &\to -e^{3t}(t - 1) \\
y(t) &\to -e^{3t}t
\end{aligned}
$$

12.7 problem 7

Internal problem ID [13118]

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], singso
```

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

✓ 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 [13119]

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

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

With initial conditions

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

✓ Solution by Maple
Time used: 0.015 (sec). Leaf size: 23

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

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

✓ 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
```

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

12.9 problem 17

Internal problem ID [13120]

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

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

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], singsol=all)
```

$$x(t) = 1$$
$$y(t) = 0$$

✓ 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
```

$$x(t) \to 1$$
$$y(t) \to 0$$

12.10 problem 18

Internal problem ID [13121]

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

$$x'(t) = 2x(t) + 4y$$
$$y' = 3x(t) + 6y$$

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) = 2*x(t)+4*y(t), diff(y(t),t) = 3*x(t)+6*y(t), x(0) = 1, y(0) = 0], sin
```

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

✓ 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
```

$$x(t) \to \frac{1}{4}(e^{8t} + 3)$$
$$y(t) \to \frac{3}{8}(e^{8t} - 1)$$

12.11 problem 19

Internal problem ID [13122]

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

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

With initial conditions

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

✓ Solution by Maple
Time used: 0.016 (sec). Leaf size: 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], sings
```

$$x(t) = \frac{1}{5} + \frac{4\,e^{5t}}{5}$$
$$y(t) = \frac{2\,e^{5t}}{5} - \frac{2}{5}$$

✓ 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
```

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

12.12 problem 21(a)

Internal problem ID [13123]

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

$$
\begin{aligned}
x'(t) &= 2y \\
y' &= 0
\end{aligned}
$$

✓ Solution by Maple
Time used: 0.016 (sec). Leaf size: 15

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

$$
\begin{aligned}
x(t) &= 2c_2t + c_1 \\
y(t) &= c_2
\end{aligned}
$$

✓ 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]
```

$$
\begin{aligned}
x(t) &\to 2c_2t + c_1 \\
y(t) &\to c_2
\end{aligned}
$$

12.13 problem 21(b)

Internal problem ID [13124]

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: 0.016 (sec). Leaf size: 15

```
dsolve([diff(x(t),t)=-2*y(t),diff(y(t),t)=0],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 [13125]

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], sings
```

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

✓ 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
```

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

13 Chapter 3. Linear Systems. Exercises section 3.6 page 342

13.1 problem 1 283
13.2 problem 2 284

13.1 problem 1

Internal problem ID [13126]

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: 0.0 (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 [13127]

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: 0.015 (sec). Leaf size: 17

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

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

✓ 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]
```

$$y(t) \to e^{-3t}\left(c_2e^{7t} + c_1\right)$$

14 Chapter 3. Linear Systems. Exercises section 3.8 page 371

14.1 problem 1 286
14.2 problem 4 288
14.3 problem 5 289
14.4 problem 6 290
14.5 problem 7 291
14.6 problem 10 292
14.7 problem 11 293
14.8 problem 12 294
14.9 problem 13 296
14.10 problem 14 297
14.11 problem 15 298
14.12 problem 16 299
14.13 problem 17 301
14.14 problem 18 302
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14.1 problem 1

Internal problem ID [13128]

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: 0.047 (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),
```

$$
\begin{aligned}
x(t) &= \frac{e^{\frac{t}{5}} c_1}{2} - \frac{c_2 e^{-\frac{t}{10}} \sin\left(\frac{\sqrt{3}\,t}{10}\right)}{4} + \frac{c_2 e^{-\frac{t}{10}} \sqrt{3}\, \cos\left(\frac{\sqrt{3}\,t}{10}\right)}{4} \\
&\quad - \frac{c_3 e^{-\frac{t}{10}} \cos\left(\frac{\sqrt{3}\,t}{10}\right)}{4} - \frac{c_3 e^{-\frac{t}{10}} \sqrt{3}\, \sin\left(\frac{\sqrt{3}\,t}{10}\right)}{4} \\
y(t) &= e^{\frac{t}{5}} c_1 - \frac{c_2 e^{-\frac{t}{10}} \sin\left(\frac{\sqrt{3}\,t}{10}\right)}{2} - \frac{c_2 e^{-\frac{t}{10}} \sqrt{3}\, \cos\left(\frac{\sqrt{3}\,t}{10}\right)}{2} \\
&\quad - \frac{c_3 e^{-\frac{t}{10}} \cos\left(\frac{\sqrt{3}\,t}{10}\right)}{2} + \frac{c_3 e^{-\frac{t}{10}} \sqrt{3}\, \sin\left(\frac{\sqrt{3}\,t}{10}\right)}{2} \\
z(t) &= e^{\frac{t}{5}} c_1 + c_2 e^{-\frac{t}{10}} \sin\left(\frac{\sqrt{3}\,t}{10}\right) + c_3 e^{-\frac{t}{10}} \cos\left(\frac{\sqrt{3}\,t}{10}\right)
\end{aligned}
$$

✓ 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 [13129]

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: 0.015 (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*
```

$$
\begin{aligned}
x(t) &= c_1 \sin(t) + c_2 \cos(t) \\
y(t) &= c_1 \cos(t) - c_2 \sin(t) \\
z(t) &= c_3 e^{2t}
\end{aligned}
$$

✓ 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]
```

$$
\begin{aligned}
x(t) &\to c_1 \cos(t) + c_2 \sin(t) \\
y(t) &\to c_2 \cos(t) - c_1 \sin(t) \\
z(t) &\to c_3 e^{2t} \\
x(t) &\to c_1 \cos(t) + c_2 \sin(t) \\
y(t) &\to c_2 \cos(t) - c_1 \sin(t) \\
z(t) &\to 0
\end{aligned}
$$

14.3 problem 5

Internal problem ID [13130]

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

$$x'(t) = -2x(t) + 3y$$
$$y' = 3x(t) - 2y$$
$$z'(t) = -z(t)$$

✓ Solution by Maple

Time used: 0.031 (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*
```

$$x(t) = c_1 e^{-5t} + c_2 e^{t}$$
$$y(t) = -c_1 e^{-5t} + c_2 e^{t}$$
$$z(t) = c_3 e^{-t}$$

✓ 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]
```

$$x(t) \to \frac{1}{2} e^{-5t} \left(c_1 \left(e^{6t} + 1\right) + c_2 \left(e^{6t} - 1\right)\right)$$
$$y(t) \to \frac{1}{2} e^{-5t} \left(c_1 \left(e^{6t} - 1\right) + c_2 \left(e^{6t} + 1\right)\right)$$
$$z(t) \to c_3 e^{-t}$$
$$x(t) \to \frac{1}{2} e^{-5t} \left(c_1 \left(e^{6t} + 1\right) + c_2 \left(e^{6t} - 1\right)\right)$$
$$y(t) \to \frac{1}{2} e^{-5t} \left(c_1 \left(e^{6t} - 1\right) + c_2 \left(e^{6t} + 1\right)\right)$$
$$z(t) \to 0$$

14.4 problem 6

Internal problem ID [13131]

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

$$
\begin{aligned}
x'(t) &= x(t) + 3z(t) \\
y' &= -y \\
z'(t) &= -3x(t) + z(t)
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 50

```
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*
```

$$
\begin{aligned}
x(t) &= e^t(c_1 \sin(3t) + c_2 \cos(3t)) \\
y(t) &= c_3 e^{-t} \\
z(t) &= e^t(c_1 \cos(3t) - c_2 \sin(3t))
\end{aligned}
$$

✓ 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]
```

$$
\begin{aligned}
x(t) &\to e^t(c_1 \cos(3t) + c_2 \sin(3t)) \\
z(t) &\to e^t(c_2 \cos(3t) - c_1 \sin(3t)) \\
y(t) &\to c_3 e^{-t} \\
x(t) &\to e^t(c_1 \cos(3t) + c_2 \sin(3t)) \\
z(t) &\to e^t(c_2 \cos(3t) - c_1 \sin(3t)) \\
y(t) &\to 0
\end{aligned}
$$

14.5 problem 7

Internal problem ID [13132]

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

$$x'(t) = x(t)$$
$$y' = 2y - z(t)$$
$$z'(t) = -y + 2z(t)$$

✓ Solution by Maple

Time used: 0.031 (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
```

$$x(t) = c_3 e^t$$
$$y(t) = c_1 e^t + c_2 e^{3t}$$
$$z(t) = c_1 e^t - c_2 e^{3t}$$

✓ 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 [13133]

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

$$
\begin{aligned}
x'(t) &= -2x(t) + y \\
y' &= -2y \\
z'(t) &= -z(t)
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.032 (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*
```

$$
\begin{aligned}
x(t) &= (c_2 t + c_1)\, \mathrm{e}^{-2t} \\
y(t) &= c_2 \mathrm{e}^{-2t} \\
z(t) &= c_3 \mathrm{e}^{-t}
\end{aligned}
$$

✓ 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]
```

$$
\begin{aligned}
x(t) &\to e^{-2t}(c_2 t + c_1) \\
y(t) &\to c_2 e^{-2t} \\
z(t) &\to c_3 e^{-t} \\
x(t) &\to e^{-2t}(c_2 t + c_1) \\
y(t) &\to c_2 e^{-2t} \\
z(t) &\to 0
\end{aligned}
$$

14.7 problem 11

Internal problem ID [13134]

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*
```

$$
\begin{aligned}
x(t) &= (c_2t + c_1)\,\mathrm{e}^{-2t} \\
y(t) &= c_2\mathrm{e}^{-2t} \\
z(t) &= c_3\mathrm{e}^{t}
\end{aligned}
$$

✓ 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]
```

$$
\begin{aligned}
x(t) &\to e^{-2t}(c_2t + c_1) \\
y(t) &\to c_2e^{-2t} \\
z(t) &\to c_3e^{t} \\
x(t) &\to e^{-2t}(c_2t + c_1) \\
y(t) &\to c_2e^{-2t} \\
z(t) &\to 0
\end{aligned}
$$

14.8 problem 12

Internal problem ID [13135]

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*
```

$$
\begin{aligned}
x(t) &= c_1 + c_2 e^{-5t} \\
y(t) &= -2c_2 e^{-5t} + \frac{c_1}{2} \\
z(t) &= c_3 e^{-t}
\end{aligned}
$$

✓ 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 [13136]

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: 0.031 (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*
```

$$
\begin{aligned}
x(t) &= c_1 + c_2 \mathrm{e}^{-5t} \\
y(t) &= -2c_2 \mathrm{e}^{-5t} + \frac{c_1}{2} \\
z(t) &= c_3
\end{aligned}
$$

✓ 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 [13137]

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: 0.031 (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*
```

$$
\begin{aligned}
x(t) &= \frac{(c_3t^2 + 2c_2t + 2c_1)\,\mathrm{e}^{-2t}}{2} \\
y(t) &= (c_3t + c_2)\,\mathrm{e}^{-2t} \\
z(t) &= c_3\mathrm{e}^{-2t}
\end{aligned}
$$

✓ 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]
```

$$
\begin{aligned}
x(t) &\to \frac{1}{2}e^{-2t}(t(c_3t + 2c_2) + 2c_1) \\
y(t) &\to e^{-2t}(c_3t + c_2) \\
z(t) &\to c_3e^{-2t}
\end{aligned}
$$

14.11 problem 15

Internal problem ID [13138]

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 [13139]

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

$$
\begin{aligned}
x'(t) &= 2x(t) - y \\
y' &= -2y + 3z(t) \\
z'(t) &= -x(t) + 3y - z(t)
\end{aligned}
$$

✓ Solution by Maple
Time used: 0.047 (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*
```

$$
\begin{aligned}
x(t) &= -c_2 e^{\left(-1+2\sqrt{3}\right)t} - c_3 e^{-\left(1+2\sqrt{3}\right)t} - \frac{2c_2 e^{\left(-1+2\sqrt{3}\right)t}\sqrt{3}}{3} + \frac{2c_3 e^{-\left(1+2\sqrt{3}\right)t}\sqrt{3}}{3} + c_1 e^{t} \\
y(t) &= c_1 e^{t} + c_2 e^{\left(-1+2\sqrt{3}\right)t} + c_3 e^{-\left(1+2\sqrt{3}\right)t} \\
z(t) &= \frac{2c_2 e^{\left(-1+2\sqrt{3}\right)t}\sqrt{3}}{3} - \frac{2c_3 e^{-\left(1+2\sqrt{3}\right)t}\sqrt{3}}{3} + \frac{c_2 e^{\left(-1+2\sqrt{3}\right)t}}{3} + \frac{c_3 e^{-\left(1+2\sqrt{3}\right)t}}{3} + c_1 e^{t}
\end{aligned}
$$

✓ 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]
```

$$
\begin{aligned}
x(t) \to \frac{1}{16} e^{-\left(\left(1+2\sqrt{3}\right)t\right)} \Bigg(& c_1\left(\left(5+3\sqrt{3}\right)e^{4\sqrt{3}t}+6e^{2\left(1+\sqrt{3}\right)t}+5-3\sqrt{3}\right) \\
& -2c_2\left(\left(1+\sqrt{3}\right)e^{4\sqrt{3}t}-2e^{2\left(1+\sqrt{3}\right)t}+1-\sqrt{3}\right) \\
& -c_3\left(\left(3+\sqrt{3}\right)e^{4\sqrt{3}t}-6e^{2\left(1+\sqrt{3}\right)t}+3-\sqrt{3}\right)\Bigg) \\
y(t) \to \frac{1}{16} e^{-\left(\left(1+2\sqrt{3}\right)t\right)} \Bigg(& c_1\left(-\left(3+\sqrt{3}\right)e^{4\sqrt{3}t}+6e^{2\left(1+\sqrt{3}\right)t}-3+\sqrt{3}\right) \\
& +2c_2\left(-\left(\sqrt{3}-3\right)e^{4\sqrt{3}t}+2e^{2\left(1+\sqrt{3}\right)t}+3+\sqrt{3}\right) \\
& +3c_3\left(\left(\sqrt{3}-1\right)e^{4\sqrt{3}t}+2e^{2\left(1+\sqrt{3}\right)t}-1-\sqrt{3}\right)\Bigg) \\
z(t) \to -\frac{1}{48} e^{-\left(\left(1+2\sqrt{3}\right)t\right)} \Bigg(& c_1\left(\left(9+7\sqrt{3}\right)e^{4\sqrt{3}t}-18e^{2\left(1+\sqrt{3}\right)t}+9-7\sqrt{3}\right) \\
& -2c_2\left(\left(5\sqrt{3}-3\right)e^{4\sqrt{3}t}+6e^{2\left(1+\sqrt{3}\right)t}-3-5\sqrt{3}\right) \\
& +3c_3\left(\left(\sqrt{3}-5\right)e^{4\sqrt{3}t}-6e^{2\left(1+\sqrt{3}\right)t}-5-\sqrt{3}\right)\Bigg)
\end{aligned}
$$

14.13 problem 17

Internal problem ID [13140]

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

$$x'(t) = -4x(t) + 3y$$
$$y' = -y + z(t)$$
$$z'(t) = 5x(t) - 5y$$

✓ Solution by Maple

Time used: 0.031 (sec). Leaf size: 101

```
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*
```

$$x(t) = e^{-t}c_1 + \frac{6c_2e^{-2t}\sin(t)}{5} - \frac{3c_2e^{-2t}\cos(t)}{5} + \frac{6\,e^{-2t}\cos(t)\,c_3}{5} + \frac{3\,e^{-2t}\sin(t)\,c_3}{5}$$
$$y(t) = e^{-t}c_1 + c_2e^{-2t}\sin(t) + e^{-2t}\cos(t)\,c_3$$
$$z(t) = -e^{-2t}(c_2\sin(t) + c_3\sin(t) - c_2\cos(t) + c_3\cos(t))$$

✓ 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]
```

$$x(t) \to \frac{1}{2}e^{-2t}\left((5c_1 - 3c_2 + 3c_3)e^t - 3(c_1 - c_2 + c_3)\cos(t) - 3(3c_1 - 3c_2 + c_3)\sin(t)\right)$$
$$y(t) \to \frac{1}{2}e^{-2t}\left((5c_1 - 3c_2 + 3c_3)e^t + (-5c_1 + 5c_2 - 3c_3)\cos(t) - (5c_1 - 5c_2 + c_3)\sin(t)\right)$$
$$z(t) \to e^{-2t}(c_3\cos(t) + (5c_1 - 5c_2 + 2c_3)\sin(t))$$

14.14 problem 18

Internal problem ID [13141]

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: 0.047 (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)
```

$$
\begin{aligned}
x(t) &= c_1 e^{\frac{\left(-11+\sqrt{1201}\right)t}{2}} + c_2 e^{-\frac{\left(11+\sqrt{1201}\right)t}{2}} \\
y(t) &= \frac{c_1 e^{\frac{\left(-11+\sqrt{1201}\right)t}{2}} \sqrt{1201}}{20} - \frac{c_2 e^{-\frac{\left(11+\sqrt{1201}\right)t}{2}} \sqrt{1201}}{20} + \frac{9c_1 e^{\frac{\left(-11+\sqrt{1201}\right)t}{2}}}{20} + \frac{9c_2 e^{-\frac{\left(11+\sqrt{1201}\right)t}{2}}}{20} \\
z(t) &= c_3 e^{-\frac{8t}{3}}
\end{aligned}
$$

✓ 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 [13142]

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: 0.031 (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)],singsol=all)
```

$$
\begin{aligned}
x(t) &= c_1 e^t + c_2 e^{-t} \\
y(t) &= -c_1 e^t + c_2 e^{-t} + c_3 e^t \\
z(t) &= c_3 e^t
\end{aligned}
$$

✓ 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
```

$$
\begin{aligned}
x(t) &\to \frac{1}{2}e^{-t}\left(c_1\left(e^{2t}+1\right) - (c_2 - c_3)\left(e^{2t}-1\right)\right) \\
y(t) &\to \frac{1}{2}e^{-t}\left(-\left(c_1\left(e^{2t}-1\right)\right) + c_2\left(e^{2t}+1\right) + c_3\left(e^{2t}-1\right)\right) \\
z(t) &\to c_3 e^t
\end{aligned}
$$

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15.1 problem 3

Internal problem ID [13145]

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)],singsol=all)
```

$$x(t) = c_2 e^{3t}$$
$$y(t) = c_1 e^{-2t}$$

✓ 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 [13147]

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

$$x'(t) = 0$$
$$y' = x(t) - y$$

✓ 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)],singsol=all)
```

$$x(t) = c_2$$
$$y(t) = c_2 + e^{-t}c_1$$

✓ Solution by Mathematica

Time used: 0.007 (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 ->
```

$$x(t) \to c_1$$
$$y(t) \to e^{-t}(c_1(e^t - 1) + c_2)$$

15.3 problem 7

Internal problem ID [13148]

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 [13149]

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: 37

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

$$
\begin{aligned}
x(t) &= c_1 \sin(t) + c_2 \cos(t) \\
y(t) &= c_1 \cos(t) - c_2 \sin(t) - c_1 \sin(t) - c_2 \cos(t)
\end{aligned}
$$

✓ 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 [13150]

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: 0.015 (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)],singsol=all)
```

$$
\begin{aligned}
x(t) &= c_1 e^{\left(\sqrt{3}-1\right)t} + c_2 e^{-\left(1+\sqrt{3}\right)t} \\
y(t) &= c_1 e^{\left(\sqrt{3}-1\right)t}\sqrt{3} - c_2 e^{-\left(1+\sqrt{3}\right)t}\sqrt{3} + 2c_1 e^{\left(\sqrt{3}-1\right)t} + 2c_2 e^{-\left(1+\sqrt{3}\right)t}
\end{aligned}
$$

✓ 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 [13151]

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: 0.016 (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)],singsol=all)
```

$$
\begin{aligned}
x(t) &= \left(-\frac{\sqrt{5}}{2}+\frac{3}{2}\right) c_1 \mathrm{e}^{\frac{\left(\sqrt{5}-3\right)t}{2}} + \left(\frac{3}{2}+\frac{\sqrt{5}}{2}\right) c_2 \mathrm{e}^{-\frac{\left(3+\sqrt{5}\right)t}{2}} \\
y(t) &= c_1 \mathrm{e}^{\frac{\left(\sqrt{5}-3\right)t}{2}} + c_2 \mathrm{e}^{-\frac{\left(3+\sqrt{5}\right)t}{2}}
\end{aligned}
$$

✓ 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
```

$$
\begin{aligned}
x(t) &\to \frac{1}{10} e^{-\frac{1}{2}\left(3+\sqrt{5}\right)t}\left(c_1\left(\left(5-3\sqrt{5}\right)e^{\sqrt{5}t}+5+3\sqrt{5}\right)+2\sqrt{5}c_2\left(e^{\sqrt{5}t}-1\right)\right) \\
y(t) &\to \frac{1}{10} e^{-\frac{1}{2}\left(3+\sqrt{5}\right)t}\left(c_2\left(\left(5+3\sqrt{5}\right)e^{\sqrt{5}t}+5-3\sqrt{5}\right)-2\sqrt{5}c_1\left(e^{\sqrt{5}t}-1\right)\right)
\end{aligned}
$$

15.7 problem 19 (iv)

Internal problem ID [13152]

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: 35

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

$$
\begin{aligned}
x(t) &= c_1 \sin(t) + c_2 \cos(t) \\
y(t) &= c_1 \sin(t) - c_2 \sin(t) + c_1 \cos(t) + c_2 \cos(t)
\end{aligned}
$$

✓ 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 [13153]

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: 0.016 (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)],singsol=all)
```

$$
\begin{aligned}
x(t) &= c_2 e^{2t} \\
y(t) &= \frac{c_2 e^{2t}}{3} + e^{-t} c_1
\end{aligned}
$$

✓ 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 [13154]

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

$$
\begin{aligned}
x'(t) &= 3x(t) + y \\
y' &= -x(t)
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.016 (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)],singsol=all)
```

$$
\begin{aligned}
x(t) &= \left(\frac{\sqrt{5}}{2} - \frac{3}{2}\right) c_2 \mathrm{e}^{-\frac{(\sqrt{5}-3)t}{2}} + \left(-\frac{3}{2} - \frac{\sqrt{5}}{2}\right) c_1 \mathrm{e}^{\frac{(3+\sqrt{5})t}{2}} \\
y(t) &= c_1 \mathrm{e}^{\frac{(3+\sqrt{5})t}{2}} + c_2 \mathrm{e}^{-\frac{(\sqrt{5}-3)t}{2}}
\end{aligned}
$$

✓ Solution by Mathematica

Time used: 0.018 (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 -
```

$$
\begin{aligned}
x(t) &\to \frac{1}{10} e^{-\frac{1}{2}(\sqrt{5}-3)t} \left(c_1\left(\left(5+3\sqrt{5}\right)e^{\sqrt{5}t} + 5 - 3\sqrt{5}\right) + 2\sqrt{5}c_2\left(e^{\sqrt{5}t} - 1\right)\right) \\
y(t) &\to -\frac{1}{10} e^{-\frac{1}{2}(\sqrt{5}-3)t} \left(2\sqrt{5}c_1\left(e^{\sqrt{5}t} - 1\right) + c_2\left(\left(3\sqrt{5}-5\right)e^{\sqrt{5}t} - 5 - 3\sqrt{5}\right)\right)
\end{aligned}
$$

15.10 problem 19 (vii)

Internal problem ID [13155]

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

$$
\begin{aligned}
x'(t) &= y \\
y' &= -4x(t) - 4y
\end{aligned}
$$

✓ Solution by Maple

Time used: 0.016 (sec). Leaf size: 35

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

$$
\begin{aligned}
x(t) &= (c_2 t + c_1)\,\mathrm{e}^{-2t} \\
y(t) &= -\mathrm{e}^{-2t}(2c_2 t + 2c_1 - c_2)
\end{aligned}
$$

✓ 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 -
```

$$
\begin{aligned}
x(t) &\to e^{-2t}(2c_1 t + c_2 t + c_1) \\
y(t) &\to e^{-2t}(c_2 - 2(2c_1 + c_2)t)
\end{aligned}
$$

15.11 problem 19 (viii)

Internal problem ID [13156]

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)],singsol=all)
```

$$x(t) = e^{-t}\left(c_1 \sin\left(\sqrt{2}\,t\right) + c_2 \cos\left(\sqrt{2}\,t\right)\right)$$
$$y(t) = \frac{e^{-t}\left(\sin\left(\sqrt{2}\,t\right)\sqrt{2}\,c_2 - \cos\left(\sqrt{2}\,t\right)\sqrt{2}\,c_1 - 2c_1 \sin\left(\sqrt{2}\,t\right) - 2c_2 \cos\left(\sqrt{2}\,t\right)\right)}{3}$$

✓ 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 [13157]

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: 0.0 (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)
```

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

✓ 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
```

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

15.13 problem 24

Internal problem ID [13158]

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 [13159]

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: 0.0 (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)
```

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

✓ 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 [13160]

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: 0.031 (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]
```

$$y(t) \to 3\cos\left(\sqrt{2}t\right) - \sin\left(\sqrt{2}t\right)$$

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16.1 problem 1

Internal problem ID [13161]

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: 0.0 (sec). Leaf size: 25

```
dsolve(diff(y(t),t$2)-diff(y(t),t)-6*y(t)=exp(4*t),y(t), singsol=all)
```

$$y(t) = \frac{(e^{6t} + 6c_2e^{5t} + 6c_1)\, e^{-2t}}{6}$$

✓ 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]
```

$$y(t) \to \frac{e^{4t}}{6} + c_1e^{-2t} + c_2e^{3t}$$

16.2 problem 2

Internal problem ID [13162]

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: 26

```
dsolve(diff(y(t),t$2)+6*diff(y(t),t)+8*y(t)=2*exp(-3*t),y(t), singsol=all)
```

$$y(t) = -\frac{\left(\mathrm{e}^{-2t} c_1 + 4\,\mathrm{e}^{-t} - 2c_2\right)\mathrm{e}^{-2t}}{2}$$

✓ 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 [13163]

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]]`

$$\boxed{y'' - y' - 2y = 5\,\mathrm{e}^{3t}}$$

✓ Solution by Maple
Time used: 0.0 (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)
```

$$y(t) = c_2\mathrm{e}^{-t} + c_1\mathrm{e}^{2t} + \frac{5\,\mathrm{e}^{3t}}{4}$$

✓ 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]
```

$$y(t) \to \frac{5e^{3t}}{4} + c_1e^{-t} + c_2e^{2t}$$

16.4 problem 4

Internal problem ID [13164]

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]]`

$$\boxed{y'' + 4y' + 13y = e^{-t}}$$

✓ 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)
```

$$y(t) = c_2 e^{-2t} \sin(3t) + c_1 e^{-2t} \cos(3t) + \frac{e^{-t}}{10}$$

✓ 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 [13165]

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: 26

```
dsolve(diff(y(t),t$2)+4*diff(y(t),t)+13*y(t)=-3*exp(-2*t),y(t), singsol=all)
```

$$y(t) = \frac{\mathrm{e}^{-2t}(3c_1 \cos(3t) + 3c_2 \sin(3t) - 1)}{3}$$

✓ 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 [13166]

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]]`

$$\boxed{y'' + 7y' + 10y = e^{-2t}}$$

✓ Solution by Maple
Time used: 0.0 (sec). Leaf size: 22

```
dsolve(diff(y(t),t$2)+7*diff(y(t),t)+10*y(t)=exp(-2*t),y(t), singsol=all)
```

$$y(t) = \frac{(t + 3c_1)\, e^{-2t}}{3} + c_2 e^{-5t}$$

✓ 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 [13167]

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: 20

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

$$y(t) = \frac{(t + 3c_2)\,e^{4t}}{3} + c_1 e^t$$

✓ 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 [13168]

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)
```

$$y(t) = \frac{(5c_1\mathrm{e}^{5t} + 5c_2 - 4t)\,\mathrm{e}^{-3t}}{5}$$

✓ 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 [13169]

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]]`

$$\boxed{y'' + 6y' + 8y = e^{-t}}$$

With initial conditions

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

✓ Solution by Maple
Time used: 0.016 (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
```

$$y(t) = \frac{(2\,e^{3t} - 3\,e^{2t} + 1)\,e^{-4t}}{6}$$

✓ 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 [13170]

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: 0.031 (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 [13171]

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: 0.015 (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
```

$$y(t) \rightarrow \frac{1}{3}e^{-2t}(\cos(3t) - 1)$$

16.12 problem 12

Internal problem ID [13172]

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: 0.016 (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 [13173]

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]]`

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

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(-t/2),y(0) = 0, D(y)(0) = 0],y(t), singsol=
```

$$y(t) = \frac{e^{-3t}}{5} - e^{-t} + \frac{4\,e^{-\frac{t}{2}}}{5}$$

✓ 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 [13174]

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]]`

$$\boxed{y'' + 4y' + 3y = e^{-2t}}$$

With initial conditions

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

✓ Solution by Maple

Time used: 0.015 (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=
```

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

✓ 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 [13175]

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]]`

$$\boxed{y'' + 4y' + 3y = \mathrm{e}^{-4t}}$$

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(-4*t),y(0) = 0, D(y)(0) = 0],y(t), singsol=
```

$$y(t) = -\frac{\mathrm{e}^{-3t}}{2} + \frac{\mathrm{e}^{-t}}{6} + \frac{\mathrm{e}^{-4t}}{3}$$

✓ 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 [13176]

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]]`

$$\boxed{y'' + 4y' + 20y = \mathrm{e}^{-\frac{t}{2}}}$$

With initial conditions

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

✓ Solution by Maple
Time used: 0.031 (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
```

$$y(t) = \frac{4\,\mathrm{e}^{-\frac{t}{2}}}{73} + \frac{(-3\sin(4t) - 8\cos(4t))\,\mathrm{e}^{-2t}}{146}$$

✓ 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 [13177]

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: 0.016 (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
```

$$y(t) = -\frac{e^{-2t}(-1 + \cos(4t))}{16}$$

✓ 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 [13178]

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: 0.015 (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
```

$$y(t) = \frac{(\sin(4t) - 2\cos(4t))\,\mathrm{e}^{-2t}}{40} + \frac{\mathrm{e}^{-4t}}{20}$$

✓ 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 [13179]

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]]`

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

✓ Solution by Maple
Time used: 0.0 (sec). Leaf size: 19

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

$$y(t) = e^{-t}\left(\frac{1}{2}t^2 + c_1 t + c_2\right)$$

✓ 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]
```

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

16.20 problem 21

Internal problem ID [13180]

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)
```

$$y(t) = \frac{5\,\mathrm{e}^{4t}}{12} - \frac{5\,\mathrm{e}^{t}}{3} + \frac{5}{4}$$

✓ 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 [13181]

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: 0.016 (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)
```

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

✓ 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
```

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

16.22 problem 23

Internal problem ID [13182]

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: 0.015 (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)
```

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

✓ 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
```

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

16.23 problem 24

Internal problem ID [13183]

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: 0.016 (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 [13184]

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]]`

$$\boxed{y'' + 9y = \mathrm{e}^{-t}}$$

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)
```

$$y(t) = \frac{\sin(3t)}{30} - \frac{\cos(3t)}{10} + \frac{\mathrm{e}^{-t}}{10}$$

✓ 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 [13185]

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: 0.016 (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 [13186]

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 [13187]

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]]`

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

With initial conditions

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

✓ Solution by Maple
Time used: 0.016 (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)
```

$$y(t) = -\frac{\sin(2t)}{10} - \frac{\cos(2t)}{5} + \frac{e^t}{5}$$

✓ 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 [13188]

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: 0.0 (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 [13189]

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]]`

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

With initial conditions

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

✓ Solution by Maple
Time used: 0.031 (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)
```

$$y(t) = \frac{\sqrt{2}\,\sin\left(\sqrt{2}\,t\right)}{6} + \frac{\cos\left(\sqrt{2}\,t\right)}{3} - \frac{e^{t}}{3}$$

✓ 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 [13190]

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
```

$$y(t) \to \frac{1}{8}\left(-6t^2 + 4t - 2\sin(2t) - 9\cos(2t) + 9\right)$$

16.31 problem 32

Internal problem ID [13191]

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: 0.015 (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 [13192]

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)
```

$$y(t) = \frac{3t^2}{8} + \frac{5\,e^{-4t}}{64} + \frac{5t}{16} - \frac{5}{64}$$

✓ 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 [13193]

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: 0.0 (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)
```

$$y(t) = \frac{7}{4} - \frac{3t}{2} + \frac{t^2}{2} + \frac{e^{-2t}}{4} - 2e^{-t}$$

✓ 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
```

$$y(t) \rightarrow \frac{1}{4}e^{-2t}\left(e^{2t}\left(2t^2 - 6t + 7\right) - 8e^t + 1\right)$$

16.34 problem 35

Internal problem ID [13194]

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: 0.015 (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 [13195]

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
```

$$y(t) \to \frac{1}{6}e^{-3t}(e^t - 1)^2(4e^t + 11)$$

16.36 problem 38

Internal problem ID [13196]

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 [13197]

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]]`

$$\boxed{y''+6y'+8y=2t+e^{-t}}$$

With initial conditions

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

✓ Solution by Maple
Time used: 0.016 (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
```

$$y(t)=\frac{5\,e^{-4t}}{48}-\frac{3}{16}+\frac{t}{4}+\frac{e^{-t}}{3}-\frac{e^{-2t}}{4}$$

✓ 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 [13198]

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 [13199]

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: 0.015 (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 [13200]

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]]`

$$\boxed{y'' + 4y = 6 + t^2 + e^t}$$

With initial conditions

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

✓ Solution by Maple
Time used: 0.016 (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)
```

$$y(t) = -\frac{\sin(2t)}{10} - \frac{63\cos(2t)}{40} + \frac{11}{8} + \frac{t^2}{4} + \frac{e^t}{5}$$

✓ 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
```

$$y(t) \to \frac{1}{40}\left(10t^2 + 8e^t - 4\sin(2t) - 63\cos(2t) + 55\right)$$

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17.1 problem 1

Internal problem ID [13201]

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)
```

$$y(t) = -\mathrm{e}^{-2t}c_1 + \frac{\cos(t)}{10} + \frac{3\sin(t)}{10} + c_2\mathrm{e}^{-t}$$

✓ 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]
```

$$y(t) \to \frac{1}{10}\left(3\sin(t) + \cos(t) + 10e^{-2t}\left(c_2e^t + c_1\right)\right)$$

17.2 problem 2

Internal problem ID [13202]

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: 0.0 (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)
```

$$y(t) = -e^{-2t}c_1 + \frac{\cos(t)}{2} + \frac{3\sin(t)}{2} + c_2e^{-t}$$

✓ 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]
```

$$y(t) \to \frac{1}{2}\left(3\sin(t) + \cos(t) + 2e^{-2t}\left(c_2e^t + c_1\right)\right)$$

17.3 problem 3

Internal problem ID [13203]

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)
```

$$y(t) = -e^{-2t}c_1 - \frac{3\cos(t)}{10} + \frac{\sin(t)}{10} + c_2e^{-t}$$

✓ 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]
```

$$y(t) \to \frac{1}{10}\left(\sin(t) - 3\cos(t) + 10e^{-2t}\left(c_2e^t + c_1\right)\right)$$

17.4 problem 4

Internal problem ID [13204]

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: 0.0 (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)
```

$$y(t) = -\mathrm{e}^{-2t} c_1 - \frac{3\cos(t)}{5} + \frac{\sin(t)}{5} + c_2 \mathrm{e}^{-t}$$

✓ 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 [13205]

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: 0.0 (sec). Leaf size: 26

```
dsolve(diff(y(t),t$2)+6*diff(y(t),t)+8*y(t)=cos(t),y(t), singsol=all)
```

$$y(t) = -\frac{e^{-4t}c_1}{2} + \frac{7\cos(t)}{85} + \frac{6\sin(t)}{85} + c_2 e^{-2t}$$

✓ 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 [13206]

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)
```

$$y(t) = -\frac{e^{-4t}c_1}{2} + c_2 e^{-2t} + \frac{4\cos(3t)}{325} - \frac{72\sin(3t)}{325}$$

✓ 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 [13207]

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)
```

$$y(t) = c_2 \mathrm{e}^{-2t} \sin(3t) + c_1 \mathrm{e}^{-2t} \cos(3t) + \frac{24\sin(2t)}{145} + \frac{27\cos(2t)}{145}$$

✓ 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 [13208]

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)
```

$$y(t) = \sin(4t)\,\mathrm{e}^{-2t}c_2 + \cos(4t)\,\mathrm{e}^{-2t}c_1 + \frac{\cos(5t)}{85} - \frac{4\sin(5t)}{85}$$

✓ 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]
```

$$y(t) \to \frac{1}{85}(\cos(5t) - 4\sin(5t)) + c_2e^{-2t}\cos(4t) + c_1e^{-2t}\sin(4t)$$

17.9 problem 9

Internal problem ID [13209]

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)
```

$$y(t) = \sin(4t)\,\mathrm{e}^{-2t}c_2 + \cos(4t)\,\mathrm{e}^{-2t}c_1 - \frac{3\sin(2t)}{20} + \frac{3\cos(2t)}{40}$$

✓ 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]
```

$$y(t) \to \frac{3}{40}(\cos(2t) - 2\sin(2t)) + c_2e^{-2t}\cos(4t) + c_1e^{-2t}\sin(4t)$$

17.10 problem 10

Internal problem ID [13210]

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: 0.0 (sec). Leaf size: 27

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

$$y(t) = (c_1 t + c_2)\,\mathrm{e}^{-t} - \frac{2\cos(3t)}{25} + \frac{3\sin(3t)}{50}$$

✓ 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 [13211]

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 [13212]

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
```

$$y(t) = \frac{4\,\mathrm{e}^{-4t}}{25} - \frac{2\,\mathrm{e}^{-2t}}{13} - \frac{2\cos(3t)}{325} + \frac{36\sin(3t)}{325}$$

✓ 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 [13213]

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
```

$$y(t) = -\frac{3\,\mathrm{e}^{-3t}\sqrt{11}\,\sin\left(\sqrt{11}\,t\right)}{1100} - \frac{9\,\mathrm{e}^{-3t}\cos\left(\sqrt{11}\,t\right)}{100} + \frac{9\cos(2t)}{100} - \frac{3\sin(2t)}{25}$$

✓ 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 [13214]

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 [13215]

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)
```

$$y(t) = e^{\frac{(\sqrt{5}-3)t}{2}} c_2 + e^{-\frac{(3+\sqrt{5})t}{2}} c_1 - \frac{8\cos(3t)}{145} + \frac{9\sin(3t)}{145}$$

✓ 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 [13216]

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)
```

$$y(t) = \sin(4t)\,e^{-2t}c_2 + \cos(4t)\,e^{-2t}c_1 + \frac{3}{20} + \frac{\sin(2t)}{20} + \frac{\cos(2t)}{10}$$

✓ 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 [13217]

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]]`

$$\boxed{y'' + 4y' + 20y = \mathrm{e}^{-t} \cos(t)}$$

✓ Solution by Maple
Time used: 0.0 (sec). Leaf size: 36

```
dsolve(diff(y(t),t$2)+4*diff(y(t),t)+20*y(t)=exp(-t)*cos(t),y(t), singsol=all)
```

$$y(t) = (c_1 \cos(4t) + c_2 \sin(4t))\, \mathrm{e}^{-2t} + \frac{4\left(\cos(t) + \frac{\sin(t)}{8}\right) \mathrm{e}^{-t}}{65}$$

✓ 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]
```

$$y(t) \to \frac{1}{130} e^{-2t} \left(e^t \sin(t) + 8e^t \cos(t) + 130c_2 \cos(4t) + 130c_1 \sin(4t)\right)$$

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18.1 problem 1 382
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18.1 problem 1

Internal problem ID [13218]

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: 0.016 (sec). Leaf size: 21

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

$$y(t) = c_2 \sin(3t) + c_1 \cos(3t) + \frac{\cos(t)}{8}$$

✓ 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 [13219]

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)
```

$$y(t) = c_2 \sin(3t) + c_1 \cos(3t) + \sin(2t)$$

✓ 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 [13220]

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: 0.0 (sec). Leaf size: 23

```
dsolve(diff(y(t),t$2)+4*y(t)=-cos(t/2),y(t), singsol=all)
```

$$y(t) = \sin(2t)\, c_2 + \cos(2t)\, c_1 - \frac{4\cos\left(\frac{t}{2}\right)}{15}$$

✓ 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 [13221]

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: 0.016 (sec). Leaf size: 29

```
dsolve(diff(y(t),t$2)+4*y(t)=3*cos(2*t),y(t), singsol=all)
```

$$y(t) = \frac{(6t + 8c_2)\sin(2t)}{8} + \frac{(8c_1 + 3)\cos(2t)}{8}$$

✓ 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 [13222]

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: 0.016 (sec). Leaf size: 27

```
dsolve(diff(y(t),t$2)+9*y(t)=2*cos(3*t),y(t), singsol=all)
```

$$y(t) = \frac{(9c_1 + 1)\cos(3t)}{9} + \frac{(t + 3c_2)\sin(3t)}{3}$$

✓ 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

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19.1 problem 27

Internal problem ID [13223]

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: 4.797 (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)
```

$$y(t) = 9\cos(2t) + \frac{5\sin(2t)}{2} + 2$$

✓ 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 [13224]

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]]`

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

With initial conditions

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

✓ Solution by Maple
Time used: 5.0 (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)
```

$$y(t) = \frac{13\, e^{-2t}}{16} + \frac{e^{2t}(4t+3)}{16}$$

✓ 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 [13225]

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: 5.5 (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
```

$$y(t) = e^{t} + (2\cos(t) - 4\sin(t))\,e^{2t}$$

✓ 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 [13226]

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: 7.156 (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),
```

$$\begin{aligned} y(t) = &\left(-\frac{1}{2}-\frac{3i}{4}\right)\text{Heaviside}\,(t-4)\,\mathrm{e}^{(-3-2i)(t-4)} \\ &+\left(-\frac{1}{2}+\frac{3i}{4}\right)\text{Heaviside}\,(t-4)\,\mathrm{e}^{(-3+2i)(t-4)} \\ &+\text{Heaviside}\,(t-4)+\mathrm{e}^{-3t}(3\cos\,(2t)+5\sin\,(2t)) \end{aligned}$$

✓ 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
```

$$y(t) \to \begin{cases} e^{2t}(3\cos(t)-5\sin(t)) & t \le 4 \\ -\frac{1}{5}e^{2t-8}\cos(4-t)+3e^{2t}\cos(t)-\frac{2}{5}e^{2t-8}\sin(4-t)-5e^{2t}\sin(t)+\frac{1}{5} & \text{True} \end{cases}$$

19.5 problem 31

Internal problem ID [13227]

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: 4.438 (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)
```

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

✓ 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 [13228]

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]]`

$$y'' + 3y = \text{Heaviside}(t-4)\cos(5t-20)$$

With initial conditions

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

✓ Solution by Maple
Time used: 6.578 (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
```

$$y(t) = -\frac{2\sqrt{3}\sin\left(\sqrt{3}\,t\right)}{3} - \frac{\text{Heaviside}(t-4)\cos(5t-20)}{22} + \frac{\text{Heaviside}(t-4)\cos\left(\sqrt{3}\,(t-4)\right)}{22}$$

✓ 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 [13229]

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]]`

$$\boxed{y'' + 4y' + 9y = 20\,\text{Heaviside}\,(-2+t)\sin(-2+t)}$$

With initial conditions

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

✓ Solution by Maple
Time used: 6.953 (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) =
```

$$y(t) = \cos\left(\sqrt{5}\,(t-2)\right)\text{Heaviside}\,(t-2)\,\mathrm{e}^{-2t+4} + \mathrm{e}^{-2t}\cos\left(t\sqrt{5}\right) + \frac{4\,\mathrm{e}^{-2t}\sqrt{5}\,\sin\left(t\sqrt{5}\right)}{5} - \text{Heaviside}\,(t-2)\left(\cos(t-2) - 2\sin(t-2)\right)$$

✓ 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
```

$$y(t)$$

$$\rightarrow \begin{cases} -\cos(2-t) + e^{4-2t}\cos\left(\sqrt{5}(t-2)\right) + e^{-2t}\cos\left(\sqrt{5}t\right) - 2\sin(2-t) + \frac{4e^{-2t}\sin\left(\sqrt{5}t\right)}{\sqrt{5}} & t > 2 \\ \frac{1}{5}e^{-2t}\left(5\cos\left(\sqrt{5}t\right) + 4\sqrt{5}\sin\left(\sqrt{5}t\right)\right) & \text{True} \end{cases}$$

19.8 problem 34

Internal problem ID [13230]

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]]`

$$y'' + 3y = \begin{cases} t & 0 \le t < 1 \\ 1 & 1 \le t \end{cases}$$

With initial conditions

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

✓ Solution by Maple
Time used: 7.829 (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),
```

$$y(t) = 2\cos\left(\sqrt{3}\,t\right) - \frac{\sqrt{3}\,\sin\left(\sqrt{3}\,t\right)}{9} + \frac{\left(\begin{cases} t & t < 1 \\ 1 + \frac{\sqrt{3}\,\sin\left(\sqrt{3}\,(t-1)\right)}{3} & 1 \le t \end{cases}\right)}{3}$$

✓ 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
```

$$y(t) \rightarrow \begin{cases} 2\cos\left(\sqrt{3}t\right) & t \leq 0 \\ \frac{1}{9}\left(3t + 18\cos\left(\sqrt{3}t\right) - \sqrt{3}\sin\left(\sqrt{3}t\right)\right) & 0 < t \leq 1 \\ \frac{1}{9}\left(18\cos\left(\sqrt{3}t\right) + \sqrt{3}\sin\left(\sqrt{3}(t-1)\right) - \sqrt{3}\sin\left(\sqrt{3}t\right) + 3\right) & \text{True} \end{cases}$$

20 Chapter 6. Laplace transform. Section 6.4. page 608

20.1 problem 2 398
20.2 problem 3 399
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20.1 problem 2

Internal problem ID [13231]

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: 15.422 (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)
```

$$y(t) = \frac{5\sqrt{3}\ \text{Heaviside}\,(t-2)\sin\left(\sqrt{3}\,(t-2)\right)}{3}$$

✓ 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 [13232]

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: 5.718 (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
```

$$y(t) = e^{-t}(\cos(2t) + \sin(2t)) + \frac{e^{-t+3} \operatorname{Heaviside}(t-3)\sin(2t-6)}{2}$$

✓ 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
```

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

20.3 problem 4

Internal problem ID [13233]

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: 5.25 (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
```

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

✓ 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 [13234]

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: 6.562 (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],
```

$$y(t) = -\frac{3\sqrt{2}\left(\text{Heaviside}\,(t-4)\,\mathrm{e}^{4-t}\sin\left(\sqrt{2}\,(t-4)\right) - \frac{\text{Heaviside}(t-1)\mathrm{e}^{-t+1}\sin\left(\sqrt{2}\,(t-1)\right)}{3}\right)}{2}$$

✓ 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 1 403
21.2 problem 2 404
21.3 problem 3 406
21.4 problem 4 408
21.5 problem 5 410
21.6 problem 6 411
21.7 problem 7 412
21.8 problem 8 413

21.1 problem 1

Internal problem ID [13235]

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]]`

$$\boxed{y'' + 2y' + 2y = \sin(4t)\,\mathrm{e}^{-2t}}$$

With initial conditions

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

✓ Solution by Maple
Time used: 5.156 (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)
```

$$y(t) = \frac{\mathrm{e}^{-2t}(-7\sin(4t) + 4\cos(4t))}{130} + \frac{128\left(\cos(t) + \frac{\sin(t)}{8}\right)\mathrm{e}^{-t}}{65}$$

✓ 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
```

$$y(t) \to \frac{1}{130}e^{-2t}\left(32e^t\sin(t) - 7\sin(4t) + 256e^t\cos(t) + 4\cos(4t)\right)$$

21.2 problem 2

Internal problem ID [13236]

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: 6.703 (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) =
```

$$y(t) = \frac{4\cos\left(\frac{\sqrt{19}\,(t-2)}{2}\right)\text{Heaviside}\,(t-2)\,\mathrm{e}^{1-\frac{t}{2}}}{137} + \frac{92\sin\left(\frac{\sqrt{19}\,(t-2)}{2}\right)\text{Heaviside}\,(t-2)\sqrt{19}\,\mathrm{e}^{1-\frac{t}{2}}}{2603} - 2\,\mathrm{e}^{-\frac{t}{2}}\cos\left(\frac{\sqrt{19}\,t}{2}\right) - \frac{2\,\mathrm{e}^{-\frac{t}{2}}\sqrt{19}\,\sin\left(\frac{\sqrt{19}\,t}{2}\right)}{19} - \frac{4\left(\cos(4t-8) + \frac{11\sin(4t-8)}{4}\right)\text{Heaviside}\,(t-2)}{137}$$

✓ 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
```

$y(t)$

$$\rightarrow \{ \quad -\frac{2}{19}e^{-t/2}\left(19\cos\left(\frac{\sqrt{19}t}{2}\right)+\sqrt{19}\sin\left(\frac{\sqrt{19}t}{2}\right)\right)$$

$$\frac{e^{-t/2}\left(-76e^{t/2}\cos(8-4t)+76e\cos\left(\frac{1}{2}\sqrt{19}(t-2)\right)-5206\cos\left(\frac{\sqrt{19}t}{2}\right)+209e^{t/2}\sin(8-4t)+92\sqrt{19}e\sin\left(\frac{1}{2}\sqrt{19}(t-2)\right)-274\sqrt{19}\sin\left(\frac{\sqrt{19}t}{2}\right)\right.}{2603}$$

21.3 problem 3

Internal problem ID [13237]

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: 6.797 (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
```

$$y(t) = -\frac{9\,\text{Heaviside}(t-4)\left(\left(\sin(2\sqrt{31})\sqrt{31} - \frac{217\cos(2\sqrt{31})}{9}\right)\cos\left(\frac{\sqrt{31}\,t}{2}\right) - \frac{217\sin\left(\frac{\sqrt{31}\,t}{2}\right)\left(\frac{9\sqrt{31}\,\cos(2\sqrt{31})}{217} + \sin(2\sqrt{3}\right.}{9}\right.}{1550}$$

$$-\frac{7\,\mathrm{e}^{-\frac{t}{2}}\left(\cos(4) - \frac{\sin(4)}{7}\right)\cos\left(\frac{\sqrt{31}\,t}{2}\right)}{50} - \frac{9\left(\cos(4) + \frac{13\sin(4)}{9}\right)\sqrt{31}\,\mathrm{e}^{-\frac{t}{2}}\sin\left(\frac{\sqrt{31}\,t}{2}\right)}{1550}$$

$$-\frac{7\left(\left(\cos(t) + \frac{\sin(t)}{7}\right)\cos(4) - \frac{\sin(4)(-7\sin(t)+\cos(t))}{7}\right)(-1 + \text{Heaviside}(t-4))}{50}$$

✓ 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
```

$$y(t) \to \frac{e^{-t/2}\Big(\theta(4-t)\left(-31e^{t/2}\sin(4-t)-9\sqrt{31}e^{2}\sin\left(\tfrac{1}{2}\sqrt{31}(t-4)\right)+217e^{t/2}\cos(4-t)-217e^{2}\cos\left(\tfrac{1}{2}\sqrt{31}(\right.\right.}{}$$

21.4 problem 4

Internal problem ID [13238]

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]]`

$$y'' + y' + 3y = (1 - \text{Heaviside}(-2+t))\, e^{\frac{1}{5}-\frac{t}{10}} \sin(-2+t)$$

With initial conditions

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

✓ Solution by Maple
Time used: 6.812 (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) =
```

$$y(t) = \frac{8000\left(\left(\cos(t) - \frac{191\sin(t)}{80}\right)\cos(2) + \frac{191\sin(2)\left(\cos(t)+\frac{80\sin(t)}{191}\right)}{80}\right)\text{Heaviside}(t-2)\, e^{-\frac{t}{10}+\frac{1}{5}}}{42881}$$
$$+ \frac{100\left(11(80\cos(2) + 191\sin(2))\cos\left(\frac{\sqrt{11}\,t}{2}\right) - 318\left(\cos(2) - \frac{782\sin(2)}{795}\right)\sin\left(\frac{\sqrt{11}\,t}{2}\right)\sqrt{11}\right)e^{\frac{1}{5}-\frac{t}{2}}}{471691}$$
$$+ \left(-\frac{4000}{42881} + \frac{9550i}{42881}\right)e^{\left(-\frac{1}{10}-i\right)(t-2)} + \left(-\frac{4000}{42881} - \frac{9550i}{42881}\right)e^{\left(-\frac{1}{10}+i\right)(t-2)}$$
$$+ \frac{200\,\text{Heaviside}(t-2)\left(\left(-159\sqrt{11}\sin\left(\sqrt{11}\right) - 440\cos\left(\sqrt{11}\right)\right)\cos\left(\frac{\sqrt{11}\,t}{2}\right) + \left(159\cos\left(\sqrt{11}\right)\sqrt{11} - 4\right.}{471691}$$
$$+ \frac{5\,e^{-\frac{t}{2}}\sqrt{11}\sin\left(\frac{\sqrt{11}\,t}{2}\right)}{11} + e^{-\frac{t}{2}}\cos\left(\frac{\sqrt{11}\,t}{2}\right)$$

✓ 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
```

$y(t)$

$$\rightarrow \left\{ \begin{array}{l} \frac{e^{-t/2}\left(-248000e^{\frac{2t}{5}+\frac{1}{5}}\cos(2-t)+5\left(\sqrt{31}\left(483881-8\sqrt[5]{e}(3295\cos(2)-1782\sin(2))\right)\sin\left(\frac{\sqrt{31}t}{2}\right)-428420e^{\frac{2t}{5}+\frac{1}{5}}\sin(2-t)\right)+31\cos\left(\right.}{15000311} \\ \frac{e^{-t/2}\left(-248000e\cos\left(\frac{1}{2}\sqrt{31}(t-2)\right)+5\sqrt{31}\left(26360e\sin\left(\frac{1}{2}\sqrt{31}(t-2)\right)+\left(483881-8\sqrt[5]{e}(3295\cos(2)-1782\sin(2))\right)\sin\left(\frac{\sqrt{31}t}{2}\right)\right)+31\cos\right.}{15000311} \end{array} \right.$$

21.5 problem 5

Internal problem ID [13239]

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: 4.594 (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)
```

$$y(t) = \cos(4t) + \frac{\sin(4t)}{4}$$

✓ 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 [13240]

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: 4.359 (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)
```

$$y(t) = \frac{\sin(2t)}{8} - \frac{t\cos(2t)}{4}$$

✓ 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]
```

$$y(t) \rightarrow \frac{1}{8}(\sin(2t) - 2t\cos(2t))$$

21.7 problem 7

Internal problem ID [13241]

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: 4.343 (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)
```

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

✓ 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 [13242]

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: 4.344 (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)
```

$$y(t) = \cos(4t) + \frac{15\sin(4t)}{64} + \frac{t}{16}$$

✓ 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]
```

$$y(t) \to \frac{1}{64}(4t + 15\sin(4t)) + \cos(4t)$$