```
> ec1:=x*diff(y(x),x)+y(x)=exp(x)
```

$$ec1 := x\left(\frac{d}{dx}\,y(x)\right)+y(x)=e^{x} \tag{1}$$

```
> cond:=y(a)=b
```

$$cond := y(a)=b \tag{2}$$

```
> sist:={ec1,cond}
```

$$sist := \left\{x\left(\frac{d}{dx}\,y(x)\right)+y(x)=e^{x}, y(a)=b\right\} \tag{3}$$

```
> sol1:=dsolve(ec1,y(x))
```

$$sol1 := y(x)=\frac{e^{x}+c_1}{x} \tag{4}$$

```
> sol2:=dsolve(sist,{y(x)})
```

$$sol2 := y(x)=\frac{e^{x}+b\,a-e^{a}}{x} \tag{5}$$

```
> restart
> ec1:=diff(y1(x),x)=y1(x)+y2(x)
```

$$ec1 := \frac{d}{dx}\,y1(x)=y1(x)+y2(x) \tag{6}$$

```
> ec2:=diff(y2(x),x)=-2*y1(x)+4*y2(x)
```

$$ec2 := \frac{d}{dx}\,y2(x)=-2\,y1(x)+4\,y2(x) \tag{7}$$

```
> sol:=dsolve({ec1,ec2},{y1(x),y2(x)})
```

$$sol := \left\{y1(x)=c_1\,e^{2x}+c_2\,e^{3x}, y2(x)=c_1\,e^{2x}+2\,c_2\,e^{3x}\right\} \tag{8}$$

```
> cond:=y1(0)=0,y2(0)=-1
```

$$cond := y1(0)=0, y2(0)=-1 \tag{9}$$

```
> sol2:=dsolve({ec1,ec2,cond},{y1(x),y2(x)})
```

$$sol2 := \left\{y1(x)=e^{2x}-e^{3x}, y2(x)=e^{2x}-2\,e^{3x}\right\} \tag{10}$$

```
> restart
> ec1:=diff(y(x),x$2)-4*diff(y(x),x)+5*y(x)=2*x^2*exp(x)
```

$$ec1 := \frac{d^2}{dx^2}\,y(x)-4\,\frac{d}{dx}\,y(x)+5\,y(x)=2\,x^2\,e^{x} \tag{11}$$

```
> sol:=dsolve(ec1,y(x))
```

$$sol := y(x)=c_2\,e^{2x}\sin(x)+c_1\,e^{2x}\cos(x)+(x+1)^2\,e^{x} \tag{12}$$

```
> cond:=y(0)=2,D(y)(0)=3
```

$$cond := y(0)=2, D(y)(0)=3 \tag{13}$$

```
> solv:=dsolve({ec1,cond},{y(x)})
```

$$solv := y(x)=(\cos(x)-2\sin(x))\,e^{2x}+(x+1)^2\,e^{x} \tag{14}$$

```
> restart
> ec:=diff(y(x),x$2)+4*y(x)=4*x
```

$$ec := \frac{d^2}{dx^2}\, y(x) + 4\, y(x) = 4\, x \tag{15}$$

```
> cond:=y(Pi)=0,D(y)(Pi)=1
```

$$cond := y(\pi) = 0, \mathrm{D}(y)(\pi) = 1 \tag{16}$$

```
> sol:=dsolve({ec,cond},{y(x)})
```

$$sol := y(x) = -\cos(2\, x)\, \pi + x \tag{17}$$

```
> ec1:=diff(y(x),x$2)+4*y(x)=0
```

$$ec1 := \frac{d^2}{dx^2}\, y(x) + 4\, y(x) = 0 \tag{18}$$

```
> solv:=dsolve(ec1,y(x))
```

$$solv := y(x) = c_1 \sin(2\, x) + c_2 \cos(2\, x) \tag{19}$$

```
> restart
> ec:=diff(y(x),x$2)+6*diff(y(x),x)+9*y(x)=6*cos(x)+8*sin(x)
```

$$ec := \frac{d^2}{dx^2}\, y(x) + 6\, \frac{d}{dx}\, y(x) + 9\, y(x) = 6 \cos(x) + 8 \sin(x) \tag{20}$$

```
> cond:=y(0)=1,D(y)(0)=1
```

$$cond := y(0) = 1, \mathrm{D}(y)(0) = 1 \tag{21}$$

```
> sol:=dsolve(ec,y(x))
```

$$sol := y(x) = e^{-3\, x}\, c_2 + e^{-3\, x}\, x\, c_1 + \sin(x) \tag{22}$$

```
> sol2:=dsolve({ec,cond},{y(x)})
```

$$sol2 := y(x) = e^{-3\, x} + 3\, e^{-3\, x}\, x + \sin(x) \tag{23}$$

```
> restart
> ec:=diff(y(x),x$2)+lambda*y(x)=0
```

$$ec := \frac{d^2}{dx^2}\, y(x) + \lambda\, y(x) = 0 \tag{24}$$

```
> cond:=y(0)=0,y(1)=0
```

$$cond := y(0) = 0, y(1) = 0 \tag{25}$$

```
> sol:=dsolve(ec,y(x))
```

$$sol := y(x) = c_1 \sin\left(\sqrt{\lambda}\, x\right) + c_2 \cos\left(\sqrt{\lambda}\, x\right) \tag{26}$$

```
> sol2:=dsolve({ec,cond},{y(x),lambda})
```

$$sol2 := \left\{\lambda = c_1, y(x) = 0\right\}, \left\{\lambda = \pi^2\, \_Z1{\sim}^2, y(x) = c_2 \sin\left(\sqrt{\pi^2\, \_Z1{\sim}^2}\, x\right)\right\} \tag{27}$$

```
> restart
> ec:=x^2*diff(y(x),x)*cos(1/x)-y(x)*sin(1/x)=-1
```

$$ec := x^2 \left(\frac{d}{dx}\, y(x)\right) \cos\left(\frac{1}{x}\right) - y(x) \sin\left(\frac{1}{x}\right) = -1 \tag{28}$$

```
> sol:=dsolve(ec,y(x))
```

$$sol := y(x) = \left(\tan\left(\frac{1}{x}\right) + c_1\right) \cos\left(\frac{1}{x}\right) \tag{29}$$

```
> cond:=limit(y(x),x=infinity)=0
```

(30)

$$cond := \lim_{x \to \infty} y(x) = 0 \qquad (30)$$

```
> solv:=dsolve({ec,cond},{y(x)})
```

$$solv := \left[\left\{ \lim_{x \to \infty} y(x) \right\} \right] \qquad (31)$$

```
> restart; with(linalg): with(DEtools):
> ec1:=diff(x(t),t)=x(t)
```

$$ec1 := \frac{d}{dt} x(t) = x(t) \qquad (32)$$

```
> ec2:=diff(y(t),t)=x(t)+2*y(t)
```

$$ec2 := \frac{d}{dt} y(t) = x(t) + 2\,y(t) \qquad (33)$$

```
> sist1:=ec1,ec2
```

$$sist1 := \frac{d}{dt} x(t) = x(t), \frac{d}{dt} y(t) = x(t) + 2\,y(t) \qquad (34)$$

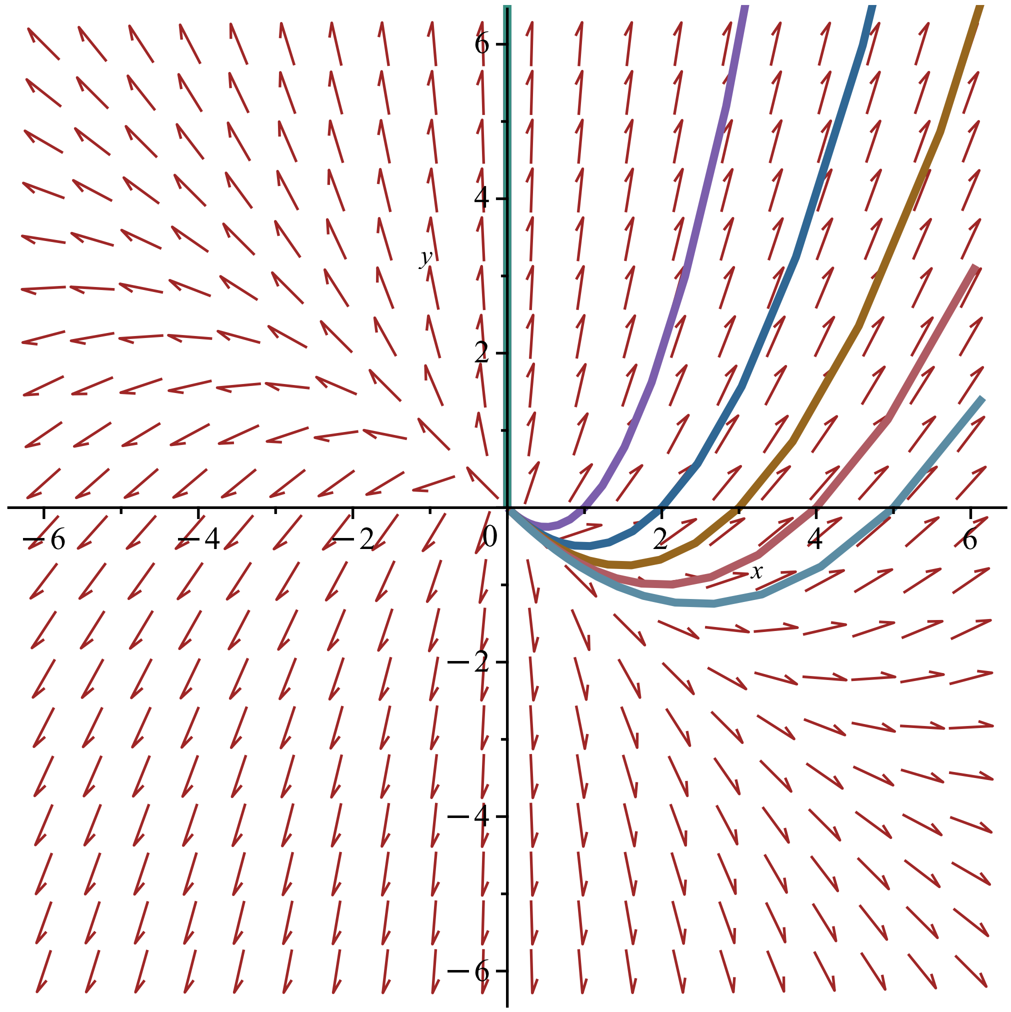
```
> A:=matrix([[1,0],[1,2]])
```

$$A := \begin{bmatrix} 1 & 0 \\ 1 & 2 \end{bmatrix} \qquad (35)$$

```
> eigenvals(A)
```

$$1, 2 \qquad (36)$$

```
> DEplot([sist1],[x(t),y(t)],t=-5..5,x=-6..6,y=-6..6,[[x(0) = 0, y
  (0) = 1], [x(0) = 0, y(0) = 2], [x(0) = 0, y(0) = 3], [x(0) = 0,
  y(0) = 4], [x(0) = 0, y(0) = 5], [x(0) = 1, y(0) = 0], [x(0) = 2,
  y(0) = 0], [x(0) = 3, y(0) = 0], [x(0) = 4, y(0) = 0], [x(0) = 5,
  y(0) = 0]])
```




```
> sol:=dsolve({sist},{x(t),y(t)})
Error, (in dsolve) not a system with respect to the unknowns {x(t), y(t)}
```

```
> restart
> ec1:=x*diff(y(x),x$2)+diff(y(x),x)=4*x
```

$$ec1 := x\left(\frac{d^2}{dx^2}\, y(x)\right) + \frac{d}{dx}\, y(x) = 4\,x \tag{37}$$

```
> cond:=y(1)=1,D(y)(1)=4
```

$$cond := y(1) = 1,\ D(y)(1) = 4 \tag{38}$$

```
> sol:=dsolve(ec1,y(x))
```

$$sol := y(x) = x^2 + c_1 \ln(x) + c_2 \tag{39}$$

```
> sol2:=dsolve({ec1,cond},{y(x)})
```

$$sol2 := y(x) = x^2 + 2\ln(x) \tag{40}$$

```
> restart
```

```
> ec:=x^2*diff(y(x),x)=x*y(x)+y(x)^2
```

$$ec := x^2\left(\frac{d}{dx}\, y(x)\right) = x\, y(x) + y(x)^2 \tag{41}$$

```
> sol:=dsolve(ec,y(x))
```
$$sol := y(x) = -\frac{x}{\ln(x) - c_1} \tag{42}$$

```
> ec2:=diff(y(x),x$2)-4*diff(y(x),x)+8*y(x)=(25*x-5)*exp(x)
```
$$ec2 := \frac{d^2}{dx^2}\, y(x) - 4\, \frac{d}{dx}\, y(x) + 8\, y(x) = (25\, x - 5)\, e^x \tag{43}$$

```
> sol2:=dsolve(ec2,y(x))
```
$$sol2 := y(x) = e^{2\, x} \sin(2\, x)\, c_2 + e^{2\, x} \cos(2\, x)\, c_1 + (5\, x + 1)\, e^x \tag{44}$$

```
> restart
> ec1:=diff(y(t),t)=-4*x(t)
```
$$ec1 := \frac{d}{dt}\, y(t) = -4\, x(t) \tag{45}$$

```
> ec2:=diff(x(t),t)=y(t)
```
$$ec2 := \frac{d}{dt}\, x(t) = y(t) \tag{46}$$

```
> sol:=dsolve({ec1,ec2},{x(t),y(t)})
```
$$sol := \{x(t) = c_1 \sin(2\, t) + c_2 \cos(2\, t), y(t) = 2\, c_1 \cos(2\, t) - 2\, c_2 \sin(2\, t)\} \tag{47}$$

```
> cond:=x(0)=eta__1,y(0)=eta__2
```
$$cond := x(0) = \eta_1, y(0) = \eta_2 \tag{48}$$

```
> sol2:=dsolve({ec1,ec2,cond},{x(t),y(t)})
```
$$sol2 := \left\{x(t) = \frac{\eta_2 \sin(2\, t)}{2} + \eta_1 \cos(2\, t), y(t) = \eta_2 \cos(2\, t) - 2\, \eta_1 \sin(2\, t)\right\} \tag{49}$$

```
> restart
> ec:=diff(y(x),x$2)+6*diff(y(x),x)+9*y(x)=27*x^2
```
$$ec := \frac{d^2}{dx^2}\, y(x) + 6\, \frac{d}{dx}\, y(x) + 9\, y(x) = 27\, x^2 \tag{50}$$

```
> sol:=dsolve(ec,y(x))
```
$$sol := y(x) = e^{-3\, x}\, c_2 + e^{-3\, x}\, x\, c_1 + 3\, x^2 - 4\, x + 2 \tag{51}$$

```
> restart
> ec:=diff(y(x),x$2)-1/x*diff(y(x),x)=2
```
$$ec := \frac{d^2}{dx^2}\, y(x) - \frac{\frac{d}{dx}\, y(x)}{x} = 2 \tag{52}$$

```
> sol:=dsolve(ec,y(x))
```
$$sol := y(x) = x^2 \ln(x) - \frac{x^2}{2} + \frac{c_1 x^2}{2} + c_2 \tag{53}$$

```
> cond:=y(1)=0,y(2)=4*ln(2)
```
$$cond := y(1) = 0, y(2) = 4\, \ln(2) \tag{54}$$

```
> sol2:=dsolve({ec,cond},{y(x)})
```
(55)

$$sol2 := y(x) = x^2 \ln(x) \tag{55}$$

```
> restart
> ec:=(1+x^3)*diff(y(x),x$2)-3*x^2*diff(y(x),x)=0
```

$$ec := (x^3+1)\left(\frac{d^2}{dx^2}\, y(x)\right) - 3\,x^2\left(\frac{d}{dx}\, y(x)\right) = 0 \tag{56}$$

```
> cond:=y(0)=0,y(2)=6
```

$$cond := y(0) = 0,\, y(2) = 6 \tag{57}$$

```
> sol:=dsolve(ec,y(x))
```

$$sol := y(x) = c_1 + \left(\frac{1}{4}\, x^4 + x\right) c_2 \tag{58}$$

```
> sol2:=dsolve({ec,cond},{y(x)})
```

$$sol2 := y(x) = \frac{1}{4}\, x^4 + x \tag{59}$$

```
> restart
> ec:=2*(x+y(x))*diff(y(x),x)=y(x)
```

$$ec := 2\,(x + y(x))\left(\frac{d}{dx}\, y(x)\right) = y(x) \tag{60}$$

```
> sol:=dsolve(ec,y(x))
```

$$sol := y(x) = \frac{1+\sqrt{c_1\, x+1}}{c_1},\, y(x) = -\frac{-1+\sqrt{c_1\, x+1}}{c_1} \tag{61}$$

```
> ec2:=(x*y(x)-x^2)*diff(y(x),x)=x^2+y(x)^2
```

$$ec2 := (x\, y(x) - x^2)\left(\frac{d}{dx}\, y(x)\right) = x^2 + y(x)^2 \tag{62}$$

```
> dsolve(ec2,y(x))
```

$$y(x) = x\, \mathrm{e}^{-\mathrm{LambertW}\left(-\frac{\mathrm{e}^{-\frac{c_1}{2}}\, \mathrm{e}^{-\frac{1}{2}}}{2\sqrt{x}}\right) - \frac{c_1}{2} - \frac{1}{2} - \frac{\ln(x)}{2}} - x \tag{63}$$

```
> ec3:=diff(y(x),x$2)+4*diff(y(x),x)+5*y(x)=(5*x+3)*exp(x)
```

$$ec3 := \frac{d^2}{dx^2}\, y(x) + 4\, \frac{d}{dx}\, y(x) + 5\, y(x) = (5\,x+3)\, \mathrm{e}^x \tag{64}$$

```
> dsolve(ec3,y(x))
```

$$y(x) = \mathrm{e}^{-2\,x} \sin(x)\, c_2 + \mathrm{e}^{-2\,x}\cos(x)\, c_1 + \frac{\mathrm{e}^x\, x}{2} \tag{65}$$

```
> ec100:=(2*x+1)*diff(z(x),x$2)-2*diff(z(x),x)=4
```

$$ec100 := (2\,x+1)\left(\frac{d^2}{dx^2}\, z(x)\right) - 2\, \frac{d}{dx}\, z(x) = 4 \tag{66}$$

```
> dsolve(ec100,z(x))
```

$$z(x) = c_1\,(x^2 + x) - 2\,x + c_2 \tag{67}$$

```
> cond:=z(0)=2,z(1)=2
```

$$cond := z(0) = 2,\, z(1) = 2 \tag{68}$$

```
> dsolve({ec100,cond},{z(x)})
```

$$z(x) = x^2 - x + 2 \tag{69}$$

```
> ec:=diff(y(x),x$2)+4*diff(y(x),x)+5*y(x)=2*exp(-x)
```

$$ec := \frac{d^2}{dx^2}\, y(x) + 4\, \frac{d}{dx}\, y(x) + 5\, y(x) = 2\, e^{-x} \tag{70}$$

```
> dsolve(ec,y(x))
```

$$y(x) = e^{-2\,x} \sin(x)\, c_2 + e^{-2\,x} \cos(x)\, c_1 + e^{-x} \tag{71}$$

```
> restart
> ec:=x*diff(y(x),x)=y(x)*(ln(y(x))-2*ln(x))
```

$$ec := x \left(\frac{d}{dx}\, y(x) \right) = y(x)\, \left(\ln(y(x)) - 2 \ln(x) \right) \tag{72}$$

```
> dsolve(ec,y(x))
```

$$y(x) = e^{c_1\, x}\, e^2\, x^2 \tag{73}$$

```
> infolevel[dsolve]:=0
```

$$infolevel_{dsolve} := 0 \tag{74}$$

```
> ?dsolve
> dsolve(ec,y(x))
```

$$y(x) = e^{c_1\, x}\, e^2\, x^2 \tag{75}$$

```
> restart
> ec:=diff(y(x),x$2)-exp(x)/(exp(x)+1)*diff(y(x),x)=exp(-x)+1
```

$$ec := \frac{d^2}{dx^2}\, y(x) - \frac{e^x \left(\frac{d}{dx}\, y(x) \right)}{e^x + 1} = e^{-x} + 1 \tag{76}$$

```
> dsolve(ec,y(x))
```

$$y(x) = x\, c_1 - x + c_1\, e^x + e^{-x} + c_2 \tag{77}$$

```
> restart
> ec:=diff(y(x),x$2)-4*diff(y(x),x)+6*y(x)=12*x+16
```

$$ec := \frac{d^2}{dx^2}\, y(x) - 4\, \frac{d}{dx}\, y(x) + 6\, y(x) = 12\, x + 16 \tag{78}$$

```
> dsolve(ec,y(x))
```

$$y(x) = e^{2\,x} \sin\left(\sqrt{2}\, x\right) c_2 + e^{2\,x} \cos\left(\sqrt{2}\, x\right) c_1 + 2\, x + 4 \tag{79}$$

```
> restart
> ec:=diff(y(x),x$2)-1/(x*ln(x))*diff(y(x),x)=12*x^2*ln(x)
```

$$ec := \frac{d^2}{dx^2}\, y(x) - \frac{\frac{d}{dx}\, y(x)}{x \ln(x)} = 12\, x^2 \ln(x) \tag{80}$$

```
> dsolve(ec,y(x))
```

$$y(x) = x^4 \ln(x) - \frac{x^4}{4} + c_1\, (x \ln(x) - x) + c_2 \tag{81}$$

```
> cond_in:=y(1)=-1/4,y(2)=exp(4)
```

$$cond\_in := y(1) = -\frac{1}{4}, y(2) = e^4 \quad \textbf{(82)}$$

```
> dsolve({ec,cond_in},{y(x)})
```

$$y(x) = x^4 \ln(x) - \frac{x^4}{4} + \frac{\left(-16\ln(2) + e^4 + 4\right)\left(x\ln(x) - x\right)}{2\ln(2) - 1} + \frac{-16\ln(2) + e^4 + 4}{2\ln(2) - 1} \quad \textbf{(83)}$$