```
> restart;
> # Homogene DGL
> DGL:=diff(y(x),x$2)-diff(y(x),x)-2*y(x)=0:l:=dsolve(DGL,y(x))
  :DGL;l;
```

$$\frac{d^2}{dx^2}\,y(x) - \frac{d}{dx}\,y(x) - 2\,y(x) = 0$$

$$y(x) = \_C1\,e^{2x} + \_C2\,e^{-x} \tag{1}$$

```
> DGL:=diff(y(x),x$2)+0*diff(y(x),x)+9*y(x)=0:l:=dsolve(DGL,y(x))
  :DGL;l;
```

$$\frac{d^2}{dx^2}\,y(x) + 9\,y(x) = 0$$

$$y(x) = \_C1\,\sin(3\,x) + \_C2\,\cos(3\,x) \tag{2}$$

```
> DGL:=diff(y(x),x$2)-4*diff(y(x),x)+4*y(x)=0:l:=dsolve(DGL,y(x))
  :DGL;l;
```

$$\frac{d^2}{dx^2}\,y(x) - 4\,\frac{d}{dx}\,y(x) + 4\,y(x) = 0$$

$$y(x) = \_C1\,e^{2x} + \_C2\,e^{2x}\,x \tag{3}$$

```
> DGL:=diff(y(x),x$2)+diff(y(x),x)+4*y(x)=0:l:=dsolve(DGL,y(x))
  :DGL;l;
```

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

$$y(x) = \_C1\,e^{-\frac{x}{2}}\,\sin\left(\frac{\sqrt{15}\,x}{2}\right) + \_C2\,e^{-\frac{x}{2}}\,\cos\left(\frac{\sqrt{15}\,x}{2}\right) \tag{4}$$

```
> DGL:=diff(y(x),x$2)+2*diff(y(x),x)+4*y(x)=0:l:=dsolve(DGL,y(x))
  :DGL;l;
```

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

$$y(x) = \_C1\,e^{-x}\,\sin(\sqrt{3}\,x) + \_C2\,e^{-x}\,\cos(\sqrt{3}\,x) \tag{5}$$

```
> DGL:=diff(y(x),x$2)+4*diff(y(x),x)+4*y(x)=0:l:=dsolve(DGL,y(x))
  :DGL;l;
```

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

$$y(x) = \_C1\,e^{-2x} + \_C2\,e^{-2x}\,x \tag{6}$$

```
> DGL:=diff(y(x),x$2)+5*diff(y(x),x)+4*y(x)=0:l:=dsolve(DGL,y(x))
  :DGL;l;
```

$$\frac{d^2}{dx^2}\,y(x) + 5\,\frac{d}{dx}\,y(x) + 4\,y(x) = 0$$

$$y(x) = \_C1\,e^{-x} + \_C2\,e^{-4x} \tag{7}$$

```
> #
> #
> #
> #
```

```
> #
> #
> # Inhomogene DGL
> DGL:=diff(y(x),x$2)-diff(y(x),x)-2*y(x)=x:l:=dsolve(DGL,y(x))
  :DGL;l;
```

$$\frac{d^2}{dx^2} y(x) - \frac{d}{dx} y(x) - 2y(x) = x$$

$$y(x) = e^{2x}\_C2 + \_C1\,e^{-x} - \frac{x}{2} + \frac{1}{4} \tag{8}$$

```
> # Ansatz fuer yp: alpha*x+beta
> #
> DGL:=diff(y(x),x$2)-diff(y(x),x)-2*y(x)=x^2:l:=dsolve(DGL,y(x))
  :DGL;l;
```

$$\frac{d^2}{dx^2} y(x) - \frac{d}{dx} y(x) - 2y(x) = x^2$$

$$y(x) = e^{2x}\_C2 + \_C1\,e^{-x} - \frac{x^2}{2} + \frac{x}{2} - \frac{3}{4} \tag{9}$$

```
> # Ansatz fuer yp: alpha*x^2+beta*x+gamma
> #
> DGL:=diff(y(x),x$2)-diff(y(x),x)-2*y(x)=exp(x):l:=dsolve(DGL,y(x)
  ):DGL;l;
```

$$\frac{d^2}{dx^2} y(x) - \frac{d}{dx} y(x) - 2y(x) = e^x$$

$$y(x) = e^{2x}\_C2 + \_C1\,e^{-x} - \frac{e^x}{2} \tag{10}$$

```
> # Ansatz fuer yp: alpha*exp(x)
> #
> DGL:=diff(y(x),x$2)-diff(y(x),x)-2*y(x)=x*exp(x):l:=dsolve(DGL,y
  (x)):DGL;l;
```

$$\frac{d^2}{dx^2} y(x) - \frac{d}{dx} y(x) - 2y(x) = x\,e^x$$

$$y(x) = e^{2x}\_C2 + \_C1\,e^{-x} - \frac{(2x+1)\,e^x}{4} \tag{11}$$

```
> # Ansatz fuer yp: alpha*x*exp(x)+beta*exp(x)
> #
> DGL:=diff(y(x),x$2)-diff(y(x),x)-2*y(x)=2*x+x*exp(x):l:=dsolve
  (DGL,y(x)):DGL;l;
```

$$\frac{d^2}{dx^2} y(x) - \frac{d}{dx} y(x) - 2y(x) = 2x + x\,e^x$$

$$y(x) = e^{2x}\_C2 + \_C1\,e^{-x} + \frac{(-2x-1)\,e^x}{4} - x + \frac{1}{2} \tag{12}$$

```
> #
> #
> #
```

```
> # Ansatz fuer yp: alpha*x*exp(x)+beta*exp(x)+gamma*x+delta
> #
> DGL:=diff(y(x),x$2)-diff(y(x),x)-2*y(x)=x*cos(x):l:=dsolve(DGL,y
  (x)):DGL;l;
```

$$\frac{d^2}{dx^2}\,y(x) - \frac{d}{dx}\,y(x) - 2\,y(x) = x\,\cos(x)$$

$$y(x) = e^{2x}\_C2 + \_C1\,e^{-x} + \frac{(-15\,x - 2)\,\cos(x)}{50} + \frac{(-5\,x + 11)\,\sin(x)}{50} \tag{13}$$

```
> # Ansatz fuer yp: alpha*x*sin(x)+beta*sin(x)+gamma*x*cos(x)+
  delta*cos(x)
> #
> DGL:=diff(y(x),x$2)-diff(y(x),x)-2*y(x)=exp(-x):l:=dsolve(DGL,y
  (x)):DGL;l;
```

$$\frac{d^2}{dx^2}\,y(x) - \frac{d}{dx}\,y(x) - 2\,y(x) = e^{-x}$$

$$y(x) = e^{2x}\_C2 + \_C1\,e^{-x} - \frac{x\,e^{-x}}{3} \tag{14}$$

```
> # Ansatz fuer yp: alpha*x*exp(x)
> #
> DGL:=diff(y(x),x$2)-diff(y(x),x)-2*y(x)=x*exp(-x):l:=dsolve(DGL,y
  (x)):DGL;l;
```

$$\frac{d^2}{dx^2}\,y(x) - \frac{d}{dx}\,y(x) - 2\,y(x) = x\,e^{-x}$$

$$y(x) = e^{2x}\_C2 + \_C1\,e^{-x} - \frac{x\,(3\,x + 2)\,e^{-x}}{18} \tag{15}$$

```
> # Ansatz fuer yp: alpha*x^2*exp(-x)+beta*x*exp(-x)
> #
> DGL:=diff(y(x),x$2)-diff(y(x),x)-2*y(x)=x*exp(2*x):l:=dsolve(DGL,
  y(x)):DGL;l;
```

$$\frac{d^2}{dx^2}\,y(x) - \frac{d}{dx}\,y(x) - 2\,y(x) = e^{2x}x$$

$$y(x) = e^{2x}\_C2 + \_C1\,e^{-x} + \frac{e^{2x}x\,(3\,x - 2)}{18} \tag{16}$$

```
> # Ansatz fuer yp: alpha*x^2*exp(2*x)+beta*x*exp(2*x)
> #
> # oder Variation der Konstanten "Integrale mit Wronski-
  Determinante"
> # phi1= exp(2*x),  phi2=exp(-x), W(x)=-3*exp(x)
> #
> # yp=1/6*x²*exp(2*x) - 1/9*x*exp(2*x) -
> # (-1/27*exp(2*x), aber das verschwindet in der homogenen
  Loesung)
```