```
> restart
> Ecua := diff(y(x), x$4) - 4·diff(y(x), x$2) + 4·y(x) = 0
```

$$Ecua := \frac{d^4}{dx^4} y(x) - 4\left(\frac{d^2}{dx^2} y(x)\right) + 4\,y(x) = 0 \tag{1}$$

```
> Cond := y(0) = 2, D(y)(0) = 4, D(D(y))(0) = 6, D(D(D(y)))(0) = 8
```

$$Cond := y(0) = 2,\ D(y)(0) = 4,\ D^{(2)}(y)(0) = 6,\ D^{(3)}(y)(0) = 8 \tag{2}$$

```
> SolGral := dsolve(Ecua)
```

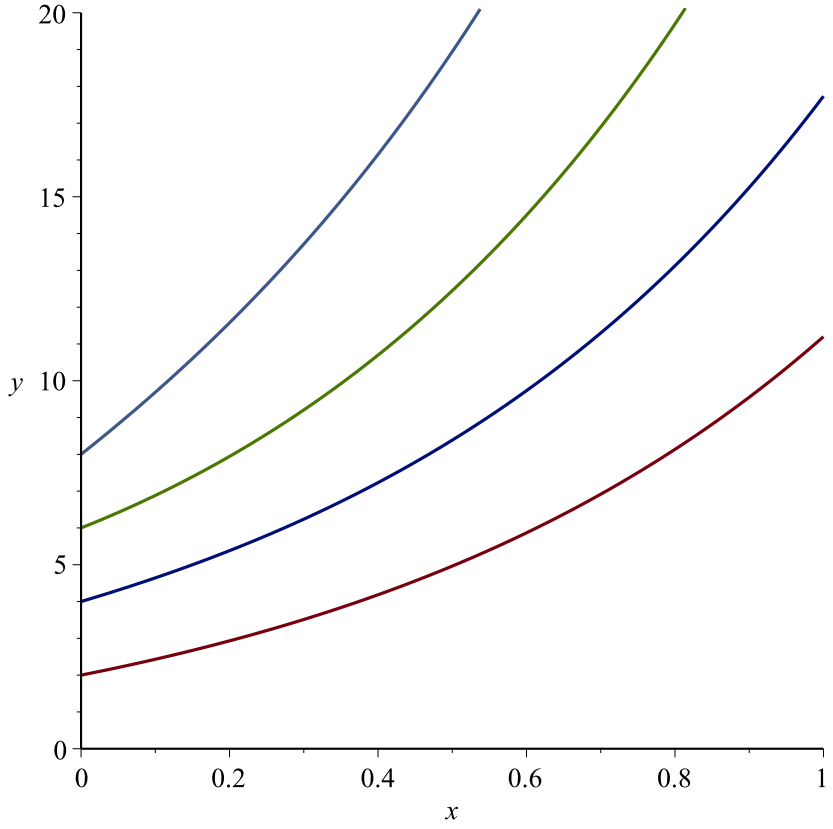
$$SolGral := y(x) = \_C1\, e^{\sqrt{2}\,x} + \_C2\, e^{-\sqrt{2}\,x} + \_C3\, e^{\sqrt{2}\,x} x + \_C4\, e^{-\sqrt{2}\,x} x \tag{3}$$

```
> SolucionParticular := dsolve({Ecua, Cond}); evalf(%, 3)
```

$$SolucionParticular := y(x) = \left(\sqrt{2}+1\right) e^{\sqrt{2}\,x} + \left(-\sqrt{2}+1\right) e^{-\sqrt{2}\,x} + \frac{1}{4}\sqrt{2}\, e^{\sqrt{2}\,x} x - \frac{1}{4}\sqrt{2}\, e^{-\sqrt{2}\,x} x$$

$$y(x) = 2.41\, e^{1.41x} - 0.41\, e^{-1.41x} + 0.352\, e^{1.41x} x - 0.352\, e^{-1.41x} x \tag{4}$$

```
> plot([rhs(SolucionParticular), rhs(diff(SolucionParticular, x)), rhs(diff(SolucionParticular, x$2)), rhs(diff(SolucionParticular, x$3))], x = 0..1, y = 0..20)
```




```
> ComCondUno := y(0) = eval(subs(x = 0, rhs(SolucionParticular)))
```

(5)

$$ComCondUno := y(0) = 2 \quad (5)$$

```
> ComCondDos := D(y)(0) = simplify(eval( subs(x = 0, rhs(diff(SolucionParticular, x)))))
```

$$ComCondDos := D(y)(0) = 4 \quad (6)$$

```
> ComCondTres := D(D(y))(0) = simplify(eval( subs(x = 0, rhs(diff(SolucionParticular, x
      $2)))))
```

$$ComCondTres := D^{(2)}(y)(0) = 6 \quad (7)$$

```
> ComCondCuatro := D(D(D(y)))(0) = simplify(eval( subs(x = 0, rhs(diff(SolucionParticular, x
      $3)))))
```

$$ComCondCuatro := D^{(3)}(y)(0) = 8 \quad (8)$$

```
> ComprobacionUno := simplify(eval(subs(y(x) = rhs(SolGral), Ecua)))
```

$$ComprobacionUno := 0 = 0 \quad (9)$$

```
> ComprobacionDos := simplify(eval(subs(y(x) = rhs(SolucionParticular), Ecua)))
```

$$ComprobacionDos := 0 = 0 \quad (10)$$

```
> yy[1] := e^(sqrt(2)*x); yy[2] := e^(-sqrt(2)*x); yy[3] := e^(sqrt(2)*x)*x; yy[4] := e^(-sqrt(2)*x)*x
```

$$yy_1 := e^{\sqrt{2}\,x}$$

$$yy_2 := e^{-\sqrt{2}\,x}$$

$$yy_3 := e^{\sqrt{2}\,x}\,x$$

$$yy_4 := e^{-\sqrt{2}\,x}\,x \quad (11)$$

```
> SolucionGeneral := y(x) = _C1*yy[1] + _C2*yy[2] + _C3*yy[3] + _C4*yy[4]
```

$$SolucionGeneral := y(x) = \_C1\, e^{\sqrt{2}\,x} + \_C2\, e^{-\sqrt{2}\,x} + \_C3\, e^{\sqrt{2}\,x}\,x + \_C4\, e^{-\sqrt{2}\,x}\,x \quad (12)$$

```
> with(linalg) :
> wronskian([yy[1], yy[2], yy[3], yy[4]], x)
```

$$\begin{bmatrix} e^{\sqrt{2}\,x} & e^{-\sqrt{2}\,x} & e^{\sqrt{2}\,x}\,x & e^{-\sqrt{2}\,x}\,x \\ \sqrt{2}\,e^{\sqrt{2}\,x} & -\sqrt{2}\,e^{-\sqrt{2}\,x} & \sqrt{2}\,e^{\sqrt{2}\,x}\,x + e^{\sqrt{2}\,x} & -\sqrt{2}\,e^{-\sqrt{2}\,x}\,x + e^{-\sqrt{2}\,x} \\ 2\,e^{\sqrt{2}\,x} & 2\,e^{-\sqrt{2}\,x} & 2\,e^{\sqrt{2}\,x}\,x + 2\sqrt{2}\,e^{\sqrt{2}\,x} & 2\,e^{-\sqrt{2}\,x}\,x - 2\sqrt{2}\,e^{-\sqrt{2}\,x} \\ 2\sqrt{2}\,e^{\sqrt{2}\,x} & -2\sqrt{2}\,e^{-\sqrt{2}\,x} & 2\sqrt{2}\,e^{\sqrt{2}\,x}\,x + 6\,e^{\sqrt{2}\,x} & -2\sqrt{2}\,e^{-\sqrt{2}\,x}\,x + 6\,e^{-\sqrt{2}\,x} \end{bmatrix} \quad (13)$$

```
> ComprobacionLinealidad := simplify(det(wronskian([yy[1], yy[2], yy[3], yy[4]], x)) <> 0)
```

$$ComprobacionLinealidad := -64 \neq 0 \quad (14)$$

```
>
>
>
>
```