```
> restart
> Ecua := y''-y=0
```

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

```
> EcuaCarac := m^2 - 1 = 0
```

$$EcuaCarac := m^2 - 1 = 0 \tag{2}$$

```
> Raiz := solve(EcuaCarac)
```

$$Raiz := 1, -1 \tag{3}$$

```
> SolGral := y(x) = _C1·exp(Raiz[1]·x) + _C2·exp(Raiz[2]·x)
```

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

```
> DerSolGral := diff(SolGral, x)
```

$$DerSolGral := \frac{d}{dx} y(x) = \_C1\, e^x - \_C2\, e^{-x} \tag{5}$$

```
> DerDerSolGral := diff(DerSolGral, x)
```

$$DerDerSolGral := \frac{d^2}{dx^2} y(x) = \_C1\, e^x + \_C2\, e^{-x} \tag{6}$$

```
> Comprobacion := rhs(DerDerSolGral) - rhs(SolGral) = 0
```

$$Comprobacion := 0 = 0 \tag{7}$$

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

$$ComprobacionDos := 0 = 0 \tag{8}$$

```
> restart
> Ecua := 3·y''-2·y'-8·y=0
```

$$Ecua := 3\left(\frac{d^2}{dx^2} y(x)\right) - 2\left(\frac{d}{dx} y(x)\right) - 8\, y(x) = 0 \tag{9}$$

```
> EcuaDos := lhs(Ecua)/3 = 0
```

$$EcuaDos := \frac{d^2}{dx^2} y(x) - \frac{2}{3}\frac{d}{dx} y(x) - \frac{8}{3} y(x) = 0 \tag{10}$$

```
> EcuaCarac := m^2 - 2/3·m - 8/3 = 0
```

$$EcuaCarac := m^2 - \frac{2}{3} m - \frac{8}{3} = 0 \tag{11}$$

```
> Raiz := solve(EcuaCarac)
```

$$Raiz := 2, -\frac{4}{3} \tag{12}$$

```
> SolGral := y(x) = _C1·exp(Raiz[1]·x) + _C2·exp(Raiz[2]·x)
```

$$SolGral := y(x) = \_C1\, e^{2x} + \_C2\, e^{-\frac{4}{3} x} \tag{13}$$

```
> restart
> Ecua := y''+ 2·y'+ y=0
```

$$Ecua := \frac{d^2}{dx^2} y(x) + 2\left(\frac{d}{dx} y(x)\right) + y(x) = 0 \tag{14}$$

> $EcuaCarac := m^2 + 2 \cdot m + 1 = 0$

$$EcuaCarac := m^2 + 2\,m + 1 = 0 \tag{15}$$

> $Raiz := solve(EcuaCarac)$

$$Raiz := -1, -1 \tag{16}$$

CASO II

> $SolGral := y(x) = \_C1 \cdot \exp(Raiz[1] \cdot x) + \_C2 \cdot x \cdot \exp(Raiz[1] \cdot x)$

$$SolGral := y(x) = \_C1\, e^{-x} + \_C2\, x\, e^{-x} \tag{17}$$

> $restart$

> $Ecua := y'' - 4 \cdot y' + 4 \cdot y = 0$

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

> $EcuaCarac := m^2 - 4 \cdot m + 4 = 0$

$$EcuaCarac := m^2 - 4\, m + 4 = 0 \tag{19}$$

> $Raiz := solve(EcuaCarac)$

$$Raiz := 2, 2 \tag{20}$$

> $SolGral := y(x) = \_C1 \cdot \exp(Raiz[1] \cdot x) + \_C2 \cdot x \cdot \exp(Raiz[1] \cdot x)$

$$SolGral := y(x) = \_C1\, e^{2x} + \_C2\, x\, e^{2x} \tag{21}$$

> $restart$

> $Ecua := y'' - 3 \cdot y' + 3 \cdot y = 0$

$$Ecua := \frac{d^2}{dx^2}\, y(x) - 3\left(\frac{d}{dx}\, y(x)\right) + 3\, y(x) = 0 \tag{22}$$

> $CondIni := y(0) = 5, D(y)(0) = -6$

$$CondIni := y(0) = 5, D(y)(0) = -6 \tag{23}$$

> $EcuaCarac := m^2 - 3 \cdot m + 3 = 0$

$$EcuaCarac := m^2 - 3\, m + 3 = 0 \tag{24}$$

> $Raiz := solve(EcuaCarac)$

$$Raiz := \frac{3}{2} + \frac{1}{2}\, I\sqrt{3}, \frac{3}{2} - \frac{1}{2}\, I\sqrt{3} \tag{25}$$

CASO III

> $SolGral := y(x) = \_C1 \cdot \exp(\text{Re}(Raiz[1]) \cdot x) \cdot \cos(\text{Im}(Raiz[1]) \cdot x) + \_C2 \cdot \exp(\text{Re}(Raiz[1]) \cdot x)$
  $\cdot \sin(\text{Im}(Raiz[1]) \cdot x)$

$$SolGral := y(x) = \_C1\, e^{\frac{3}{2}x} \cos\left(\frac{1}{2}\sqrt{3}\, x\right) + \_C2\, e^{\frac{3}{2}x} \sin\left(\frac{1}{2}\sqrt{3}\, x\right) \tag{26}$$

> $CondIni$

$$y(0) = 5, D(y)(0) = -6 \tag{27}$$

> $ParaUno := simplify(subs(x = 0, rhs(SolGral) = rhs(CondIni[1])))$

$$ParaUno := \_C1 = 5 \tag{28}$$

> $ParaDos := simplify(subs(x = 0, rhs(diff(SolGral, x)) = rhs(CondIni[2])))$

$$ParaDos := \frac{3}{2}\, \_C1 + \frac{1}{2}\, \_C2\, \sqrt{3} = -6 \tag{29}$$

> $with(linalg):$

> $Parametro := solve(\{ParaUno, ParaDos\}, \{\_C1, \_C2\})$

$$Parametro := \{\_C1 = 5, \_C2 = -9\sqrt{3}\} \tag{30}$$

> $SolPart := subs(\_C1 = rhs(Parametro[1]), \_C2 = rhs(Parametro[2]), SolGral)$

$$SolPart := y(x) = 5\,e^{\frac{3}{2}x}\cos\left(\frac{1}{2}\sqrt{3}\,x\right) - 9\sqrt{3}\,e^{\frac{3}{2}x}\sin\left(\frac{1}{2}\sqrt{3}\,x\right) \tag{31}$$

> $simplify(eval(subs(y(x) = rhs(SolPart), Ecua)))$

$$0 = 0 \tag{32}$$

> $CondicionUno := y(0) = simplify(eval(subs(x = 0, rhs(SolPart))))$

$$CondicionUno := y(0) = 5 \tag{33}$$

> $CondicionDos := D(y)(0) = simplify(eval(subs(x = 0, rhs(diff(SolPart, x)))))$

$$CondicionDos := D(y)(0) = -6 \tag{34}$$

> $SolGralFinal := dsolve(Ecua)$

$$SolGralFinal := y(x) = \_C1\,e^{\frac{3}{2}x}\sin\left(\frac{1}{2}\sqrt{3}\,x\right) + \_C2\,e^{\frac{3}{2}x}\cos\left(\frac{1}{2}\sqrt{3}\,x\right) \tag{35}$$

> $SolPartFinal := dsolve(\{Ecua, CondIni\})$

$$SolPartFinal := y(x) = 5\,e^{\frac{3}{2}x}\cos\left(\frac{1}{2}\sqrt{3}\,x\right) - 9\sqrt{3}\,e^{\frac{3}{2}x}\sin\left(\frac{1}{2}\sqrt{3}\,x\right) \tag{36}$$

> $restart$

> $Ecua := \dfrac{d^2}{dx^2}y(x) - 4\left(\dfrac{d}{dx}y(x)\right) + 4\,y(x) = 6\cdot\exp(2\,x)$

$$Ecua := \frac{d^2}{dx^2}y(x) - 4\left(\frac{d}{dx}y(x)\right) + 4\,y(x) = 6\,e^{2x} \tag{37}$$

Parametro variables

> $EcuaHom := lhs(Ecua) = 0$

$$EcuaHom := \frac{d^2}{dx^2}y(x) - 4\left(\frac{d}{dx}y(x)\right) + 4\,y(x) = 0 \tag{38}$$

> $Q := rhs(Ecua)$

$$Q := 6\,e^{2x} \tag{39}$$

> $EcuaCarac := m^2 - 4\cdot m + 4 = 0$

$$EcuaCarac := m^2 - 4\,m + 4 = 0 \tag{40}$$

> $Raiz := solve(EcuaCarac)$

$$Raiz := 2, 2 \tag{41}$$

> $yy[1] := \exp(Raiz[1]\cdot x); yy[2] := x\cdot\exp(Raiz[1]\cdot x)$

$$yy_1 := e^{2x}$$

$$yy_2 := x\,e^{2x} \tag{42}$$

> $SolGral := y(x) = \_C1\cdot yy[1] + \_C2\cdot yy[2]$

$$SolGral := y(x) = \_C1\,e^{2x} + \_C2\,x\,e^{2x} \tag{43}$$

> $SolGralNoHom := y(x) = A(x)\cdot yy[1] + B(x)\cdot yy[2]$

$$SolGralNoHom := y(x) = A(x)\,e^{2x} + B(x)\,x\,e^{2x} \tag{44}$$

> $with(linalg)$:

> $WW := wronskian([yy[1], yy[2]], x)$

$$WW := \begin{bmatrix} e^{2x} & x\,e^{2x} \\ 2\,e^{2x} & e^{2x} + 2\,x\,e^{2x} \end{bmatrix} \tag{45}$$

> $BB := array([0, Q])$

$$BB := \begin{bmatrix} 0 & 6\,e^{2x} \end{bmatrix} \tag{46}$$

> $Para := linsolve(WW, BB)$

$$Para := \begin{bmatrix} -6\,x & 6 \end{bmatrix} \tag{47}$$

> $Aprima := Para[1]; Bprima := Para[2]$

$$Aprima := -6\,x$$
$$Bprima := 6 \tag{48}$$

> $A(x) := int(Aprima, x) + \_C1$

$$A(x) := -3\,x^2 + \_C1 \tag{49}$$

> $B(x) := int(Bprima, x) + \_C2$

$$B(x) := 6\,x + \_C2 \tag{50}$$

> $SolFinal := simplify(SolGralNoHom)$

$$SolFinal := y(x) = e^{2x}\left(\_C2\,x + 3\,x^2 + \_C1\right) \tag{51}$$

> $restart$

>