> *restart*

> $Ecua := y''' - 6\,y'' + 12\,y' - 8\,y = 0$

$$Ecua := \frac{d^3}{dx^3}\,y(x) - 6\left(\frac{d^2}{dx^2}\,y(x)\right) + 12\left(\frac{d}{dx}\,y(x)\right) - 8\,y(x) = 0 \tag{1}$$

> $SolGral := dsolve(Ecua)$

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

> $EcuaCarac := m^3 - 6\,m^2 + 12\,m - 8 = 0$

$$EcuaCarac := m^3 - 6\,m^2 + 12\,m - 8 = 0 \tag{3}$$

> $Raiz := solve(EcuaCarac)$

$$Raiz := 2, 2, 2 \tag{4}$$

> $yy[1] := \exp(Raiz[1]\cdot x);\; yy[2] := x\cdot\exp(Raiz[1]\cdot x);\; yy[3] := x^2\cdot\exp(Raiz[1]\cdot x)$

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

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

$$yy_3 := x^2\,e^{2x} \tag{5}$$

> $with(linalg):$

> $WW := wronskian([yy[1], yy[2], yy[3]], x)$

$$WW := \begin{bmatrix} e^{2x} & x\,e^{2x} & x^2\,e^{2x} \\ 2\,e^{2x} & e^{2x} + 2\,x\,e^{2x} & 2\,x\,e^{2x} + 2\,x^2\,e^{2x} \\ 4\,e^{2x} & 4\,e^{2x} + 4\,x\,e^{2x} & 2\,e^{2x} + 8\,x\,e^{2x} + 4\,x^2\,e^{2x} \end{bmatrix} \tag{6}$$

> $ComprobarUno := det(WW) \neq 0$

$$ComprobarUno := 2\left(e^{2x}\right)^3 \neq 0 \tag{7}$$

> $ComprobarDos := eval(subs(y(x) = rhs(SolGral), Ecua))$

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

> $CondIni := y(0) = 4,\; D(y)(0) = -3,\; D(D(y))(0) = 2$

$$CondIni := y(0) = 4,\; D(y)(0) = -3,\; D^{(2)}(y)(0) = 2 \tag{9}$$

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

$$SolPart := y(x) = 4\,e^{2x} - 11\,x\,e^{2x} + 15\,x^2\,e^{2x} \tag{10}$$

> $EcuaUno := simplify(subs(x = 0, rhs(SolGral) = 4))$

$$EcuaUno := \_C1 = 4 \tag{11}$$

> $EcuaDos := simplify(subs(x = 0, rhs(diff(SolGral, x)) = -3))$

$$EcuaDos := 2\,\_C1 + \_C2 = -3 \tag{12}$$

> $EcuaTres := simplify(subs(x = 0, rhs(diff(SolGral, x\$2)) = 2))$

$$EcuaTres := 4\,\_C1 + 4\,\_C2 + 2\,\_C3 = 2 \tag{13}$$

> $Para := solve(\{EcuaUno, EcuaDos, EcuaTres\}, \{\_C1, \_C2, \_C3\})$

$$Para := \{\_C1 = 4,\; \_C2 = -11,\; \_C3 = 15\} \tag{14}$$

> $SolPart := subs(\_C1 = rhs(Para[1]), \_C2 = rhs(Para[2]), \_C3 = rhs(Para[3]), SolGral)$

$$SolPart := y(x) = 4\,e^{2x} - 11\,x\,e^{2x} + 15\,x^2\,e^{2x} \tag{15}$$

> *restart*

> $EcuaDos := y'' + y' + y = 0$

$$EcuaDos := \frac{d^2}{dx^2} y(x) + \frac{d}{dx} y(x) + y(x) = 0 \tag{16}$$

> $SolGral := dsolve(EcuaDos)$

$$SolGral := y(x) = \_C1 \, e^{-\frac{1}{2} x} \sin\left(\frac{1}{2} \sqrt{3} \, x\right) + \_C2 \, e^{-\frac{1}{2} x} \cos\left(\frac{1}{2} \sqrt{3} \, x\right) \tag{17}$$

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

$$EcuaCarac := m^2 + m + 1 = 0 \tag{18}$$

> $Raiz := solve(EcuaCarac)$

$$Raiz := -\frac{1}{2} + \frac{1}{2} \, I\sqrt{3}, \, -\frac{1}{2} - \frac{1}{2} \, I\sqrt{3} \tag{19}$$

> $yy[1] := \exp(Re(Raiz[1]) \cdot x) \cdot \cos(Im(Raiz[1]) \cdot x)$

$$yy_1 := e^{-\frac{1}{2} x} \cos\left(\frac{1}{2} \sqrt{3} \, x\right) \tag{20}$$

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

$$yy_2 := e^{-\frac{1}{2} x} \sin\left(\frac{1}{2} \sqrt{3} \, x\right) \tag{21}$$

> $with(linalg) :$

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

$$WW := \left[\left[e^{-\frac{1}{2} x} \cos\left(\frac{1}{2} \sqrt{3} \, x\right), e^{-\frac{1}{2} x} \sin\left(\frac{1}{2} \sqrt{3} \, x\right)\right],\right.$$

$$\left[-\frac{1}{2} \, e^{-\frac{1}{2} x} \cos\left(\frac{1}{2} \sqrt{3} \, x\right) - \frac{1}{2} \, e^{-\frac{1}{2} x} \sin\left(\frac{1}{2} \sqrt{3} \, x\right) \sqrt{3}, \, -\frac{1}{2} \, e^{-\frac{1}{2} x} \sin\left(\frac{1}{2} \sqrt{3} \, x\right)\right.$$

$$\left.\left. + \frac{1}{2} \, e^{-\frac{1}{2} x} \cos\left(\frac{1}{2} \sqrt{3} \, x\right) \sqrt{3}\right]\right] \tag{22}$$

> $Comprobar := simplify(det(WW)) \neq 0$

$$Comprobar := \frac{1}{2} \, e^{-x} \sqrt{3} \neq 0 \tag{23}$$

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

$$SolGralDos := y(x) = \_C1 \, e^{-\frac{1}{2} x} \cos\left(\frac{1}{2} \sqrt{3} \, x\right) + \_C2 \, e^{-\frac{1}{2} x} \sin\left(\frac{1}{2} \sqrt{3} \, x\right) \tag{24}$$

> $SolGral$

$$y(x) = \_C1 \, e^{-\frac{1}{2} x} \sin\left(\frac{1}{2} \sqrt{3} \, x\right) + \_C2 \, e^{-\frac{1}{2} x} \cos\left(\frac{1}{2} \sqrt{3} \, x\right) \tag{25}$$

> $EcuaDos$

$$\frac{d^2}{dx^2} y(x) + \frac{d}{dx} y(x) + y(x) = 0 \tag{26}$$

> $ComprobarDos := simplify(eval(subs(y(x) = rhs(SolGralDos), EcuaDos)))$

$$ComprobarDos := 0 = 0 \tag{27}$$

> $restart$

> $Ecua := expand\left((m - 1 + I)^2 \cdot (m - 1 - I)^2 \right) = 0$

$$Ecua := m^4 - 4\,m^3 + 8\,m^2 - 8\,m + 4 = 0 \qquad \textbf{(28)}$$

> $EcuaNueva := y'''' - 4\,y''' + 8\,y'' - 8\,y' + 4\,y = 0$

$$EcuaNueva := \frac{d^4}{dx^4}\,y(x) - 4\left(\frac{d^3}{dx^3}\,y(x) \right) + 8\left(\frac{d^2}{dx^2}\,y(x) \right) - 8\left(\frac{d}{dx}\,y(x) \right) + 4\,y(x) = 0 \qquad \textbf{(29)}$$

> $SolGralNueva := dsolve(EcuaNueva)$

$$SolGralNueva := y(x) = \_C1\,e^x \sin(x) + \_C2\,e^x \cos(x) + \_C3\,e^x \sin(x)\,x + \_C4\,e^x \cos(x)\,x \qquad \textbf{(30)}$$

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