> *restart*

> *SolucionGeneral* $:= y(x) = C_1 \cdot \exp(3\,x) + C_2 \cdot \exp(-3\,x) + 4 \cdot x \cdot \exp(3\,x) + 2 \cdot \exp(2\,x)$

$$SolucionGeneral := y(x) = C_1\,e^{3x} + C_2\,e^{-3x} + 4\,x\,e^{3x} + 2\,e^{2x} \tag{1}$$

> *Sistema* $:= diff(SolucionGeneral, x), diff(SolucionGeneral, x\$2) : Sistema_1; Sistema_2;$

$$\frac{d}{dx}\,y(x) = 3\,C_1\,e^{3x} - 3\,C_2\,e^{-3x} + 4\,e^{3x} + 12\,x\,e^{3x} + 4\,e^{2x}$$

$$\frac{d^2}{dx^2}\,y(x) = 9\,C_1\,e^{3x} + 9\,C_2\,e^{-3x} + 24\,e^{3x} + 36\,x\,e^{3x} + 8\,e^{2x} \tag{2}$$

> *Parametro* $:= solve\big(\{Sistema\}, \{C_1, C_2\}\big) : Parametro_1; Parametro_2;$

$$C_1 = \frac{1}{18}\,\frac{\frac{d^2}{dx^2}\,y(x) + 3\left(\frac{d}{dx}\,y(x)\right) - 20\,e^{2x} - 36\,e^{3x} - 72\,x\,e^{3x}}{e^{3x}}$$

$$C_2 = -\frac{1}{18}\,\frac{-\left(\frac{d^2}{dx^2}\,y(x)\right) + 3\left(\frac{d}{dx}\,y(x)\right) - 4\,e^{2x} + 12\,e^{3x}}{e^{-3x}} \tag{3}$$

> *EcuacionInicial* $:= simplify\big(subs\big(C_1 = rhs(Parametro_1), C_2 = rhs(Parametro_2),$
> $SolucionGeneral\big)\big)$

$$EcuacionInicial := y(x) = \frac{1}{9}\,\frac{d^2}{dx^2}\,y(x) + \frac{10}{9}\,e^{2x} - \frac{8}{3}\,e^{3x} \tag{4}$$

> *EcuacionSegunda* $:= lhs(EcuacionInicial) \cdot (-9) = rhs(EcuacionInicial) \cdot (-9)$

$$EcuacionSegunda := -9\,y(x) = -\left(\frac{d^2}{dx^2}\,y(x)\right) - 10\,e^{2x} + 24\,e^{3x} \tag{5}$$

> *EcuacionFinal* $:= lhs(EcuacionSegunda) + \frac{d^2}{dx^2}\,y(x) = rhs(EcuacionSegunda) + \frac{d^2}{dx^2}\,y(x)$

$$EcuacionFinal := -9\,y(x) + \frac{d^2}{dx^2}\,y(x) = -10\,e^{2x} + 24\,e^{3x} \tag{6}$$

> *SolucionGeneral*;

$$y(x) = C_1\,e^{3x} + C_2\,e^{-3x} + 4\,x\,e^{3x} + 2\,e^{2x} \tag{7}$$

> *SolucionHomogenea* $:= y(x) = C_1\,e^{3x} + C_2\,e^{-3x}$

$$SolucionHomogenea := y(x) = C_1\,e^{3x} + C_2\,e^{-3x} \tag{8}$$

> *SolucionParticularNoHomogenea* $:= y(x) = 4\,x\,e^{3x} + 2\,e^{2x}$

$$SolucionParticularNoHomogenea := y(x) = 4\,x\,e^{3x} + 2\,e^{2x} \tag{9}$$

> $m_1 := 3; m_2 := -3$

$$m_1 := 3$$

$$m_2 := -3 \tag{10}$$

> *EcuacionCaracteristica* $:= expand\big((m - m_1) \cdot (m - m_2)\big) = 0$

$$\tag{11}$$

$$EcuacionCaracteristica := m^2 - 9 = 0 \tag{11}$$

> $EcuacionHomogenea := diff(y(x), x\$2) - 9 \cdot y(x) = 0$

$$EcuacionHomogenea := -9\, y(x) + \frac{d^2}{dx^2}\, y(x) = 0 \tag{12}$$

> $EcuacionNoHomogenea := lhs(EcuacionHomogenea) = Q$

$$EcuacionNoHomogenea := -9\, y(x) + \frac{d^2}{dx^2}\, y(x) = Q \tag{13}$$

> $Q := eval(subs(y(x) = rhs(SolucionParticularNoHomogenea), lhs(EcuacionHomogenea)));$

$$Q := -10\, e^{2x} + 24\, e^{3x} \tag{14}$$

> $EcuacionNoHomogenea;$

$$-9\, y(x) + \frac{d^2}{dx^2}\, y(x) = -10\, e^{2x} + 24\, e^{3x} \tag{15}$$

> $SolGral := dsolve(EcuacionNoHomogenea)$

$$SolGral := y(x) = e^{3x}\_C2 + e^{-3x}\_C1 + 2\, e^{2x} + 4\, x\, e^{3x} - \frac{2}{3}\, e^{3x} \tag{16}$$

> $SolGraDos := dsolve(EcuacionFinal)$

$$SolGraDos := y(x) = e^{3x}\_C2 + e^{-3x}\_C1 + 2\, e^{2x} + 4\, x\, e^{3x} - \frac{2}{3}\, e^{3x} \tag{17}$$

> $SolucionGeneral$

$$y(x) = C_1\, e^{3x} + C_2\, e^{-3x} + 4\, x\, e^{3x} + 2\, e^{2x} \tag{18}$$

> $EcuacionFinal$

$$-9\, y(x) + \frac{d^2}{dx^2}\, y(x) = -10\, e^{2x} + 24\, e^{3x} \tag{19}$$

> $EcuacionGeneralHomogenea := lhs(EcuacionFinal) = 0$

$$EcuacionGeneralHomogenea := -9\, y(x) + \frac{d^2}{dx^2}\, y(x) = 0 \tag{20}$$

> $QQ := rhs(EcuacionFinal)$

$$QQ := -10\, e^{2x} + 24\, e^{3x} \tag{21}$$

> $EcuacionCaract := m \cdot \cdot 2 - 9 = 0$

$$EcuacionCaract := m^2 - 9 = 0 \tag{22}$$

> $Raiz := solve(EcuacionCaract)$

$$Raiz := 3, -3 \tag{23}$$

> $SolUno := y(x) = \exp(Raiz_1 \cdot x); SolDos := y(x) = \exp(Raiz_2 \cdot x)$

$$SolUno := y(x) = e^{3x}$$
$$SolDos := y(x) = e^{-3x} \tag{24}$$

> $SolucionNoHom := y(x) = A \cdot rhs(SolUno) + B \cdot rhs(SolDos)$

$$SolucionNoHom := y(x) = A\, e^{3x} + B\, e^{-3x} \tag{25}$$

> $with(linalg):$
> $AA := wronskian([rhs(SolUno), rhs(SolDos)], x)$

$$AA := \begin{bmatrix} e^{3x} & e^{-3x} \\ 3\,e^{3x} & -3\,e^{-3x} \end{bmatrix} \tag{26}$$

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

$$BB := \begin{bmatrix} 0 & -10\,e^{2x} + 24\,e^{3x} \end{bmatrix} \tag{27}$$

> $SOL := simplify(linsolve(AA, BB))$

$$SOL := \begin{bmatrix} \dfrac{1}{3}\,\left(-5\,e^{2x} + 12\,e^{3x}\right)\,e^{-3x} & -\dfrac{1}{3}\,\left(-5\,e^{2x} + 12\,e^{3x}\right)\,e^{3x} \end{bmatrix} \tag{28}$$

> $Aprima := expand(SOL_1); Bprima := expand(SOL_2)$

$$Aprima := -\frac{5}{3\,e^{x}} + 4$$

$$Bprima := \frac{5}{3}\,\left(e^{x}\right)^{5} - 4\,\left(e^{x}\right)^{6} \tag{29}$$

> $A := int(Aprima, x) + C_1; B := int(Bprima, x) + C_2$

$$A := \frac{5}{3\,e^{x}} + 4\,x + C_1$$

$$B := \frac{1}{3}\,\left(e^{x}\right)^{5} - \frac{2}{3}\,\left(e^{x}\right)^{6} + C_2 \tag{30}$$

> $simplify(SolucionNoHom)$

$$y(x) = 2\,e^{2x} + 4\,x\,e^{3x} + C_1\,e^{3x} - \frac{2}{3}\,e^{3x} + C_2\,e^{-3x} \tag{31}$$

> $SolGral$

$$y(x) = e^{3x}\,\_C2 + e^{-3x}\,\_C1 + 2\,e^{2x} + 4\,x\,e^{3x} - \frac{2}{3}\,e^{3x} \tag{32}$$

>