

$$\begin{aligned} &> \text{restart} \\ &> \text{Ecuacion} := y''' - 27 \cdot y = 8 \cdot \exp(3 \cdot x) \\ &\quad \text{Ecuacion} := \frac{d^3}{dx^3} y(x) - 27 y(x) = 8 e^{3x} \end{aligned} \quad (1)$$

$$\begin{aligned} &> \text{EcuacionHom} := \text{lhs}(\text{Ecuacion}) = 0 \\ &\quad \text{EcuacionHom} := \frac{d^3}{dx^3} y(x) - 27 y(x) = 0 \end{aligned} \quad (2)$$

$$\begin{aligned} &> Q := \text{rhs}(\text{Ecuacion}) \\ &\quad Q := 8 e^{3x} \end{aligned} \quad (3)$$

$$\begin{aligned} &> \text{EcuacionCaract} := m \cdot 3 - 27 = 0 \\ &\quad \text{EcuacionCaract} := m^3 - 27 = 0 \end{aligned} \quad (4)$$

$$\begin{aligned} &> \text{Raiz} := \text{solve}(\text{EcuacionCaract}) \\ &\quad \text{Raiz} := 3, -\frac{3}{2} + \frac{3}{2} i\sqrt{3}, -\frac{3}{2} - \frac{3}{2} i\sqrt{3} \end{aligned} \quad (5)$$

$$\begin{aligned} &> \text{SolucionUno} := y(x) = \exp(\text{Raiz}_1 \cdot x) \\ &\quad \text{SolucionUno} := y(x) = e^{3x} \end{aligned} \quad (6)$$

$$\begin{aligned} &> \text{SolucionDos} := y(x) = \exp(\text{Re}(\text{Raiz}_2) \cdot x) \cdot \cos(\text{Im}(\text{Raiz}_2) \cdot x) \\ &\quad \text{SolucionDos} := y(x) = e^{-\frac{3}{2}x} \cos\left(\frac{3}{2}\sqrt{3}x\right) \end{aligned} \quad (7)$$

$$\begin{aligned} &> \text{SolucionTres} := y(x) = \exp(\text{Re}(\text{Raiz}_2) \cdot x) \cdot \sin(\text{Im}(\text{Raiz}_2) \cdot x) \\ &\quad \text{SolucionTres} := y(x) = e^{-\frac{3}{2}x} \sin\left(\frac{3}{2}\sqrt{3}x\right) \end{aligned} \quad (8)$$

$$\begin{aligned} &> \text{SolucionHom} := y(x) = C_1 \cdot \text{rhs}(\text{SolucionUno}) + C_2 \cdot \text{rhs}(\text{SolucionDos}) + C_3 \\ &\quad \cdot \text{rhs}(\text{SolucionTres}) \\ &\quad \text{SolucionHom} := y(x) = C_1 e^{3x} + C_2 e^{-\frac{3}{2}x} \cos\left(\frac{3}{2}\sqrt{3}x\right) + C_3 e^{-\frac{3}{2}x} \sin\left(\frac{3}{2}\sqrt{3}x\right) \end{aligned} \quad (9)$$

$$\begin{aligned} &> \text{SolucionNoHom} := y(x) = A(x) \cdot \text{rhs}(\text{SolucionUno}) + B(x) \cdot \text{rhs}(\text{SolucionDos}) + D(x) \\ &\quad \cdot \text{rhs}(\text{SolucionTres}) \\ &\quad \text{SolucionNoHom} := y(x) = A(x) e^{3x} + B(x) e^{-\frac{3}{2}x} \cos\left(\frac{3}{2}\sqrt{3}x\right) + D(x) e^{-\frac{3}{2}x} \sin\left(\frac{3}{2}\sqrt{3}x\right) \end{aligned} \quad (10)$$

$$\begin{aligned} &> \\ &> \\ &> \text{with}(\text{linalg}) : \\ &> WW := \text{wronskian}([\text{rhs}(\text{SolucionUno}), \text{rhs}(\text{SolucionDos}), \text{rhs}(\text{SolucionTres})], x); \\ &\quad WW := \left[\left[e^{3x}, e^{-\frac{3}{2}x} \cos\left(\frac{3}{2}\sqrt{3}x\right), e^{-\frac{3}{2}x} \sin\left(\frac{3}{2}\sqrt{3}x\right) \right], \right. \\ &\quad \left. \left[3 e^{3x}, -\frac{3}{2} e^{-\frac{3}{2}x} \cos\left(\frac{3}{2}\sqrt{3}x\right) - \frac{3}{2} e^{-\frac{3}{2}x} \sin\left(\frac{3}{2}\sqrt{3}x\right) \sqrt{3}, \right. \right. \end{aligned} \quad (11)$$

$$\left[-\frac{3}{2} e^{-\frac{3}{2}x} \sin\left(\frac{3}{2} \sqrt{3} x\right) + \frac{3}{2} e^{-\frac{3}{2}x} \cos\left(\frac{3}{2} \sqrt{3} x\right) \sqrt{3}, \right. \\ \left[9 e^{3x}, -\frac{9}{2} e^{-\frac{3}{2}x} \cos\left(\frac{3}{2} \sqrt{3} x\right) + \frac{9}{2} e^{-\frac{3}{2}x} \sin\left(\frac{3}{2} \sqrt{3} x\right) \sqrt{3}, \right. \\ \left. \left. -\frac{9}{2} e^{-\frac{3}{2}x} \sin\left(\frac{3}{2} \sqrt{3} x\right) - \frac{9}{2} e^{-\frac{3}{2}x} \cos\left(\frac{3}{2} \sqrt{3} x\right) \sqrt{3} \right] \right]$$

> $BB := \text{array}([0, 0, Q])$

$$BB := \begin{bmatrix} 0 & 0 & 8 e^{3x} \end{bmatrix} \quad (12)$$

> $SOL := \text{simplify}(\text{linsolve}(WW, BB)) :$

> $Aprima := SOL_1$

$$Aprima := \frac{8}{27} \quad (13)$$

> $Bprima := SOL_2$

$$Bprima := -\frac{8}{81} e^{\frac{9}{2}x} \sqrt{3} \left(-3 \sin\left(\frac{3}{2} \sqrt{3} x\right) + \cos\left(\frac{3}{2} \sqrt{3} x\right) \sqrt{3} \right) \quad (14)$$

> $Dprima := SOL_3$

$$Dprima := -\frac{8}{81} e^{\frac{9}{2}x} \sqrt{3} \left(3 \cos\left(\frac{3}{2} \sqrt{3} x\right) + \sin\left(\frac{3}{2} \sqrt{3} x\right) \sqrt{3} \right) \quad (15)$$

> $A(x) := \text{int}(Aprima, x) + C_1; B(x) := \text{int}(Bprima, x) + C_2; D(x) := \text{int}(Dprima, x) + C_3;$

$$A(x) := \frac{8}{27} x + C_1$$

$$B(x) := \frac{8}{27} \sqrt{3} \left(-\frac{1}{18} e^{\frac{9}{2}x} \cos\left(\frac{3}{2} \sqrt{3} x\right) \sqrt{3} + \frac{1}{6} e^{\frac{9}{2}x} \sin\left(\frac{3}{2} \sqrt{3} x\right) \right) \\ - \frac{4}{81} e^{\frac{9}{2}x} \cos\left(\frac{3}{2} \sqrt{3} x\right) - \frac{4}{243} e^{\frac{9}{2}x} \sqrt{3} \sin\left(\frac{3}{2} \sqrt{3} x\right) + C_2$$

$$D(x) := -\frac{8}{27} \sqrt{3} \left(\frac{1}{6} e^{\frac{9}{2}x} \cos\left(\frac{3}{2} \sqrt{3} x\right) + \frac{1}{18} e^{\frac{9}{2}x} \sqrt{3} \sin\left(\frac{3}{2} \sqrt{3} x\right) \right) \\ + \frac{4}{243} e^{\frac{9}{2}x} \cos\left(\frac{3}{2} \sqrt{3} x\right) \sqrt{3} - \frac{4}{81} e^{\frac{9}{2}x} \sin\left(\frac{3}{2} \sqrt{3} x\right) + C_3 \quad (16)$$

> $\text{simplify}(\text{SolucionNoHom})$

$$y(x) = \frac{8}{27} e^{3x} x + C_1 e^{3x} + C_2 e^{-\frac{3}{2}x} \cos\left(\frac{3}{2} \sqrt{3} x\right) - \frac{8}{81} e^{3x} + C_3 e^{-\frac{3}{2}x} \sin\left(\frac{3}{2} \sqrt{3} x\right) \quad (17)$$

> SolucionHom

$$y(x) = C_1 e^{3x} + C_2 e^{-\frac{3}{2}x} \cos\left(\frac{3}{2} \sqrt{3} x\right) + C_3 e^{-\frac{3}{2}x} \sin\left(\frac{3}{2} \sqrt{3} x\right) \quad (18)$$

> $\text{SolGral} := \text{dsolve}(\text{Ecuacion})$

$$\begin{aligned}
 SolGral := y(x) = & \frac{8}{27} x (e^x)^3 + {}_C1 e^{3x} + {}_C2 e^{-\frac{3}{2}x} \cos\left(\frac{3}{2}\sqrt{3}x\right) \\
 & + {}_C3 e^{-\frac{3}{2}x} \sin\left(\frac{3}{2}\sqrt{3}x\right)
 \end{aligned}
 \tag{19}$$