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> restart
> Ecuacion := diff(y(t), t$2) - 8*diff(y(t), t) + 16*y(t) = 5*exp(4*t)
      Ecuacion :=  $\frac{d^2}{dt^2} y(t) - 8 \left( \frac{d}{dt} y(t) \right) + 16 y(t) = 5 e^{4t}$  (1)
=
>
SOLUCION
> EcuaHom := lhs(Ecuacion) = 0
      EcuaHom :=  $\frac{d^2}{dt^2} y(t) - 8 \left( \frac{d}{dt} y(t) \right) + 16 y(t) = 0$  (2)
=
> EcuaCarac := m*2 - 8*m + 16 = 0
      EcuaCarac :=  $m^2 - 8m + 16 = 0$  (3)
=
> Raiz := solve(EcuaCarac)
      Raiz := 4, 4 (4)
=
> SolHom := y(t) = C[1]*exp(Raiz[1]*t) + C[2]*t*exp(Raiz[1]*t)
      SolHom :=  $y(t) = C_1 e^{4t} + C_2 t e^{4t}$  (5)
=
> yy[1] := exp(Raiz[1]*t); yy[2] := t*exp(Raiz[1]*t)
      yy1 :=  $e^{4t}$ 
      yy2 :=  $t e^{4t}$  (6)
=
> SolNoHom := y(t) = A*yy[1] + B*yy[2]
      SolNoHom :=  $y(t) = A e^{4t} + B t e^{4t}$  (7)
=
> with(linalg) :
> WW := wronskian([yy[1], yy[2]], t)
      WW :=  $\begin{bmatrix} e^{4t} & t e^{4t} \\ 4 e^{4t} & e^{4t} + 4 t e^{4t} \end{bmatrix}$  (8)
=
> BB := array([0, rhs(Ecuacion)])
      BB :=  $\begin{bmatrix} 0 & 5 e^{4t} \end{bmatrix}$  (9)
=
> DerParVar := linsolve(WW, BB) : Aprima := DerParVar[1]; Bprima := DerParVar[2]
      Aprima :=  $-5 t$ 
      Bprima :=  $5$  (10)
=
> A := int(Aprima, t) + C[1]; B := int(Bprima, t) + C[2]
      A :=  $-\frac{5}{2} t^2 + C_1$ 
      B :=  $5 t + C_2$  (11)
=
> SolNoHom
       $y(t) = \left( -\frac{5}{2} t^2 + C_1 \right) e^{4t} + (5 t + C_2) t e^{4t}$  (12)
=
> SolNoHomDos := y(t) = C[1]*exp(4*t) + C[2]*t*exp(4*t) +  $\frac{5}{2} \cdot t \cdot 2 \cdot \exp(4 t)$  (13)

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$$\text{SolNoHomDos} := y(t) = \frac{5}{2} e^{4t} t^2 + C_1 e^{4t} + C_2 t e^{4t} \quad (13)$$

> Ecuacion

$$\frac{d^2}{dt^2} y(t) - 8 \left(\frac{d}{dt} y(t) \right) + 16 y(t) = 5 e^{4t} \quad (14)$$

> Comprobacion := eval(subs(y(t) = rhs(SolNoHomDos), Ecuacion))

$$\text{Comprobacion} := 5 e^{4t} = 5 e^{4t} \quad (15)$$

> restart

> SolGral := y(x) = C[1]·exp(-2·x)·cos(3·x) + C[2]·exp(-2·x)·sin(3·x) + cos(3·x) + 5·sin(3·x)

$$\text{SolGral} := y(x) = C_1 e^{-2x} \cos(3x) + C_2 e^{-2x} \sin(3x) + \cos(3x) + 5 \sin(3x) \quad (16)$$

> CondFront := y(0) = 3, y\left(\frac{\text{Pi}}{2}\right) = 3

$$\text{CondFront} := y(0) = 3, y\left(\frac{1}{2} \pi\right) = 3 \quad (17)$$

> Sist := eval(subs(x=0, rhs(SolGral) = 3)), eval\left(subs\left(x = \frac{\text{Pi}}{2}, \text{rhs}(SolGral) = 3\right)\right) : Sist[1];
Sist[2]

$$C_1 + 1 = 3$$

$$-5 - C_2 e^{-\pi} = 3 \quad (18)$$

> Para := solve({Sist}, {C[1], C[2]}) : Para[1]; Para[2]

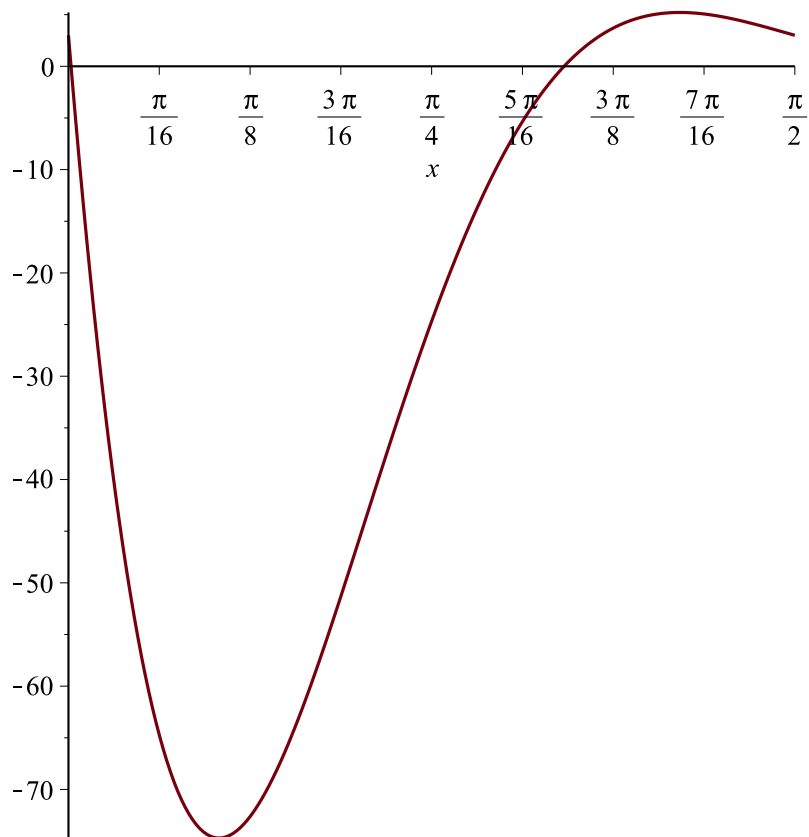
$$C_1 = 2$$

$$C_2 = -\frac{8}{e^{-\pi}} \quad (19)$$

> SolPart := subs(C[1] = rhs(Para[1]), C[2] = rhs(Para[2]), SolGral)

$$\text{SolPart} := y(x) = 2 e^{-2x} \cos(3x) - \frac{8 e^{-2x} \sin(3x)}{e^{-\pi}} + \cos(3x) + 5 \sin(3x) \quad (20)$$

> plot(rhs(SolPart), x = 0 .. \frac{\text{Pi}}{2})



> SolGral

$$y(x) = C_1 e^{-2x} \cos(3x) + C_2 e^{-2x} \sin(3x) + \cos(3x) + 5 \sin(3x) \quad (21)$$

> DerSolGral := diff(SolGral, x)

$$\begin{aligned} \text{DerSolGral} := \frac{d}{dx} y(x) = & -2 C_1 e^{-2x} \cos(3x) - 3 C_1 e^{-2x} \sin(3x) - 2 C_2 e^{-2x} \sin(3x) \\ & + 3 C_2 e^{-2x} \cos(3x) - 3 \sin(3x) + 15 \cos(3x) \end{aligned} \quad (22)$$

> DerDerSolGral := diff(SolGral, x\$2)

$$\begin{aligned} \text{DerDerSolGral} := \frac{d^2}{dx^2} y(x) = & -5 C_1 e^{-2x} \cos(3x) + 12 C_1 e^{-2x} \sin(3x) - 5 C_2 e^{-2x} \sin(3x) \\ & - 12 C_2 e^{-2x} \cos(3x) - 9 \cos(3x) - 45 \sin(3x) \end{aligned} \quad (23)$$

> Sistema := DerSolGral, DerDerSolGral

$$\begin{aligned} \text{Sistema} := \frac{d}{dx} y(x) = & -2 C_1 e^{-2x} \cos(3x) - 3 C_1 e^{-2x} \sin(3x) - 2 C_2 e^{-2x} \sin(3x) \\ & + 3 C_2 e^{-2x} \cos(3x) - 3 \sin(3x) + 15 \cos(3x), \frac{d^2}{dx^2} y(x) = -5 C_1 e^{-2x} \cos(3x) \end{aligned} \quad (24)$$

$$+ 12 C_1 e^{-2x} \sin(3x) - 5 C_2 e^{-2x} \sin(3x) - 12 C_2 e^{-2x} \cos(3x) - 9 \cos(3x) - 45 \sin(3x)$$

> Parametros := solve({Sistema}, {C[1], C[2]}) : Parametros[1]; Parametros[2]

$$C_1 = \frac{1}{39} \frac{1}{e^{-2x} (\cos(3x)^2 + \sin(3x)^2)} \left(153 \cos(3x)^2 - 3 \left(\frac{d^2}{dx^2} y(x) \right) \cos(3x) - 78 \cos(3x) \sin(3x) - 12 \cos(3x) \left(\frac{d}{dx} y(x) \right) + 2 \left(\frac{d^2}{dx^2} y(x) \right) \sin(3x) + 75 \sin(3x)^2 - 5 \sin(3x) \left(\frac{d}{dx} y(x) \right) \right)$$

$$C_2 = -\frac{1}{39} \frac{1}{e^{-2x} (\cos(3x)^2 + \sin(3x)^2)} \left(93 \cos(3x)^2 + 2 \left(\frac{d^2}{dx^2} y(x) \right) \cos(3x) - 78 \cos(3x) \sin(3x) - 5 \cos(3x) \left(\frac{d}{dx} y(x) \right) + 3 \left(\frac{d^2}{dx^2} y(x) \right) \sin(3x) + 171 \sin(3x)^2 + 12 \sin(3x) \left(\frac{d}{dx} y(x) \right) \right) \quad (25)$$

> EcuacionDiferencial := simplify(subs(C[1] = rhs(Parametros[1]), C[2] = rhs(Parametros[2]), SolGral))

$$EcuacionDiferencial := y(x) = \frac{64}{13} \cos(3x) - \frac{1}{13} \frac{d^2}{dx^2} y(x) + \frac{8}{13} \sin(3x) - \frac{4}{13} \frac{d}{dx} y(x) \quad (26)$$

> EcuacionDiferencialNoHomogenea := 13 · $\left(lhs(EcuacionDiferencial) - \left(-\frac{1}{13} \frac{d^2}{dx^2} y(x) \right) - -\frac{4}{13} \frac{d}{dx} y(x) \right) = 13 \cdot \left(rhs(EcuacionDiferencial) - \left(-\frac{1}{13} \frac{d^2}{dx^2} y(x) \right) - -\frac{4}{13} \frac{d}{dx} y(x) \right)$

$$EcuacionDiferencialNoHomogenea := 13 y(x) + \frac{d^2}{dx^2} y(x) + 4 \left(\frac{d}{dx} y(x) \right) = 64 \cos(3x) + 8 \sin(3x) \quad (27)$$

> restart

> Ecua := diff(y(x), x) - cos(x) · y(x) = sin(2 · x)

$$Ecua := \frac{d}{dx} y(x) - \cos(x) y(x) = \sin(2x) \quad (28)$$

> pp := -cos(x)

$$pp := -\cos(x) \quad (29)$$

> qq := sin(2 · x)

$$qq := \sin(2x) \quad (30)$$

> SolGral := y(x) = expand(C[1] · exp(-int(pp, x)) + exp(-int(pp, x)) · int(exp(int(pp, x)) · qq, x))

$$SolGral := y(x) = C_1 e^{\sin(x)} - 2 \sin(x) - 2 \quad (31)$$

