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[> restart
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[TEOREM DE EXISTENCIA Y UNICIDAD DE LA SOLUACION PARTICULAR POR P.
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[> EcuacionUno := diff(y(x), x) = x*y(x)
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$$EcuacionUno := \frac{d}{dx} y(x) = x y(x) \quad (1)$$

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[> F := x*y
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$$F := x y \quad (2)$$

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[> DerF := diff(F, y)
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$$DerF := x \quad (3)$$

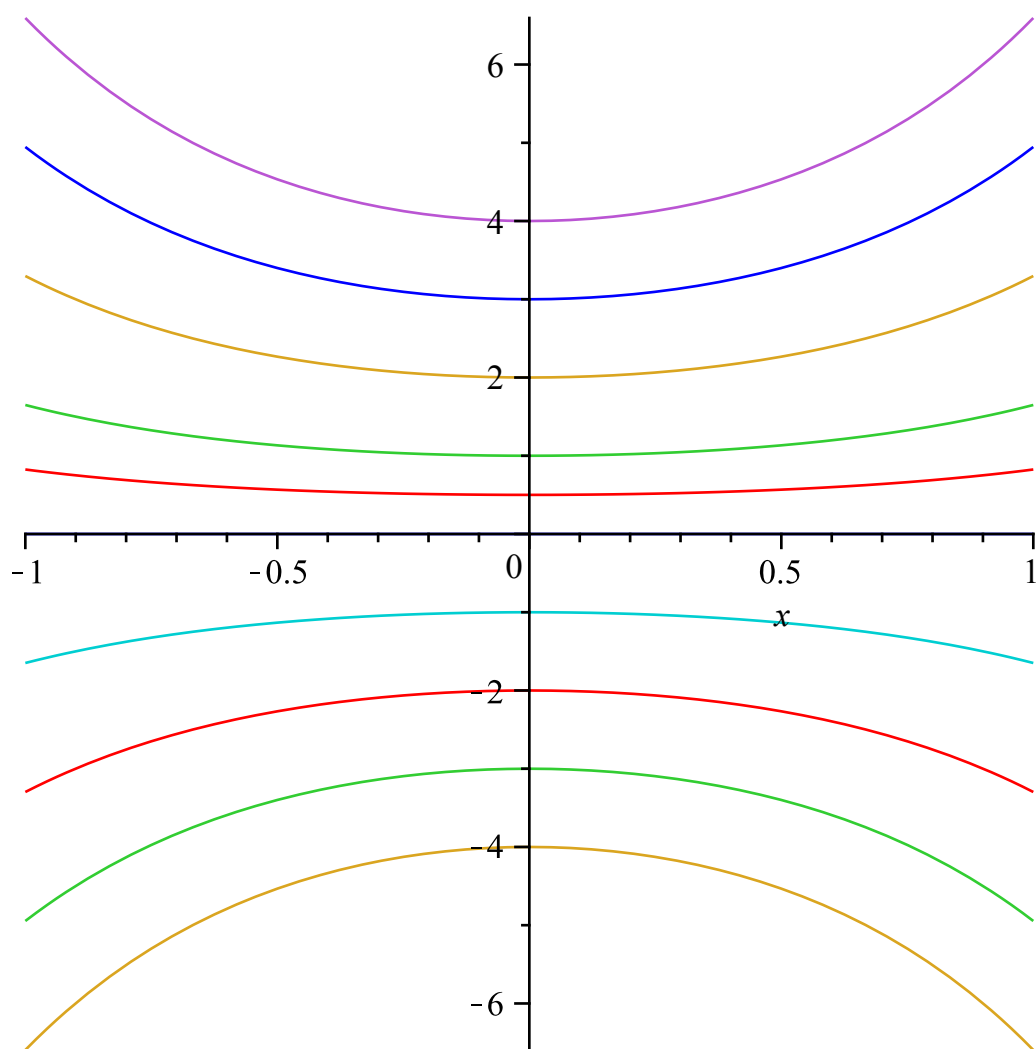
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[> SolucionUno := dsolve(EcuacionUno)
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$$SolucionUno := y(x) = _C1 e^{\frac{1}{2} x^2} \quad (4)$$

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[> plot([subs(_C1 = 1/2, rhs(SolucionUno)), subs(_C1 = 1, rhs(SolucionUno)), subs(_C1 = 2,
rhs(SolucionUno)), subs(_C1 = 3, rhs(SolucionUno)), subs(_C1 = 4,
rhs(SolucionUno)), subs(_C1 = -1, rhs(SolucionUno)), subs(_C1 = -2,
rhs(SolucionUno)), subs(_C1 = -3, rhs(SolucionUno)), subs(_C1 = -4,
rhs(SolucionUno)), subs(_C1 = 0, rhs(SolucionUno))], x = -1 .. 1)
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> EcuacionDos := diff(y(x), x) =  $\frac{y(x)}{x}$ 
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$$EcuacionDos := \frac{d}{dx} y(x) = \frac{y(x)}{x} \quad (5)$$

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> F :=  $\frac{y}{x}$ 
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$$F := \frac{y}{x} \quad (6)$$

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> DerF := diff(F, y)
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$$DerF := \frac{1}{x} \quad (7)$$

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> SolucionDos := dsolve(EcuacionDos)
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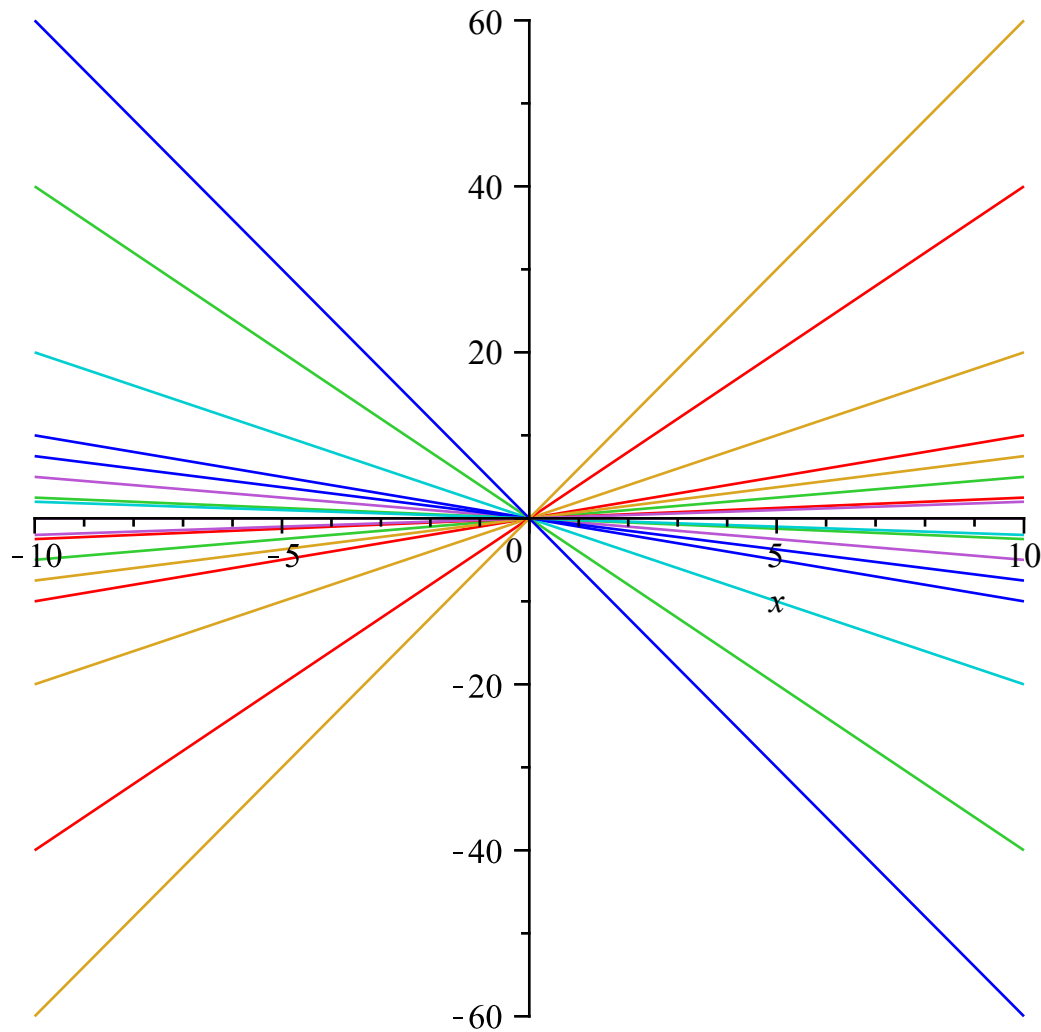
$$SolucionDos := y(x) = _C1 x \quad (8)$$

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> plot( [ subs(_C1 = 1, rhs(SolucionDos)), subs(_C1 =  $\frac{1}{2}$ , rhs(SolucionDos)), subs(_C1 = 2, rhs(SolucionDos)), subs(_C1 = -1, rhs(SolucionDos)), subs(_C1 = - $\frac{1}{2}$ , rhs(SolucionDos)) ] )
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rhs(SolucionDos) ), subs(_C1=-2, rhs(SolucionDos) ), subs(_C1=1/4,
rhs(SolucionDos) ), subs(_C1=-1/4, rhs(SolucionDos) ), subs(_C1=3/4,
rhs(SolucionDos) ), subs(_C1=-3/4, rhs(SolucionDos) ), subs(_C1=1/5,
rhs(SolucionDos) ), subs(_C1=-1/5, rhs(SolucionDos) ), subs(_C1=4,
rhs(SolucionDos) ), subs(_C1=-4, rhs(SolucionDos) ), subs(_C1=6,
rhs(SolucionDos) ), subs(_C1=-6, rhs(SolucionDos) ), subs(_C1=0,
rhs(SolucionDos) ) ], x=-10..10)

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> SolucionGeneral := y(x) = C1·exp(2 x) + C2·exp(x)·cos(3 x) + C3·exp(x)·sin(3 x) + 5
·exp(-2 x) + 6 x·2
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$$\text{SolucionGeneral} := y(x) = C_1 e^{2x} + C_2 e^x \cos(3x) + C_3 e^x \sin(3x) + 5 e^{-2x} + 6x^2 \quad (9)$$

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> SolucionHom := y(x) = C1·exp(2 x) + C2·exp(x)·cos(3 x) + C3·exp(x)·sin(3 x)
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$$\text{SolucionHom} := y(x) = C_1 e^{2x} + C_2 e^x \cos(3x) + C_3 e^x \sin(3x) \quad (10)$$

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> SolPart := y(x) = 5·exp(-2 x) + 6 x·2
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$$\text{SolPart} := y(x) = 5 e^{-2x} + 6 x^2 \quad (11)$$

> $\text{Sistema} := \text{diff}(\text{SolucionHom}, x), \text{diff}(\text{SolucionHom}, x\$2), \text{diff}(\text{SolucionHom}, x\$3) :$
 $\text{Sistema}_1; \text{Sistema}_2; \text{Sistema}_3;$

$$\frac{d}{dx} y(x) = 2 C_1 e^{2x} + C_2 e^x \cos(3x) - 3 C_2 e^x \sin(3x) + C_3 e^x \sin(3x) + 3 C_3 e^x \cos(3x)$$

$$\frac{d^2}{dx^2} y(x) = 4 C_1 e^{2x} - 8 C_2 e^x \cos(3x) - 6 C_2 e^x \sin(3x) - 8 C_3 e^x \sin(3x) + 6 C_3 e^x \cos(3x)$$

$$\frac{d^3}{dx^3} y(x) = 8 C_1 e^{2x} - 26 C_2 e^x \cos(3x) + 18 C_2 e^x \sin(3x) - 26 C_3 e^x \sin(3x) - 18 C_3 e^x \cos(3x) \quad (12)$$

> $\text{Parametro} := \text{solve}(\{\text{Sistema}\}, \{C_1, C_2, C_3\}) : \text{Parametro}_1; \text{Parametro}_2; \text{Parametro}_3$

$$C_1 = \frac{1}{20} \frac{10 \left(\frac{d}{dx} y(x) \right) - 2 \left(\frac{d^2}{dx^2} y(x) \right) + \frac{d^3}{dx^3} y(x)}{e^{2x}}$$

$$C_2 = \frac{1}{30} \frac{1}{e^x (\sin(3x)^2 + \cos(3x)^2)} \left(-3 \sin(3x) \left(\frac{d^2}{dx^2} y(x) \right) + 2 \sin(3x) \left(\frac{d}{dx} y(x) \right) + \sin(3x) \left(\frac{d^3}{dx^3} y(x) \right) - 3 \cos(3x) \left(\frac{d^2}{dx^2} y(x) \right) + 6 \left(\frac{d}{dx} y(x) \right) \cos(3x) \right)$$

$$C_3 = -\frac{1}{30} \frac{1}{e^x (\sin(3x)^2 + \cos(3x)^2)} \left(-3 \cos(3x) \left(\frac{d^2}{dx^2} y(x) \right) + 2 \left(\frac{d}{dx} y(x) \right) \cos(3x) + 3 \sin(3x) \left(\frac{d^2}{dx^2} y(x) \right) - 6 \sin(3x) \left(\frac{d}{dx} y(x) \right) + \left(\frac{d^3}{dx^3} y(x) \right) \cos(3x) \right) \quad (13)$$

> $\text{EcuacionInicial} := \text{simplify}(\text{subs}(C_1 = \text{rhs}(\text{Parametro}_1), C_2 = \text{rhs}(\text{Parametro}_2), C_3 = \text{rhs}(\text{Parametro}_3), \text{SolucionHom}))$

$$\text{EcuacionInicial} := y(x) = \frac{7}{10} \frac{d}{dx} y(x) - \frac{1}{5} \frac{d^2}{dx^2} y(x) + \frac{1}{20} \frac{d^3}{dx^3} y(x) \quad (14)$$

> $\text{EcuacionHom} := \text{lhs}(\text{EcuacionInicial}) \cdot (-20) - \text{rhs}(\text{EcuacionInicial}) \cdot (-20) = 0$

$$\text{EcuacionHom} := -20 y(x) + 14 \left(\frac{d}{dx} y(x) \right) - 4 \left(\frac{d^2}{dx^2} y(x) \right) + \frac{d^3}{dx^3} y(x) = 0 \quad (15)$$

> $Q := \text{simplify}(\text{eval}(\text{subs}(y(x) = \text{rhs}(\text{SolPart}), \text{lhs}(\text{EcuacionHom}))))$

$$Q := -360 e^{-2x} - 120 x^2 + 168 x - 48 \quad (16)$$

> $\text{EcuacionNoHom} := \text{lhs}(\text{EcuacionHom}) = Q$

$$\text{EcuacionNoHom} := -20 y(x) + 14 \left(\frac{d}{dx} y(x) \right) - 4 \left(\frac{d^2}{dx^2} y(x) \right) + \frac{d^3}{dx^3} y(x) = -360 e^{-2x} - 120 x^2 + 168 x - 48 \quad (17)$$

> $\text{SolucionFinal} := \text{dsolve}(\text{EcuacionNoHom})$

$$\text{SolucionFinal} := y(x) = 5 e^{-2x} + 6 x^2 + _C1 e^{2x} + _C2 e^x \cos(3x) + _C3 e^x \sin(3x) \quad (18)$$

> $\text{SolucionGeneral};$



$$y(x) = C_1 e^{2x} + C_2 e^x \cos(3x) + C_3 e^x \sin(3x) + 5 e^{-2x} + 6 x^2$$

(19)