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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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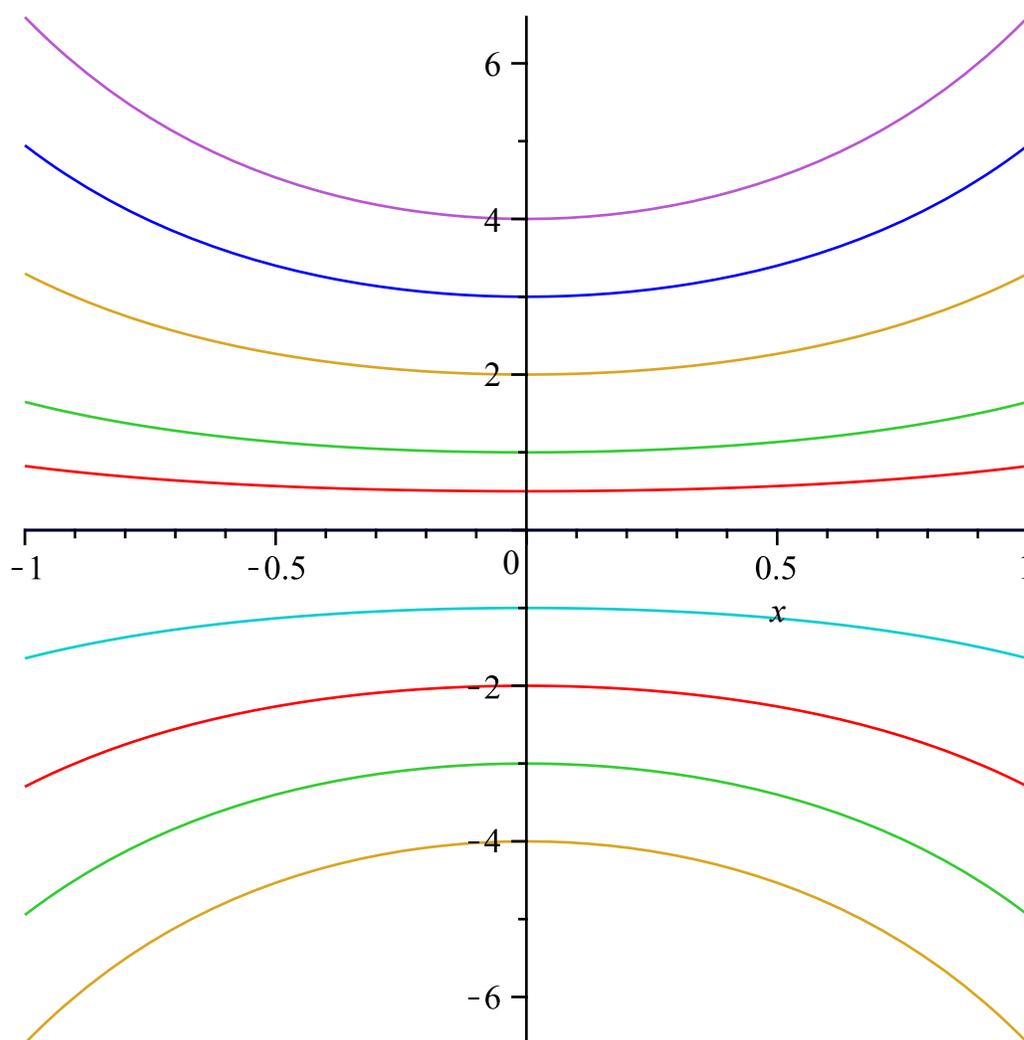
$$DerF := x \quad (3)$$

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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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> restart

> EcuacionDos := diff(y(x), x) = $\frac{y(x)}{x}$

$$EcuacionDos := \frac{d}{dx} y(x) = \frac{y(x)}{x} \quad (5)$$

> F := $\frac{y}{x}$

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

> DerF := diff(F, y)

$$DerF := \frac{1}{x} \quad (7)$$

> SolucionDos := dsolve(EcuacionDos)

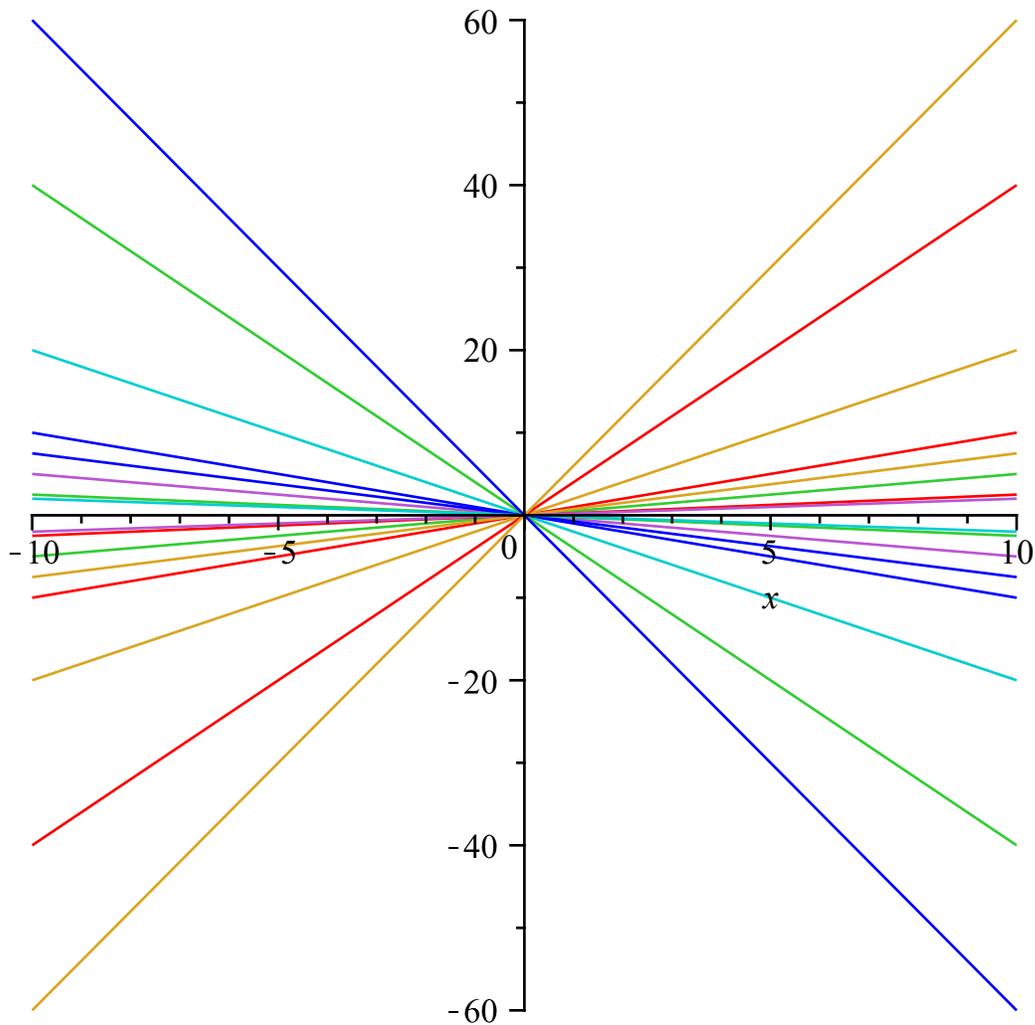
$$SolucionDos := y(x) = _C1 x \quad (8)$$

> plot($\left[\text{subs}(_C1 = 1, \text{rhs}(\text{SolucionDos})), \text{subs}(_C1 = \frac{1}{2}, \text{rhs}(\text{SolucionDos})), \text{subs}(_C1 = 2, \text{rhs}(\text{SolucionDos})), \text{subs}(_C1 = -1, \text{rhs}(\text{SolucionDos})), \text{subs}(_C1 = -\frac{1}{2}, \text{rhs}(\text{SolucionDos})) \right]$)

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

> *Sistema* := diff(*SolucionHom*, x), diff(*SolucionHom*, x\$2), diff(*SolucionHom*, x\$3) :
*Sistema*₁; *Sistema*₂; *Sistema*₃;

$$\begin{aligned} \frac{d}{dx} y(x) &= 2 C_1 e^{2x} + C_2 e^x \cos(3x) - 3 C_2 e^x \sin(3x) + C_3 e^x \sin(3x) + 3 C_3 e^x \cos(3x) \\ \frac{d^2}{dx^2} y(x) &= 4 C_1 e^{2x} - 8 C_2 e^x \cos(3x) - 6 C_2 e^x \sin(3x) - 8 C_3 e^x \sin(3x) + 6 C_3 e^x \cos(3x) \\ \frac{d^3}{dx^3} y(x) &= 8 C_1 e^{2x} - 26 C_2 e^x \cos(3x) + 18 C_2 e^x \sin(3x) - 26 C_3 e^x \sin(3x) \\ &\quad - 18 C_3 e^x \cos(3x) \end{aligned} \quad (12)$$

> *Parametro* := solve({*Sistema*}, {C₁, C₂, C₃}) : *Parametro*₁; *Parametro*₂; *Parametro*₃

$$\begin{aligned} C_1 &= \frac{1}{20} \frac{10 \left(\frac{d}{dx} y(x) \right) - 2 \left(\frac{d^2}{dx^2} y(x) \right) + \frac{d^3}{dx^3} y(x)}{e^{2x}} \\ C_2 &= \frac{1}{30} \frac{1}{e^x (\sin(3x)^2 + \cos(3x)^2)} \left(-3 \sin(3x) \left(\frac{d^2}{dx^2} y(x) \right) + 2 \sin(3x) \left(\frac{d}{dx} y(x) \right) \right. \\ &\quad \left. + \sin(3x) \left(\frac{d^3}{dx^3} y(x) \right) - 3 \cos(3x) \left(\frac{d^2}{dx^2} y(x) \right) + 6 \left(\frac{d}{dx} y(x) \right) \cos(3x) \right) \\ C_3 &= -\frac{1}{30} \frac{1}{e^x (\sin(3x)^2 + \cos(3x)^2)} \left(-3 \cos(3x) \left(\frac{d^2}{dx^2} y(x) \right) + 2 \left(\frac{d}{dx} y(x) \right) \cos(3x) \right. \\ &\quad \left. + 3 \sin(3x) \left(\frac{d^2}{dx^2} y(x) \right) - 6 \sin(3x) \left(\frac{d}{dx} y(x) \right) + \left(\frac{d^3}{dx^3} y(x) \right) \cos(3x) \right) \end{aligned} \quad (13)$$

> *EcuacionInicial* := simplify(subs(C₁ = rhs(*Parametro*₁), C₂ = rhs(*Parametro*₂), C₃ = rhs(*Parametro*₃), *SolucionHom*))

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

> *EcuacionHom* := lhs(*EcuacionInicial*) · (-20) - rhs(*EcuacionInicial*) · (-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* := simplify(eval(subs(y(x) = rhs(*SolPart*), lhs(*EcuacionHom*))))

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

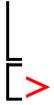
> *EcuacionNoHom* := lhs(*EcuacionHom*) = *Q*

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

> *SolucionFinal* := dsolve(*EcuacionNoHom*)

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

> *SolucionGeneral*;



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

(19)