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> restart
> Ecua := diff(y(x, t), x$2) + 5·diff(y(x, t), x, t) + 6·diff(y(x, t), t$2) = 0
      Ecua :=  $\frac{\partial^2}{\partial x^2} y(x, t) + 5 \frac{\partial^2}{\partial t \partial x} y(x, t) + 6 \frac{\partial^2}{\partial t^2} y(x, t) = 0$  (1)
=
> SolGral := pdsolve(Ecua)
      SolGral :=  $y(x, t) = f_1(t - 3x) + f_2(t - 2x)$  (2)
=
> EcuaCarac := m^2 + 5·m + 6 = 0
      EcuaCarac :=  $m^2 + 5m + 6 = 0$  (3)
=
> Raiz := solve(EcuaCarac)
      Raiz :=  $-2, -3$  (4)
=
> SolGral := y(x, t) = _F[1](t + Raiz[1]·x) + _F[2](t + Raiz[2]·x)
      SolGral :=  $y(x, t) = _F_1(t - 2x) + _F_2(t - 3x)$  (5)
=
> restart
> Ecua := diff(z(x, y), x$2) + diff(z(x, y), x, y) + diff(z(x, y), y$2) = 0
      Ecua :=  $\frac{\partial^2}{\partial x^2} z(x, y) + \frac{\partial^2}{\partial x \partial y} z(x, y) + \frac{\partial^2}{\partial y^2} z(x, y) = 0$  (6)
=
> EcuaCarac := m^2 + m + 1 = 0
      EcuaCarac :=  $m^2 + m + 1 = 0$  (7)
=
> Raiz
:= solve(EcuaCarac)
      Raiz :=  $-\frac{1}{2} + \frac{I\sqrt{3}}{2}, -\frac{1}{2} - \frac{I\sqrt{3}}{2}$  (8)
=
>
> SolFinal := pdsolve(Ecua)
      SolFinal :=  $z(x, y) = f_1\left(y - \left(\frac{1}{2} + \frac{I\sqrt{3}}{2}\right)x\right) + f_2\left(y - \left(\frac{1}{2} - \frac{I\sqrt{3}}{2}\right)x\right)$  (9)
=
> ComprobarUno := simplify(eval(subs(z(x, y) = rhs(SolFinal), Ecua)))
      ComprobarUno :=  $0 = 0$  (10)
=
> restart
> Ecua := diff(z(x, y), x$2) - 4·diff(z(x, y), x, y) + 4·diff(z(x, y), y$2) = 0
      Ecua :=  $\frac{\partial^2}{\partial x^2} z(x, y) - 4 \frac{\partial^2}{\partial x \partial y} z(x, y) + 4 \frac{\partial^2}{\partial y^2} z(x, y) = 0$  (11)
=
> SolGralUno := pdsolve(Ecua)
      SolGralUno :=  $z(x, y) = f_1(y + 2x) + f_2(y + 2x)x$  (12)
=
> SolGralDos := z(x, y) = F[1](y + 2·x) + F[2](y + 2·x)·y
      SolGralDos :=  $z(x, y) = F_1(y + 2x) + F_2(y + 2x)y$  (13)
=
> ComprobacionUno := simplify(eval(subs(z(x, y) = rhs(SolGralUno), Ecua)))
      ComprobacionUno :=  $0 = 0$  (14)
=
> ComprobacionDos := simplify(eval(subs(z(x, y) = rhs(SolGralDos), Ecua)))

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$$\text{ComprobacionDos} := 0 = 0 \quad (15)$$

$$> \text{EcuaCarac} := m^2 - 4 \cdot m + 4 = 0$$

$$\text{EcuaCarac} := m^2 - 4 m + 4 = 0 \quad (16)$$

$$> \text{Raiz} := \text{solve}(\text{EcuaCarac})$$

$$\text{Raiz} := 2, 2 \quad (17)$$

$$> \text{SolGralTres} := z(x, y) = F[1](y + \text{Raiz}[1] \cdot x) + F[2](y + \text{Raiz}[2] \cdot x) \cdot x$$

$$\text{SolGralTres} := z(x, y) = F_1(y + 2 x) + F_2(y + 2 x) x \quad (18)$$

$$> \text{restart}$$

$$> \text{Ecua} := \text{diff}(z(x, y), x\$2) + 6 \cdot \text{diff}(z(x, y), y) = z(x, y)$$

$$\text{Ecua} := \frac{\partial^2}{\partial x^2} z(x, y) + 6 \frac{\partial}{\partial y} z(x, y) = z(x, y) \quad (19)$$

$$> \text{SolUno} := z(x, y) = P(x) \cdot G(y)$$

$$\text{SolUno} := z(x, y) = P(x) G(y) \quad (20)$$

$$> \text{EcuaDos} := \text{eval}(\text{subs}(z(x, y) = \text{rhs}(\text{SolUno}), \text{Ecua}))$$

$$\text{EcuaDos} := \left(\frac{d^2}{dx^2} P(x) \right) G(y) + 6 P(x) \left(\frac{d}{dy} G(y) \right) = P(x) G(y) \quad (21)$$

$$> \text{SepUno} := \left(\frac{\left(\text{lhs}(\text{EcuaDos}) - 6 P(x) \left(\frac{d}{dy} G(y) \right) \right)}{P(x) \cdot G(y)} \right)$$

$$= \text{simplify} \left(\frac{\left(\text{rhs}(\text{EcuaDos}) - 6 P(x) \left(\frac{d}{dy} G(y) \right) \right)}{P(x) \cdot G(y)} \right)$$

$$\text{SepUno} := \frac{\frac{d^2}{dx^2} P(x)}{P(x)} = \frac{G(y) - 6 \frac{d}{dy} G(y)}{G(y)} \quad (22)$$

$$> \text{EcuaX} := \text{lhs}(\text{SepUno}) = \alpha; \text{EcuaY} := \text{rhs}(\text{SepUno}) = \alpha$$

$$\text{EcuaX} := \frac{\frac{d^2}{dx^2} P(x)}{P(x)} = \alpha$$

$$\text{EcuaY} := \frac{G(y) - 6 \frac{d}{dy} G(y)}{G(y)} = \alpha \quad (23)$$

$$> \text{EcuaXcero} := \text{subs}(\alpha = 0, \text{EcuaX})$$

$$\text{EcuaXcero} := \frac{\frac{d^2}{dx^2} P(x)}{P(x)} = 0 \quad (24)$$

$$> \text{EcuaYcero} := \text{subs}(\alpha = 0, \text{EcuaY})$$

$$\text{EcuaYcero} := \frac{G(y) - 6 \frac{d}{dy} G(y)}{G(y)} = 0 \quad (25)$$

$$\begin{aligned} &> \text{SolXcero} := \text{dsolve}(\text{EcuaXcero}) \\ &\quad \text{SolXcero} := P(x) = c_1 x + c_2 \end{aligned} \quad (26)$$

$$\begin{aligned} &> \text{SolYcero} := \text{dsolve}(\text{EcuaYcero}) \\ &\quad \text{SolYcero} := G(y) = c_1 e^{\frac{y}{6}} \end{aligned} \quad (27)$$

$$\begin{aligned} &> \text{SolGralCero} := z(x, y) = \text{rhs}(\text{SolXcero}) \cdot (\text{subs}(c_1 = 1, \text{rhs}(\text{SolYcero}))) \\ &\quad \text{SolGralCero} := z(x, y) = (c_1 x + c_2) e^{\frac{y}{6}} \end{aligned} \quad (28)$$

$$\begin{aligned} &> \text{EcuaXpos} := \text{subs}(\text{alpha} = \beta^2, \text{EcuaX}) \\ &\quad \text{EcuaXpos} := \frac{\frac{d^2}{dx^2} P(x)}{P(x)} = \beta^2 \end{aligned} \quad (29)$$

$$\begin{aligned} &> \text{EcuaYpos} := \text{subs}(\text{alpha} = \beta^2, \text{EcuaY}) \\ &\quad \text{EcuaYpos} := \frac{G(y) - 6 \frac{d}{dy} G(y)}{G(y)} = \beta^2 \end{aligned} \quad (30)$$

$$\begin{aligned} &> \text{SolXpos} := \text{dsolve}(\text{EcuaXpos}) \\ &\quad \text{SolXpos} := P(x) = c_1 e^{-\beta x} + c_2 e^{\beta x} \end{aligned} \quad (31)$$

$$\begin{aligned} &> \text{SolYpos} := \text{dsolve}(\text{EcuaYpos}) \\ &\quad \text{SolYpos} := G(y) = c_1 e^{-\frac{(\beta-1)(\beta+1)y}{6}} \end{aligned} \quad (32)$$

$$\begin{aligned} &> \text{SolGralPos} := z(x, y) = \text{rhs}(\text{SolXpos}) \cdot (\text{subs}(c_1 = 1, \text{rhs}(\text{SolYpos}))) \\ &\quad \text{SolGralPos} := z(x, y) = (c_1 e^{-\beta x} + c_2 e^{\beta x}) e^{-\frac{(\beta-1)(\beta+1)y}{6}} \end{aligned} \quad (33)$$

$$\begin{aligned} &> \text{EcuaXneg} := \text{subs}(\text{alpha} = -\beta^2, \text{EcuaX}) \\ &\quad \text{EcuaXneg} := \frac{\frac{d^2}{dx^2} P(x)}{P(x)} = -\beta^2 \end{aligned} \quad (34)$$

$$\begin{aligned} &> \text{EcuaYneg} := \text{subs}(\text{alpha} = -\beta^2, \text{EcuaY}) \\ &\quad \text{EcuaYneg} := \frac{G(y) - 6 \frac{d}{dy} G(y)}{G(y)} = -\beta^2 \end{aligned} \quad (35)$$

$$\begin{aligned} &> \text{SolXneg} := \text{dsolve}(\text{EcuaXneg}) \\ &\quad \text{SolXneg} := P(x) = c_1 \sin(\beta x) + c_2 \cos(\beta x) \end{aligned} \quad (36)$$

$$\begin{aligned} &> \text{SolYneg} := \text{dsolve}(\text{EcuaYneg}) \\ &\quad \text{SolYneg} := G(y) = c_1 e^{\frac{(\beta^2+1)y}{6}} \end{aligned} \quad (37)$$

$$> \text{SolGralNeg} := z(x, y) = \text{rhs}(\text{SolXneg}) \cdot (\text{subs}(c_1 = 1, \text{rhs}(\text{SolYneg})))$$

$$SolGralNeg := z(x, y) = (c_1 \sin(\beta x) + c_2 \cos(\beta x)) e^{\frac{(\beta^2 + 1)y}{6}} \quad (38)$$

> SolGralPos

$$z(x, y) = (c_1 e^{-\beta x} + c_2 e^{\beta x}) e^{-\frac{(\beta - 1)(\beta + 1)y}{6}} \quad (39)$$

> SolGralCero

$$z(x, y) = (c_1 x + c_2) e^{\frac{y}{6}} \quad (40)$$

> SolGralNeg

$$z(x, y) = (c_1 \sin(\beta x) + c_2 \cos(\beta x)) e^{\frac{(\beta^2 + 1)y}{6}} \quad (41)$$

> Ecua

$$\frac{\partial^2}{\partial x^2} z(x, y) + 6 \frac{\partial}{\partial y} z(x, y) = z(x, y) \quad (42)$$

> ComprobacionCero := simplify(eval(subs(z(x, y) = rhs(SolGralCero), lhs(Ecua) - rhs(Ecua) = 0)))

$$ComprobacionCero := 0 = 0 \quad (43)$$

> ComprobacionPos := simplify(eval(subs(z(x, y) = rhs(SolGralPos), lhs(Ecua) - rhs(Ecua) = 0)))

$$ComprobacionPos := 0 = 0 \quad (44)$$

> ComprobacionNeg := simplify(eval(subs(z(x, y) = rhs(SolGralNeg), lhs(Ecua) - rhs(Ecua) = 0)))

$$ComprobacionNeg := 0 = 0 \quad (45)$$

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