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> restart
> Ecua := diff(z(x,y), x$2) - 5*diff(z(x,y), x,y) + 6*diff(z(x,y), y$2) = 0
      Ecua :=  $\frac{\partial^2}{\partial x^2} z(x,y) - 5 \frac{\partial^2}{\partial x \partial y} z(x,y) + 6 \frac{\partial^2}{\partial y^2} z(x,y) = 0$  (1)
> SolGral := pdsolve(Ecua)
      SolGral :=  $z(x,y) = f_1(y + 2x) + f_2(y + 3x)$  (2)
> Comprobar := simplify(eval(subs(z(x,y) = rhs(SolGral), Ecua)))
      Comprobar :=  $0 = 0$  (3)
> SolPartUno := z(x,y) = (y + 2x)^3 - sqrt(y + 3x)
      SolPartUno :=  $z(x,y) = (y + 2x)^3 - \sqrt{y + 3x}$  (4)
> ComprobarUno := simplify(eval(subs(z(x,y) = rhs(SolPartUno), Ecua)))
      ComprobarUno :=  $0 = 0$  (5)
> SolPartDos := z(x,y) = cos(y + 2x) - 6*sin(y + 3x)
      SolPartDos :=  $z(x,y) = \cos(y + 2x) - 6 \sin(y + 3x)$  (6)
> ComprobarDos := simplify(eval(subs(z(x,y) = rhs(SolPartDos), Ecua)))
      ComprobarDos :=  $0 = 0$  (7)
> restart
> Ecua := diff(y(x,t), x$2) - 4*diff(y(x,t), x,t) + 4*diff(y(x,t), t$2) = 0
      Ecua :=  $\frac{\partial^2}{\partial x^2} y(x,t) - 4 \frac{\partial^2}{\partial t \partial x} y(x,t) + 4 \frac{\partial^2}{\partial t^2} y(x,t) = 0$  (8)
> f(t + m*x)
      f(mx + t) (9)
> EcuaCarac := m^2 - 4*m + 4 = 0
      EcuaCarac :=  $m^2 - 4m + 4 = 0$  (10)
> Raiz := solve(EcuaCarac)
      Raiz :=  $2, 2$  (11)
> SolGralUno := y(x,t) = f[1](t + 2*x) + f[2](t + 2*x)*x
      SolGralUno :=  $y(x,t) = f_1(t + 2x) + f_2(t + 2x)x$  (12)
> SolGralDos := y(x,t) = f[1](t + 2*x) + f[2](t + 2*x)*t
      SolGralDos :=  $y(x,t) = f_1(t + 2x) + f_2(t + 2x)t$  (13)
> ComprobarUno := simplify(eval(subs(y(x,t) = rhs(SolGralUno), Ecua)))
      ComprobarUno :=  $0 = 0$  (14)
> ComprobarDos := simplify(eval(subs(y(x,t) = rhs(SolGralDos), Ecua)))
      ComprobarDos :=  $0 = 0$  (15)
> SolGral := pdsolve(Ecua)
      SolGral :=  $y(x,t) = f_1(t + 2x) + f_2(t + 2x)x$  (16)
> restart
METODO VARIABLES SEPARABLES
> Ecua := diff(z(x,y), y$2) + 4*diff(z(x,y), x) = z(x,y)

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$$Ecua := \frac{\partial^2}{\partial y^2} z(x, y) + 4 \frac{\partial}{\partial x} z(x, y) = z(x, y) \quad (17)$$

$$\begin{aligned} &> HipotesisInicial := z(x, y) = F(x) \cdot G(y) \\ &\quad HipotesisInicial := z(x, y) = F(x) G(y) \end{aligned} \quad (18)$$

$$\begin{aligned} &> EcuaDos := eval(subs(z(x, y) = rhs(HipotesisInicial), Ecua)) \\ &\quad EcuaDos := F(x) \left(\frac{d^2}{dy^2} G(y) \right) + 4 \left(\frac{d}{dx} F(x) \right) G(y) = F(x) G(y) \end{aligned} \quad (19)$$

$$\begin{aligned} &> EcuaSeparable := lhs(EcuaDos) - 4 \left(\frac{d}{dx} F(x) \right) G(y) = rhs(EcuaDos) - 4 \left(\frac{d}{dx} F(x) \right) G(y) \\ &\quad EcuaSeparable := F(x) \left(\frac{d^2}{dy^2} G(y) \right) = F(x) G(y) - 4 \left(\frac{d}{dx} F(x) \right) G(y) \end{aligned} \quad (20)$$

$$\begin{aligned} &> EcuaSeparada := \frac{lhs(EcuaSeparable)}{F(x) \cdot G(y)} = simplify\left(\frac{rhs(EcuaSeparable)}{F(x) \cdot G(y)}\right) \\ &\quad EcuaSeparada := \frac{\frac{d^2}{dy^2} G(y)}{G(y)} = \frac{F(x) - 4 \frac{d}{dx} F(x)}{F(x)} \end{aligned} \quad (21)$$

$$\begin{aligned} &> EcuaSepY := lhs(EcuaSeparada) = \alpha \\ &\quad EcuaSepY := \frac{\frac{d^2}{dy^2} G(y)}{G(y)} = \alpha \end{aligned} \quad (22)$$

$$\begin{aligned} &> EcuaSepX := rhs(EcuaSeparada) = \alpha \\ &\quad EcuaSepX := \frac{F(x) - 4 \frac{d}{dx} F(x)}{F(x)} = \alpha \end{aligned} \quad (23)$$

$$\begin{aligned} &> EcuaYcero := subs(alpha = 0, EcuaSepY) \\ &\quad EcuaYcero := \frac{\frac{d^2}{dy^2} G(y)}{G(y)} = 0 \end{aligned} \quad (24)$$

$$\begin{aligned} &> EcuaXcero := subs(alpha = 0, EcuaSepX) \\ &\quad EcuaXcero := \frac{F(x) - 4 \frac{d}{dx} F(x)}{F(x)} = 0 \end{aligned} \quad (25)$$

$$\begin{aligned} &> SolGralCeroX := dsolve(EcuaXcero) \\ &\quad SolGralCeroX := F(x) = c_1 e^{\frac{x}{4}} \end{aligned} \quad (26)$$

$$\begin{aligned} &> SolGralCeroY := dsolve(EcuaYcero) \\ &\quad SolGralCeroY := G(y) = c_1 y + c_2 \end{aligned} \quad (27)$$

$$> \text{SolGralCero} := z(x, y) = \text{subs}(c_1 = 1, \text{rhs}(\text{SolGralCeroX})) \cdot \text{rhs}(\text{SolGralCeroY})$$

$$\text{SolGralCero} := z(x, y) = e^{\frac{x}{4}} (c_1 y + c_2) \quad (28)$$

$$> \text{EcuaYpos} := \text{subs}(\alpha = \beta^2, \text{EcuaSepY})$$

$$\text{EcuaYpos} := \frac{\frac{d^2}{dy^2} G(y)}{G(y)} = \beta^2 \quad (29)$$

$$> \text{EcuaXpos} := \text{subs}(\alpha = \beta^2, \text{EcuaSepX})$$

$$\text{EcuaXpos} := \frac{F(x) - 4 \frac{d}{dx} F(x)}{F(x)} = \beta^2 \quad (30)$$

$$> \text{SolGralPosX} := \text{dsolve}(\text{EcuaXpos})$$

$$\text{SolGralPosX} := F(x) = c_1 e^{-\frac{(\beta-1)(\beta+1)x}{4}} \quad (31)$$

$$> \text{SolGralPosY} := \text{dsolve}(\text{EcuaYpos})$$

$$\text{SolGralPosY} := G(y) = c_1 e^{\beta y} + c_2 e^{-\beta y} \quad (32)$$

$$> \text{SolGralPos} := z(x, y) = \text{subs}(c_1 = 1, \text{rhs}(\text{SolGralPosX})) \cdot \text{rhs}(\text{SolGralPosY})$$

$$\text{SolGralPos} := z(x, y) = e^{-\frac{(\beta-1)(\beta+1)x}{4}} (c_1 e^{\beta y} + c_2 e^{-\beta y}) \quad (33)$$

$$> \text{EcuaYneg} := \text{subs}(\alpha = -\beta^2, \text{EcuaSepY})$$

$$\text{EcuaYneg} := \frac{\frac{d^2}{dy^2} G(y)}{G(y)} = -\beta^2 \quad (34)$$

$$> \text{EcuaXneg} := \text{subs}(\alpha = -\beta^2, \text{EcuaSepX})$$

$$\text{EcuaXneg} := \frac{F(x) - 4 \frac{d}{dx} F(x)}{F(x)} = -\beta^2 \quad (35)$$

$$> \text{SolGralNegX} := \text{dsolve}(\text{EcuaXneg})$$

$$\text{SolGralNegX} := F(x) = c_1 e^{\frac{(\beta^2+1)x}{4}} \quad (36)$$

$$> \text{SolGralNegY} := \text{dsolve}(\text{EcuaYneg})$$

$$\text{SolGralNegY} := G(y) = c_1 \sin(\beta y) + c_2 \cos(\beta y) \quad (37)$$

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

$$\text{SolGralNeg} := z(x, y) = e^{\frac{(\beta^2+1)x}{4}} (c_1 \sin(\beta y) + c_2 \cos(\beta y)) \quad (38)$$

$$> \text{SolGralPos}$$

$$z(x, y) = e^{-\frac{(\beta-1)(\beta+1)x}{4}} (c_1 e^{\beta y} + c_2 e^{-\beta y}) \quad (39)$$

> *SolGralCero*

$$z(x, y) = e^{\frac{x}{4}} (c_1 y + c_2) \quad (40)$$

> *Ecua*

$$\frac{\partial^2}{\partial y^2} z(x, y) + 4 \frac{\partial}{\partial x} z(x, y) = z(x, y) \quad (41)$$

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

$$\text{ComprobarCuatro} := 0 = 0 \quad (42)$$

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

$$\text{ComprobarCinco} := 0 = 0 \quad (43)$$

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

$$\text{ComprobarSeis} := 0 = 0 \quad (44)$$

> *restart*

> *Ecua* := *diff(y(x, t), x) + diff(y(x, t), x, t) - diff(y(x, t), t) = 0*

$$\text{Ecua} := \frac{\partial}{\partial x} y(x, t) + \frac{\partial^2}{\partial t \partial x} y(x, t) - \frac{\partial}{\partial t} y(x, t) = 0 \quad (45)$$

> *Hipo* := *y(x, t) = P(x) · Q(t)*

$$\text{Hipo} := y(x, t) = P(x) Q(t) \quad (46)$$

> *EcuaSeparable* := *eval(subs(y(x, t) = rhs(Hipo), Ecua))*

$$\text{EcuaSeparable} := \left(\frac{d}{dx} P(x) \right) Q(t) + \left(\frac{d}{dx} P(x) \right) \left(\frac{d}{dt} Q(t) \right) - P(x) \left(\frac{d}{dt} Q(t) \right) = 0 \quad (47)$$

> *EcuaSeparada* := *simplify* $\left(\frac{\left(\text{lhs}(\text{EcuaSeparable}) + P(x) \left(\frac{d}{dt} Q(t) \right) \right)}{P(x) \cdot \left(Q(t) + \frac{d}{dt} Q(t) \right)} \right)$

$$= \frac{\left(\text{rhs}(\text{EcuaSeparable}) + P(x) \left(\frac{d}{dt} Q(t) \right) \right)}{P(x) \cdot \left(Q(t) + \frac{d}{dt} Q(t) \right)}$$

$$\text{EcuaSeparada} := \frac{\frac{d}{dx} P(x)}{P(x)} = \frac{\frac{d}{dt} Q(t)}{Q(t) + \frac{d}{dt} Q(t)} \quad (48)$$

> *EcuaSepX* := *lhs(EcuaSeparada) = alpha*

$$\text{EcuaSepX} := \frac{\frac{d}{dx} P(x)}{P(x)} = \alpha \quad (49)$$

> *EcuaSepT* := *rhs(EcuaSeparada) = alpha*

$$EcuaSepT := \frac{\frac{d}{dt} Q(t)}{Q(t) + \frac{d}{dt} Q(t)} = \alpha \quad (50)$$

$$> EcuaXcero := subs(alpha=0, EcuaSepX)$$

$$EcuaXcero := \frac{\frac{d}{dx} P(x)}{P(x)} = 0 \quad (51)$$

$$> EcuaTcero := subs(alpha=0, EcuaSepT)$$

$$EcuaTcero := \frac{\frac{d}{dt} Q(t)}{Q(t) + \frac{d}{dt} Q(t)} = 0 \quad (52)$$

$$> SolXcero := dsolve(EcuaXcero)$$

$$SolXcero := P(x) = c_1 \quad (53)$$

$$> SolTcero := dsolve(EcuaTcero)$$

$$SolTcero := Q(t) = c_1 \quad (54)$$

$$> SolGralCero := y(x, t) = _C1$$

$$SolGralCero := y(x, t) = c_1 \quad (55)$$

$$> EcuaXpos := subs(alpha=\beta^2, EcuaSepX)$$

$$EcuaXpos := \frac{\frac{d}{dx} P(x)}{P(x)} = \beta^2 \quad (56)$$

$$> EcuaTpos := subs(alpha=\beta^2, EcuaSepT)$$

$$EcuaTpos := \frac{\frac{d}{dt} Q(t)}{Q(t) + \frac{d}{dt} Q(t)} = \beta^2 \quad (57)$$

$$> SolXpos := dsolve(EcuaXpos)$$

$$SolXpos := P(x) = c_1 e^{\beta^2 x} \quad (58)$$

$$> SolTpos := dsolve(EcuaTpos)$$

$$SolTpos := Q(t) = c_1 e^{-\frac{\beta^2 t}{(\beta-1)(\beta+1)}} \quad (59)$$

$$> SolGralPos := y(x, t) = subs(c_1=1, rhs(SolXpos)) \cdot rhs(SolTpos)$$

$$SolGralPos := y(x, t) = e^{\beta^2 x} c_1 e^{-\frac{\beta^2 t}{(\beta-1)(\beta+1)}} \quad (60)$$

$$> EcuaXneg := subs(alpha=-\beta^2, EcuaSepX)$$

$$EcuaXneg := \frac{\frac{d}{dx} P(x)}{P(x)} = -\beta^2 \quad (61)$$

> $EcuaTneg := \text{subs}(\text{alpha} = -\beta^2, EcuaSepT)$

$$EcuaTneg := \frac{\frac{d}{dt} Q(t)}{Q(t) + \frac{d}{dt} Q(t)} = -\beta^2 \quad (62)$$

> $SolXneg := \text{dsolve}(EcuaXneg)$

$$SolXneg := P(x) = c_I e^{-\beta^2 x} \quad (63)$$

> $SolTneg := \text{dsolve}(EcuaTneg)$

$$SolTneg := Q(t) = c_I e^{-\frac{\beta^2 t}{\beta^2 + 1}} \quad (64)$$

> $SolGralNeg := y(x, t) = \text{subs}(c_I = 1, \text{rhs}(SolXneg)) \cdot \text{rhs}(SolTneg)$

$$SolGralNeg := y(x, t) = e^{-\beta^2 x} c_I e^{-\frac{\beta^2 t}{\beta^2 + 1}} \quad (65)$$

> $Ecua$

$$\frac{\partial}{\partial x} y(x, t) + \frac{\partial^2}{\partial t \partial x} y(x, t) - \frac{\partial}{\partial t} y(x, t) = 0 \quad (66)$$

> $ComprobarUno := \text{simplify}(\text{eval}(\text{subs}(y(x, t) = \text{rhs}(SolGralPos), \text{lhs}(Ecua) - \text{rhs}(Ecua) = 0)))$

$$ComprobarUno := 0 = 0 \quad (67)$$

> $ComprobarDos := \text{simplify}(\text{eval}(\text{subs}(y(x, t) = \text{rhs}(SolGralNeg), \text{lhs}(Ecua) - \text{rhs}(Ecua) = 0)))$

$$ComprobarDos := 0 = 0 \quad (68)$$

> restart

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