> *restart*

> *Ecuacion* := *diff*(F(x, y), x$2) + 3·*diff*(F(x, y), y) = 5·F(x, y)

$$Ecuacion := \frac{\partial^2}{\partial x^2} F(x,y) + 3\left(\frac{\partial}{\partial y} F(x,y)\right) = 5\,F(x,y) \quad \textbf{(1)}$$

> *with*(*PDEtools*)

[*CanonicalCoordinates*, *ChangeSymmetry*, *CharacteristicQ*, *CharacteristicQInvariants*, *ConservedCurrentTest*, *ConservedCurrents*, *ConsistencyTest*, *D_Dx*, *DeterminingPDE*, *Eta_k*, *Euler*, *FromJet*, *InfinitesimalGenerator*, *Infinitesimals*, *IntegratingFactorTest*, *IntegratingFactors*, *InvariantSolutions*, *InvariantTransformation*, *Invariants*, *Laplace*, *Library*, *PDEplot*, *PolynomialSolutions*, *ReducedForm*, *SimilaritySolutions*, *SimilarityTransformation*, *SymmetrySolutions*, *SymmetryTest*, *SymmetryTransformation*, *TWSolutions*, *ToJet*, *build*, *casesplit*, *charstrip*, *dchange*, *dcoeffs*, *declare*, *diff_table*, *difforder*, *dpolyform*, *dsubs*, *mapde*, *separability*, *splitstrip*, *splitsys*, *undeclare*] **(2)**

> *Solucion* := *pdsolve*(*Ecuacion*)

$$Solucion := (F(x,y) = \_F1(x)\,\_F2(y))\ \&\text{where}\left[\left\{\frac{d^2}{dx^2}\_F1(x) = \_c_1\,\_F1(x),\ \frac{d}{dy}\_F2(y) = -\frac{1}{3}\_c_1\,\_F2(y) + \frac{5}{3}\_F2(y)\right\}\right] \quad \textbf{(3)}$$

> *SolucionGeneral* := *build*(*Solucion*)

$$SolucionGeneral := F(x,y) = e^{\sqrt{\_c_1}\,x}\,\_C3\,e^{-\frac{1}{3}y\_c_1}\,e^{\frac{5}{3}y}\,\_C1 + \frac{\_C3\,e^{-\frac{1}{3}y\_c_1}\,e^{\frac{5}{3}y}\,\_C2}{e^{\sqrt{\_c_1}\,x}} \quad \textbf{(4)}$$

> *Ecuacion*;

$$\frac{\partial^2}{\partial x^2} F(x,y) + 3\left(\frac{\partial}{\partial y} F(x,y)\right) = 5\,F(x,y) \quad \textbf{(5)}$$

> *EcuacionSeparable* := *simplify*(*eval*(*subs*(F(x, y) = f(x)·g(y), *Ecuacion*)))

$$EcuacionSeparable := \left(\frac{d^2}{dx^2} f(x)\right) g(y) + 3\,f(x)\left(\frac{d}{dy} g(y)\right) = 5\,f(x)\,g(y) \quad \textbf{(6)}$$

$$> EcuacionSeparada := \frac{lhs(EcuacionSeparable) - 3\,f(x)\left(\frac{d}{dy} g(y)\right)}{f(x)\cdot g(y)} = simplify\left(\frac{rhs(EcuacionSeparable) - 3\,f(x)\left(\frac{d}{dy} g(y)\right)}{f(x)\cdot g(y)}\right)$$

$$EcuacionSeparada := \frac{\frac{d^2}{dx^2} f(x)}{f(x)} = \frac{5\,g(y) - 3\left(\frac{d}{dy} g(y)\right)}{g(y)} \quad \textbf{(7)}$$

> *EcuacionX* := *lhs*(*EcuacionSeparada*) = alpha

$$EcuacionX := \frac{\frac{d^2}{dx^2} f(x)}{f(x)} = \alpha \quad \textbf{(8)}$$

> $EcuacionY := rhs(EcuacionSeparada) = \text{alpha}$

$$EcuacionY := \frac{5\, g(y) - 3 \left(\frac{d}{dy}\, g(y)\right)}{g(y)} = \alpha \tag{9}$$

> $SolucionXcero := dsolve(subs(\text{alpha} = 0, EcuacionX))$

$$SolucionXcero := f(x) = \_C1\, x + \_C2 \tag{10}$$

> $SolucionYcero := dsolve(subs(\text{alpha} = 0, EcuacionY))$

$$SolucionYcero := g(y) = \_C1\, e^{\frac{5}{3}\, y} \tag{11}$$

> $SolucionGralCero := F(x, y) = rhs(SolucionXcero) \cdot subs(\_C1 = 1, rhs(SolucionYcero))$

$$SolucionGralCero := F(x, y) = (\_C1\, x + \_C2)\, e^{\frac{5}{3}\, y} \tag{12}$$

> $Ecuacion$

$$\frac{\partial^2}{\partial x^2}\, F(x, y) + 3 \left(\frac{\partial}{\partial y}\, F(x, y)\right) = 5\, F(x, y) \tag{13}$$

> $Comprobacion_0 := simplify(eval(subs(F(x, y) = rhs(SolucionGralCero), lhs(Ecuacion)$
$- rhs(Ecuacion) = 0)))$

$$Comprobacion_0 := 0 = 0 \tag{14}$$

> $SolucionXneg := dsolve(subs(\text{alpha} = -\text{beta} \cdot \cdot 2, EcuacionX))$

$$SolucionXneg := f(x) = \_C1\, \sin(\beta\, x) + \_C2\, \cos(\beta\, x) \tag{15}$$

> $SolucionYneg := dsolve(subs(\text{alpha} = -\text{beta} \cdot \cdot 2, EcuacionY))$

$$SolucionYneg := g(y) = \_C1\, e^{\frac{1}{3}\, (5 + \beta^2)\, y} \tag{16}$$

> $SolucionGralNeg := F(x, y) = rhs(SolucionXneg) \cdot subs(\_C1 = 1, rhs(SolucionYneg))$

$$SolucionGralNeg := F(x, y) = (\_C1\, \sin(\beta\, x) + \_C2\, \cos(\beta\, x))\, e^{\frac{1}{3}\, (5 + \beta^2)\, y} \tag{17}$$

> $Ecuacion$

$$\frac{\partial^2}{\partial x^2}\, F(x, y) + 3 \left(\frac{\partial}{\partial y}\, F(x, y)\right) = 5\, F(x, y) \tag{18}$$

> $Comprobacion_1 := simplify(eval(subs(F(x, y) = rhs(SolucionGralNeg), lhs(Ecuacion)$
$- rhs(Ecuacion) = 0)))$

$$Comprobacion_1 := 0 = 0 \tag{19}$$

> $SolucionXpos := dsolve(subs(\text{alpha} = \text{beta} \cdot \cdot 2, EcuacionX))$

$$SolucionXpos := f(x) = \_C1\, e^{-\beta x} + \_C2\, e^{\beta x} \tag{20}$$

> $SolucionYpos := dsolve(subs(\text{alpha} = \text{beta} \cdot \cdot 2, EcuacionY))$

$$SolucionYpos := g(y) = \_C1\, e^{-\frac{1}{3}\, (-5 + \beta^2)\, y} \tag{21}$$

> $SolucionGralPos := F(x, y) = rhs(SolucionXpos) \cdot subs(\_C1 = 1, rhs(SolucionYpos))$

$$SolucionGralPos := F(x, y) = (\_C1\, e^{-\beta x} + \_C2\, e^{\beta x})\, e^{-\frac{1}{3}\, (-5 + \beta^2)\, y} \tag{22}$$

> $Ecuacion$

(23)

$$\frac{\partial^2}{\partial x^2} F(x,y) + 3\left(\frac{\partial}{\partial y} F(x,y)\right) = 5\,F(x,y) \quad \mathbf{(23)}$$

> $Comprobacion_2 := simplify(eval(subs(F(x,y) = rhs(SolucionGralPos), lhs(Ecuacion) - rhs(Ecuacion) = 0)))$

$$Comprobacion_2 := 0 = 0 \quad \mathbf{(24)}$$

> $EcuacionSeparadaDos := simplify\left(\frac{lhs(EcuacionSeparable) - 3\,f(x)\left(\frac{d}{dy} g(y)\right) - 5\,f(x)\,g(y)}{f(x)\cdot g(y)}\right) = simplify\left(\frac{rhs(EcuacionSeparable) - 3\,f(x)\left(\frac{d}{dy} g(y)\right) - 5\,f(x)\,g(y)}{f(x)\cdot g(y)}\right)$

$$EcuacionSeparadaDos := \frac{\frac{d^2}{dx^2} f(x) - 5\,f(x)}{f(x)} = -\frac{3\left(\frac{d}{dy} g(y)\right)}{g(y)} \quad \mathbf{(25)}$$

> $EcuacionXdos := lhs(EcuacionSeparadaDos) = \mathrm{alpha}$

$$EcuacionXdos := \frac{\frac{d^2}{dx^2} f(x) - 5\,f(x)}{f(x)} = \alpha \quad \mathbf{(26)}$$

> $EcuacionYdos := rhs(EcuacionSeparadaDos) = \mathrm{alpha}$

$$EcuacionYdos := -\frac{3\left(\frac{d}{dy} g(y)\right)}{g(y)} = \alpha \quad \mathbf{(27)}$$

> $SolucionXceroDos := dsolve(subs(\mathrm{alpha} = 0, EcuacionXdos))$

$$SolucionXceroDos := f(x) = \_C1\, e^{\sqrt{5}\,x} + \_C2\, e^{-\sqrt{5}\,x} \quad \mathbf{(28)}$$

> $SolucionYceroDos := dsolve(subs(\mathrm{alpha} = 0, EcuacionYdos))$

$$SolucionYceroDos := g(y) = \_C1 \quad \mathbf{(29)}$$

> $SolucionGralCeroDos := F(x,y) = rhs(SolucionXceroDos)\cdot subs(\_C1 = 1, rhs(SolucionYceroDos))$

$$SolucionGralCeroDos := F(x,y) = \_C1\, e^{\sqrt{5}\,x} + \_C2\, e^{-\sqrt{5}\,x} \quad \mathbf{(30)}$$

> $Ecuacion$

$$\frac{\partial^2}{\partial x^2} F(x,y) + 3\left(\frac{\partial}{\partial y} F(x,y)\right) = 5\,F(x,y) \quad \mathbf{(31)}$$

> $Comprobacion_3 := simplify(eval(subs(F(x,y) = rhs(SolucionGralCeroDos), lhs(Ecuacion) - rhs(Ecuacion) = 0)))$

$$Comprobacion_3 := 0 = 0 \quad \mathbf{(32)}$$

> $SolucionXnegDos := dsolve(subs(\mathrm{alpha} = -\mathrm{beta}\cdot\cdot 2, EcuacionXdos))$

$$SolucionXnegDos := f(x) = \_C1 \sin\left(\sqrt{-5+\beta^2}\,x\right) + \_C2 \cos\left(\sqrt{-5+\beta^2}\,x\right) \quad \mathbf{(33)}$$

> $SolucionYnegDos := dsolve(subs(\mathrm{alpha} = -\mathrm{beta}\cdot\cdot 2, EcuacionYdos))$

$$SolucionYnegDos := g(y) = \_C1\, e^{\frac{1}{3}\beta^2 y} \quad \mathbf{(34)}$$

> $SolucionGralNegDos := F(x,y) = rhs(SolucionXnegDos)\cdot subs(\_C1 = 1, rhs(SolucionYnegDos))$

$$SolucionGralNegDos := F(x,y) = \left(\_C1 \sin\left(\sqrt{-5+\beta^2}\, x\right) + \_C2 \cos\left(\sqrt{-5+\beta^2}\, x\right)\right) e^{\frac{1}{3}\beta^2 y} \quad (35)$$

> $Ecuacion$

$$\frac{\partial^2}{\partial x^2} F(x,y) + 3\left(\frac{\partial}{\partial y} F(x,y)\right) = 5\, F(x,y) \quad (36)$$

> $Comprobacion_4 := simplify(eval(subs(F(x,y) = rhs(SolucionGralNegDos), lhs(Ecuacion) - rhs(Ecuacion) = 0)))$

$$Comprobacion_4 := 0 = 0 \quad (37)$$

> $SolucionXposDos := dsolve(subs(\mathrm{alpha} = \mathrm{beta}\cdot\cdot 2, EcuacionXdos))$

$$SolucionXposDos := f(x) = \_C1 \sin\left(\sqrt{-5-\beta^2}\, x\right) + \_C2 \cos\left(\sqrt{-5-\beta^2}\, x\right) \quad (38)$$

> $SolucionYposDos := dsolve(subs(\mathrm{alpha} = \mathrm{beta}\cdot\cdot 2, EcuacionYdos))$

$$SolucionYposDos := g(y) = \_C1\, e^{-\frac{1}{3}\beta^2 y} \quad (39)$$

> $SolucionGralPosDos := F(x,y) = rhs(SolucionXposDos)\cdot subs(\_C1 = 1, rhs(SolucionYposDos))$

$$SolucionGralPosDos := F(x,y) = \left(\_C1 \sin\left(\sqrt{-5-\beta^2}\, x\right) + \_C2 \cos\left(\sqrt{-5-\beta^2}\, x\right)\right) e^{-\frac{1}{3}\beta^2 y} \quad (40)$$

> $Ecuacion$

$$\frac{\partial^2}{\partial x^2} F(x,y) + 3\left(\frac{\partial}{\partial y} F(x,y)\right) = 5\, F(x,y) \quad (41)$$

> $Comprobacion_5 := simplify(eval(subs(F(x,y) = rhs(SolucionGralPosDos), lhs(Ecuacion) - rhs(Ecuacion) = 0)))$

$$Comprobacion_5 := 0 = 0 \quad (42)$$

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