

[> restart :

3) Dada la siguiente ecuación diferencial con condiciones iniciales:

a) Obtener su solución particular (**sin usar dsolve**)

[> EcuacionDiferencial := $\frac{\sin(2 \cdot x)}{y(x)} + x + \left(y(x) - \frac{\sin(x) \cdot 2}{y(x) \cdot 2} \right) \cdot \text{diff}(y(x), x) = 0;$
CondicionesIniciales := $y(\pi) = -2;$
EcuacionDiferencial := $\frac{\sin(2 x)}{y(x)} + x + \left(y(x) - \frac{\sin(x)^2}{y(x)^2} \right) \left(\frac{d}{dx} y(x) \right) = 0$
CondicionesIniciales := $y(\pi) = -2$ (1)

b) Graficar dicha solución particular en un intervalo $-4 < x < 4$

[> EcuacionDiferencial

$$\frac{\sin(2 x)}{y(x)} + x + \left(y(x) - \frac{\sin(x)^2}{y(x)^2} \right) \left(\frac{d}{dx} y(x) \right) = 0$$
 (2)

[> CondicionesIniciales

$$y(\pi) = -2$$
 (3)

[> $M(x, y) := \frac{\sin(2 \cdot x)}{y} + x$

$$M(x, y) := \frac{\sin(2 x)}{y} + x$$
 (4)

[> $N(x, y) := \left(y - \frac{\sin(x)^2}{y^2} \right)$

$$N(x, y) := y - \frac{\sin(x)^2}{y^2}$$
 (5)

[> ComprobacionUno := $\text{simplify}(\text{diff}(M(x, y), y) - \text{diff}(N(x, y), x)) = 0$
ComprobacionUno := $0 = 0$ (6)

[> IntegralX := $\text{int}(M(x, y), x)$

[> SolucionGeneral := $\text{IntegralX} + \text{int}((N(x, y) - \text{diff}(\text{IntegralX}, y), y)) = C1$

$$\text{SolucionGeneral} := \frac{1}{2} x^2 + \frac{1}{2} y^2 + \frac{\sin(x)^2}{y} = C1$$
 (7)

[> Parametro := $\text{eval}(\text{subs}(x = \pi, y = -2, \text{SolucionGeneral}))$

$$\text{Parametro} := \frac{1}{2} \pi^2 + 2 = C1 \quad (8)$$

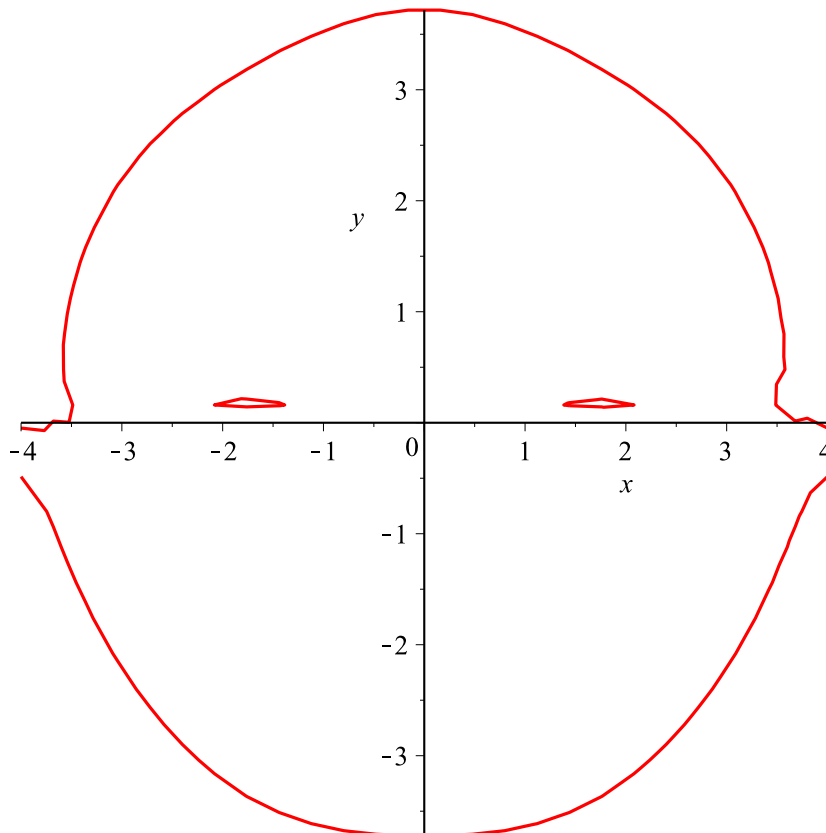
> *SolucionParticular* := subs(C1 = lhs(Parametro), SolucionGeneral)

$$\text{SolucionParticular} := \frac{1}{2} x^2 + \frac{1}{2} y^2 + \frac{\sin(x)^2}{y} = \frac{1}{2} \pi^2 + 2 \quad (9)$$

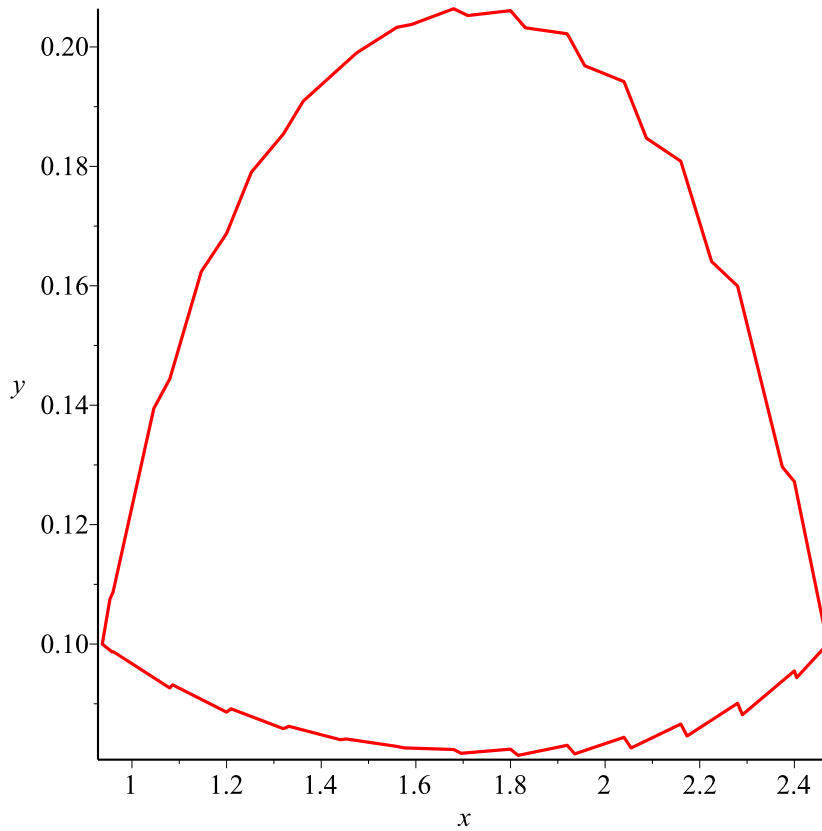
> with(plots)

[animate, animate3d, animatecurve, arrow, changecoords, complexplot, complexplot3d, conformal, conformal3d, contourplot, contourplot3d, coordplot, coordplot3d, densityplot, display, dualaxisplot, fieldplot, fieldplot3d, gradplot, gradplot3d, graphplot3d, implicitplot, implicitplot3d, inequal, interactive, interactiveparams, intersectplot, listcontplot, listcontplot3d, listdensityplot, listplot, listplot3d, loglogplot, logplot, matrixplot, multiple, odeplot, pareto, plotcompare, pointplot, pointplot3d, polarplot, polygonplot, polygonplot3d, polyhedra_supported, polyhedraplot, rootlocus, semilogplot, setcolors, setoptions, setoptions3d, spacecurve, sparsematrixplot, surfdata, textplot, textplot3d, tubeplot] (10)

> implicitplot(SolucionParticular, x=-4..4, y=-4..4)



> implicitplot(SolucionParticular, x=0..3, y=-2..1.5)



> *EcuacionDiferencial*

$$\frac{\sin(2x)}{y(x)} + x + \left(y(x) - \frac{\sin(x)^2}{y(x)^2} \right) \left(\frac{d}{dx} y(x) \right) = 0 \quad (11)$$

> *SolucionGeneral*

$$\frac{1}{2} x^2 + \frac{1}{2} y^2 + \frac{\sin(x)^2}{y} = CI \quad (12)$$

> *SolucionParticular*

$$\frac{1}{2} x^2 + \frac{1}{2} y^2 + \frac{\sin(x)^2}{y} = \frac{1}{2} \pi^2 + 2 \quad (13)$$

> *DerivadaUno* := simplify(isolate(EcuacionDiferencial, diff(y(x), x)))

$$DerivadaUno := \frac{d}{dx} y(x) = \frac{(\sin(2x) + x y(x)) y(x)}{-y(x)^3 + \sin(x)^2} \quad (14)$$

> *SolucionGeneralOriginal* := $\frac{1}{2} x^2 + \frac{1}{2} y(x)^2 + \frac{\sin(x)^2}{y(x)} = CI$

$$SolucionGeneralOriginal := \frac{1}{2} x^2 + \frac{1}{2} y(x)^2 + \frac{\sin(x)^2}{y(x)} = CI \quad (15)$$

$$\begin{aligned}
 &> \text{DerivadaDos} := \text{simplify}(\text{isolate}(\text{diff}(\text{SolucionGeneralOriginal}, x), \text{diff}(y(x), x))) \\
 &\quad \text{DerivadaDos} := \frac{d}{dx} y(x) = - \frac{(2 \sin(x) \cos(x) + x y(x)) y(x)}{y(x)^3 - 1 + \cos(x)^2} \quad (16)
 \end{aligned}$$

$$\begin{aligned}
 &> \text{ComprobaciunDos} := \text{simplify}(\text{rhs}(\text{DerivadaUno}) - \text{rhs}(\text{DerivadaDos})) = 0 \\
 &\quad \text{ComprobaciunDos} := 0 = 0 \quad (17)
 \end{aligned}$$

$$\begin{aligned}
 &> \text{SolucionParticularOriginal} := \frac{1}{2} x^2 + \frac{1}{2} y(x)^2 + \frac{\sin(x)^2}{y(x)} = \frac{1}{2} \pi^2 + 2 \\
 &\quad \text{SolucionParticularOriginal} := \frac{1}{2} x^2 + \frac{1}{2} y(x)^2 + \frac{\sin(x)^2}{y(x)} = \frac{1}{2} \pi^2 + 2 \quad (18)
 \end{aligned}$$

$$\begin{aligned}
 &> \text{DerivadaTres} := \text{simplify}(\text{isolate}(\text{diff}(\text{SolucionParticularOriginal}, x), \text{diff}(y(x), x))) \\
 &\quad \text{DerivadaTres} := \frac{d}{dx} y(x) = - \frac{(2 \sin(x) \cos(x) + x y(x)) y(x)}{y(x)^3 - 1 + \cos(x)^2} \quad (19)
 \end{aligned}$$

$$\begin{aligned}
 &> \text{ComprobaciunDos} := \text{simplify}(\text{rhs}(\text{DerivadaUno}) - \text{rhs}(\text{DerivadaTres})) = 0 \\
 &\quad \text{ComprobaciunDos} := 0 = 0 \quad (20)
 \end{aligned}$$

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