

```
> restart
> Ecuacion := (1 - x·2·y(x)) + x·2·(y(x) - x)·diff(y(x), x) = 0
      Ecuacion := 1 - x2 y(x) + x2 (y(x) - x) (  $\frac{d}{dx}$  y(x) ) = 0 (1)
```

```
> with(DEtools);
[AreSimilar, DENormal, DEplot, DEplot3d, DEplot_polygon, DFactor, DFactorLCLM, (2)
 DFactorsols, Dchangevar, FunctionDecomposition, GCRD, Gosper, Heunsols,
 Homomorphisms, IVPsol, IsHyperexponential, LCLM, MeijerGsols,
 MultiplicativeDecomposition, ODEInvariants, PDEchangecoords, PolynomialNormalForm,
 RationalCanonicalForm, ReduceHyperexp, RiemannPsols, Xchange, Xcommutator, Xgauge,
 Zeilberger, abelsol, adjoint, autonomous, bernoullisol, buildsol, buildsym, canoni, caseplot,
 casesplit, checkrank, chinisol, clairautsol, constcoeffsols, convertAlg, convertsys,
 dalembertsol, dcoeffs, de2diffop, dfieldplot, diff_table, diffop2de, dperiodic_sols, dpolyform,
 dsubs, eigenring, endomorphism_charpoly, equinv, eta_k, eulersols, exactsol, expsols,
 exterior_power, firint, firtest, formal_sol, gen_exp, generate_ic, genhomosol, gensys,
 hamilton_eqs, hypergeomsols, hyperode, indicialeq, infgen, initialdata, integrate_sols,
 intfactor, invariants, kovacicols, leftdivision, liesol, line_int, linearsol, matrixDE,
 matrix_riccati, maxdimsystems, moser_reduce, muchange, mult, mutest, newton_polygon,
 normalG2, ode_int_y, ode_y1, odeadvisor, odepde, parametricsol, particularsol,
 phaseportrait, poincare, polysols, power_equivalent, rational_equivalent, ratsols, redode,
 reduceOrder, reduce_order, regular_parts, regularsp, remove_RootOf, riccati_system,
 riccatisol, rifread, rifsimp, rightdivision, rtaylor, separablesol, singularities, solve_group,
 super_reduce, symgen, symmetric_power, symmetric_product, symtest, transinv, translate,
 untranslate, varparam, zoom]
```

```
> odeadvisor(Ecuacion)
[_rational, [_1st_order, _with_symmetry [F(x), G(x)]], [_Abel, 2nd type, class B]] (3)
```

```
> intfactor(Ecuacion)
      1
      x2 (4)
```

```
> M := 1 - x·2·y; N := x·2·(y - x)
      M := 1 - x2 y
      N := x2 (y - x) (5)
```

```
> DerMy := diff(M, y)
      DerMy := -x2 (6)
```

```
> DerNx := diff(N, x)
      DerNx := 2 x (y - x) - x2 (7)
```

```
> comprobacion := simplify(DerMy - DerNx)
      comprobacion := 2 x (-y + x) (8)
```

```
> F := (DerMy - DerNx) / N
      F := - 2 / x (9)
```

$$\begin{aligned} &> \text{SolFactor} := \text{int}\left(\frac{1}{\mu}, \mu\right) = \text{int}(F, x) \\ &\qquad\qquad\qquad \text{SolFactor} := \ln(\mu) = -2 \ln(x) \end{aligned} \quad (10)$$

$$\begin{aligned} &> \text{FactorInt} := \text{isolate}(\text{SolFactor}, \mu) \\ &\qquad\qquad\qquad \text{FactorInt} := \mu = \frac{1}{x^2} \end{aligned} \quad (11)$$

$$\begin{aligned} &> \text{MM} := \text{expand}(\text{rhs}(\text{FactorInt}) \cdot M); \text{NN} := \text{rhs}(\text{FactorInt}) \cdot N \\ &\qquad\qquad\qquad \text{MM} := \frac{1}{x^2} - y \\ &\qquad\qquad\qquad \text{NN} := y - x \end{aligned} \quad (12)$$

$$\begin{aligned} &> \text{EcuacionExacta} := \left(\frac{1}{x \cdot 2} - y(x)\right) + (y(x) - x) \cdot \text{diff}(y(x), x) = 0 \\ &\qquad\qquad\qquad \text{EcuacionExacta} := \frac{1}{x^2} - y(x) + (y(x) - x) \left(\frac{d}{dx} y(x)\right) = 0 \end{aligned} \quad (13)$$

$$\begin{aligned} &> \text{ComprobacionDos} := \text{simplify}(\text{diff}(\text{MM}, y) - \text{diff}(\text{NN}, x)) = 0 \\ &\qquad\qquad\qquad \text{ComprobacionDos} := 0 = 0 \end{aligned} \quad (14)$$

$$\begin{aligned} &> \text{IntMMx} := \text{int}(\text{MM}, x) \\ &\qquad\qquad\qquad \text{IntMMx} := -\frac{1}{x} - yx \end{aligned} \quad (15)$$

$$\begin{aligned} &> \text{SolucionGeneral} := \text{expand}(\text{simplify}(\text{IntMMx} + \text{int}(\text{NN} - \text{diff}(\text{IntMMx}, y)), y)) = C_1 \\ &\qquad\qquad\qquad \text{SolucionGeneral} := -\frac{1}{x} - yx + \frac{1}{2} y^2 = C_1 \end{aligned} \quad (16)$$

$$\begin{aligned} &> \text{SolGral} := \text{dsolve}(\text{Ecuacion}) \\ &\qquad\qquad\qquad \text{SolGral} := y(x) = \frac{x^2 + \sqrt{x^4 + 2x - 2} \cdot C_1 x^2}{x}, y(x) = -\frac{-x^2 + \sqrt{x^4 + 2x - 2} \cdot C_1 x^2}{x} \end{aligned} \quad (17)$$

$$\begin{aligned} &> \text{SolGralDos} := \text{exactsol}(\text{EcuacionExacta}) \\ &\qquad\qquad\qquad \text{SolGralDos} := \left\{ y(x) = \frac{x^2 + \sqrt{x^4 + 2x - 2} \cdot C_1 x^2}{x}, y(x) = -\frac{-x^2 + \sqrt{x^4 + 2x - 2} \cdot C_1 x^2}{x} \right\} \end{aligned} \quad (18)$$

> restart

>

$$242. (2xy^2 - 3y^3) dx + (7 - 3xy^2) dy = 0,$$

$$\begin{aligned} &> \text{Ecuacion} := (2 \cdot x \cdot y(x) \cdot 2 - 3 \cdot y(x) \cdot 3) + (7 - 3 \cdot x \cdot y(x) \cdot 2) \cdot \text{diff}(y(x), x) = 0 \\ &\qquad\qquad\qquad \text{Ecuacion} := 2xy(x)^2 - 3y(x)^3 + (7 - 3xy(x)^2) \left(\frac{d}{dx} y(x)\right) = 0 \end{aligned} \quad (19)$$

> with(DEtools):

$$\begin{aligned} &> \text{odeadvisor}(\text{Ecuacion}) \\ &\qquad\qquad\qquad [_{\text{rational}}] \end{aligned} \quad (20)$$

$$\begin{aligned} &> \text{intfactor}(\text{Ecuacion}) \\ &\qquad\qquad\qquad \frac{1}{y(x)^2} \end{aligned} \quad (21)$$

$$\begin{aligned}
 & \text{> } M := 2 \cdot x \cdot y \cdot 2 - 3 \cdot y \cdot 3; N := 7 - 3 \cdot x \cdot y \cdot 2 \\
 & \qquad \qquad \qquad M := 2 \, x \, y^2 - 3 \, y^3 \\
 & \qquad \qquad \qquad N := 7 - 3 \, x \, y^2
 \end{aligned} \tag{22}$$

$$\begin{aligned}
 & \text{> } FactInt := \frac{1}{y^2} \\
 & \qquad \qquad \qquad FactInt := \frac{1}{y^2}
 \end{aligned} \tag{23}$$

$$\begin{aligned}
 & \text{> } MM := expand(FactInt \cdot M); NN := expand(FactInt \cdot N) \\
 & \qquad \qquad \qquad MM := 2 \, x - 3 \, y \\
 & \qquad \qquad \qquad NN := \frac{7}{y^2} - 3 \, x
 \end{aligned} \tag{24}$$

$$\begin{aligned}
 & \text{> } Comprobacion := simplify(diff(MM, y) - diff(NN, x)) = 0 \\
 & \qquad \qquad \qquad Comprobacion := 0 = 0
 \end{aligned} \tag{25}$$

$$\begin{aligned}
 & \text{> } IntNNy := int(NN, y) \\
 & \qquad \qquad \qquad IntNNy := -\frac{7}{y} - 3 \, x \, y
 \end{aligned} \tag{26}$$

$$\begin{aligned}
 & \text{> } SolGral := expand(IntNNy + int((MM - diff(IntNNy, x)), x)) = C_1 \\
 & \qquad \qquad \qquad SolGral := -\frac{7}{y} - 3 \, x \, y + x^2 = C_1
 \end{aligned} \tag{27}$$

>