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> restart
> Ecua := x^2 + y^2 - 2·x·y·y'=0

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$$Ecua := x^2 + y(x)^2 - 2 x y(x) \left( \frac{d}{dx} y(x) \right) = 0 \quad (1)$$

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> with(DEtools):
> odeadvisor(Ecua)

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$$[_homogeneous, class A], _rational, _Bernoulli] \quad (2)$$

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> M := x^2 + y^2

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$$M := x^2 + y^2 \quad (3)$$

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> Mlambda := simplify(subs(x=lambda·x, y=lambda·y, M))

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$$Mlambda := \lambda^2 (x^2 + y^2) \quad (4)$$

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> N := -2·x·y

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$$N := -2 y x \quad (5)$$

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> Nlambda := simplify(subs(x=lambda·x, y=lambda·y, N))

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$$Nlambda := -2 \lambda^2 y x \quad (6)$$

COEFICIENTES HOMOGENEOS

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> EcuaDos := simplify(isolate(simplify(eval(subs(y(x)=x·u(x), Ecua))), diff(u(x), x)))

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$$EcuaDos := \frac{d}{dx} u(x) = \frac{1 - u(x)^2}{2 x u(x)} \quad (7)$$

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> odeadvisor(EcuaDos)

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$$[_separable] \quad (8)$$

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> MM := u^2 - 1

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$$MM := u^2 - 1 \quad (9)$$

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> NN := 2·x·u

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$$NN := 2 x u \quad (10)$$

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> P := 1; Q := MM; R := 2·x; S := u

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$$\begin{aligned} P &:= 1 \\ Q &:= u^2 - 1 \\ R &:= 2 x \\ S &:= u \end{aligned} \quad (11)$$

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> SolGralU := int(P/R, x) + int(S/Q, u) = C[1]

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$$SolGralU := \frac{\ln(x)}{2} + \frac{\ln(u-1)}{2} + \frac{\ln(u+1)}{2} = C_1 \quad (12)$$

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> SolGralUU := simplify(exp(lhs(SolGralU))) = C[1]

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$$SolGralUU := \sqrt{x} \sqrt{u-1} \sqrt{u+1} = C_1 \quad (13)$$

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> SolGralUUU := lhs(SolGralUU)^2 = C[1]

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$$SolGralUUU := x (u-1) (u+1) = C_1 \quad (14)$$

$$\begin{aligned} &> \text{SolFinal} := \text{expand}\left(\text{simplify}\left(\text{subs}\left(u = \frac{y(x)}{x}, \text{SolGralUUU}\right)\right)\right) \\ &\text{SolFinal} := \frac{y(x)^2}{x} - x = C_1 \end{aligned} \quad (15)$$

$$\begin{aligned} &> \text{DerSolFinal} := \text{simplify}(\text{isolate}(\text{diff}(\text{SolFinal}, x), \text{diff}(y(x), x))) \\ &\text{DerSolFinal} := \frac{d}{dx} y(x) = \frac{x^2 + y(x)^2}{2 x y(x)} \end{aligned} \quad (16)$$

$$\begin{aligned} &> \text{Ecua} \\ &x^2 + y(x)^2 - 2 x y(x) \left( \frac{d}{dx} y(x) \right) = 0 \end{aligned} \quad (17)$$

$$\begin{aligned} &> \text{DerEcua} := \text{simplify}(\text{isolate}(\text{Ecua}, \text{diff}(y(x), x))) \\ &\text{DerEcua} := \frac{d}{dx} y(x) = \frac{x^2 + y(x)^2}{2 x y(x)} \end{aligned} \quad (18)$$

$$\begin{aligned} &> \text{ComprobarUno} := \text{simplify}(\text{rhs}(\text{DerSolFinal}) - \text{rhs}(\text{DerEcua})) = 0 \\ &\text{ComprobarUno} := 0 = 0 \end{aligned} \quad (19)$$

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POR FACTOR INTEGRANTE

$$\begin{aligned} &> \text{FactInt} := \text{intfactor}(\text{Ecua}) \\ &\text{FactInt} := \frac{1}{x^2} \end{aligned} \quad (20)$$

$$\begin{aligned} &> \text{MMM} := \text{FactInt} \cdot M \\ &\text{MMM} := \frac{x^2 + y^2}{x^2} \end{aligned} \quad (21)$$

$$\begin{aligned} &> \text{NNN} := \text{simplify}(\text{FactInt} \cdot N) \\ &\text{NNN} := -\frac{2 y}{x} \end{aligned} \quad (22)$$

$$\begin{aligned} &> \text{diff}(\text{MMM}, y) = \text{diff}(\text{NNN}, x) \\ &\frac{2 y}{x^2} = \frac{2 y}{x^2} \end{aligned} \quad (23)$$

$$\begin{aligned} &> \text{EcuaTres} := \frac{x^2 + y(x)^2}{x^2} - \frac{2 y(x)}{x} \cdot \text{diff}(y(x), x) = 0 \\ &\text{EcuaTres} := \frac{x^2 + y(x)^2}{x^2} - \frac{2 y(x) \left( \frac{d}{dx} y(x) \right)}{x} = 0 \end{aligned} \quad (24)$$

$$\begin{aligned} &> \text{odeadvisor}(\text{EcuaTres}) \\ &[[\_homogeneous, class A], \_exact, \_rational, \_Bernoulli] \end{aligned} \quad (25)$$

$$\begin{aligned} &> \text{IntMMMx} := \text{int}(\text{MMM}, x) \\ &\text{IntMMMx} := x - \frac{y^2}{x} \end{aligned} \quad (26)$$

$$> \text{SolFinalCuatro} := \text{simplify}(\text{IntMMMx} + \text{int}((\text{NNN} - \text{diff}(\text{IntMMMx}, y)), y)) = C[1]$$

$$SolFinalCuatro := x - \frac{y^2}{x} = C_1 \quad (27)$$

> SolFinal

$$\frac{y(x)^2}{x} - x = C_1 \quad (28)$$

> restart

$$Ecua := x^4 \cdot \log(x) - 2 \cdot x \cdot y^3 + 3 \cdot x^2 y^2 \cdot y' = 0$$

$$Ecua := x^4 \ln(x) - 2 x y(x)^3 + 3 x^2 y(x)^2 \left( \frac{d}{dx} y(x) \right) = 0 \quad (29)$$

> with(DEtools):

> odeadvisor(Ecua)

$$[_Bernoulli] \quad (30)$$

> intfactor(Ecua)

$$\frac{1}{x^4} \quad (31)$$

$$M := x^4 \cdot \log(x) - 2 \cdot x \cdot y^3$$

$$M := x^4 \ln(x) - 2 x y^3 \quad (32)$$

$$N := 3 \cdot x^2 y^2$$

$$N := 3 x^2 y^2 \quad (33)$$

$$DerMy := \text{diff}(M, y)$$

$$DerMy := -6 x y^2 \quad (34)$$

$$DerNx := \text{diff}(N, x)$$

$$DerNx := 6 x y^2 \quad (35)$$

Si el factor integrante es función sólo de x

$$FactX := \frac{(DerMy - DerNx)}{N}$$

$$FactX := -\frac{4}{x} \quad (36)$$

$$EcuaFactInt := \text{isolate}\left(\text{int}\left(\frac{1}{\text{mu}}, \text{mu}\right) = \text{int}(FactX, x), \text{mu}\right)$$

$$EcuaFactInt := \mu = \frac{1}{x^4} \quad (37)$$

$$MM := \text{expand}(\text{rhs}(EcuaFactInt) \cdot M)$$

$$MM := \ln(x) - \frac{2 y^3}{x^3} \quad (38)$$

$$NN := \text{expand}(\text{rhs}(EcuaFactInt) \cdot N)$$

$$NN := \frac{3 y^2}{x^2} \quad (39)$$

$$\text{Comprobar} := \text{diff}(MM, y) = \text{diff}(NN, x)$$

$$Comprobar := -\frac{6y^2}{x^3} = -\frac{6y^2}{x^3} \quad (40)$$

$$> SolGral := int(MM, x) + int((NN - diff(int(MM, x), y)), y) = _C[1]$$

$$SolGral := \frac{y^3}{x^2} + x \ln(x) - x = _C_1 \quad (41)$$

$$> Ecua$$

$$x^4 \ln(x) - 2xy(x)^3 + 3x^2y(x)^2 \left( \frac{d}{dx} y(x) \right) = 0 \quad (42)$$

$$> SolFinal := \frac{y(x)^3}{x^2} + x \ln(x) - x = _C_1$$

$$SolFinal := \frac{y(x)^3}{x^2} + x \ln(x) - x = _C_1 \quad (43)$$

$$> DerEcua := expand(isolate(Ecua, diff(y(x), x)))$$

$$DerEcua := \frac{d}{dx} y(x) = -\frac{x^2 \ln(x)}{3y(x)^2} + \frac{2y(x)}{3x} \quad (44)$$

$$> DerSolFinal := expand(isolate(diff(SolFinal, x), diff(y(x), x)))$$

$$DerSolFinal := \frac{d}{dx} y(x) = -\frac{x^2 \ln(x)}{3y(x)^2} + \frac{2y(x)}{3x} \quad (45)$$

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