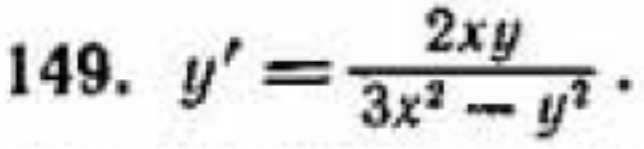


> restart

> 

> EcuacionCero := diff(y(x), x) = $\frac{2 \cdot x \cdot y(x)}{3 \cdot x \cdot 2 - y(x) \cdot 2}$

$$EcuacionCero := \frac{d}{dx} y(x) = \frac{2 x y(x)}{3 x^2 - y(x)^2} \quad (1)$$

> Ecuacion := -2 · x · y(x) + (3 · x · 2 - y(x) · 2) · diff(y(x), x) = 0

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

> with(DEtools) :

> odeadvisor(Ecuacion)

$$[[_homogeneous, class A], _rational, _dAlembert] \quad (3)$$

> EcuacionDos := simplify(eval(subs(y(x) = u(x) · x, Ecuacion)))

$$EcuacionDos := -x^2 \left(-u(x) - 3 \left(\frac{d}{dx} u(x) \right) x + u(x)^2 x \left(\frac{d}{dx} u(x) \right) + u(x)^3 \right) = 0 \quad (4)$$

> odeadvisor(EcuacionDos)

$$[_separable] \quad (5)$$

> EcuacionTres := isolate(EcuacionDos, diff(u(x), x))

$$EcuacionTres := \frac{d}{dx} u(x) = \frac{u(x) - u(x)^3}{-3 x + u(x)^2 x} \quad (6)$$

> $T := \frac{u - u^3}{-3 + u^2}; V := -x$

$$T := \frac{u - u^3}{-3 + u^2}$$

$$V := -x \quad (7)$$

> $\int \left(\frac{1}{T}, u \right); \int \left(\frac{1}{V}, x \right)$

$$\frac{-3 \ln(u) + \ln(u + 1) + \ln(-1 + u)}{-\ln(x)} \quad (8)$$

> SolucionInicial := simplify($\int \left(\frac{1}{T}, u \right) + \int \left(\frac{1}{V}, x \right)$) = C₁

$$SolucionInicial := -3 \ln(u) + \ln(u + 1) + \ln(-1 + u) - \ln(x) = C_1 \quad (9)$$

> SolUno := -3 ln(u(x)) + ln(-1 + u(x)) + ln(u(x) + 1) - ln(x) = C₁

$$SolUno := -3 \ln(u(x)) + \ln(-1 + u(x)) + \ln(u(x) + 1) - \ln(x) = C_1 \quad (10)$$

> DerU := simplify(isolate(diff(SolUno, x), diff(u(x), x)))

$$DerU := \frac{d}{dx} u(x) = -\frac{u(x) (-1 + u(x)^2)}{x (-3 + u(x)^2)} \quad (11)$$

> EcuacionTres

$$\frac{d}{dx} u(x) = \frac{u(x) - u(x)^3}{-3x + u(x)^2 x} \quad (12)$$

> comprobacion := simplify(rhs(DerU) - rhs(EcuacionTres)) = 0
comprobacion := 0 = 0

(13)

> SolucionPosterior := isolate(isolate(SolucionInicial, x), exp(C₁))

$$\text{SolucionPosterior} := e^{C_1} = \frac{-1 + u^2}{x u^3} \quad (14)$$

> SolucionGeneral := simplify(subs(u = y/x, rhs(SolucionPosterior))) = C₁

$$\text{SolucionGeneral} := -\frac{x^2 - y^2}{y^3} = C_1 \quad (15)$$

> SolGral := -\frac{x^2 - y(x)^2}{y(x)^3} = C₁

$$\text{SolGral} := -\frac{-y(x)^2 + x^2}{y(x)^3} = C_1 \quad (16)$$

> DerXY := expand(isolate(diff(SolGral, x), diff(y(x), x)))

$$\text{DerXY} := \frac{d}{dx} y(x) = -\frac{2xy(x)}{y(x)^2 - 3x^2} \quad (17)$$

> Ecuacion

$$-2xy(x) + (3x^2 - y(x)^2) \left(\frac{d}{dx} y(x) \right) = 0 \quad (18)$$

> IsoEcua := isolate(Ecuacion, diff(y(x), x))

$$\text{IsoEcua} := \frac{d}{dx} y(x) = \frac{2xy(x)}{3x^2 - y(x)^2} \quad (19)$$

> comprobacion₁ := simplify(rhs(DerXY) - rhs(IsoEcua)) = 0

$$\text{comprobacion}_1 := 0 = 0 \quad (20)$$

> restart

> **146. $xy' = y + \sqrt{y^2 - x^2}$.**

> Ecuacion := y(x) + sqrt(y(x)·2 - x·2) - x·diff(y(x), x) = 0

$$\text{Ecuacion} := y(x) + \sqrt{y(x)^2 - x^2} - x \left(\frac{d}{dx} y(x) \right) = 0 \quad (21)$$

> with(DEtools) :

> odeadvisor(Ecuacion)

$$[[_{\text{homogeneous}}, \text{class } A], _{\text{rational}}, _{\text{dAlembert}}] \quad (22)$$

> EcuacionDos := isolate(simplify(eval(subs(y(x) = u(x)·x, Ecuacion))), diff(u(x), x))

(23)

$$EcuacionDos := \frac{d}{dx} u(x) = \frac{\sqrt{x^2 (u(x)^2 - 1)}}{x^2} \quad (23)$$

$$\begin{aligned} &> EcuacionTres := lhs(EcuacionDos) \cdot 2 = rhs(EcuacionDos) \cdot 2 \\ &EcuacionTres := \left(\frac{d}{dx} u(x) \right)^2 = \frac{u(x)^2 - 1}{x^2} \end{aligned} \quad (24)$$

$$\begin{aligned} &> odeadvisor(EcuacionTres) \\ &[_{separable}] \end{aligned} \quad (25)$$

$$\begin{aligned} &> EcuacionCuatro := diff(u(x), x) = \frac{\text{sqrt}(u(x)^2 - 1)}{x} \\ &EcuacionCuatro := \frac{d}{dx} u(x) = \frac{\sqrt{u(x)^2 - 1}}{x} \end{aligned} \quad (26)$$

$$\begin{aligned} &> odeadvisor(EcuacionCuatro) \\ &[_{separable}] \end{aligned} \quad (27)$$

$$\begin{aligned} &> T := \sqrt{u^2 - 1}; V := -x \\ &T := \sqrt{u^2 - 1} \\ &V := -x \end{aligned} \quad (28)$$

$$\begin{aligned} &> SolucionInicial := int\left(\frac{1}{T}, u\right) + int\left(\frac{1}{V}, x\right) = C_1 \\ &SolucionInicial := \ln(u + \sqrt{u^2 - 1}) - \ln(x) = C_1 \end{aligned} \quad (29)$$

$$\begin{aligned} &> SolucionPosterior := isolate(isolate(SolucionInicial, x), \exp(C_1)) \\ &SolucionPosterior := e^{C_1} = \frac{u + \sqrt{u^2 - 1}}{x} \end{aligned} \quad (30)$$

$$\begin{aligned} &> SolucionGeneral := subs\left(u = \frac{y}{x}, rhs(SolucionPosterior)\right) = C_1 \\ &SolucionGeneral := \frac{\frac{y}{x} + \sqrt{\frac{y^2}{x^2} - 1}}{x} = C_1 \end{aligned} \quad (31)$$

$$\begin{aligned} &> SolucionDos := lhs(SolucionGeneral) \cdot x = rhs(SolucionGeneral) \cdot x \\ &SolucionDos := \frac{y}{x} + \sqrt{\frac{y^2}{x^2} - 1} = C_1 x \end{aligned} \quad (32)$$

$$\begin{aligned} &> SolucionTres := lhs(SolucionDos) - \frac{y}{x} = rhs(SolucionDos) - \frac{y}{x} \\ &SolucionTres := \sqrt{\frac{y^2}{x^2} - 1} = C_1 x - \frac{y}{x} \end{aligned} \quad (33)$$

$$\begin{aligned} &> SolucionCuatro := lhs(SolucionTres) \cdot 2 = rhs(SolucionTres) \cdot 2 \\ &SolucionCuatro := \frac{y^2}{x^2} - 1 = \left(C_1 x - \frac{y}{x}\right)^2 \end{aligned} \quad (34)$$

$$> SolucionCinco := simplify(lhs(SolucionCuatro) \cdot x \cdot 2) = simplify(rhs(SolucionCuatro) \cdot x \cdot 2)$$

$$\text{SolucionCinco} := y^2 - x^2 = (C_1 x^2 - y)^2 \quad (35)$$

$$> \text{Parametro} := \text{isolate}(\text{SolucionCinco}, C_1)$$

$$\text{Parametro} := C_1 = \frac{y + \sqrt{y^2 - x^2}}{x^2} \quad (36)$$

$$> \text{SolucionFinal} := \text{rhs}(\text{Parametro}) = C_1$$

$$\text{SolucionFinal} := \frac{y + \sqrt{y^2 - x^2}}{x^2} = C_1 \quad (37)$$

$$> \text{SolGral} := \frac{y(x) + \sqrt{y(x)^2 - x^2}}{x^2} = C_1$$

$$\text{SolGral} := \frac{y(x) + \sqrt{y(x)^2 - x^2}}{x^2} = C_1 \quad (38)$$

$$> \text{DerX} := \text{isolate}(\text{diff}(\text{SolGral}, x), \text{diff}(y(x), x))$$

$$\text{DerX} := \frac{d}{dx} y(x) = \frac{\frac{2(y(x) + \sqrt{y(x)^2 - x^2})\sqrt{y(x)^2 - x^2}}{x} + x}{y(x) + \sqrt{y(x)^2 - x^2}} \quad (39)$$

$$> \text{Ecuacion}$$

$$y(x) + \sqrt{y(x)^2 - x^2} - x \left(\frac{d}{dx} y(x) \right) = 0 \quad (40)$$

$$> \text{IsoXY} := \text{isolate}(\text{Ecuacion}, \text{diff}(y(x), x))$$

$$\text{IsoXY} := \frac{d}{dx} y(x) = -\frac{-y(x) - \sqrt{y(x)^2 - x^2}}{x} \quad (41)$$

$$> \text{comprobacion} := \text{simplify}(\text{rhs}(\text{DerX}) - \text{rhs}(\text{IsoXY})) = 0$$

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

$$> \text{restart}$$

$$> \text{Int}(\sec(\theta), \theta) = \text{int}(\sec(\theta), \theta)$$

$$\int \sec(\theta) d\theta = \ln(\sec(\theta) + \tan(\theta)) \quad (43)$$

>

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