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> restart
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$$154. \quad y^3 dx + 2(x^2 - xy^2) dy = 0.$$

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> Ecuacion := y(x)·3 + 2·(x·2 - x·y(x)·2)·diff(y(x), x) = 0
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$$Ecuacion := y(x)^3 + 2(x^2 - xy(x)^2) \left(\frac{d}{dx} y(x) \right) = 0 \quad (1)$$

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> with(DEtools):
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> odeadvisor(Ecuacion)
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[[_homogeneous, class G], _rational] (2)
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> EcuacionDos := simplify(isolate(expand(eval(subs(y(x) = u(x)·x, Ecuacion))), diff(u(x), x)))
```

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

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> odeadvisor(EcuacionDos)
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[[_homogeneous, class G], _rational] (4)
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> intfactor(Ecuacion)
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$$\frac{1}{y(x) x^2} \quad (5)$$

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> M := y·3; N := 2·(x·2 - x·y·2)
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$$M := y^3$$

$$N := 2x^2 - 2xy^2 \quad (6)$$

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> FactInt := 1/(x·2·y)
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$$FactInt := \frac{1}{yx^2} \quad (7)$$

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> MM := simplify(M·FactInt)
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$$MM := \frac{y^2}{x^2} \quad (8)$$

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> NN := expand(N·FactInt)
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$$NN := \frac{2}{y} - \frac{2y}{x} \quad (9)$$

```
> comprobacion := simplify(diff(MM, y) - diff(NN, x)) = 0
```

$$comprobacion := 0 = 0 \quad (10)$$

```
> IntMMx := int(MM, x)
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$$IntMMx := -\frac{y^2}{x} \quad (11)$$

```
> SolucionGeneral := IntMMx + int((NN - diff(IntMMx, y)), y) = C1
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$$SolucionGeneral := -\frac{y^2}{x} + 2 \ln(y) = C_1 \quad (12)$$

> restart

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$$147. 4x^2 - xy + y^2 + y'(x^2 - xy + 4y^2) = 0.$$

> Ecuacion := $4 \cdot x \cdot 2 - x \cdot y(x) + y(x) \cdot 2 + (x \cdot 2 - x \cdot y(x) + 4 \cdot y(x) \cdot 2) \cdot \text{diff}(y(x), x) = 0$

$$\text{Ecuacion} := 4x^2 - xy(x) + y(x)^2 + (x^2 - xy(x) + 4y(x)^2) \left(\frac{d}{dx} y(x) \right) = 0 \quad (13)$$

> with(DEtools):

> odeadvisor(Ecuacion)

[[_homogeneous, class A], _rational, _dAlembert] (14)

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

$$\text{EcuacionDos} := \frac{d}{dx} u(x) = - \frac{4(u(x) + 1)(u(x)^2 - u(x) + 1)}{x(1 - u(x) + 4u(x)^2)} \quad (15)$$

> odeadvisor(EcuacionDos)

[_separable] (16)

$$P := x; Q := \frac{4(u + 1)(u^2 - u + 1)}{(1 - u + 4u^2)}$$

$$P := x$$

$$Q := \frac{4(u + 1)(u^2 - u + 1)}{1 - u + 4u^2} \quad (17)$$

> Solucion := int($\frac{1}{P}, x$) + int($\frac{1}{Q}, u$) = C₁

$$\text{Solucion} := \ln(x) + \frac{1}{2} \ln(u + 1) + \frac{1}{4} \ln(u^2 - u + 1) = C_1 \quad (18)$$

> SolucionPrima := lhs(Solucion) · 4 = rhs(Solucion) · 4

$$\text{SolucionPrima} := 4 \ln(x) + 2 \ln(u + 1) + \ln(u^2 - u + 1) = 4 C_1 \quad (19)$$

> SolucionBiPrima := expand(exp(lhs(SolucionPrima))) = C₁

$$\text{SolucionBiPrima} := x^4 u^4 + x^4 u^3 + x^4 u + x^4 = C_1 \quad (20)$$

> SolucionFinal := subs($u = \frac{y}{x}$, SolucionBiPrima)

$$\text{SolucionFinal} := y^4 + x y^3 + x^3 y + x^4 = C_1 \quad (21)$$

> SolucionDerivable := $y(x)^4 + x y(x)^3 + x^3 y(x) + x^4 = C_1$

$$\text{SolucionDerivable} := y(x)^4 + x y(x)^3 + x^3 y(x) + x^4 = C_1 \quad (22)$$

> EcuacionSegunda := simplify(isolate(diff(SolucionDerivable, x), diff(y(x), x)))

$$\text{EcuacionSegunda} := \frac{d}{dx} y(x) = - \frac{y(x)^2 - x y(x) + 4 x^2}{x^2 - x y(x) + 4 y(x)^2} \quad (23)$$

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

(24)

$$EcuacionOriginal := \frac{d}{dx} y(x) = \frac{-4x^2 + xy(x) - y(x)^2}{x^2 - xy(x) + 4y(x)^2} \quad (24)$$

$$\begin{aligned} &> comprobacionDos := simplify(rhs(EcuacionSegunda) - rhs(EcuacionOriginal)) = 0 \\ &\quad \quad \quad comprobacionDos := 0 = 0 \end{aligned} \quad (25)$$

> Ecuacion

$$4x^2 - xy(x) + y(x)^2 + (x^2 - xy(x) + 4y(x)^2) \left(\frac{d}{dx} y(x) \right) = 0 \quad (26)$$

> intfactor(Ecuacion)

$$\frac{1}{(y(x)^2 - xy(x) + x^2)(y(x) + x)} \quad (27)$$

$$> FactInt := \frac{1}{(y^2 - xy + x^2)(y + x)}$$

$$FactInt := \frac{1}{(x^2 - xy + y^2)(x + y)} \quad (28)$$

$$> M := 4x^2 - xy + y^2; N := x^2 - xy + 4y^2$$

$$M := 4x^2 - xy + y^2$$

$$N := x^2 - xy + 4y^2 \quad (29)$$

> MM := simplify(M·FactInt)

$$MM := \frac{4x^2 - xy + y^2}{(x^2 - xy + y^2)(x + y)} \quad (30)$$

> NN := simplify(N·FactInt)

$$NN := \frac{x^2 - xy + 4y^2}{(x + y)(x^2 - xy + y^2)} \quad (31)$$

> comprobacionTres := simplify(diff(MM, y) - diff(NN, x)) = 0

$$\quad \quad \quad comprobacionTres := 0 = 0 \quad (32)$$

> SolucionExacta := int(MM, x) + int((NN - diff(int(MM, x), y)), y) = C₁

$$SolucionExacta := 2 \ln(x + y) + \ln(x^2 - xy + y^2) = C_1 \quad (33)$$

> SolucionMuyExacta := expand(exp(lhs(SolucionExacta))) = C₁

$$SolucionMuyExacta := y^4 + xy^3 + x^3y + x^4 = C_1 \quad (34)$$

> SolucionFinal

$$y^4 + xy^3 + x^3y + x^4 = C_1 \quad (35)$$

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