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> restart
> Ecua := (3·x·y2 + 20·x2·y3 + 12·y4) + (2·x2·y + 15·x3·y2 + 24·x·y3)·y'=0
Ecua := 3 x y(x)2 + 20 x2 y(x)3 + 12 y(x)4 + (2 x2 y(x) + 15 x3 y(x)2 + 24 x y(x)3) ( d/dx
y(x) ) = 0
(1)

with(DEtools):
> odeadvisor(Ecua)
[_rational]
(2)

> Mxy := 3·x·y2 + 20·x2·y3 + 12·y4
Mxy := 20 x2 y3 + 12 y4 + 3 x y2
(3)

> Nxy := 2·x2·y + 15·x3·y2 + 24·x·y3
Nxy := 15 x3 y2 + 24 x y3 + 2 x2 y
(4)

> DMy := diff(Mxy, y)
DMy := 60 x2 y2 + 48 y3 + 6 y x
(5)

> DNx := diff(Nxy, x)
DNx := 45 x2 y2 + 24 y3 + 4 y x
(6)

> Q := simplify( (DMy - DNx) / Nxy )
Q := 1/x
(7)

> FactorIntegrante := isolate( int( 1/F, F ) = int(Q, x), F )
FactorIntegrante := F = x
(8)

> Ecua
3 x y(x)2 + 20 x2 y(x)3 + 12 y(x)4 + (2 x2 y(x) + 15 x3 y(x)2 + 24 x y(x)3) ( d/dx y(x) ) = 0
(9)

> EcuaDos := expand(rhs(FactorIntegrante)·Ecua)
EcuaDos := 3 y(x)2 x2 + 20 x3 y(x)3 + 12 x y(x)4 + 2 y(x) ( d/dx y(x) ) x3 + 15 ( d/dx
y(x) ) x4 y(x)2 + 24 ( d/dx y(x) ) x2 y(x)3 = 0
(10)

> odeadvisor(EcuaDos)
[_exact, _rational]
(11)

> EcuaTres := isolate(EcuaDos, diff(y(x), x))
EcuaTres := d/dx y(x) = (-20 x3 y(x)3 - 12 x y(x)4 - 3 y(x)2 x2) / (15 y(x)2 x4 + 24 x2 y(x)3 + 2 y(x) x3)
(12)

> MMxy := -(-20 x3 y3 - 12 x y4 - 3 y2 x2)
MMxy := 20 x3 y3 + 12 x y4 + 3 x2 y2
(13)

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$$\begin{aligned} > NNxy := 15 y^2 x^4 + 24 x^2 y^3 + 2 y \cdot x^3 \\ & \quad NNxy := 15 y^2 x^4 + 24 x^2 y^3 + 2 y x^3 \end{aligned} \quad (14)$$

$$\begin{aligned} > IntMM := int(MMxy, x) \\ & \quad IntMM := y^2 (5 y x^4 + 6 x^2 y^2 + x^3) \end{aligned} \quad (15)$$

$$\begin{aligned} > SolGral := IntMM + int((NNxy - diff(IntMM, y)), y) = \_CI \\ & \quad SolGral := y^2 (5 y x^4 + 6 x^2 y^2 + x^3) = \_CI \end{aligned} \quad (16)$$

$$\begin{aligned} > DerEcua := simplify(isolate(Ecua, diff(y(x), x))) \\ & \quad DerEcua := \frac{d}{dx} y(x) = - \frac{y(x) (20 x^2 y(x) + 12 y(x)^2 + 3 x)}{x (15 x^2 y(x) + 24 y(x)^2 + 2 x)} \end{aligned} \quad (17)$$

$$\begin{aligned} > SolFinal := y(x)^2 (5 y(x) x^4 + 6 x^2 y(x)^2 + x^3) = \_CI \\ & \quad SolFinal := y(x)^2 (5 y(x) x^4 + 6 y(x)^2 x^2 + x^3) = \_CI \end{aligned} \quad (18)$$

$$\begin{aligned} > DerSolFinal := simplify(isolate(diff(SolFinal, x), diff(y(x), x))) \\ & \quad DerSolFinal := \frac{d}{dx} y(x) = - \frac{y(x) (20 x^2 y(x) + 12 y(x)^2 + 3 x)}{x (15 x^2 y(x) + 24 y(x)^2 + 2 x)} \end{aligned} \quad (19)$$

> with(DEtools) :

$$\begin{aligned} > FactInt := intfactor(Ecua) \\ & \quad FactInt := x \end{aligned} \quad (20)$$

> restart

$$\begin{aligned} > Ecua := (3 \cdot x^2 \cdot y + 20 \cdot x^3 \cdot y^2 + 12 \cdot x \cdot y^3) + (2 \cdot x^3 + 15 \cdot x^4 \cdot y + 24 \cdot x^2 \cdot y^2) \cdot y' = 0 \\ & \quad Ecua := 3 x^2 y(x) + 20 x^3 y(x)^2 + 12 x y(x)^3 + (2 x^3 + 15 x^4 y(x) + 24 x^2 y(x)^2) \left( \frac{d}{dx} y(x) \right) \\ & \quad = 0 \end{aligned} \quad (21)$$

> with(DEtools) :

$$\begin{aligned} > odeadvisor(Ecua) \\ & \quad [_{rational}] \end{aligned} \quad (22)$$

$$\begin{aligned} > intfactor(Ecua) \\ & \quad y(x) \end{aligned} \quad (23)$$

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$$\begin{aligned} > Intfact := y \\ & \quad Intfact := y \end{aligned} \quad (24)$$

$$\begin{aligned} > Mxy := 3 \cdot x^2 \cdot y + 20 \cdot x^3 \cdot y^2 + 12 \cdot x \cdot y^3 \\ & \quad Mxy := 20 x^3 y^2 + 12 x y^3 + 3 x^2 y \end{aligned} \quad (25)$$

$$\begin{aligned} > Nxy := 2 \cdot x^3 + 15 \cdot x^4 \cdot y + 24 \cdot x^2 \cdot y^2 \\ & \quad Nxy := 15 x^4 y + 24 x^2 y^2 + 2 x^3 \end{aligned} \quad (26)$$

$$\begin{aligned} > DMy := diff(Mxy, y) \\ & \quad DMy := 40 x^3 y + 36 x y^2 + 3 x^2 \end{aligned} \quad (27)$$

$$\begin{aligned} > DNx := diff(Nxy, x) \\ & \quad DNx := 60 x^3 y + 48 x y^2 + 6 x^2 \end{aligned} \quad (28)$$

$$\begin{aligned} &> \text{EcuaFactInt} := \text{isolate}\left(\text{int}\left(\frac{1}{F}, F\right) = \text{simplify}\left(\text{int}\left(\frac{(DNx - DMy)}{Mxy}, y\right)\right), F\right) \\ &\text{EcuaFactInt} := F = y \end{aligned} \quad (29)$$

$$\begin{aligned} &> MMxy := \text{expand}(\text{rhs}(\text{EcuaFactInt}) \cdot Mxy) \\ &MMxy := 20 x^3 y^3 + 12 x y^4 + 3 x^2 y^2 \end{aligned} \quad (30)$$

$$\begin{aligned} &> NNxy := \text{expand}(\text{rhs}(\text{EcuaFactInt}) \cdot Nxy) \\ &NNxy := 15 x^4 y^2 + 24 x^2 y^3 + 2 x^3 y \end{aligned} \quad (31)$$

$$\begin{aligned} &> MM := 20 x^3 y(x)^3 + 12 x y(x)^4 + 3 x^2 y(x)^2 \\ &MM := 20 x^3 y(x)^3 + 12 x y(x)^4 + 3 x^2 y(x)^2 \end{aligned} \quad (32)$$

$$\begin{aligned} &> NN := 15 x^4 y(x)^2 + 24 x^2 y(x)^3 + 2 x^3 y(x) \\ &NN := 15 x^4 y(x)^2 + 24 x^2 y(x)^3 + 2 x^3 y(x) \end{aligned} \quad (33)$$

$$\begin{aligned} &> \text{EcuaDos} := MM + NN \cdot \text{diff}(y(x), x) = 0 \\ &\text{EcuaDos} := 20 x^3 y(x)^3 + 12 x y(x)^4 + 3 x^2 y(x)^2 + (15 x^4 y(x)^2 + 24 x^2 y(x)^3 \\ &\quad + 2 x^3 y(x)) \left( \frac{d}{dx} y(x) \right) = 0 \end{aligned} \quad (34)$$

$$\begin{aligned} &> \text{odeadvisor}(\text{EcuaDos}) \\ &[_{\text{exact}}, _{\text{rational}}] \end{aligned} \quad (35)$$

> restart

$$\begin{aligned} &> \text{Ecua} := (3 \cdot x \cdot y + 20 \cdot x^2 \cdot y^2 + 12 \cdot y^3) + (2 \cdot x^2 + 15 \cdot x^3 \cdot y + 24 \cdot x \cdot y^2) \cdot y' = 0 \\ &\text{Ecua} := 3 x y(x) + 20 x^2 y(x)^2 + 12 y(x)^3 + (2 x^2 + 15 x^3 y(x) + 24 x y(x)^2) \left( \frac{d}{dx} y(x) \right) = 0 \end{aligned} \quad (36)$$

> with(DEtools):

$$\begin{aligned} &> \text{odeadvisor}(\text{Ecua}) \\ &[_{\text{rational}}] \end{aligned} \quad (37)$$

$$\begin{aligned} &> \text{simplify}(\text{intfactor}(\text{Ecua})) \\ &\frac{1}{x (5 x^2 y(x) + 6 y(x)^2 + x) y(x)} \end{aligned} \quad (38)$$

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