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Trabalho 3 - CIV

a) a = 5 + 1

$$x y' + 2y \ln(ay) = axy$$

$$x y' + 2y \ln(6y) = 6xy$$

$$u = \ln(6y)$$
$$e^u = e^{\ln(6y)}$$
$$6y = e^u$$
$$y = e^u/6$$

$$\frac{du}{dx} = \frac{d(\ln(6y))}{dx} = \frac{1}{6y} \cdot 6 \frac{dy}{dx}$$

$$u' = \frac{1}{y} \cdot y'$$

$$y' = u'y$$

Substituindo na equação.

$$x[u'y] + 2yu = 6xy$$
$$xu' + 2u = 6x \quad \div x$$
$$u' + \frac{2}{x} u = 6 \Rightarrow \text{EDO Linear}$$

$$I(x) = e^{\int \frac{2}{x} dx} \Rightarrow e^{2\ln|x|} \Rightarrow e^{\ln|x^2|} \Rightarrow I(x) = x^2$$

$$\int x^2 \cdot 6 \, dx = \frac{6x^3}{3} = 2x^3 + \mathbb{C}$$

$$u(x) = \frac{1}{I(x)} \left(\int I(x) \cdot B(x) \, dx + \mathbb{C} \right)$$

$$u(x) = \frac{1}{x^2} \left(2x^3 + \mathbb{C} \right)$$

$$u(x) = 2x + \frac{\mathbb{C}}{x^2}$$

$$u = \ln(6y)$$

$$\therefore \ln(6y) = 2x + \frac{\mathbb{C}}{x^2}$$

b)

$$\ln(6y) = 2x + \frac{\mathbb{C}}{x^2}$$

$$e^{\ln(6y)} = e^{2x + \mathbb{C}/x^2}$$

$$6y = e^{2x + \mathbb{C}/x^2}$$

$$y = \frac{e^{2x + \mathbb{C}/x^2}}{6}$$

$$y' = \frac{1}{6} \cdot e^{2x + \mathbb{C}/x^2} \cdot \left(2 + (-2x^{-3}\mathbb{C}) \right)$$

$$y' = \frac{1}{6} \cdot e^{2x + \mathbb{C}/x^2} \left(2 - \frac{2\mathbb{C}}{x^3} \right) = e^{2x + \mathbb{C}/x^2} \cdot \frac{(2 - \frac{2\mathbb{C}}{x^3})}{6}$$

$$xy' + 2y \ln(6y) = 6xy \qquad \therefore \mathbb{C} = 0$$

$$x\left(\frac{e^{2x}(2)}{6}\right) + 2\left(\frac{e^{2x}}{6}\right)\ln(6y) = 6x\left(\frac{e^{2x}}{6}\right) \div e^{2x} \cdot (y)$$

$$xy + 2y\ln(6y) = 6xy$$

c) $y(6) = 7$

$$\ln(6y) = 2x + \frac{C}{x^2}$$

$$\frac{C}{x^2} = \ln(6y) - 2x$$

$$C = x^2(\ln(6y) - 2x)$$

$$C = (6)^2[\ln(6[7]) - 2(6)]$$

$$C \cong 19,59$$

$$\therefore y = \frac{e^{2x + 19,59/x^2}}{6}$$

d)