

Hidráulica I – 2024/2025
1º MAP – 14/03/2025

Problema 3

a)

$$\vec{a} = \frac{D\vec{u}}{Dt} \quad \underline{0,2 \text{ val}}$$

$$a_x = \frac{\partial u}{\partial t} + u \frac{\partial u}{\partial x} + v \frac{\partial u}{\partial y} = 2x + 4xt^2 \quad \underline{0,5 \text{ val}}$$

$$a_y = \frac{\partial v}{\partial t} + u \frac{\partial v}{\partial x} + v \frac{\partial v}{\partial y} = 2y + 4yt^2 \quad \underline{0,5 \text{ val}}$$

Para $x = 1$, $y = 1$ e $t = 1$, vem

$$\vec{a} = (2 \times 1 + 4 \times 1 \times 1^2)\vec{i} + (2 \times 1 + 4 \times 1 \times 1^2)\vec{j} \quad \underline{0,5 \text{ val}}$$

$$\vec{a} = (6\vec{i} + 6\vec{j}) \text{ ms}^{-2} \quad \underline{0,3 \text{ val}}$$

b)

$$\frac{dx}{u} = \frac{dy}{v} \rightarrow \frac{dx}{2xt} = \frac{dy}{2yt} \quad \underline{0,5 \text{ val}}$$

$$\int_{x_0}^x \frac{dx}{2xt} = \int_{y_0}^y \frac{dy}{2yt} \rightarrow \int_{x_0}^x \frac{1}{x} dx = \int_{y_0}^y \frac{1}{y} dy \rightarrow \ln \frac{x}{x_0} = \ln \frac{y}{y_0} \quad \underline{1,0 \text{ val}}$$

$$\frac{x}{x_0} = \frac{y}{y_0} \rightarrow y = \frac{xy_0}{x_0}$$

Para $t = 0$ s, $x_0 = 1$ m, $y_0 = 1$ m e, pelo que a equação das linhas de corrente é: $y = x$ 0,5 val