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NAME

Fluids-ID

Quiz 5. The velocity field is given by the equation below;

$$\mathbf{V} = v \mathbf{j} = \left( \frac{8}{t} + 5y \right) \mathbf{j}$$

- 1) Find the unsteady (local) acceleration of  $a_y$
- 2) Find the convective acceleration of  $a_y$
- 3) Find the acceleration field  $\mathbf{a}$

Note: Attendance (+2 points), format (+1 point)

Acceleration:

$$a_x = \frac{\partial u}{\partial t} + u \frac{\partial u}{\partial x} + v \frac{\partial u}{\partial y} + w \frac{\partial u}{\partial z}$$

$$a_y = \frac{\partial v}{\partial t} + u \frac{\partial v}{\partial x} + v \frac{\partial v}{\partial y} + w \frac{\partial v}{\partial z}$$

$$a_z = \frac{\partial w}{\partial t} + u \frac{\partial w}{\partial x} + v \frac{\partial w}{\partial y} + w \frac{\partial w}{\partial z}$$

**Solution:**

- 1) Local acceleration of
- $a_y$

$$(a_y)_{local} = \frac{\partial v}{\partial t} = -\frac{8}{t^2} \quad (+3 \text{ points})$$

- 2) Convective acceleration of
- $a_y$

$$(a_y)_{conv} = v \frac{\partial v}{\partial y} = \left( \frac{8}{t} + 5y \right) (5) = \frac{40}{t} + 25y \quad (+3 \text{ points})$$

- 3) Acceleration field

$$\mathbf{a} = a_y \mathbf{j} = \left( -\frac{8}{t^2} + \frac{40}{t} + 25y \right) \mathbf{j} \quad (+1 \text{ point})$$