

1) $\vec{v} = Ax y \vec{i} + By^2 \vec{j}$ $A=4$ $B=-2$

$\vec{\omega} = ?$ $\psi = ?$

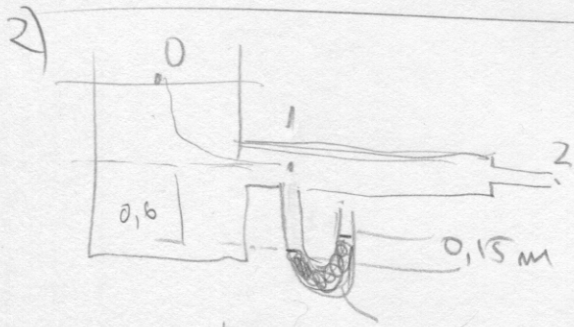
$\vec{\omega} = \frac{1}{2} \left[\left(\frac{\partial v}{\partial x} - \frac{\partial u}{\partial y} \right) \vec{k} \right] = \frac{1}{2} (0 - 4x) \vec{k} = -2x \vec{k} = \vec{\omega}$

$u = \frac{\partial \psi}{\partial y}$ $v = -\frac{\partial \psi}{\partial x}$

$\frac{\partial \psi}{\partial y} = 4xy$ $\frac{\partial \psi}{\partial x} = 2y^2$

$\psi = 2xy^2 + f(x)$ $\psi = 2xy^2 + f(y)$

$\psi = 2xy^2$



$\rho z_0 + \frac{\rho V_0^2}{2} + \frac{p_0}{\rho} = \rho z_1 + \frac{\rho V_1^2}{2} + \frac{p_1}{\rho}$

$z_0 = 3,6$ $z_1 = 0$ $V_0 = 0$ $p_0 = 0$

$g \cdot 3,6 = \frac{V_1^2}{2} + \frac{p_1}{\rho}$

$p_1 = 0 + \rho_{H_2O} (0,15 - 0,6)$

$3,6 = \frac{V_1^2}{2g} + \frac{p_1}{\rho_A}$

$\frac{p_1}{\rho_A} = d_{H_2O} (0,15 - 0,6)$

$3,6 = \frac{V_1^2}{2g} + 1,44$

$\frac{p_1}{\rho_A} = 1,44$

$V_1 = \sqrt{2 \cdot 9,8 \cdot 2,16}$

$V_1 = 6,5 \text{ [m/s]}$

$Q = 0,012 \text{ m}^3/\text{s}$

3) a) $\dot{m} = 0$

$\rho z_0 + \frac{\rho V_0^2}{2} + \frac{p_0}{\rho} = \rho z_2 + \frac{\rho V_2^2}{2} + \frac{p_2}{\rho} + h_l$

$V_1 = V_2 = 0$ $p_1 = p_2 = 0$

$g \Delta z = 9,8 \cdot 15,2 = 148,96 \text{ J/kg}$ $\Delta z = z_1 - z_2$

$\rho z_1 = \rho z_2 + h_l + \frac{\dot{m}}{\dot{m}}$

$9,8(0 - 15,2) = 148,96 + \frac{\dot{w}}{\dot{m}}$

$\frac{\dot{w}}{\dot{m}} = -297,92 \text{ J/kg}$

$\dot{m} = \rho Q = \frac{1.000 \cdot 0,38}{60}$

$\dot{m} = 6,3 \text{ kg/s}$

$\dot{w} = 1,886 \text{ kW}$

4) $\rho z_1 + \frac{\rho V_1^2}{2} + \frac{p_1}{\rho} = \rho z_2 + \frac{\rho V_2^2}{2} + \frac{p_2}{\rho}$

$z_1 = 0$ $z_2 = 4$ $p_2 = 0$

$V_1 D_1^2 = V_2 D_2^2$ $V_2 = 15 \text{ m/s}$

$0 + \frac{3,75^2}{2} + \frac{p_1}{\rho} = 9,8 \cdot 4 + \frac{15^2}{2}$

$V_1 = 15 \cdot \frac{0,05^2}{0,1^2} = 3,75 \text{ m/s}$

$\frac{p_1}{\rho} = 39,2 + \frac{15^2 - 3,75^2}{2} = 144 \text{ J/kg}$

$p_1 = 115.735 \text{ [N/m}^2\text{]}$