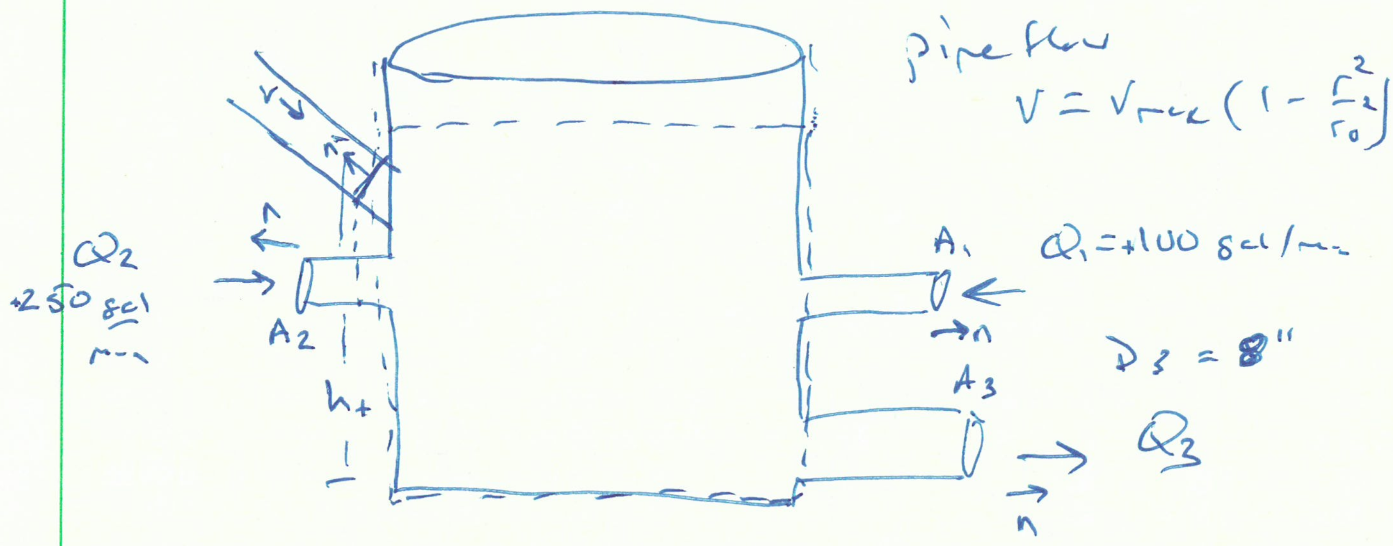


What's Q_3? Assume h_t stays constant

What's V_3?

R.T.T.

$$0 = \frac{\partial}{\partial t}\int_{cv} \rho \, dV + \int_{cs} \rho V \cdot n \, dA$$

0 steady height

$$\int_{cs} \rho V \cdot n \, dA = 0$$

$$\int_{A_1} \rho V \cdot n \, dA + \int_{A_2} \rho V \cdot n \, dA + \int_{A_3} \rho V \cdot n \, dA$$

$$-\int_{A_1} \rho V_1 \, dA - \int_{A_2} \rho V_2 \, dA + \int_{A_3} \rho V_3 \, dA$$

Assume ρ is incompressible and uniform velocities

~~$-\rho A_1$~~

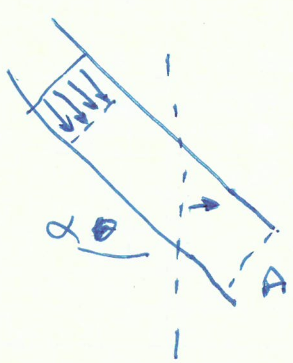
$$-\rho V_1 A_1 - \rho V_2 A_2 + \rho V_3 A_3 = 0$$

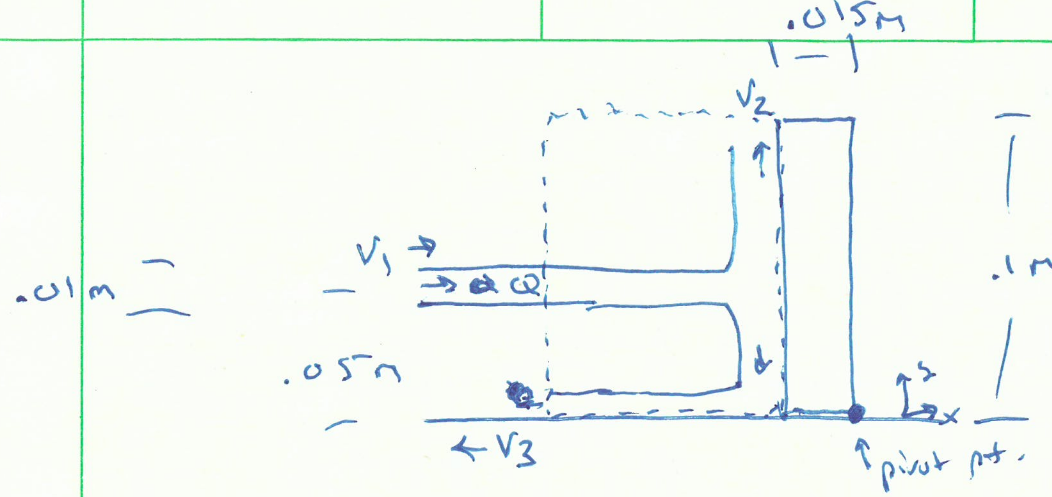
$$\rho V_3 A_3 = \rho V_1 A_1 + \rho V_2 A_2$$

$$V_3 A_3 = V_1 A_1 + V_2 A_2$$

$$Q_3 = Q_1 + Q_2$$

$$V_3 = \frac{Q_1 + Q_2}{A_3}$$

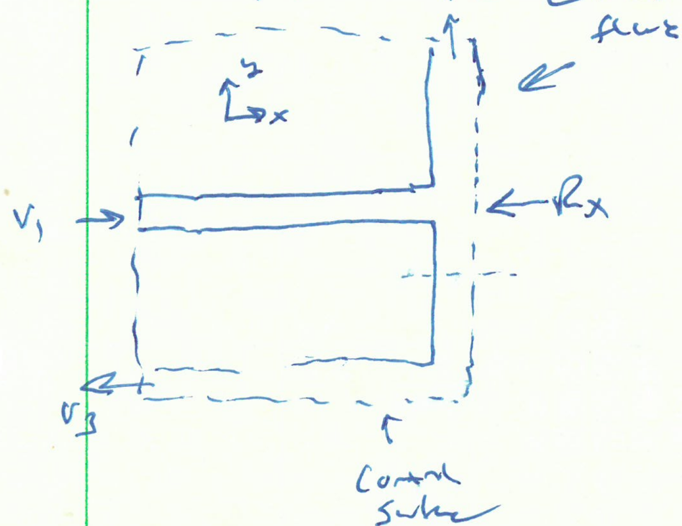


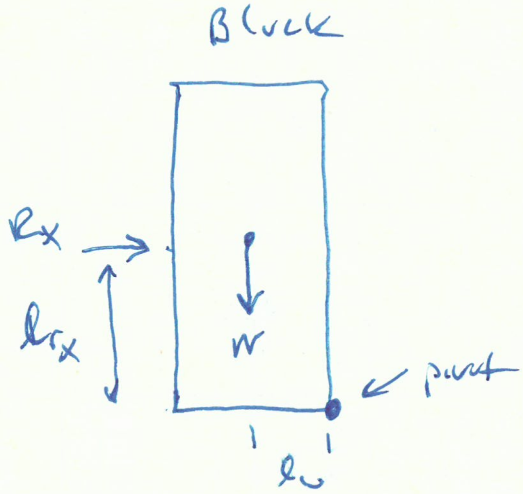


Assume it doesn't slide

Weight of block 6N

what's the minimum flow rate to make the block tip?





topples when $\sum M = 0$

$$R_x l_{rx} = W l_w \Rightarrow R_x = \frac{W l_w}{l_{rx}}$$

$$\sum F_x = \frac{\partial}{\partial t}\left(\rho V_x d\forall\right) + \int_{CS} \rho V_x (\vec{V} \cdot n)\, dA$$

$$-R_x = 0 + \int_{CS} \rho V_x (\vec{V} \cdot n)\, dA$$

$$\int_{CS} \rho v_x (v \cdot n)\, dA = \int_{A_1} \rho v_x (v \cdot n)\, dA + \int_{A_2} \rho v_x (v \cdot n)\, dA$$

$v_x \to 0$: V_2 is in y direction, no x comp.

$$+ \int_{A_3} \rho v_x (v \cdot n)\, dA$$

$$= \int \rho V_1 (V_1 \cdot n)\, dA$$

$$= \int_{A_1} \rho V_1 (-V_1)\, dA + \int_{A_3} \rho V_3 (V_3)\, dA$$

incompressible uniform flow

$$= -\rho V_1^2 A_1 + \rho V_3^2 A_3$$

assume $V_3 < V_1 \Rightarrow V_3^2 \ll V_1^2$

$$-R_x = -\rho V_1^2 A_1$$

$$V_1 = \sqrt{\frac{R_x}{\rho A_1}}$$

$Q = 2.66 \times 10^{-4}\ m^3/s$

$$Q = V_1 A_1 = \sqrt{\frac{R_x A_1}{\rho}} = \sqrt{\frac{W l_w A_1}{l_{rx}\, \rho}}$$