

Example (like HW)

A garden hose w/ inner diameter 2 cm, carries water at 2.0 m/s. To spray your friend, you place your thumb over the nozzle giving an effective opening diameter of 0.5 cm. What is the speed of the water exiting the hose? What is the pressure difference between inside the hose and outside?

Continuity Equation

$$\begin{aligned}A_1 v_1 &= A_2 v_2 \\v_2 &= v_1 (A_1/A_2) \\&= v_1 (\pi r_1^2 / \pi r_2^2) \\&= 2 \text{ m/s} \times 16 = 32 \text{ m/s}\end{aligned}$$

Bernoulli Equation

$$\begin{aligned}P_1 + \rho g y_1 + \frac{1}{2} \rho v_1^2 &= P_2 + \rho g y_2 + \frac{1}{2} \rho v_2^2 \\P_1 - P_2 &= \frac{1}{2} \rho (v_2^2 - v_1^2) \\&= \frac{1}{2} \times (1000 \text{ kg/m}^3) (1020 \text{ m}^2/\text{s}^2) = 5.1 \times 10^5 \text{ PA}\end{aligned}$$

