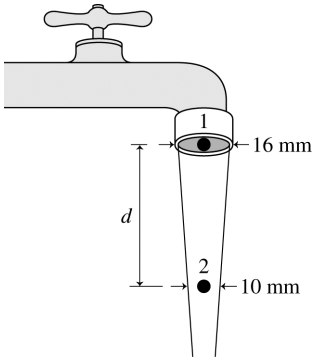
15.62. **Model:** Treat the water as an ideal fluid obeying Bernoulli's equation. A streamline begins at the faucet and continues down the stream.

Visualize:



The pressure at point 1 is p_1 and the pressure at point 2 is p_2. Both p_1 and p_2 are atmospheric pressure. The velocity and the area at point 1 are v_1 and A_1 and they are v_2 and A_2 at point 2. Let the distance of point 2 below point 1 be d.

Solve: Bernoulli's equation at points 1 and 2 is

$$p_1 + \tfrac{1}{2}\rho v_1^2 + \rho g y_1 = p_2 + \tfrac{1}{2}\rho v_2^2 + \rho g y_2 \Rightarrow \rho g d = \tfrac{1}{2}\rho\left(v_2^2 - v_1^2\right)$$

From the continuity equation,

$$v_1 A_1 = v_2 A_2 \Rightarrow (1.0\ \text{m/s})\pi\left(8.0\times10^{-3}\ \text{m}\right)^2 = v_2\pi\left(5.0\times10^{-3}\ \text{m}\right)^2 \Rightarrow v_2 = 2.56\ \text{m/s}$$

Going back to Bernoulli's equation, we have

$$gd = \tfrac{1}{2}\left[(2.56\ \text{m/s})^2 - (1.0\ \text{m/s})^2\right] \Rightarrow d = 0.283\ \text{m} = 28.3\ \text{cm}$$