1. (5 points) A firefighter puts out a fire with a hose of diameter 2.0 cm. If the water flow through the hose is 8.0 liters/second, how fast does the water stream out of the hose?

\[ \frac{dV}{dt} = \sqrt{A} = \sqrt{\pi (10^{-2} \text{ m})^2} = \frac{8 \times 10^{-3} \text{ m}^3}{s} \]

\[ \Rightarrow \frac{dV}{dt} = \frac{80}{\pi} = 25.46 \text{ m/s} = 25 \text{ m/s} \]

2. (5 points) What is the force that the firefighter must hold the hose to keep it from moving as the water spurts out toward the fire? Use 1.0g/cc the density of water. Is it a large force?

\[ \frac{dp}{dt} = F = \frac{d(mv)}{dt} = \frac{\Delta (mv)}{\Delta t} = \frac{8 \times 10^{-3} \text{ m}^3 (10^3 \text{ kg}) (25 \text{ m/s})}{1 \text{ sec}} \]

\[ = 204 \text{ N} \Rightarrow \text{ equivalent 46 lbs} \]

\[ (20.8 \text{ kg}) \text{ g} \Rightarrow \text{ Its a large force!} \]