# PHY 250: Homework 3

### Fall 2020

Death-line: October 23th

## Exercise 1

Water stands at a depth $H$ in a large, open tank whose side walls are vertical. A hole is made in one of the walls at a depth $h$ below the water surface. (a) At what distance $R$ from the foot of the wall does the emerging stream strike the floor? (b) How far above the bottom of the tank could a second hole be cut so that the stream emerging from it could have the same range as for the first hole?
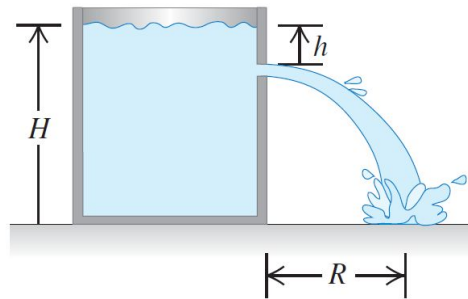


## Exercise 2

A liquid flowing from a vertical pipe has a definite shape as it flows from the pipe. To get the equation for this shape, assume that the liquid is in free fall once it leaves the pipe. Just as it leaves the pipe, the liquid has speed $v_0$ and the radius of the stream of liquid is $r_0$ (a) Find an equation for the speed of the liquid as a function of the distance $y$ it has fallen. Combining this with the equation of continuity, find an expression for the radius of the stream as a function of $y$. (b) If water flows out of a vertical pipe at a speed of 1.2 $m/s$ how far below the outlet will the radius be one-half the original radius of the stream?

## Exercise 3

Force and Torque on a Dam. A dam has the shape of a rectangular solid. The side facing the lake has area $A$ and height $H$. The surface of the freshwater lake behind the dam is

at the top of the dam. (a) Show that the net horizontal force exerted by the water on the dam equals $\frac{1}{2}\rho g H A$. (b) Show that the torque exerted by the water about an axis along the bottom of the dam is $\rho g A H^2/6$.