

PHY 2048: Physic 1, Discussion Section 1243H

Quiz 9 (Homework Set #11)

Name:**UFID:**

Formula sheets are not allowed. Do not store equations in your calculator. You have to *solve* problems on your own; memorizing final algebraic expressions from homework assignments and just plugging numbers into them will not give you full credit. Leave all your work.

Water is pumped steadily out of a flooded basement at a speed of 5.00 m/s through a uniform hose of diameter 2.00 cm. The hose passes out through a window to a street ditch 3.00 m above the waterline.

a) What is the mass of the water pumped out of the basement in one second?

During time interval Δt , the mass of the water pumped out of the basement is

$$\Delta m = \rho \Delta V = \rho \pi (d/2)^2 v \Delta t$$

Therefore, the mass of the water pumped out in one second is

$$\Delta m / \Delta t = \rho \pi (d/2)^2 v = 1.57 \text{ kg/s}$$

b) What is the power of the pump?

The work-energy theorem yields

$$W = \Delta E = \Delta K + \Delta U = (1/2) \Delta m v^2 + \Delta m g h,$$

where W is the work done by the pump. Since the power of the pump is defined as the work done by the pump in one second, we have

$$P = W / \Delta t = (1/2) (\Delta m / \Delta t) v^2 + (\Delta m / \Delta t) g h = 65.8 \text{ W}$$