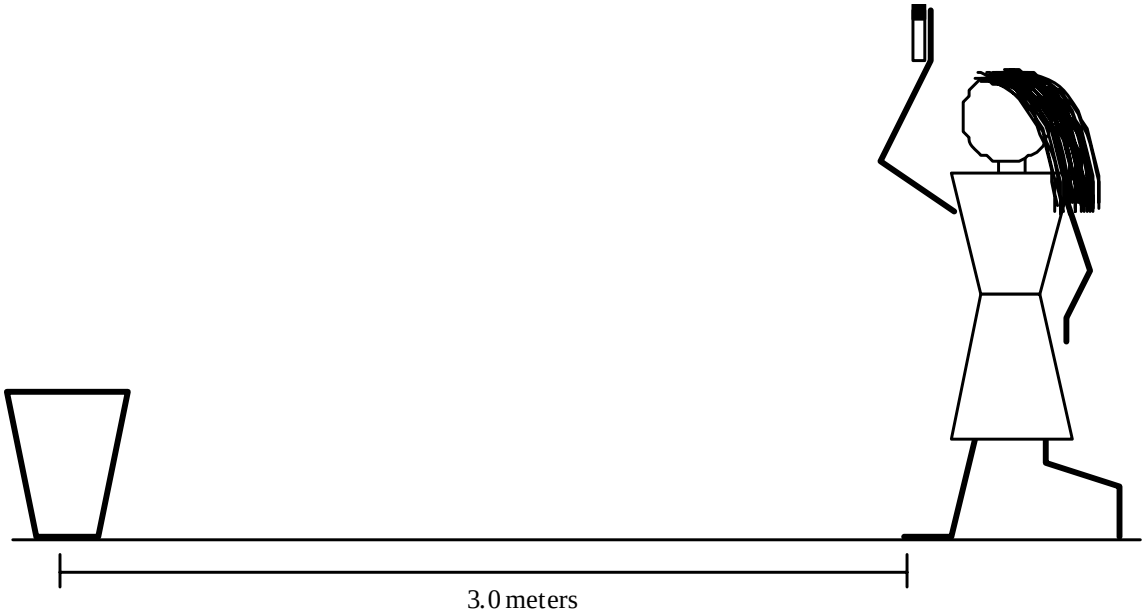
Quiz #4: Physics 201

NAME: _____

Do **YOUR OWN WORK** and **SHOW ALL OF IT!** (Continue on back, clearly labeled, if necessary)

This quiz does NOT require the use of a calculator but you may use one if you like. You may write answers as algebraic expressions (that is, x = 33.7 and y = 108.4, and that the answer is (x/y) kg m/s^2). **PLEASE USE THE VALUE OF 10 m/s^2 for g!**

All answers **MUST** include appropriate **units and dimensions**.



1. A college teacher threw away a whiteboard marker. When she threw it, her hand was exactly 0.80 meters above the top of the wastebasket and 3.0 meters away horizontally. When the marker left her hand it had a speed of 5.0 m/s and the vertical component of its velocity was 3.0 m/s.

   a) What was the horizontal component of the velocity of the marker when it left her hand?

   We are given two components of a vector and we only need to find the third. The speed is the magnitude of the velocity and 3.0 m/s is the upward vertical component.

   $$v_x = \sqrt{(5.0\ m/s)^2 - (3.0\ m/s)^2} = 4.0\ m/s$$

See next page!

b) The marker would land in the wastebasket if it reached the top of the basket with a **horizontal position** anywhere from 2.9 m to 3.1 m from where it left her hand. Did it land in the wastebasket? If not, where did it land?

There are lots of ways to attack this one, but the most obvious is probably to figure out the time when it will be at the height of the top of the wastebasket ant then to find the horizontal position at that time. We have…

$y = y_0 + v_{oy}t - \frac{1}{2} g\, t^2$

$0 = (0.80\ m) + (3.0\ m/s)\, t - \left(\frac{1}{2}\right)(10.0\ m/s^2)\, t^2$

Factoring or using the quatdratic formula:

$t = -0.20\ s$ or $+0.80\ s$

Clearly we want 0.80 *s*.

$\Delta x = (0.80\ s)(4.0\ m/s) = 3.2\ m$

She missed. She overshot the wastebasket by 0.10 m.

c) What was the speed of the marker 0.50 seconds after it left her hand?

$v_x = 4.0\ m/s$ (because it is constant)

$v_y = v_{0y} - gt = (3.0\ m/s) - (10.0\ m/s^2)(0.50\ s) = -2.0\ m/s$

$speed = \sqrt{(4.0\ m/s)^2 + (-2.0\ m/s)^2} = 4.5\ m/s$