

UNIVERSITY OF ALABAMA  
Department of Physics and Astronomy

PH 105 LeClair

Summer 2012

## Problem Set 2

### Instructions:

1. Answer all questions below. All questions have equal weight.
2. Show your work for full credit; using the problem template is recommended.
3. All problems are due Friday 1 June 2012 at the start of lecture.
4. You may collaborate, but everyone must turn in their own work.

1. *HRW 4.15* A particle leaves the origin with an initial velocity  $\vec{v} = (3.00 \hat{i})$  m/s and a constant acceleration  $\vec{a} = (-1.00 \hat{i} - 0.500 \hat{j})$  m/s<sup>2</sup>. When it reaches its maximum x coordinate, what are its (a) velocity and (b) position vectors?
2. *HRW 4.23* A projectile is fired horizontally from a gun that is 45.0 m above flat ground, emerging from the gun with a speed of 250 m/s. (a) How long does the projectile remain in the air? (b) At what horizontal distance from the firing point does it strike the ground? (c) What is the magnitude of the vertical component of its velocity as it strikes the ground?
3. *HRW 4.35* A rifle that shoots a bullet at 460 m/s is to be aimed at a target 45.7 m away. If the center of the target is level with the rifle, how high above the target must the rifle barrel be pointed so that the bullet hits dead center?
4. A batter hits a baseball coming off of the bat at a 45° angle, making contact a distance 1.22 m above the ground. Over level ground, the batted ball has a range of 107 m. Will the ball clear a 7.32 m tall fence at a distance of 97.5 m? Justify your answer. *Hint: use the range equation to get the velocity, then use the trajectory equation to find the path of the ball.*