

PHYS 111 K

HOMEWORK #5

Due : 1 October 2015

Remember these points in doing these problems :

- Draw a diagram representing the situation.
- Ask yourself ' what is this question about?' ' What am I being asked to do, and what information am I being given?'
- Begin with the relevant equations that you will use to solve the problem. Keep all calculations in analytic form (i.e., symbols only) until you are ready to calculate; only then substitute the appropriate numerical values. The solutions posted from past homework assignments will demonstrate how to do this.
- Remember to use units whenever you use numerical values.

1. A dive bomber, diving at an angle of 53° with the vertical releases a bomb at an altitude of 800 m. The bomb hits the ground 5 s after being released. Find :

a) The speed of the bomber.

b) How far the bomb traveled horizontally after release.

c) The horizontal and vertical components of the bomb's velocity just before striking the ground. (5 pts each part)

2. A ball (a baseball, tennis ball, any kind of ball) is struck 1 m above the ground. Its launch angle is 45° with respect to a horizontal plane parallel to the ground. If the ball encountered no obstacles, it would have a horizontal range of 105 m. However, there is a 7 m high fence 95 m down range from the launch point. Will the ball clear the fence? (As always, show all work) (20 pts)

3. Two children are kicking a ball to each other. One child kicks the ball (from the ground) with an initial velocity of 20 m/s at an angle of 45° degree with respect to the ground (these are very strong children). The second child is 55 m away and starts running toward the ball at the instant it is kicked. How fast must the second child run to catch the ball just before it strikes the ground?

4. The Earth revolves in a (nearly) circular orbit around the sun at a (nearly) constant speed. (Assume for this problem the Earth executes uniform circular motion around the sun.) What is the acceleration of the Earth toward the sun?

5. One rainy day you are sitting in a Red Line car waiting to pull out of Loyola. While you are stationary (with respect to the station), you notice that the rain drops' streaks on the window are vertical with respect to you. After the train pulls out of the station and moves south at constant speed V , you notice that the raindrops' streaks on the window now make an angle θ with respect to the vertical. Find a relationship between the speed of the falling raindrops, v , and the speed of the train (V) and the angle θ . (Now look up online "aberration of starlight" to see why telescopes need

to take the motion of the Earth into account when observing distant stars.)

6. Question 80, p. 115

7. Consider Question 84, p. 115. Write the equations of motion for the projectile in terms of θ , v_o , v_{train} , and g .

8. For 15 points extra credit, find the solution requested in the statement of question 84.