Homework No. 04 (Fall 2024)

PHYS 205A-002: UNIVERSITY PHYSICS

School of Physics and Applied Physics, Southern Illinois University–Carbondale

Due date: Friday, 2024 Sep 13, 2:00 PM, on D2L

Instructions

- You are encouraged to use any of the resources to complete this homework. However, the extent to which you depend on resources while doing this homework is a measure of how much extra work you need to put in to master the associated concepts. Solutions should be the last resource.
- Links to solutions are provided. Further, links to few variations of the problem are provided that serve as practice problems.
- Describe your thought process in detail and organize it clearly. Make sure your answer has units and right number of significant digits.
- Additional problems, with hyperlinks to exams, are available in Lecture Notes.
- After completion, scan the pages as a single PDF file, and submit the file on D2L (under Assesments → Assignments). You can replace your PDF file, only the last file is graded.

Problems

1. (**10 points.**) The launch speed of a projectile is three times its speed at maximum height. Find the launch angle.

   [**Solution**]

2. (**10 points.**) (Based on Problem 15 in Chapter 4 of textbook.) The range of a projectile is three times its maximum height. Find the launch angle.

   [**Solution**]

3. (**10 points.**) A student slides a mass off the top of a horizontal table. The height of the table is 1.30 m. The mass slides off the table with a horizontal velocity of 3.50 m/s. How far from the base of the table does the mass strike the floor?

   [**Solution** and **erratum**]

4. (**10 points.**) (Based on Example 4.4 in textbook.) A stone is thrown upward from the top of a building at a angle of 30.0° to the horizontal with an initial speed of 10.0 m/s. The height from which the stone is thrown is 45.0 m above the ground. How long does it take to reach the ground? How will the answer change if the stone is thrown downward at an angle of 30.0° to the horizontal with an initial speed of 10.0 m/s.

   [**Solution**]

5. (**10 points.**) A placekicker must kick a football from a point 36.0 m (about 40 yards) from the goal. Half the crowd hopes the ball will clear the crossbar, which is 3.05 m high. When kicked, the ball leaves the ground with a speed of 20.0 m/s at an angle of 40.0° to the horizontal. By how much does the ball clear or fall short of clearing the crossbar? (Enter a negative answer if it falls short.)

   [**Solution**]

6. (**10 points.**) A rifle is aimed at a bullseye. The muzzle speed of the bullet is 750 m/s. The gun is pointed directly at the center of the bullseye, but the bullet strikes the target 0.25 m below the center. What is the horizontal distance between the end of the rifle and the bullseye?

   [**Solution**]