

Homework No. 03A (Fall 2021)

PHYS 203A: COLLEGE PHYSICS

Department of Physics, Southern Illinois University–Carbondale

Due date: Tuesday, 2021 Sep 7, 12.30pm, on D2L

Instructions

- Describe your thought process in detail and organize it clearly. Make sure your answer has the correct units and the right number of significant digits.
- After completion, scan the pages as a single PDF file, and submit the file on D2L (Assessments → Assignments).

1. **(10 points.)** A particle is moving such that its initial position, at time $t = 0$, is given by

$$\vec{\mathbf{r}}_0 = (2.0\hat{\mathbf{i}} + 3.0\hat{\mathbf{j}}) \text{ m}, \quad (1)$$

and its initial velocity is given by

$$\vec{\mathbf{v}}_0 = (5.0\hat{\mathbf{i}} + 15\hat{\mathbf{j}}) \frac{\text{m}}{\text{s}}. \quad (2)$$

Find the position and velocity of the particle at time $t = 1.0$ s if it moves with uniform acceleration

$$\vec{\mathbf{a}} = (0.0\hat{\mathbf{i}} - 9.8\hat{\mathbf{j}}) \frac{\text{m}}{\text{s}^2}. \quad (3)$$

2. **(10 points.)** An airplane flying horizontally at a uniform speed of 50.0 m/s over level ground releases a bundle of food supplies. Ignore the effect of air on the bundle. The bundle is dropped from a height of 300.0 m.

- (a) How does the horizontal component of velocity of the bundle change with time during the drop.
- (b) Determine the time taken for the drop. How will this time change if the the airplane was moving faster or slower?
3. **(10 points.)** A bullet is fired horizontally with speed 500.0 m/s at the bullseye (from the same level). The bullseye is a horizontal distance 100.0 m away. Since the bullet will fall under gravity, it will miss the bullseye. By what vertical distance does the bullet miss the bullseye?
4. **(10 points.)** A batter hits a ball with an initial velocity 32.0 m/s at an angle of 45° above the horizontal. The ball is 1.2 m above the ground at the time of hit. There is a 10.0 m high fence, which is a horizontal distance 100.0 m away from the batter. Determine whether the ball clears the fence. What is the distance between the top of the fence and the center of the ball when the ball passes/reaches the fence?