

Midterm Exam No. 01 (Fall 2024)

PHYS 205A-002: UNIVERSITY PHYSICS

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

Date: 2024 Sep 16

(Name)

(Signature)

Instructions

1. Seating direction: Please be seated on seats with seat-numbers divisible by 4.
2. Total time = 50 minutes.
3. There are 4 conceptual questions and 3 problems in this exam.
4. Equation sheet is provided separately.
5. To be considered for partial credit you need to present your work in detail and organize it clearly.
6. A simple calculator (with trigonometric functions) is allowed.
7. Use of smart devices, including smart watches, is strictly prohibited. They should stay out of reach during the exam.
8. Restroom breaks are allowed. Under questionable circumstances this might lead up to a Makeup Exam.
9. Academic misconduct will lead to a failing grade in the course.

1. (5 points.) Consider the equation

$$t = \frac{x}{v} + b, \tag{1}$$

where we are given that t has the dimension of time and x has the dimension of distance. Deduce the dimension of b .

2. (**5 points.**) You throw a ball vertically up at 4.9 m/s. Neglect air resistance. Determine the time it takes to return back to your hands.

3. (5 points.) Find the components of vector **A** whose magnitude is 10.0 m and its direction is 30.0° counterclockwise with respect to the negative y axis.

4. (5 points.) A projectile is launched with an initial velocity of magnitude $v_0 = 25 \text{ m/s}$ at an angle $\theta_0 = 30^\circ$ above the horizontal. What is the magnitude and direction of the velocity of the projectile when it is at the highest point B in Figure 1?

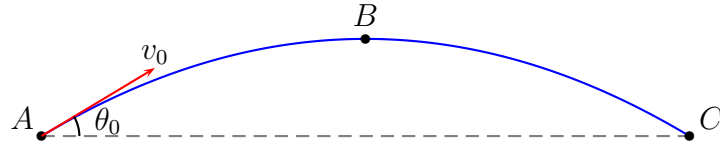


Figure 1: Problem 4.

5. **(10 points.)** A speeding car is moving at a constant speed of 85 miles/hour (38 m/s). A police car is initially at rest. As soon as the speeder crosses the police car the cop starts chasing the speeder at a constant acceleration of 3.0 m/s^2 . Determine the time it takes for the cop to catch up with the speeder.

6. **(10 points.)** A golfer takes two strokes to putt a golf ball into a hole. On the first stroke, the ball moves 5.0 m at an angle 45.0° West of North. On the second, it moves 2.0 m along West. If the golfer had instead hit the ball directly into the hole on the first stroke, what would have been the magnitude and direction of the ball's displacement?

7. (10 points.) A student slides a mass off the top of a horizontal table. The height of the table is 1.10 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?