

Midterm Exam No. 01 (Spring 2026)

PHYS 205A-001: UNIVERSITY PHYSICS

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

Date: 2026 Feb 09

(Name)

(Signature)

Instructions

1. Seating direction: In alternate rows, B, D, F, . . . , on even-numbered seats.
2. Total time = 50 minutes.
3. There are 4 conceptual questions and 3 problems in this exam.
4. Equation sheet is provided separately.
5. 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. Academic misconduct will lead to a failing grade in the course.

1. (5 points.) Given the expression

$$E = \sqrt{m^2c^4 + p^2c^2}, \quad (1)$$

where m is measured in units of mass and $[c] = LT^{-1}$. Determine the dimension of the quantity represented by the symbol p . That is, given

$$[p] = M^\alpha L^\beta T^\gamma, \quad (2)$$

determine α , β , and γ .

2. (5 points.) The position of an object moving in a straight line as a function of time is plotted in Figure 1. The slope of the curve in the position-time graph at 3.0 hours is zero. Thus, the velocity of the object at 3.0 hours is zero. Is the acceleration of object at 3.0 hours zero? If so, explain. If not, why not?

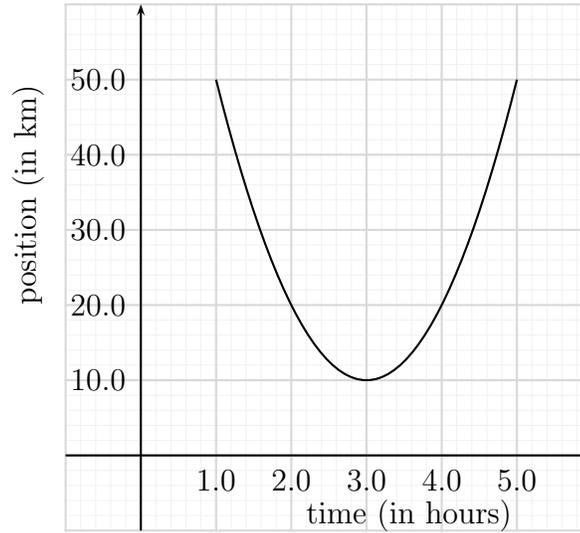


Figure 1: Problem 2.

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 x 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 2?

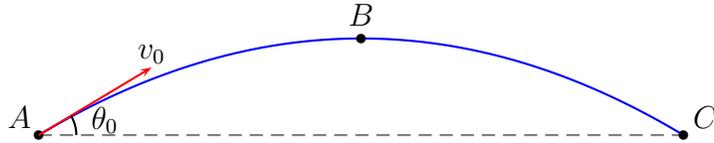


Figure 2: Problem 4.

5. (10 points.) A fish is dropped by a pelican that is rising steadily at a speed 6.0 m/s . What is the velocity of the fish when it reaches the water 15 m below.

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 $60.^\circ$ West of North. On the second, it moves 3.7 m at an angle 43° South of 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 package is dropped from an aeroplane while it is moving horizontally with a speed of 45 m/s at a height of 75 m from the ground. What is the speed of the package right before it hits the ground?