

Midterm Exam No. 01 (2014 Fall)

PHYS 205A: University Physics

Date: 2014 Sep 10

(Name)

(Signature)

Instructions

1. Total time = 50 minutes.
2. There are 10 questions in this exam.
3. Equation sheet is provided separately.
4. To obtain partial credit for your work you need to show your work in detail and organize it clearly.

1. (10 points.) The equation

$$x = 6At^5 + 3Bt^2 \tag{1}$$

describes the motion of an object, with x having the dimension of length and t having the dimension of time. Determine the dimensions of the constants A and B . (Use L for the dimension of length and T for the dimension of time.)

2. (10 points.) An object having an initial velocity of -5.0 m/s moves with constant acceleration 5.00 m/s^2 and over a time interval reaches a final velocity of 10.0 m/s .

- (a) What is its displacement during the time interval?
- (b) What is the total distance it travels during the interval?

3. (10 points.) A baseball is hit so that it travels straight upward after being struck by the bat. A fan observes that it takes time T for the ball to reach its maximum height.
- (a) Find the ball's initial velocity.
 - (b) Find the height it reaches.

4. (10 points.) Starting at time $t = 0$, an object moves along a straight line. Its coordinate in meters is given by

$$x(t) = 75t - 1.0t^3, \quad (2)$$

where t is in seconds. What is its acceleration when it momentarily stops?

5. (10 points.) Two vectors $\vec{\mathbf{A}}$ and $\vec{\mathbf{B}}$ have equal magnitudes of 5.00 m and 10.00 m respectively. Vector $\vec{\mathbf{A}}$ is pointing along the negative x axis, and vector $\vec{\mathbf{B}}$ makes an angle of 60° with positive x axis. Express the resultant vector $\vec{\mathbf{A}} + \vec{\mathbf{B}}$ in unit-vector notation.

6. (10 points.) If

$$\vec{\mathbf{A}} - \vec{\mathbf{B}} = 2\vec{\mathbf{C}} \quad (3)$$

$$\vec{\mathbf{A}} + \vec{\mathbf{B}} = 4\vec{\mathbf{C}}, \quad (4)$$

and

$$\vec{\mathbf{C}} = 3\hat{\mathbf{i}} + 4\hat{\mathbf{j}}, \quad (5)$$

then what are $\vec{\mathbf{A}}$ and $\vec{\mathbf{B}}$?

7. (10 points.) Suppose that the position vector for a particle is given as a function of time by vector

$$\vec{\mathbf{r}}(t) = \left[b + \frac{1}{2}at^2 \right] \hat{\mathbf{i}} + [d + ct] \hat{\mathbf{j}}. \quad (6)$$

Determine the velocity vector as a function of time.

8. (10 points.) A bullet shot horizontally from a gun:
- (a) never strikes the ground
 - (b) strikes the ground much sooner than one dropped from the same point at the same instant
 - (c) strikes the ground much later than one dropped vertically from the same point at the same instant
 - (d) travels in a straight line
 - (e) strikes the ground at approximately the same time as one dropped vertically from the same point at the same instant

9. **(10 points.)** A projectile's launch speed is five times its speed at maximum height. Find launch angle θ_0 .

10. **(10 points.)** An airplane is in level flight at an altitude of 0.50 km and a speed of 150 km/h. At what horizontal distance d from the target should it release a heavy bomb to hit the target? Use $g = 10 \text{ m/s}^2$.