Midterm Exam No. 01 (2016 Fall)

PHYS 205A: University Physics

Date: 2016 Sep 16

(Name) (Signature)

Instructions

1. Seating direction: Please be seated on seats with seat-numbers divisible by 3.
2. Total time = 50 minutes.
3. There are 8 questions in this exam.
4. Equation sheet is provided separately.
5. To be considered for partial credit you need to show your work in detail and organize it clearly.
6. A simple calculator (with trigonometric functions) is allowed.
7. Use of mobile phones is strictly prohibited. It should stay out of reach during the exam.

1. (**10 points.**) You come across the following expression

$$K = \pi(r_1 + r_2)\sqrt{h^2 + (r_2 - r_1)^2}, \tag{1}$$

where the variables r_1 and r_2 represent distances. You do not know the definitions of the variables h and K a priori. Using dimensional analysis deduce if the expression K could represent a perimeter, a area, or a volume.
Note: To be eligible for partial credit please explain your reasoning clearly.

2. (**10 points.**) Starting at time $t = 0$, an object moves along a straight line. Its coordinate x in meters is given by

$$x = 54\,t - 2.0\,t^3, \tag{2}$$

where t is in seconds. Determine the time when it momentarily stops?

3. (**10 points.**) A truck covers 37.5 m before coming to stop, while slowing down with uniform acceleration (deccelerating) at the rate of $3.00\,\mathrm{m/s^2}$. Find the time taken for the truck to cover this distance.

4. (**10 points.**) A speeding car is moving at a constant speed of $v = 80.0\,\text{miles/hour}$ ($35.8\,\text{m/s}$). 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 $a = 2.0\,\text{m/s}^2$. Determine the time it takes for the cop to catch up with the speeder.

5. (**10 points.**) A baseball is hit so that it travels straight upward after being struck by the bat. A student observes that it takes 2.80 s for the ball to reach its maximum height. Find the ball's initial velocity.

6. (**10 points.**) A man pushing a mop across a floor causes it to undergo two displacements. The first has a magnitude of 44 cm and makes an angle of 40° anticlockwise with the positive x axis. Find the magnitude and direction of the second displacement, if the resultant displacement (of the first and second together) has a magnitude of 88 cm and is directed at an angle of 75° clockwise to the negative x axis.

7. (**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 table does the mass strike the floor?

8. (**10 points.**) A ball is tossed from an upper-story window of a building. The ball is given an initial velocity of 8.50 m/s at an angle of 18.0° above the horizontal. It strikes the ground 6.00 s later. Find the height from which the ball was thrown.