# Midterm Exam 02 (2017 Fall)

## PHYS 203A-002: College Physics

Date: 2017 Oct 12

(Name) (Signature)

## Instructions

1. Seating direction: Please be seated on seats with seat numbers divisible by 3.
2. Total time = 75 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.**) As a tennis ball is struck, it departs from the racket horizontally with a speed of 30.0 m/s. The ball hits the court at a horizontal distance of 20.0 m from the racket. How far (vertially) above the court is the tennis ball when it leaves the racket?

2. (**10 points.**) A swimmer, capable of swimming at a speed of 1.6 m/s in still water (i.e., the swimmer can swim with a speed of 1.6 m/s relative to the water), starts to swim directly across a 1.2-km-wide river. However, the current is 1.00 m/s relative to the ground, and it carries the swimmer downstream. How far downstream will the swimmer be upon reaching the other side of the river?

3. (**10 points.**) Two skaters, a man and a woman, are standing on ice. Neglect any friction between the skate blades and the ice. The mass of the man is 99 kg, and the mass of the woman is 66 kg. The woman pushes on the man with a force of 65 N due East. Determine the magnitude and direction of the acceleration of the woman as a consequence.

4. (**10 points.**) Figure 1 shows three particles far away from any other objects and located on a straight line. The masses of these particles are $m_1 = 300.0\,\text{kg}$, $m_2 = 500.0\,\text{kg}$, and $m_3 = 200.0\,\text{kg}$. The distances are $r_{12} = 50.0\,\text{m}$ and $r_{23} = 25.0\,\text{m}$. Find the magnitude and direction of the net gravitational force acting on $m_2$.


Figure 1: Problem 4

5. (**10 points.**) Two objects (30.0 kg and 36.0 kg) are connected by a massless string that passes over a massless, frictionless pulley. The pulley hangs from the ceiling.

   (a) Find the acceleration of the objects.

   (b) If the 36.0 kg mass is initially at rest at a height of 3.0 m from ground, how long does it take for it to reach the ground.

6. (**10 points.**) An 75.0-kg baseball player slides into second base. The coefficient of kinetic friction between the player and the ground is 0.50.

   (a) What is the magnitude of the frictional force?

   (b) If the player comes to rest after 1.5 s, what was his initial velocity?

7. (**10 points.**) A 250 g ball on a stick is whirled on a vertical circle at a constant speed. When the ball is at the three o'clock position, the stick's (radial) tension is 15 N. Find the tension in the stick when the ball is at the twelve o'clock position.

8. (**10 points.**) A stuntman whose mass is 75 kg drives a car at a uniform speed of 30.0 m/s through the bottom of a valley, the cross section of which can be approximated by a circle of radius $R = 150$ m. What is the normal force acting on the stuntman while crossing the deepest part of the valley?

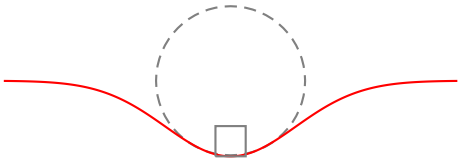

Figure 2: Problem 8