PHYSICS 111                         PRACTICE MIDTERM

NAME____________________________________

REC. INSTR. ______________________________

INSTRUCTIONS: PLEASE READ THE FOLLOWING BEFORE YOU START THE EXAM

1. Write your name and your recitation instructor's name on each page of the exam.
2. This exam consists of X pages, with 2 sections:
   a) SECTION I: One LAB question. (Graded separately from Midterm)
   b) SECTION II: Midterm Exam (this part will be curved)
      Part A. 8 multiple choice questions (5 points each). These questions receive NO partial credit.
      Part B. 2 problems (30 points each). You are required to show work to receive any credit on this part of the exam.

3. This is a closed book, closed note exam. You may have a calculator and a writing implement.
4. You have 48 min to complete the entire exam. If you find yourself getting stuck on a problem, move on to the next problem.

Constants and equations:

acceleration due to gravity on earth: \( g = 9.8 \text{ m/s}^2 \)
\[ \sum \vec{F} = m\vec{a} \]
\[ v = v_{\text{initial}} + at \]
\[ x = x_{\text{initial}} + v_{\text{initial}}t + \frac{1}{2}at^2 \]
\[ v^2 = v_{\text{initial}}^2 + 2a(x - x_{\text{initial}}) \]
Laboratory Problem 1 (5 points)

In the force table diagram below, the two forces have equal magnitudes of 100N. The angle θ = 45°. Answer TRUE or FALSE: The three forces are in equilibrium.
1. The average velocity of an object is equal to its instantaneous velocity. This statement is:
   a) always true
   b) never true
   c) is true only when the velocity is constant
   d) is true only when the velocity is increasing at a constant rate
   e) is true only when the object is moving in a straight line

2. A runner runs one quarter around a circular path of radius 10 m. What is the magnitude of the displacement of the runner?
   a) 0
   b) 10.0 m
   c) 14.1 m
   d) 15.7 m
   e) 31.0 m

3. A golf ball is hit from the ground with a velocity of 20 m/s at an angle of 30° to the vertical. Neglect air resistance. What is the speed of the ball at its maximum height?
   a) 0
   b) 9.8 m/s
   c) 10 m/s
   d) 17.3 m/s
   e) 20 m/s

4. Three books (X, Y and Z) rest on a table. The weight of each book is indicated. The force exerted by book Z on book Y is:
   a) 0
   b) 5N
   c) 9N
   d) 14 N
   e) 19 N
5. A motorist travels 30 miles at 60 mph and another 60 miles at 30 mph. The average speed of the motorist for the entire trip is:

   a) 32 mph
   b) 36 mph
   c) 40 mph
   d) 45 mph
   e) 55 mph

6. A 50kg suitcase is lying at rest on a horizontal floor. The coefficient of static friction between the suitcase and the floor is 0.90 and the coefficient of kinetic friction is 0.70. You push on the suitcase with a horizontal force of 75 N. During this time the force of friction on the suitcase is:

   a) 50 N
   b) 75 N
   c) 343 N
   d) 441 N
   e) 490 N

7. Ball 1 is thrown upward from the ground with an initial speed of 25 m/s. At the same instant, Ball 2 is dropped from a window. If Ball 2 hits the ground at the same time as Ball 1 reaches the window, how high up is the window?

   a) 9.9 m
   b) 11.9 m
   c) 21.9 cm
   d) 31.9 m
   e) 41.9 m

8. One 5.0kg bucket is hanging by a massless cord from another 5.0kg bucket also hanging by a massless cord as shown. If the two buckets are pulled upward with an acceleration of 1.8 m/s² by the upper cord, the tension in the lower cord is

   a) 116N
   b) 40N
   c) 49N
   d) 98N
   e) 58N

![Diagram of two buckets hanging with an upward acceleration of 1.8 m/s²]
Problem 1

A crate of mass 90 kg is sliding down on a ramp that is tilted at an angle $\theta = 30^\circ$. The coefficient of kinetic friction between the crate and the slope is 0.41.

a) (8 pts) Draw a free body diagram for the crate showing all forces acting on it. Clearly indicate the direction of these forces in your diagram.

b) (8 pts) The crate starts from rest and travels 4 m along the plane when it is found to have a velocity of 3.35 m/s. Find the acceleration of the crate down the incline.

c) (7 pts) What is the magnitude of the net force acting on the crate parallel to the ramp?

d) (7 pts) What is the magnitude of the net force acting on the crate normal to the ramp?
Problem 2
An archer (at ground level) shoots an arrow into the air (at time $t=0$) at an angle of $\theta^\circ$ above the horizontal.

![Diagram of an arrow being shot at an angle $\theta=45^\circ$ with initial velocity $v=35$ m/s, starting from position $x=0$, $y=0$.]

a. (7 pts) In the initial velocity of the arrow is 35 m/s at $45^\circ$ above the horizontal, find the x and y components of the arrows velocity vector.

b. (7 pts) Find the maximum height reached by the arrow.

c. (8 pts) Find the x and y components of the landing position if the launch position is $x=0$, $y=0$ m.

d. (8 pts) Find the velocity (x and y components) of the arrow when it lands.