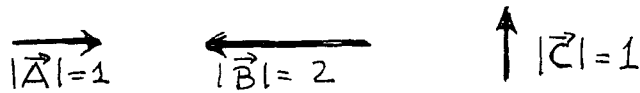
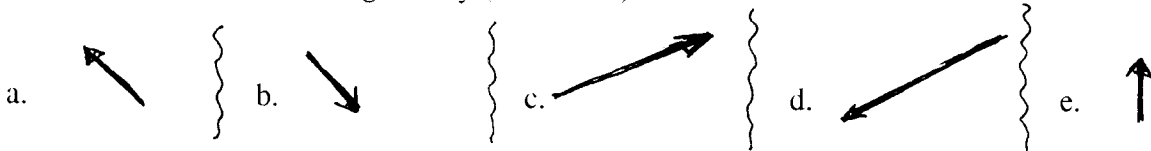


This is a multiple choice test. There is only one correct choice in each question. There is no penalty for guessing wrong. Circle the correct answer neatly, and do not circle more than one answer. Some questions require a calculation, which will not be graded for partial credit.

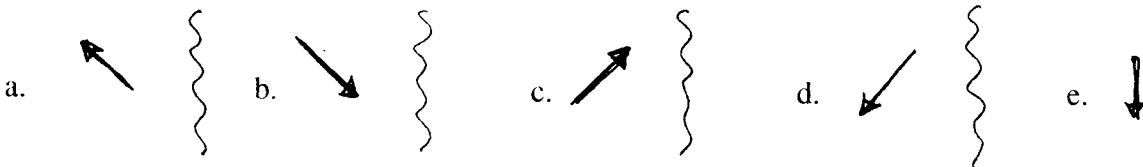
A. The first three questions refer to the pictures below, which show vectors **A**, **B**, and **C**.



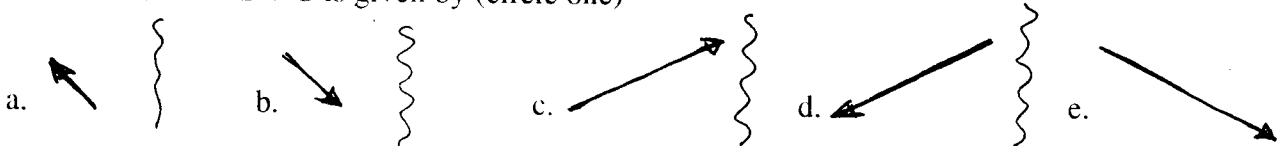
1. The vector **A + B + C** is given by (circle one)



2. The vector **A - C** is given by (circle one)



3. The vector **A - B + C** is given by (circle one)



B. The next three questions refer to the following statement: A runner goes five kilometers west at 10 km/h, and one kilometer south at 2 km/h.

4. The displacement of the runner from the starting point is (approximately)

- a. 4.9 km b. 5.1 km c. 4 km d. 6 km e. 7 km

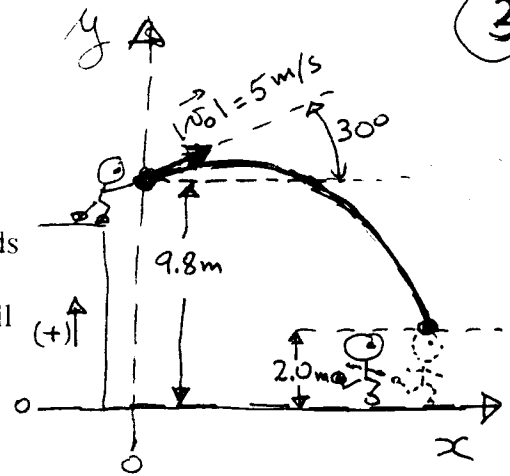
5. The average velocity of the runner is:

- a) 6 km/h b. 4 km/h c. 5.1 km/h d. 4.9 km/h e. 7 km/h

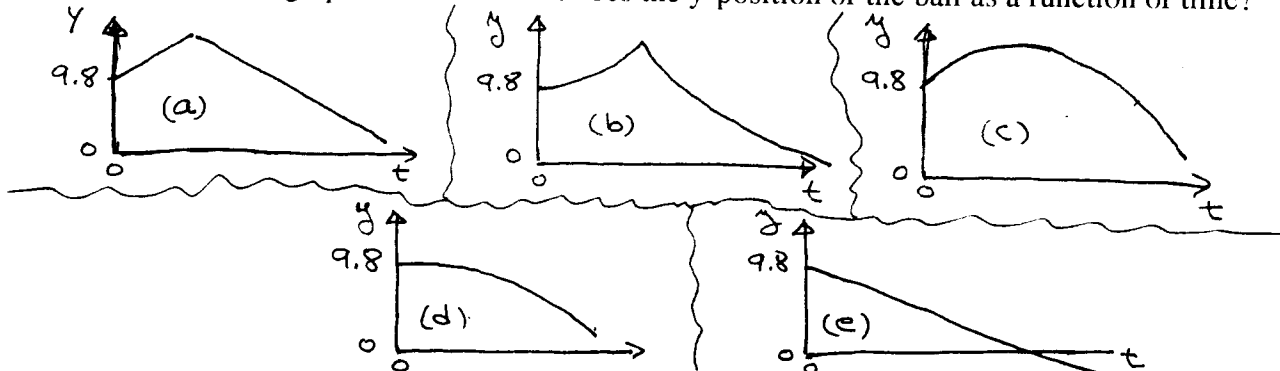
6. The average speed of the runner is:

- a) 6 km/h b. 4 km/h c. 5.1 km/h d. 4.9 km/h e. 7 km/h

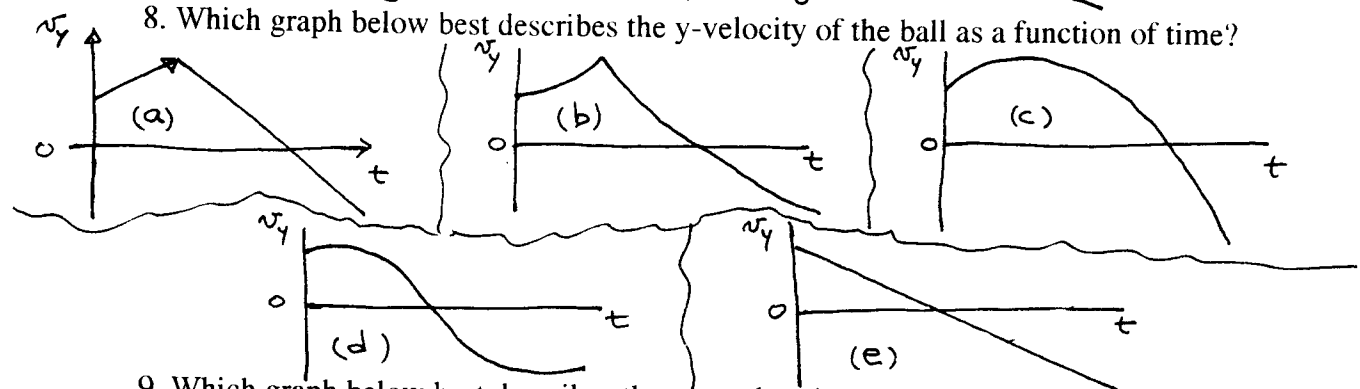
C. The next four questions refer to the picture at right and the following problem. A man on a ledge throws a ball towards a person running away at 3 m/s. The initial velocity of the ball is 5 m/s in a direction 30 degrees above the horizontal. The ball hits the person on the head. Use the dimensions and the coordinate axis shown on the picture (do not change the coordinate axis!!!!)



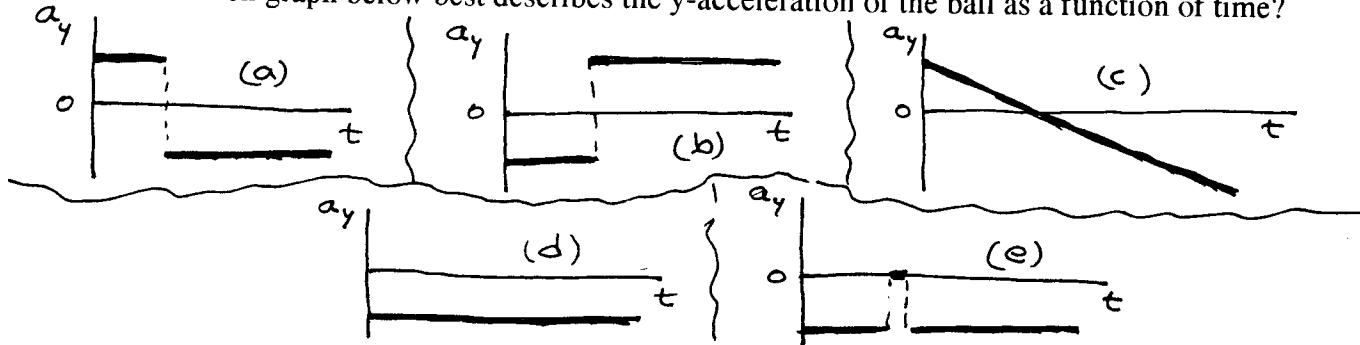
7. Which graph below best describes the y-position of the ball as a function of time?



8. Which graph below best describes the y-velocity of the ball as a function of time?



9. Which graph below best describes the y-acceleration of the ball as a function of time?



10. The time it takes the ball to hit the running man's head is approximately (circle one):

- a, 0.3 s.
- b. 1.3 s.
- c. 1.4 s.
- d. 1.5 s.
- e 1.7 s.

This page contains three short problems/questions, independent from each other.

(5 points) **PROBLEM 1.** A bug crawls on a table at a constant speed of three inches in one minute. If one inch is equivalent to 0.0254 meters, calculate the speed of the bug in meters/second (show your "one line" of work for credit).

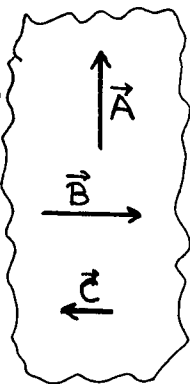
(9 points) **PROBLEM 2.** You are given three vector displacements, **A**, **B**, and **C**, as shown at right. Their magnitudes are $A=2m$, $B=2m$, and $C=1m$.

Below each equation below, make vector drawings showing the following math operations (label all the vectors)

a. $A + B + C = D$

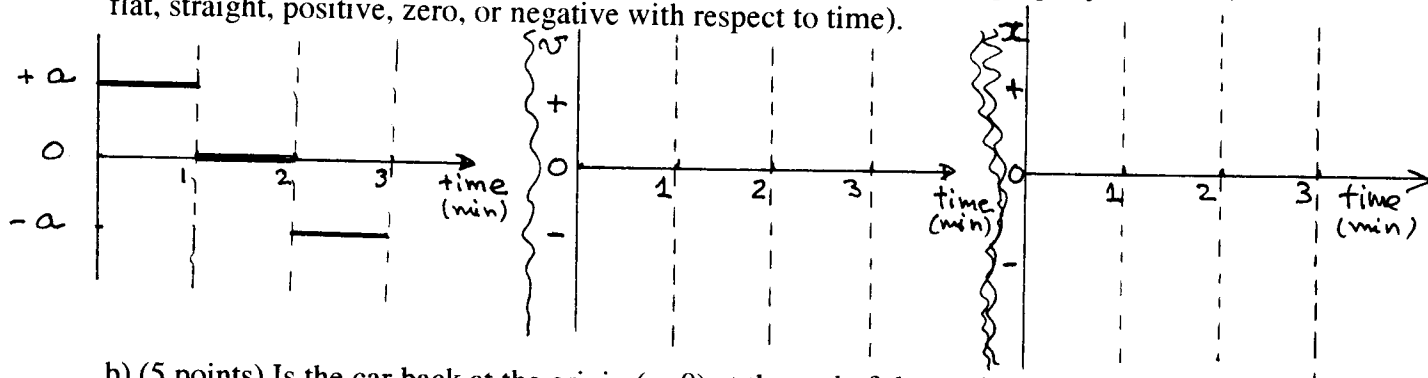
b. $A + C + B = E$

c. $A - B + C = F$



(21 points). **PROBLEM 3.** A car driver is testing his physics knowledge along a straight portion of highway. He starts at $t=0$ at $x=0$. The acceleration of his car is shown on the left graph.

a) (16 points) Complete the velocity vs. time and position vs. time graphs (qualitatively, no quantitative answer necessary, but important to show if graphed property is curved, flat, straight, positive, zero, or negative with respect to time).



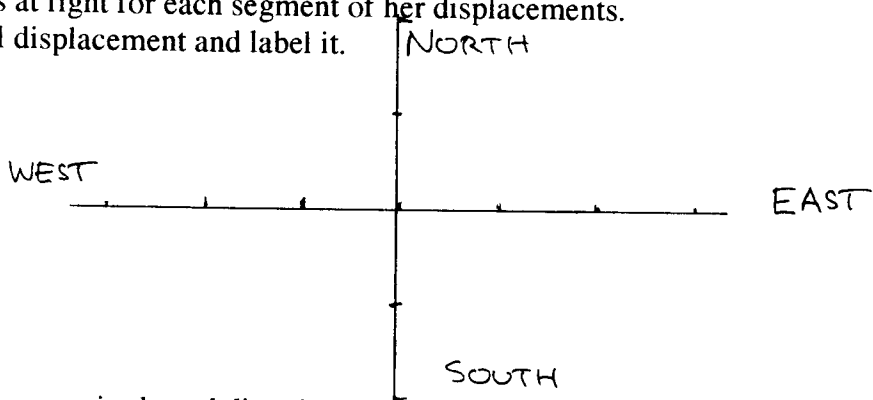
b) (5 points) Is the car back at the origin ($x=0$) at the end of the testing? YES or NO Circle one answer and write a short sentence explaining what you circled. No credit without the sentence.

Phys 114A, Autumn 1999, First Exam NAME.....

(33 points) **PROBLEM 4.** A runner starts a race at O and goes East for 1 km at 10 km/hour. She turns South and runs another 1 km at 5 km/hour. Finally, she turns East again and runs one more km (her last!) at 2 km/hour.

a. (5 points) Draw vectors at right for each segment of her displacements. Draw a vector for her total displacement and label it.

Each mark is 1 km.



b. (10 points) Calculate the magnitude and direction of her total displacement vector.

c. (6 points) Calculate the time taken by her to complete the race.

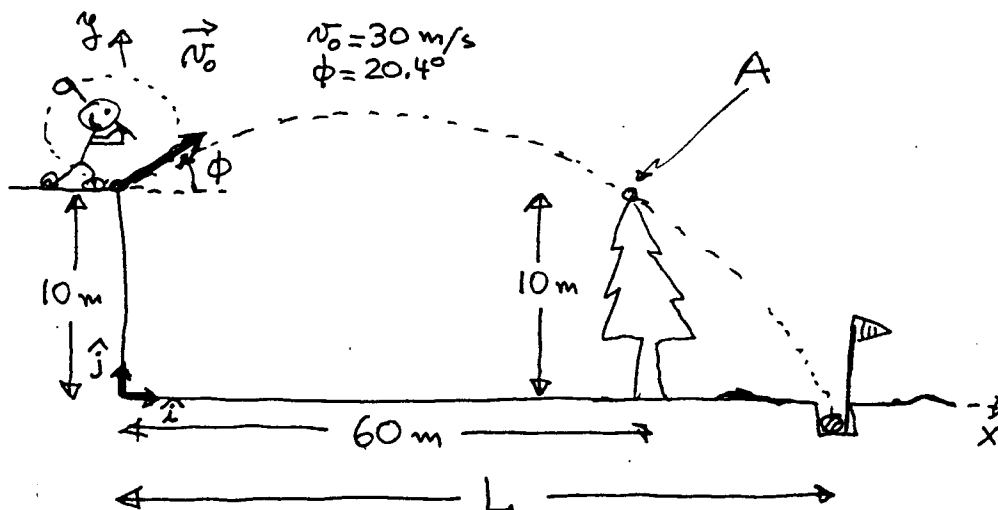
d.(6 points) Calculate the magnitude and direction of the average velocity of the runner for the entire race.

e.(6 points) Calculate the average speed of the runner for the entire race.

Name.....

Problem 1 (25 points)

A very accurate (and lucky!) golfer sends his first shot into the cup. The ball barely clears the top (point A) of a 10 m tall tree which is 60 m away. All relevant information is in the figure below.

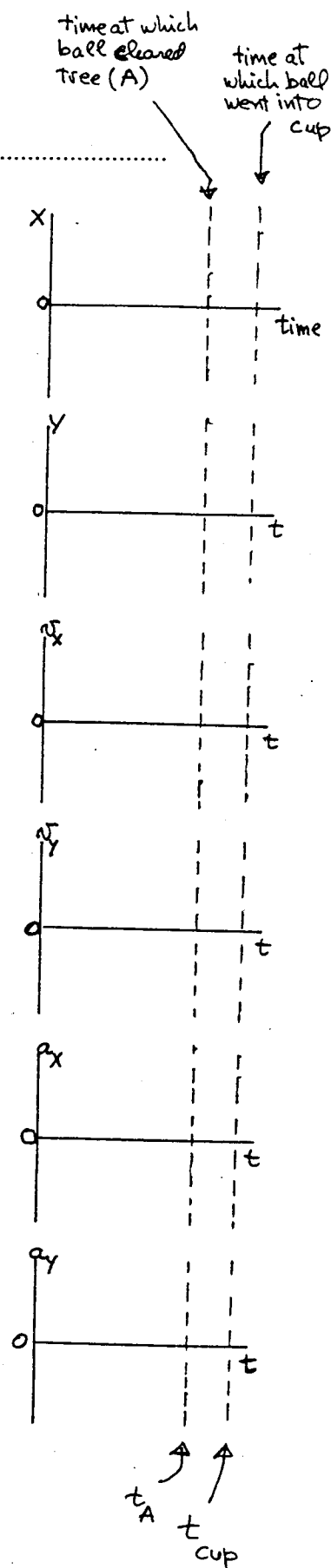


(3 points) a) For the travelling ball at point A, draw in the picture its position vector (\mathbf{R}), its instantaneous velocity vector (\mathbf{v}), and its instantaneous acceleration vector (\mathbf{a}). The system of coordinates and its origin are shown.

(6 points) b) Write in cartesian (x, y) vector form those vectors at point A, in the coordinate system shown. For example, $\mathbf{R} = X \mathbf{i} + Y \mathbf{j}$; include the correct numerical and sign values for all the components of \mathbf{R} , \mathbf{v} , and \mathbf{a} .

(12 points) c) In the axis shown at right, draw qualitatively correct drawings for the various components of \mathbf{R} , \mathbf{v} , and \mathbf{a} , as a function of time.

(4 points) d) Set up the equations to calculate how far the cup is and briefly explain how you would proceed with the calculation.
NUMERICAL ANSWER NOT NECESSARY.



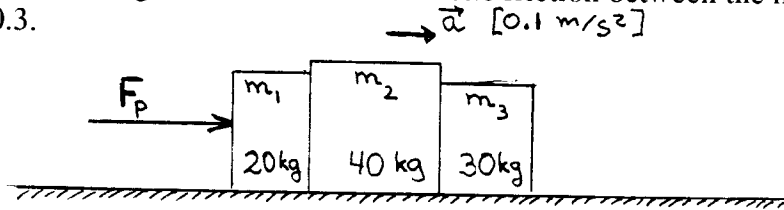
THIS EXAMPLE INCLUDES FRICTION FORCES

2

$$F_{1f} = \mu_k F_{N1} \quad F_{2f} = \mu_k F_{N2} \quad F_{3f} = \mu_k F_{N3}$$

Phys 114A, Autumn 1999, Second Exam ~~SAME~~... WHICH POINT... ←

(36 points) **PROBLEM 1.** The three masses shown below are on a horizontal table. They are pushed by a force F_p such that they accelerate with $a=0.1 \text{ m/s}^2$. Assume $m_1 = 20 \text{ kg}$, $m_2=40\text{kg}$, and $m_3=30\text{kg}$. The coefficient of kinetic friction between the masses and the table is $\mu_k=0.3$.



a) (15 points) In the three dots below, draw free body diagrams of all the forces acting on each individual mass, m_1 , m_2 , and m_3 . Make sure to label each force in a clear way (for example, F_{G1} as the weight of m_1 , F_{12} the force on m_1 coming from m_2 , and so on)



MASS 1

MASS 2

MASS 3

b) (6 points) Of all the forces you have indicated above, write below all the pairs which are equal and opposite by NEWTON'S THIRD LAW. Use the same labels for the forces as you used in Part (a) above.

c) (5 points) Is there a net force on m_2 , YES or NO? If YES, write down its value in Newtons and a one-sentence explanation. If NO, write a one-sentence explanation.

d) (10 points) Calculate the magnitude of the pushing force F_p .