General Physics
Physics 101
Test #1 – Fall 2013
Friday 9/27/13
Prof. Bob Ekey

Name (print):_____

I hereby declare upon my word of honor that
I have neither given nor received unauthorized
help on this work.

Signature:_____

Part I. Multiple Choice (3 pts each)

Instructions:

Please clearly circle one and only one answer for each of the following.
Show all of your work. Partial credit may be given if you include your work.

Questions:

1. A student derives an equation of the form $\frac{a}{2v^2}$.

What are the combined SI base units for this equation?

(a) $\frac{1}{m}$

(b) $\frac{m^3}{s^5}$

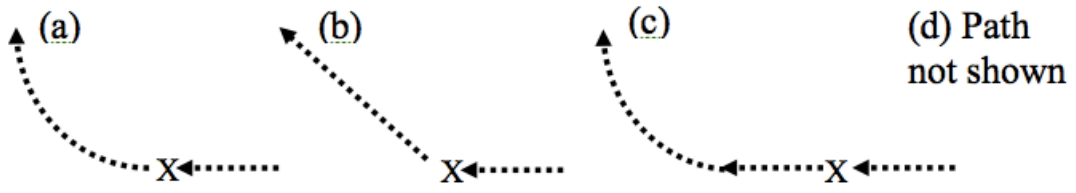
(c) $\frac{1}{s}$

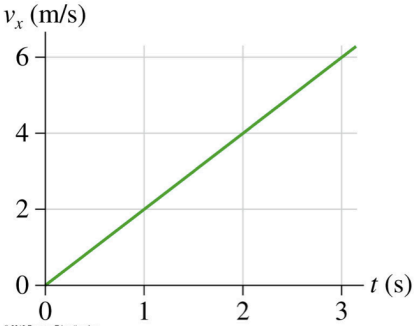
(d) m

2. A heard of rhinos is traveling at 10 m/s. They are getting tired, and have slowed to 4.0 m/s. If this occurs over 141 m, what is the acceleration of the heard?

(a) 0.2979 m/s^2
(b) -1.5 m/s^2
(c) 0.13 m/s^2
(d) -0.30 m/s^2

3. A hockey puck slides to the left at 1.0 m/s on a 2D horizontal (level) surface. A rocket on the puck is aimed in the +y direction, and is fired (X). Which of the following shows the path of the puck post-fire? Assume the rocket continually fires after point (X).





4. The following velocity versus time graph shows a particle moving along the x-axis. Its initial position is $x_o = 2.0$m at $t_o = 0.0$ s. At t = 3.0 s, what is the particle's position?

(a) 9.0 m
(b) 2.0 m
(c) 11.0 m
(d) 4.0 m/s^2

5. A rocket car is launched from rest across a level floor with a constant acceleration. A 2nd rocket is added to the car, and the car now launches from rest with double the original acceleration. What is a correct description of the "two rocket" car's subsequent motion? Ignore friction and assume the rocket continually fires.

(a) The car moves with a constant speed that is bigger than the original speed.
(b) The car speed increases to a constant value greater than the original speed.
(c) The car moves with a continually increasing speed.
(d) The speed of the car is the same in either situation.

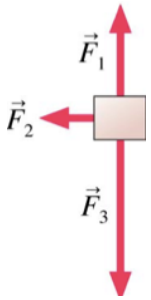
6. A ball thrown horizontally at 25 m/s travels a horizontal distance of 50 m before hitting the ground. From what height was the ball thrown?

(a) 2.0 m
(b) 9.8 m
(c) 1.2 m
(d) 20 m

7. What are the x and y components of this vector?

$$a = (100\ \tfrac{m}{s^2}, 36.9°\ counterclockwise\ \ from\ negative\ \ y-axis)$$

(a) $\left(-80.0\hat{i} - 60.0\hat{j}\right)$
(b) $a_x = 60.0$ m/s^2 & $a_y = -80.0$ m/s^2
(c) (-60.0 m/s^2, 80.0 m/s^2)
(d) 60.0 m/s^2 in the –y-direction & 80.0 m/s^2 in the –x-direction.



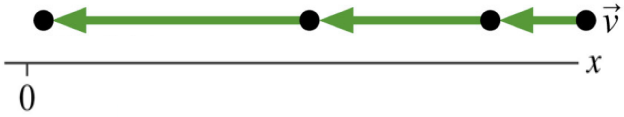
8. Three forces are acting on an object as shown.
In what general direction does the net (total) force point?

(a) North-West
(b) South-West
(c) Due West
(d) The net force is zero

9. Santa slips and falls from the top of a peaked roof that is very icy. He achieves a velocity of 9.8 m/s when he leaves the roof after falling for 2.0 seconds from rest. What is the angle of the roof with respect to the horizontal?

(a) 60°
(b) 30°
(c) 0.0087°
(d) 27°

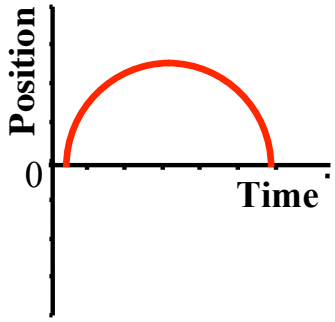
10. For the following motion diagram, what is false?



(a) Velocity is decreasing
(b) Acceleration is negative
(c) Velocity is negative
(d) Position is positive

11. A golf ball is hit on level ground with an initial velocity of 100 m/s at an angle of 30° above the horizontal. How long is the ball in the air before it lands?

(a) 5.0 s
(b) 20 s
(c) 18 s
(d) 10 s



12. Which of the following statements about this position versus time graph is true? Assume the moving object is a rigid body and only moving in one-dimension.

(a) The object has a non-zero velocity at its maximum height.

(b) The object has a moment of zero acceleration during the motion

(c) The rise and fall time for the motion are the same.

(d) The velocity changes from positive decreasing to positive increasing.

Part II. Short answer problems (12 pts each)

Instructions:

Solve three of the following four problems. If you try to solve all four problems, please clearly indicate which problems you wish to have graded. If you do not indicate this, I will assume you want me to grade problems one, two and three.

Please show all of your work, including equations without numbers.

Please provide units with all answers.

Partial credit may be given if you include your work.

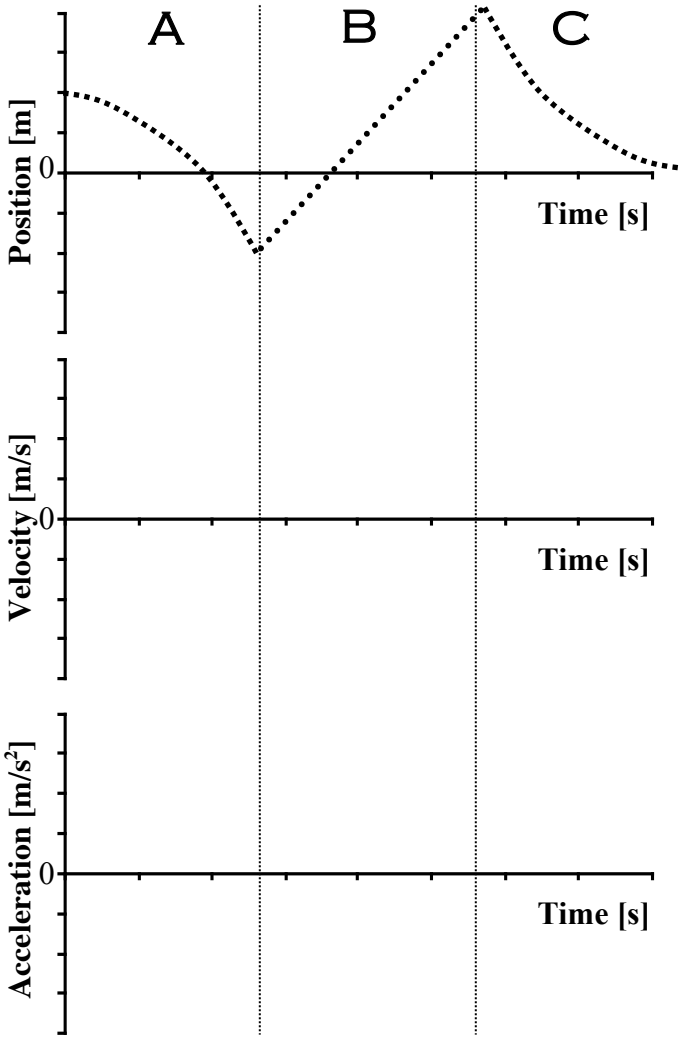
Question 1. **Grade this problem? Yes or No (circle one)**

For the following position versus time graph do the following,

(a) Sketch the velocity versus time.
What knowledge/definition are you using to make this sketch?

(b) Sketch the acceleration versus time.
What knowledge/definition are you using to make this sketch?

Note: You do not need to provide any numbers in your answers.
Note: On the velocity vs. time graph all lines should be straight - sloped or horizontal
Note: Your sketches and description will be graded independently.



(c) In each section (A-C) describe the motion.
(x, v and a)

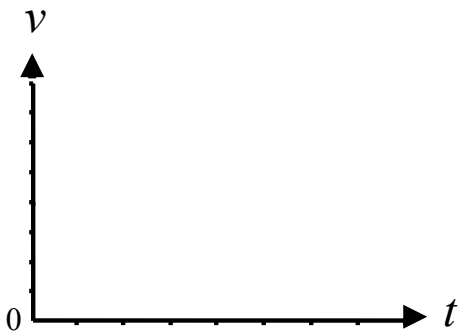
Question 2. **Grade this problem? Yes or No (circle one)**

You would like to stick a wet spit wad on the ceiling, so you toss it straight-up with a speed of 10 m/s and it takes 0.10 seconds for the spit wad to hit the ceiling.

(a) What is the velocity of the spit wad right before it hits the ceiling?
A numerical answer is required.

(b) If you launched the spit wad from a height of 2.0 m from the floor, what is the vertical distance between the floor and ceiling?

(c) Sketch a velocity vs time plot that could show the motion of the spit-wad prior to the collision with the ceiling. Please explain the shape & meaning of the graph.



(d) During the collision of the spit-wad with the ceiling, it takes 1.0 ms for the spit-wad to come to rest. What is the magnitude and direction of its acceleration?

Question 3. **Grade this problem? Yes or No (circle one)**

A tornado filled with sharks, a Sharknado if you will, has been spotted heading towards Alliance from Sebring.

(a) Explain whether it is possible for the distance the Sharknado travels to Alliance is greater than the displacement it travels. Words are necessary in your explanations, a diagram and/or equations may help.

A shark is launched from the Sharknado with initial velocity components of $v = \left[100\hat{i} + 50\hat{j}\right] \frac{m}{s}$ from a vertical height of 75 m with respect to the ground.

(b) What is the vertical velocity of the Shark right before it hits the ground?

(c) What is the flight time of the shark from launch to landing on the ground?

(d) What is the horizontal displacement of the Shark with respect to its launch point?

Question 4. **Grade this problem? Yes or No (circle one)**

Astronauts training for space flight are strapped into a rocket car. The rocket car achieves a velocity of 100 m/s to the west during its flight, and a parachute is deployed to cause it to stop.

(a) Draw a motion diagram for this situation including the velocity and acceleration vectors and labeled starting and final locations.

(b) If the acceleration of the car is a constant 10 m/s^2 to the east, how far did the rocket car travel after the parachute is deployed? Be sure to state the direction of the displacement in words.

(c) How long did it take the car to stop after the parachute is deployed?

(d) What is the cars displacement when it has traveled for half the time found in (c)?