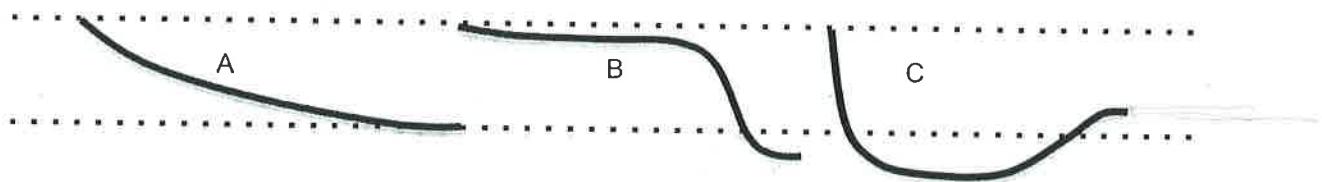


## Big Exam #2, 141, Schwartz Nar

From the syllabus: In order to achieve an "A": Consistently

- correctly identifies underlying physics concepts,
- sets up problem with good drawing and reasons,
- formulates method to solve problem,
- correctly uses units and
- verifies whether answer makes sense.

1. Shown are three frictionless tracks, each is of equal length, but bent differently. I drop a marble down each track.



- a) We want to know which marbles come off with the highest speed. Explain which lens you will use and why.

I would use the lens, energy, because you can then look at the potential energy versus kinetic energy and get an idea of the velocity based on kinetic energy.

- b) Rank the tracks according to final speed when it goes off the track, from fastest to slowest, or state why they all come off with the same speed.

B > A > C B has the lowest end of the track so all energy would be KE. A does not have the same height when the marble leaves the track so it has less energy. The marble comes off track C with much KE.

- c) We want to know which marbles took the most time. Explain which lens you will use PE & KE.

Because this question involves height and is asking about velocity, the best lens to use is energy. The marble on track B would take the longest to get to the bottom because it spends a long time with a lot of PE, but not much KE. Marbles on tracks A and C would have similar times

- d) Rank the tracks according to time taken to get to the end of the track, from shortest time to longest time, or state why they all take the same time.

C < A < B

leaving  
the  
track

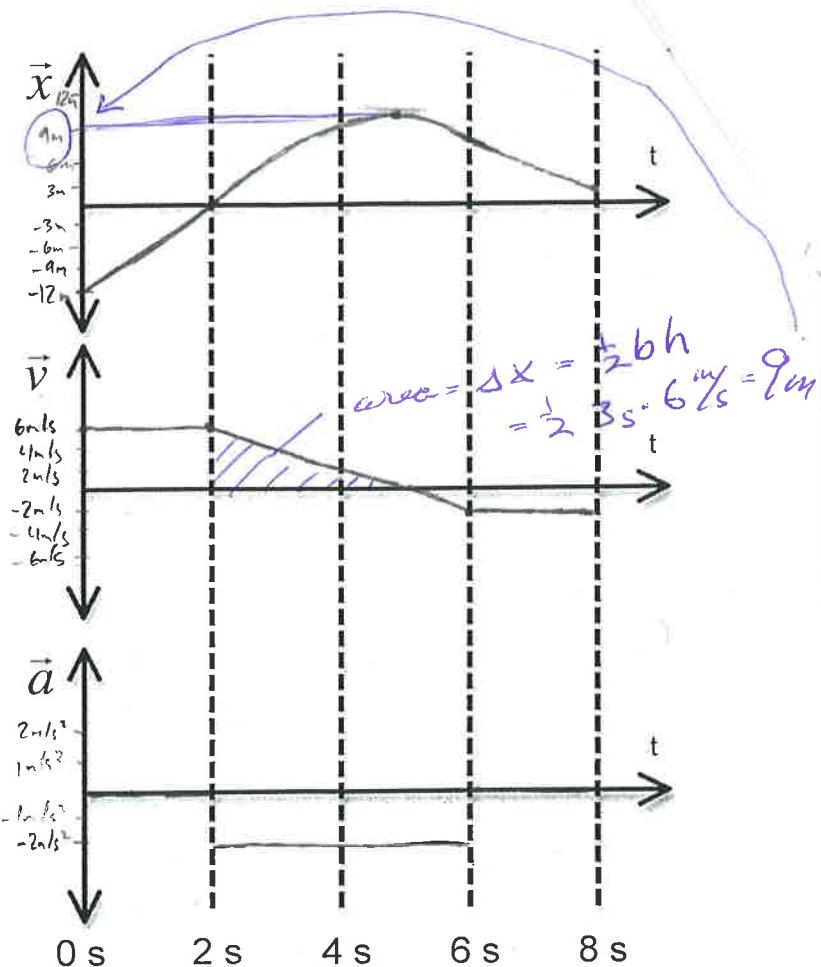


nic!

2. An object starts at  $\vec{x} = -12 \text{ m}$  with constant velocity,  $\vec{v} = +6 \text{ m/s}$  for 2 s. Between  $t=2$  s and  $t = 6$  s, the object experiences an acceleration of  $-2 \text{ m/s}^2$ . That is, the acceleration is in the opposite direction as the initial velocity. After 6 s, the acceleration is zero. Please graph the acceleration, velocity, and displacement as a function of time. Please also label the y axes so the graphs make sense.

Using kinematics, we know that we can use the values of acceleration to determine the slope of velocity, and the values of velocity to determine the slope of position.

& we are dealing only w/  $\vec{x}, \vec{v}, \vec{a}$ , and time



3. Consider the object at  $t = 4 \text{ s}$ . The object is 100 kg, and has two ropes pulling on it, rope A in the  $+\hat{x}$  direction, and rope B in the  $-\hat{x}$  direction.

- a) Which rope is pulling harder? (remember what you have to do to get a "A")

$$a = -2 \text{ m/s}^2$$

$$m = 100 \text{ kg}$$

Using dynamics, we know that rope B must be pulling harder because the object is receiving an acceleration in the direction of rope B (the  $-\hat{x}$  direction)

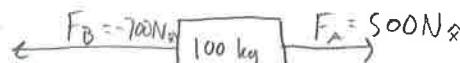


- b) If the tension on the rope pulling in the  $+\hat{x}$  direction is 500 N, what is the tension in the rope pulling in the  $-\hat{x}$  direction?

$$a = -2 \text{ m/s}^2$$

$$m = 100 \text{ kg}$$

$$F_{\text{net}} = ma_x = 100 \text{ kg} (-2 \text{ m/s}^2) = -200 \text{ N}$$



So the magnitude of the force provided by rope B must be 200 N greater than that of rope A, so:

$$\vec{F}_B = -700 \text{ N} \hat{x}$$

$$\text{and } \sum \vec{F} = 500 \text{ N} \hat{x} - 700 \text{ N} \hat{x} = -200 \text{ N}, \text{ and } \vec{a} = \frac{\vec{F}}{m} = \frac{-200 \text{ N}}{100 \text{ kg}}$$