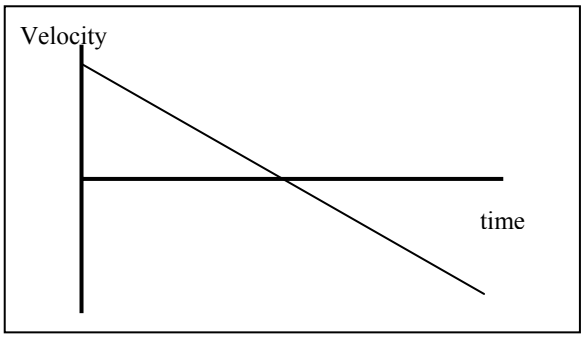
Spring 2002 Physics 2048 Test 2 solutions Dr. Saul

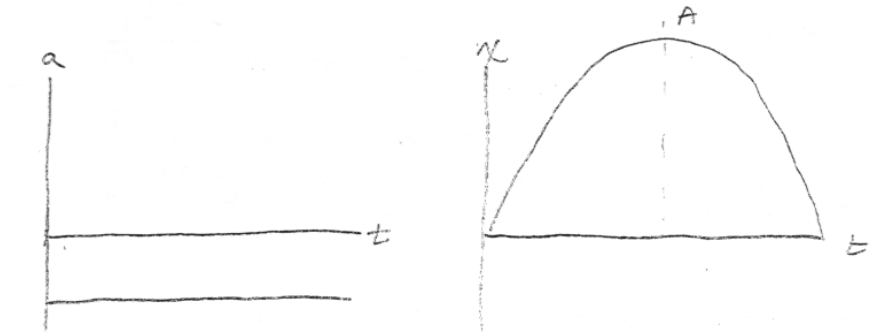
Problem 3 (Essay 10 points)
You may use diagrams and equations but no calculations in your response for this problem.

A cart can move to the right or left along a horizontal track (the positive part of the x axis) as shown in the figure below. Assume that friction is small enough that it can be ignored. A sonic ranger is used (as shown) to measure the position, velocity, and acceleration of the cart. The track is not necessarily flat or horizontal. In addition, the track may be tipped or the cart may be pulled or pushed. For the first run, the sonic ranger displays a graph of the velocity that looks like the graph shown at the right.



- Describe the motion of the cart in words
- Draw graphs showing what the sonic ranger would display for the cart's position and the cart's acceleration.
- USE WHAT YOU'VE LEARNED FROM CLASS SO FAR to explain in words how you came up with your answers

(mark point A as the point where v = 0 m/s.)
From a student solution: *The cart starts with an initial positive velocity which means it is moving away from the sonic ranger. The rate at which it is traveling goes down until it reaches 0 at point A. Then it continues down then having a negative velocity so moving towards the ranger.*



In class we've learned that velocity, acceleration, and position are all intertwined. From the velocity graph given you can find the position graph by the integral or area under the graph of the velocity. We see at point A it [position] *and because the area after A in v vs. t is negative (below t-axis) that the values for x vs. t decrease. We also learned in class that the a vs. t graph is the derivative (or graph of the slope) of the velocity vs. time graph. As we can see from the v vs. t graph, the slope is always the same and always negative, so the a vs. t values correspond giving a constant negative value.*

Dr. Saul's comment: Although choppy, this essay received 10 out of 10 points and is correct in each detail. However, it could be improved by noting in the first paragraph that the slope is constant and therefore the acceleration is constant. In addition, one could note that since velocity is the slope of the x vs. t graph, the slope of the x vs. t graph should decrease in slope throughout.