

Name _____

HC 209
GALILEO'S CART

For our experiments with Galileo's laws of motion, we will be using a computer motion detector setup. The experiment includes 1) a cart, track, block of wood (to prop up track), 2) a motion detector, 3) cabling that connects the detector to a laptop, 4) a laptop running an application that plots the signals from the detector. The laptop should have a window running with a button that says "collect data". Once this button is pushed the laptop will plot the distance, velocity and acceleration data from the motion detector. As there are only a few seconds of information on the screen, you need to start the cart and push the button fairly close in time. Note that often the "scaling" button at the top is needed to see the plotted lines as they are often compressed in the y-axis.

For each of the following problems, you should:

- 1) Draw a picture of your experimental setup.
- 2) Label the positive and negative directions.
- 3) Display the initial velocity vector of the cart.
- 4) Plot the resulting position/velocity/acceleration lines on the given diagrams.

Problem 1: Consider a cart moving away from the motion detector at a steady (i.e. constant) velocity.

Draw the experiment:

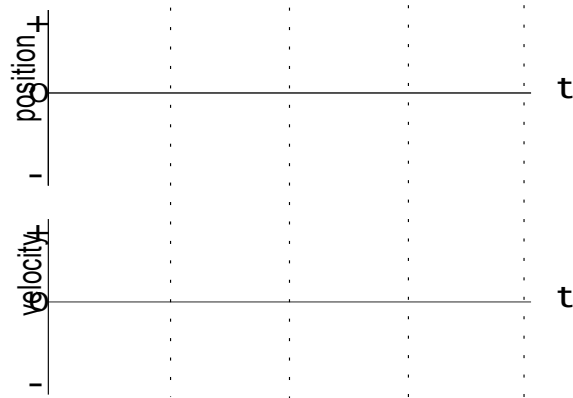
On the diagram below sketch the position and velocity graphs for the cart's motion.



Problem 2: Consider a cart moving toward the motion detector at a steady (i.e., constant) velocity.

Draw the experiment:

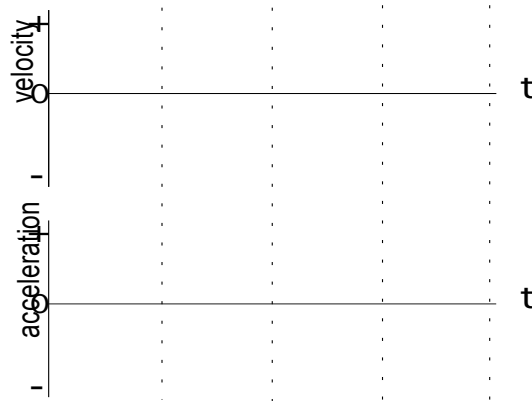
On the diagram below sketch the position and velocity graphs for the cart's motion.



Problem 3: Consider a cart moving away from the motion detector and speeding up at a steady rate.

Draw the experiment:

On the diagram below sketch the velocity and acceleration graphs for the cart's motion.



Problem 4: Consider a cart moving away from the motion detector and slowing down at a steady rate.

Draw the experiment:

On the diagram below sketch the velocity and acceleration graphs for the cart's motion.



Problem 5: Consider a cart is subjected to a constant force in the direction away from the motion detector. Sketch on the axes on the right your predictions for the velocity and acceleration of the cart moving toward the motion detector and slowing down at a steady rate. (Start your graph after the push that gets the cart moving.)

Draw the experiment:

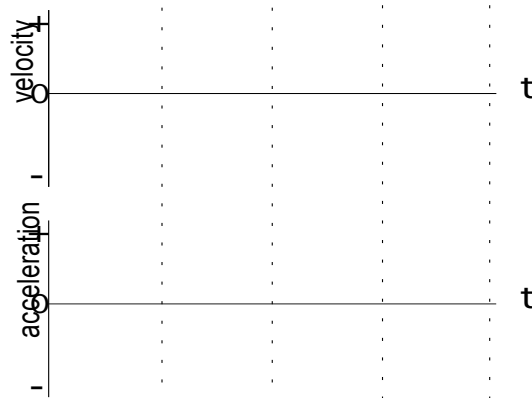
On the diagram below sketch the velocity and acceleration graphs for the cart's motion.



Problem 6: Consider a cart subjected to a constant force in the direction away from the motion detector. Sketch on the axes on the right the velocity and acceleration of the cart after it is given a short push toward the motion detector (and is released) as the cart slows down moving toward the detector, comes *momentarily* to rest and then speeds up moving away from the detector.

Draw the experiment:

On the diagram below sketch the velocity and acceleration graphs for the cart's motion.



Problem 7: The origin of the coordinate system is on the floor, and the positive direction is upward. A ball is thrown, moves upward, slowing down, reaches its highest point and falls back downward speeding up as it falls. Sketch on the axes the velocity-time and acceleration-time graphs of the ball from the moment just after it is released until the moment just before it hits the floor.

Draw the experiment:

On the diagram below sketch the velocity and acceleration graphs for the cart's motion.

