Lab 2-1: Constant Speed & Velocity

Purpose: 1. To learn how to use Logger Pro and the motion detectors in lab.
2. To define the term *constant speed*.
3. To differentiate between *speed* and *velocity*.

Materials: 1 car meter stick stopwatch motion detector

Procedure:

1. Using the meter stick and the stopwatch, determine the speed of your toy car. Do a few trials in an attempt to be as accurate as possible. Record all your data in a neat table in the space below, and show your neat calculations.
   Data

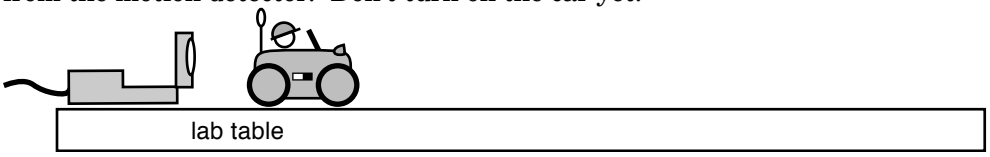
   Calculations

   Speed of Car: _____

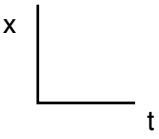
   a. In order to determine the speed of the car, does it matter how far the car traveled?

2. Start up Logger Pro and open the file "02 Cart" which is in the folder "Physics with Vernier." Your teacher will show you how to log in and do this.

3. Set up the motion detector on the lab table as shown below. Make sure that the switch on the motion detector is set to the cart and not the ball. Place the car so that it can drive away from the motion detector. Don't turn on the car yet.



4. The motion detector will record the position of the car about 30 times a second, and then present those positions as a graph. What do you think the position vs time graph will look like once you turn on the car?



5. Make sure someone is ready to catch the car if it goes off the edge of the table. Click on the "Collect" button to start recording data. Once you hear the motion detector making noise, turn on the car. Don't let it fall off the table.

6. On the position vs time graph, determine the slope of the line while the car was moving with a constant speed by highlighting the middle half of that region of the graph. Then click on the button labeled "Linear Fit". Record the graphs and slopes in the space provided in the data section. When a graph is horizontal, don't bother doing a linear fit - just call the slope zero.

7. We will NEVER use the y-intercept calculated by Logger Pro when using the motion detectors. They will ALWAYS be nonsense because a time of zero will always be way before the part of the graph we care about. However, you should think about what the intercept should be, if we imagine time starting when we care about the data.

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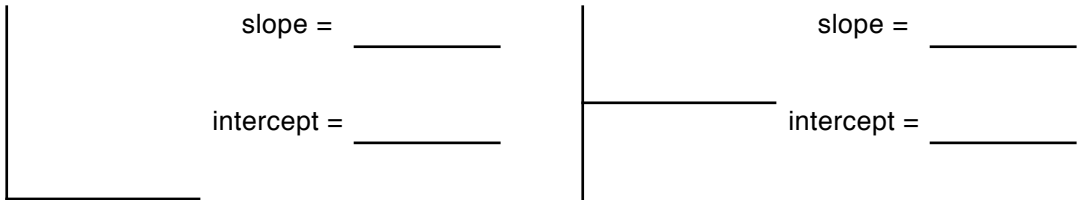
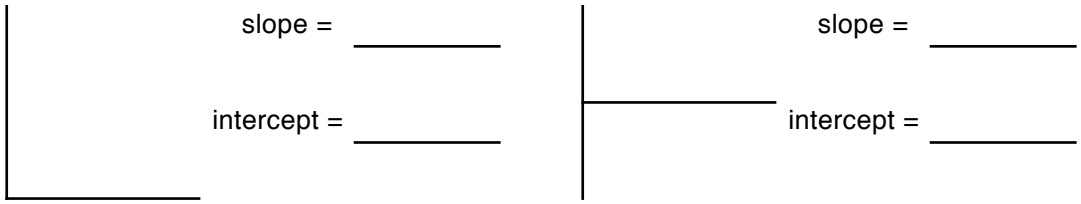
8. Repeat the above to find the graphs of position and velocity vs time when the car is going with a constant speed, but heading towards the motion detector. (i.e. start the car at the other end of the table.)

Data:

Car moving away from the motion detector:



Car moving towards the motion detector:



Questions:

1. You made 4 graphs. What were the equations that describe those graphs?

2. How does the speed you first calculated compare to the <u>slopes</u> of the position graphs and the <u>values</u> of the velocity graphs.

3. Compare and contrast the two position graphs and the two velocity graphs.

4. The cars travel with a constant speed. How does each graph show that constant speed?

5. What is the difference between speed and velocity?