Lab 8: Position and Velocity

1. Open the **Position and Velocity** LoggerPro file that accompanies this lab to collect data. Start by standing about 1 meter in front of the motion detector. Start collecting data, but stand still for about 2 seconds once the data collector starts clicking. Take a step or two towards the detector and stop for another couple seconds. Now take a step or two backwards, away from the detector, and stand still until data collection stops. On your handout, sketch the Position vs Time graph you just created on the computer.

2. Some questions:

   (a) Imagine a number line painted on the floor of the classroom. The motion detector

   measures position relative to this coordinate system. What physical location corresponds to the origin of the coordinate system? In other words, where would you measure a position of 0m, or $x = 0$? How do you know?

   (b) Is is possible for the detector to measure a negative position? Explain your reasoning.

   (c) Displacement measures the change in position and can be calculated by taking the final value of x minus the initial value ($x_f - x_i$). Which direction (toward or away from the motion detector) corresponds to a positive displacement? How do you know?

   (d) When you were standing still during data collection, did the position recorded by the motion detector change at all or does it show you to be *exactly* motionless? Explain.

3. Walk away from the motion detector at a constant speed (this may take some practice!). Sketch the result on your handout.

   (a) Describe the shape of the position vs time graph (if it is straight is is the slope steep, horizontal, down, up, etc? If it is curved is it curved up, down, steep, shallow, etc?).

(b) Describe the shape of the velocity vs time graph.

4. Walk away from the motion detector at a constant speed, moving with a greater speed than you did in the previous exercise. Sketch the result on your handout.

   (a) Describe the shape of the position vs time graph.

   (b) Describe the shape of the velocity vs time graph.

   (c) Compare the two position vs time graphs you just made. Note the similarities as well as the differences.

   (d) Compare the two velocity vs time graphs you just made. Note the similarities as well as the differences.

5. Now, walk toward the motion detector at a constant speed. Sketch the result on your handout.

   (a) Describe the shape of the position vs time graph.

   (b) Describe the shape of the velocity vs time graph.

   (c) What aspect of the position vs time graph shows that you are moving toward the motion detector rather than way from it? Explain.

(d) What aspect of the velocity vs time graph shows that you are moving toward the motion detector rather than way from it? Explain.

6. Some more questions to summarize your results:

   (a) Given a position vs time graph, how can you tell whether the speed is constant?

   (b) Given a velocity vs time graph, how can you tell whether the speed is constant?

   (c) Given a position vs time graph, how can you tell the direction of motion?

   (d) Given a velocity vs time graph, how can you tell the direction of motion?

   (e) Given a position vs time graph, what tells you the speed of the object? Is this consistent with the formula for velocity ($v = \frac{\Delta x}{\Delta t}$)? Explain

   (f) Given a velocity vs time graph, what tells you the speed of the object?

7. On your handout, there are descriptions of six different motions. They are given to you as either a graph of position vs time, a graph of velocity vs time, or a written description of what is happening. You will fill in the other two types of description using the information given to you.