Name: _____   *Period:* _____

REAL-TIME PHYSICS LAB #2: VELOCITY – TIME GRAPHS OF YOUR MOTION

In this experiment, we will continue learning about the how motion is represented with graphs. In this lab, we will use "speed" to describe how fast you are moving. "Velocity" takes into account your speed, as well as the direction you are moving. Remember, velocity can be positive or negative!

Procedure:

1. Setup the motion detector and your lab station in the same fashion as RTP Lab #1.

2. On the Meter screen, tap Duration, then change the data-collection length to 5 seconds. Select OK. Select the tab that looks like a graph. Under the "Graph" tab, choose "Show Graph" and select "Graph 2."

3. To begin collecting data, hit the green "Collect" button in the lower right corner of the LabQuest screen.

4. <u>AFTER COLLECTING DATA</u>: Choose Graph ► Graph Options. Under "Graph 2 Y-Axis," set the top value as 2.00 $^m/_s$ and the bottom value as -2.00 $^m/_s$
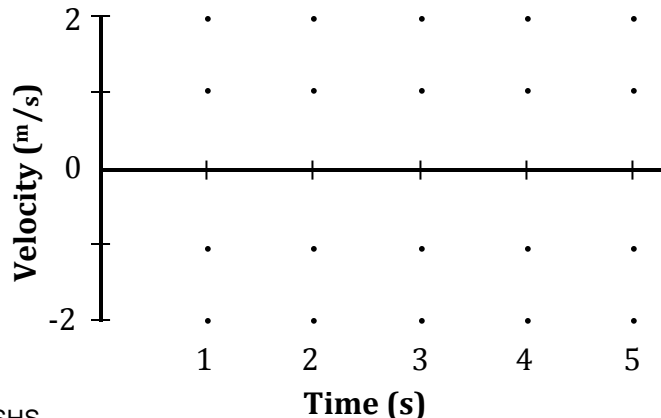
Part I: Walking the Graph

Move in front of the motion detector as describe below. Sketch the resulting graph on the axes provided using smooth patterns (leave out bumps that are mostly due to your steps).
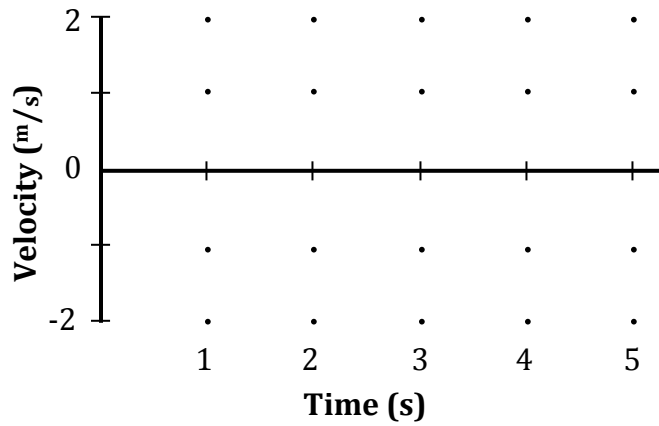
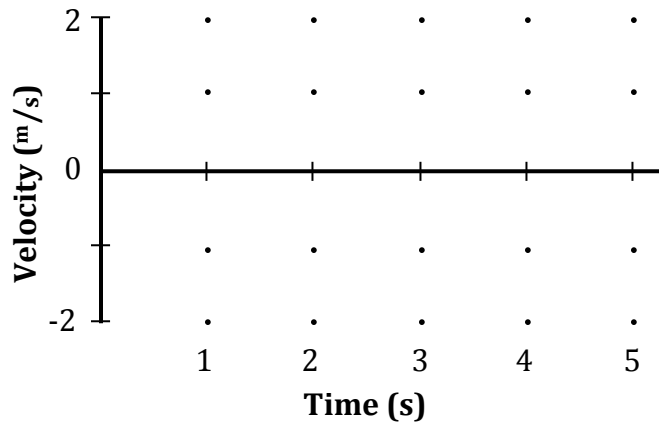a) Walk away from the detector *slowly* and *steadily*. Try again until you're satisfied.
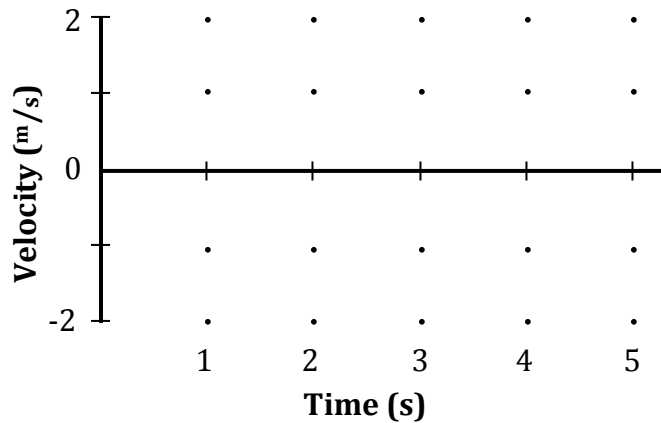
b) Walk away from the detector *medium fast* and *steadily*.

c) Walk toward from the detector *slowly* and *steadily*.

d) Walk toward from the detector *medium fast* and *steadily*.

1. What was the most important difference between the graphs you made by walking away from the detector slowly and the one made by walking away more quickly?

_____

_____

2. How are the velocity-time graphs different for motion toward and motion away from the detector?

_____

_____

Part II: Predicting the Graph

Predict the velocity-time graph produced when a person walks away from the detector slowly and steadily for 10 seconds, stops for 4 seconds, and the walks towards the detector steadily about twice as fast as before. Draw your prediction on the axes using a dotted line.

Compare predictions with the rest of your group. Once you agree, draw your group's prediction on the using a solid line in a different color. (Do not erase your original prediction.)

PREDICTION
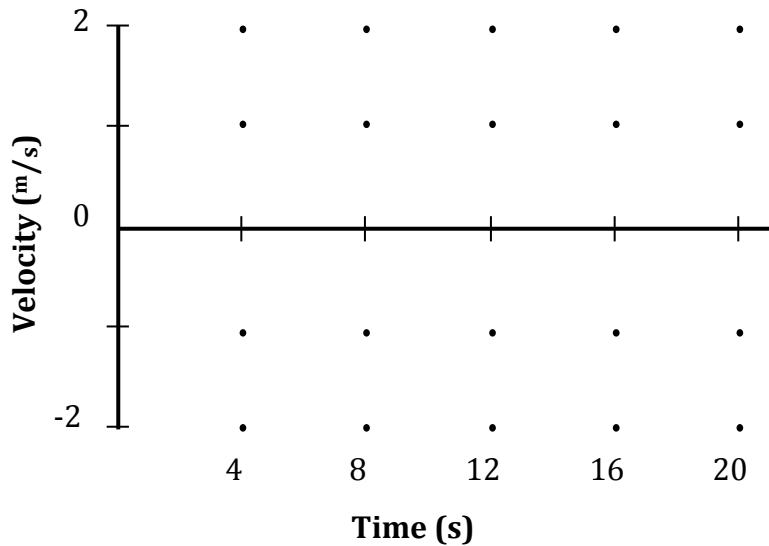
Now test your prediction. *Make sure to adjust the time scale to 20 seconds!* Move in the way described and graph your motion. When you are satisfied with your graph, draw your group's final result on the axes below. (Be sure the 4 second stop shows clearly!)

FINAL RESULT
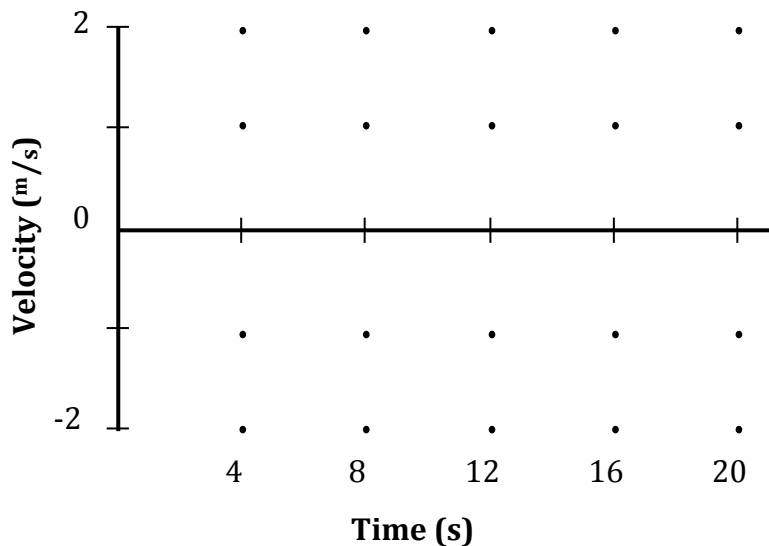
***Note:** How fast you move is your speed, the rate of change of distance with respect to time. Velocity implies both speed and direction. As you have seen, for motion along a line (the positive x axis) the sign (+ or -) of the velocity indicates the direction. If you move away from the detector (origin) your velocity is positive, and if you move toward the detector, your velocity is negative.*

The faster you move away from the origin, the larger positive number your velocity is. The faster you move toward the origin, the "larger" negative number your velocity is. That is -4 m/s is twice as fast as -2 m/s and both motions are toward the origin.

Part III: Matching the Graph

From the Analysis Menu, choose Motion Match ► New Velocity. A target graph will be displayed for you to match. (Make sure that the times and velocities match up!)

3. **Quantitatively** (using appropriate numbers) draw your matched graph in the space below. Label your scale!

Time (s)
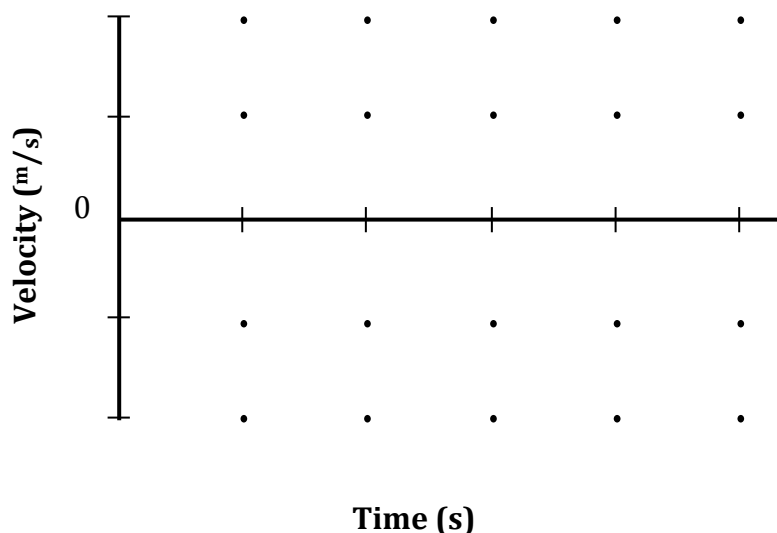
4. Describe how you had to move to match each part of the graph.

5. Is it possible for an object to move so that it produces an absolutely vertical line on a velocity-time graph? Explain.