MOTION LAB:
Matching Position and Velocity Graphs

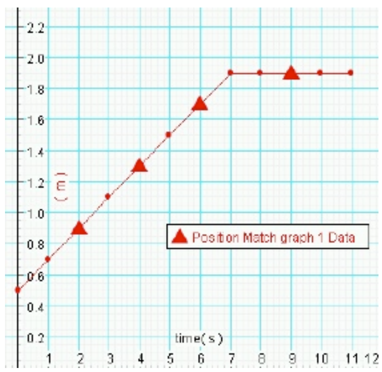
<u>INTRODUCTION</u>:

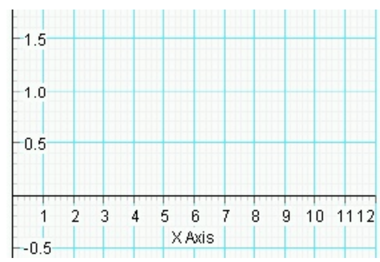
Motion Sensors used along with your TI graphing allow graphs to be viewed while the data is actually being collected. In this case, you will walk towards or away from a motion sensor (a sonar device), and as you walk, the velocity versus time graph of your walking will be immediately graphed. This means that as you move, your body motions will be graphed before your eyes.

You will attempt to walk in such a way so as to produce a graph on the screen that looks like the ones in this lab.

POSITION MATCHING GRAPH 1

Graph 1:





Write description of how to walk to produce this graph in this space:

<u>GENERAL INSTRUCTIONS:</u>
<u>THESE APPLY TO EACH GRAPH PRESENTED ON THE FOLLOWING PAGES</u>

1. Begin by writing below the graph, a detailed description of how you must walk in order to produce the given graph. Include “towards” or “away from sensor” in EVERY written description.

2. Compare what you wrote with that of other group members and discuss together any differences of opinion. See if you can come to agreement before trying to walk the graph motion.

3. EACH group member will then try to walk in such a way as to produce a position graph that matches the one shown fairly closely. Perform the “walk” and repeat it two or three times - or more if needed to get your graph to match the one shown. If you have serious difficulties with getting “smooth” motion, you can try standing still

and moving a textbook towards and away from the sensor so as to produce the graph. This works better for some people.

2. Draw a sketch with a solid line on the blank graph beside the example to show how your best walk-graph looked.

4. BEFORE viewing the velocity graph that corresponds to the position graph, each person makes and draws a prediction – using a dashed curve – on the empty grid provided next to the position graph – of what he/she thinks the corresponding velocity graph will look like. Keep in mind that a positive velocity means walking “away” from the sensor and negative velocity means walking “towards” the sensor.

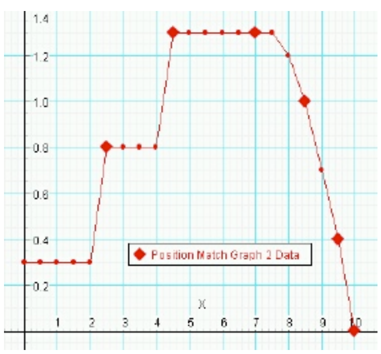
5. Compare your predicted velocity graphs with each other and discuss any differences. See if you can come to agreement – or whether you agree to disagree until the actual graph is viewed.

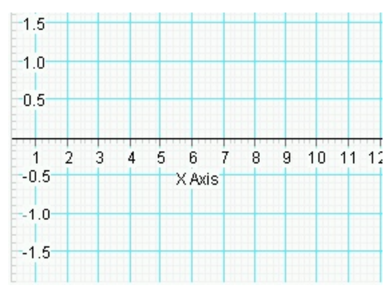
6. Sketch the actual velocity graph with a solid line on the same grid on which you drew your predicted version.

7. If there was any place on the velocity graph where the velocity was zero - changing from negative to positive or vice versa, then view what the distance graph looked like at that same moment and write down what you see.

POSITION MATCHING GRAPH 2

Graph 2:

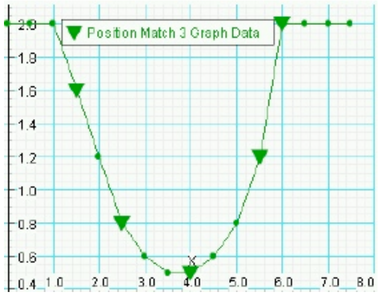


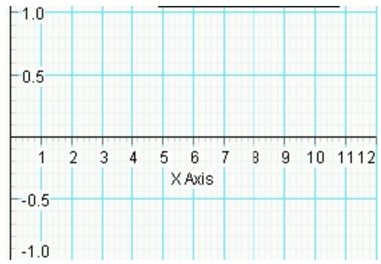


Write description of how to walk to produce this graph in this space:

POSITION MATCHING GRAPH 3

Graph 3:

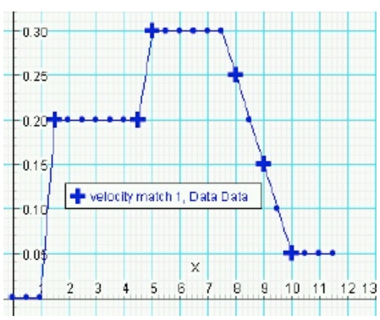


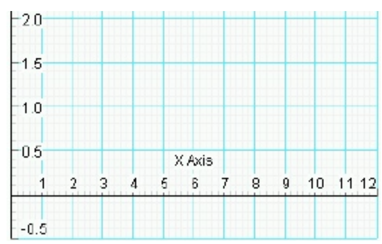


Write description of how to walk to produce this graph in this space:

VELOCITY GRAPH MATCHING:
NOTE: Begin at a distance of 0.5 meters from the sensor when doing the walks for this situation.

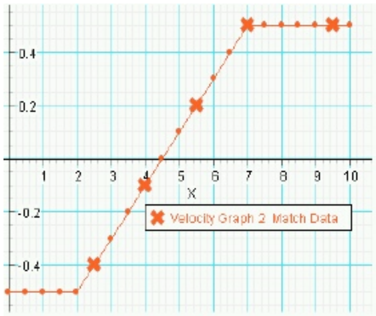
Velocity Graph 1:

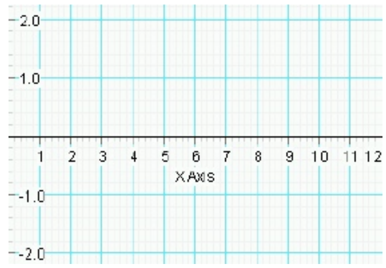




Write description of how to walk to produce this graph in this space:

VELOCITY MATCH GRAPH 2:
NOTE: Assume the INITIAL POSITION is 1.8 meters away from the sensor when making predictions and when actually doing the walk.





Write description of how to walk to produce this graph in this space:

Questions:

1. How is velocity represented on Displacement graphs?

2. How is direction represented on Displacement graphs?

3. How is direction represented on Velocity graphs

4. How is acceleration represented on Displacement graphs?

5. How is acceleration represented on Velocity graphs?

6. When is acceleration positive? When is it negative? How is this represented on a Velocity graph?