Name:_____ Block:_____ Date:_____

Motion Detector Lab

The motion detector measures the time it takes for a high frequency sound pulse to travel from the detector to an object and back. Using this round-trip time and the speed of sound, the interface can determine the distance to the object; that is, its position. It can then use the change in position to calculate the object's velocity and acceleration. All of this information can be displayed in a graph. A qualitative analysis of these graphs is a helpful way of furthering one's understanding of motion.

PROCEDURE

1. Acquire a LabQuest from the charging dock, a motion detector, a meter stick, and an object with a large, flat surface such as a textbook.

2. Make sure your motion detector is switched to the person/ball icon. Connect the motion detector to DIG 1 of the LabQuest.

3. Put the motion detector flat on the table with nothing above it. Monitor the position readings – do they make sense? Now hold your book above the motion detector – did the position change?

4. Hold the book stationary 1 meter above the motion detector and press the play button. Data collection will begin and graphs of the book's position and velocity should appear. The position graph should show a horizontal line and the velocity graph should read a constant zero.

5. Use the motion detector to generate graphs for each of the motions described on your data collection sheet. (If you ever feel like the detector is not giving you enough time to collect data, you can extend the time by doing the following: tap Sensors, then Data Collection, and then Length and manually make the length longer.) Sketch the general trend of each graph on your data collection sheet. This means that if the graph is squiggly but basically linear, draw it as a line without all the bumps.

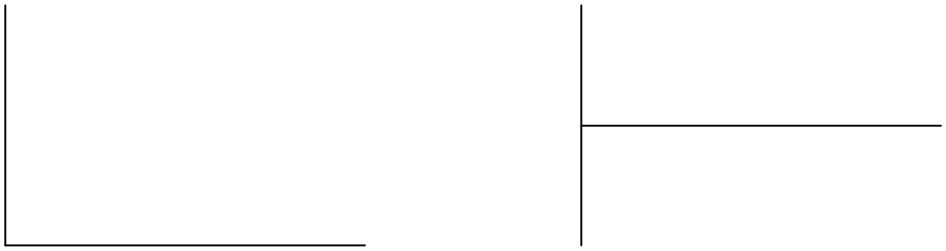
6. Now you are going to attempt to match graphs generated by the motion detector. Tap Analyze, then Motion Match, and then New Position Match. A target graph will be displayed for you to match. Draw a picture of each target graph and decide as a group how the book must be moved to match it. Press play and try to match the shape of the target. As long as the general shape matches it is not critical to have your graph overlap the target graph. When you are able to match the graph, write down a description of how the book was moved. Repeat this for two more target position graphs.

7. Finally, you are going to attempt to match velocity graphs. This is much harder to do! Stick with it until you are able to successfully mimic three graphs.

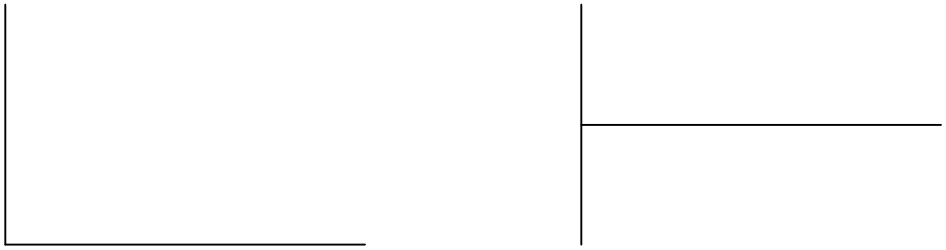
8. Return your materials to where you found them.

DATA COLLECTION

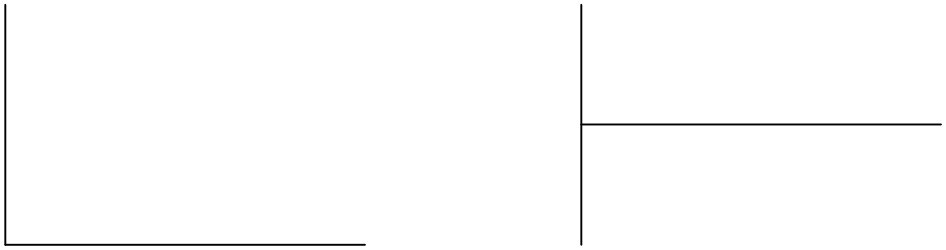
1. An object moves away from the motion detector at a steady speed.



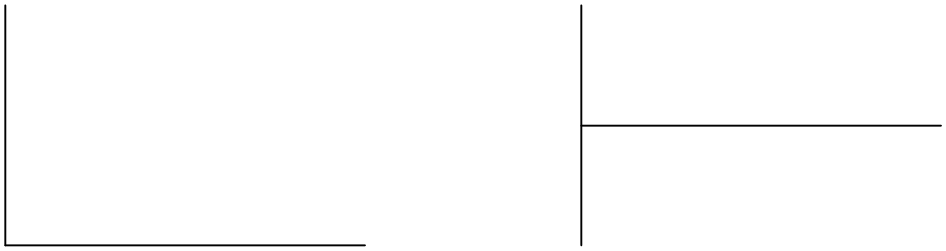
2. An object moves toward the motion detector at a steady speed.



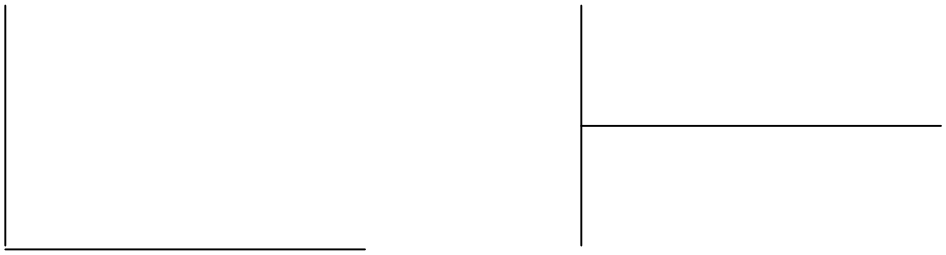
3. An object moves away from the motion detector, pauses, then comes towards it.



4. An object moves towards the motion detector, pauses, then continues towards it.



5. An object moves away from the motion detector and gets faster and faster.



GRAPH MATCHING

Position Graphs

1.  Description

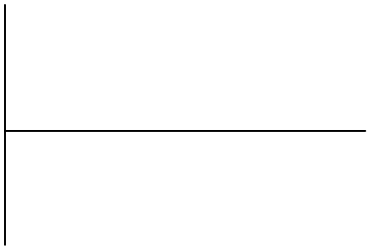
2.  Description

3.  Description

Velocity Graphs

1.  Description

2.  Description

3.  Description

ANALYSIS

1. How does the position graph differ if one is walking slowly vs. quickly?

2. How does the position graph differ if one is walking towards the motion detector vs. away it?

3. What does the position graph look like if an object is standing still?

4. What does the position graph look like if an object is moving at constant speed?

5. What does the position graph look like if an object is getting faster or slower?

6. How does the velocity graph differ if one is walking slowly vs. quickly?

7. How does the velocity graph differ if one is walking towards the motion detector vs. away from it?

8. What does the velocity graph look like if an object is standing still?

9. What does the velocity graph look like if an object is moving at constant speed?

10. What does the velocity graph look like if an object is getting faster or slower?