Name_____

Class_____

Lab Partners _____

INTRODUCTION TO MOTION

Investigation 1: Distance(Position)-Time Graphs of Your Motion

To find out

How you can measure your motion with a motion detector

How your motion looks as a distance (position)-time graph

Materials

MacMotion software (*Motion* for MS-DOS)
motion detector
Universal Laboratory Interface (ULI)
number line on floor in meters (optional)

Introduction

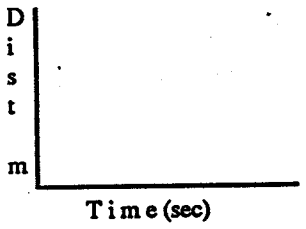
In this investigation, you will use a motion detector to plot a distance (position)-time graph of your motion. As you walk (or jump, or run), the graph on the computer screen displays how far away from the detector you are.

- *"Distance" is short for "distance from the motion detector."*
- The motion detector is the *origin* from which distances are measured.
- It detects the closest object directly in front of it (including your arms if you swing them as you walk).
- It will not correctly measure anything closer than 1/2 meter. When making your graphs don't go closer than 1/2 meter from the motion detector.

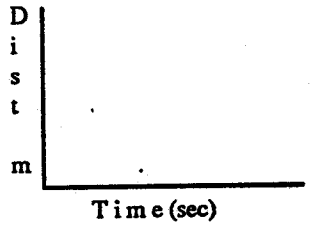
Activity 1 **Making Distance-Time Graphs**

1. Open the *MacMotion* program. To start the program, use the mouse to double click on the MacMotion icon. The graph axes should appear on the screen. (Be sure the ULI is connected to the computer and turned on, and the motion detector is plugged into port #2.)
2. When you are ready to start graphing distance, click once on the **Start** "button" in the bottom left-hand corner of the screen.
3. Adjust the distance reading. If you have a number line and you want the detector to produce readings that agree, stand at the 2-meter mark on the number line and have someone move the detector until the reading is 2 meters.
4. Make distance-time graphs for different walking speeds and directions.

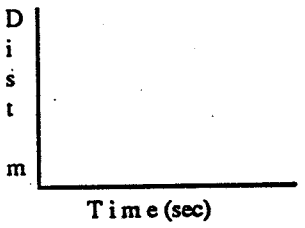
a. Start at the 1/2-meter mark and make a distance/time graph, walking away from the detector (origin) *slowly and steadily.* Sketch the graph on the right.



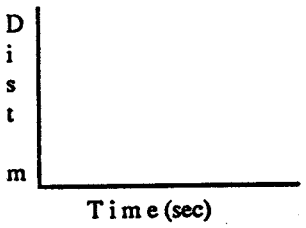
b. Make a distance/time graph, walking away from the detector (origin) *medium fast and steadily.* Sketch the graph.



c. Make a distance/time graph, walking toward the detector (origin) *slowly and steadily.* Sketch the graph.



d. Make a distance/time graph, walking toward the detector (origin) *medium fast and steadily.* Sketch the graph.



Questions

Describe the difference between the graph you made by walking away slowly and the one made by walking away more quickly. (Q1)

Describe the difference between the graph made by walking toward and the one made walking away from the motion detector. (Q2)

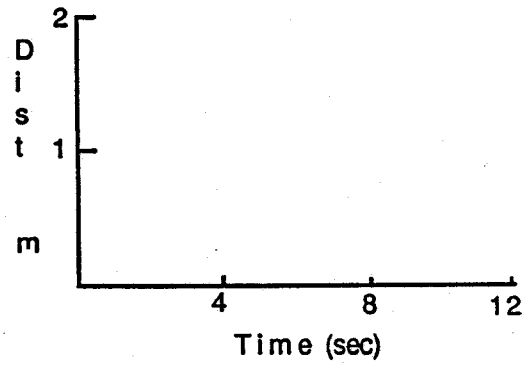
Prediction

Predict the graph produced when a person starts at the 1-meter mark, walks away from the detector slowly and steadily for 4 seconds, stops for 4 seconds, and then walks toward the detector quickly. Draw your prediction on the left axes on the next page using a dotted line.

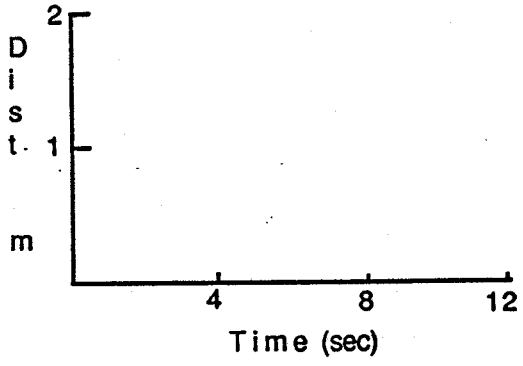
Compare predictions with the rest of your group. See if you can all agree.

Draw your group's prediction on the left hand axes using a solid line. (Do not erase your original prediction.)

PREDICTION



FINAL RESULT



5. Do the experiment. Move in the way described and graph your motion. When you are satisfied with your graph, draw your group's final result on the right axes.

Question Is your prediction the same as the final result? If not, describe how you would move to make a graph that looks like your *prediction.* (Q3)

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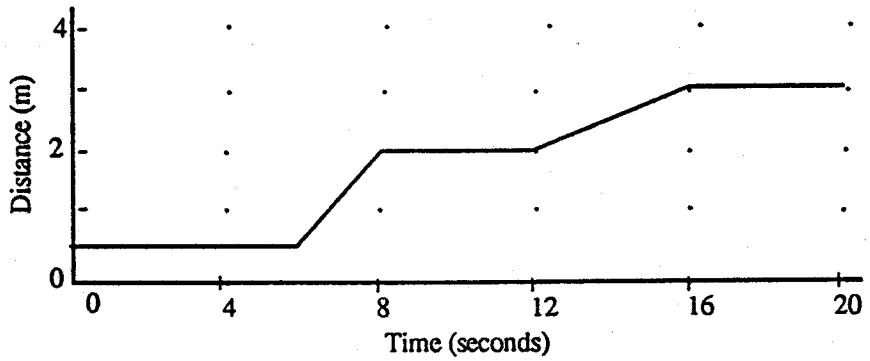
Activity 2 **Matching a Distance Graph**

In this activity you will match a distance graph shown on the computer screen.

1. Display the distance graph on the screen. Pull down the File Menu and select **Open.** Double click on **Distance Match.** The distance graph below will appear on the screen.



This graph is stored in the computer as **Data B.** New data from the motion detector are always stored as **Data A,** and can therefore be collected without erasing the **Distance Match** graph. (Clear any data remaining from previous experiments in **Data A** by selecting **Clear Data A** from the Data Menu.)

2. Move to match the distance graph shown on the computer screen. You must move to duplicate the **Distance Match** graph. You may try a number of times. Work as a team. Get the times right. Get the distances right. Each person should take a turn.

Question What was the difference in the way you moved to produce the two differently sloped parts of the graph you just matched? (Q4)

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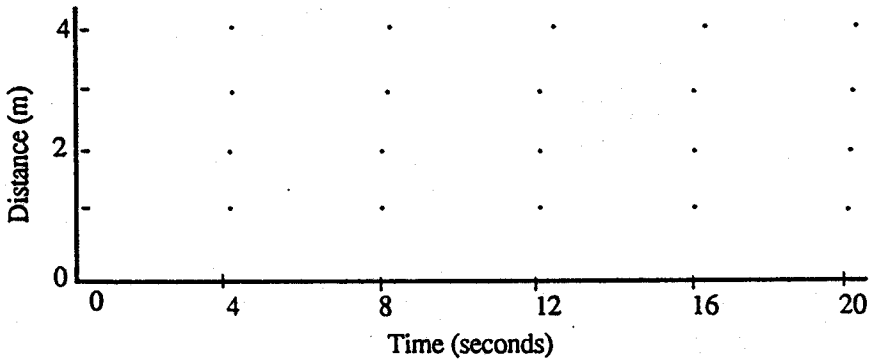
Activity 3 Other Distance-Time Graphs

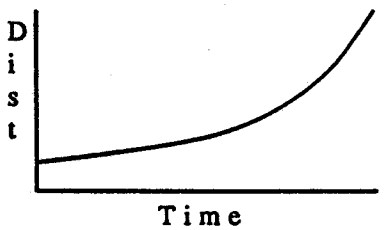
It will be less confusing if you remove the **Distance Match** graph from the screen before doing the exercises below. To do this, select **Clear Data B** from the Data Menu.

1. Make up your own distance(postition)-time graph. Use straight lines, no curves. Sketch the graph below with a dashed line. Now see how well someone in your group can duplicate this graph on the screen.

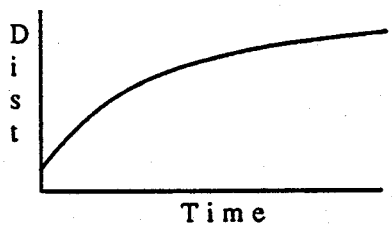


Draw the best attempt by a group member to match your distance-time graph on the same axes. Use a solid line.

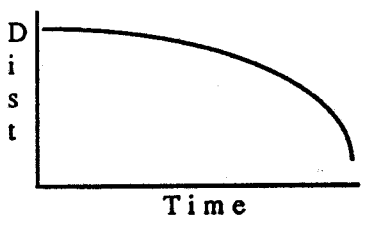
2. Can you make a curved distance-time graph? Try to make each of the graphs shown below.



Graph 1



Graph 2



Graph 3

Describe how you must move to produce a distance-time graph with each of the shapes shown.

Graph 1 answer:_____

Graph 2 answer:_____

Graph 3 answer:_____