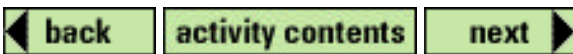


ACTIVITY CONTENTS:

Displaying Velocity

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- [Thinking About the Question](#)
- [Materials](#)
- [Safety](#)
- [Investigation I: Moving at the same speed...](#)
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Displaying Velocity Introduction

Discovery Question:

When am I changing velocity or accelerating?

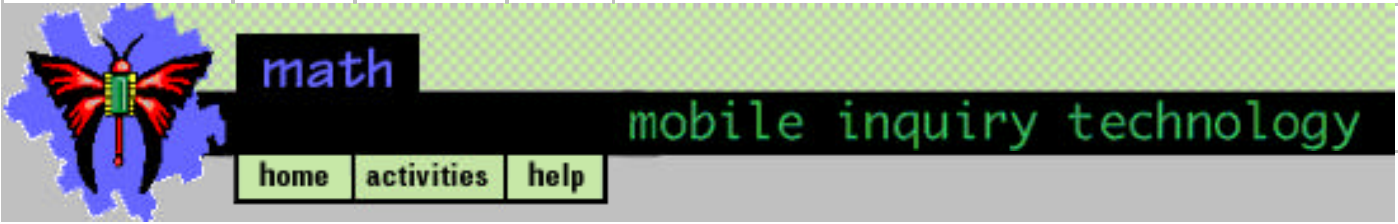


This activity will allow you to see and analyze velocity in a graphical form.

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Thinking About the Question

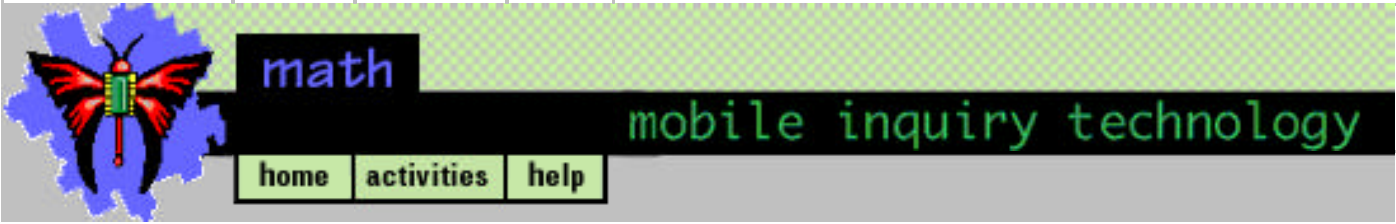
When am I changing velocity or accelerating?

Some things go fast like a car driving down the highway or a jet flying across the country. The earth goes really fast around the sun. For example, a train traveling to from Boston to San Francisco travels at so many kilometers in an hour. If it is not an express train, it stops at several cities along the way. A graph of this motion tells you how fast and in what direction the train is moving as it crosses the country.

Think about other objects that show you a change in velocity. Be prepared to share your list with the class.

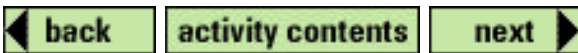
A graph of distance versus time gives certain information visually about the motion of an object. It shows if an object is speeding up or slowing down. It also tells you what direction an object is moving. The main emphasis in this activity is to relate distance versus time graphs to actual movements by using a sonar ranger.

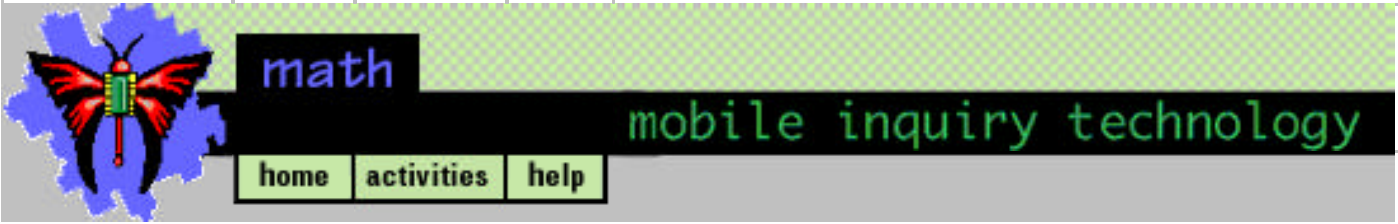




Displaying Velocity Materials

- sonar ranger (ultrasonic motion detector)
- stool
- masking tape
- meter stick
- pen
- long serial cord (3-5 meters)
- CCSR (sonar ranger) software





Displaying Velocity Safety

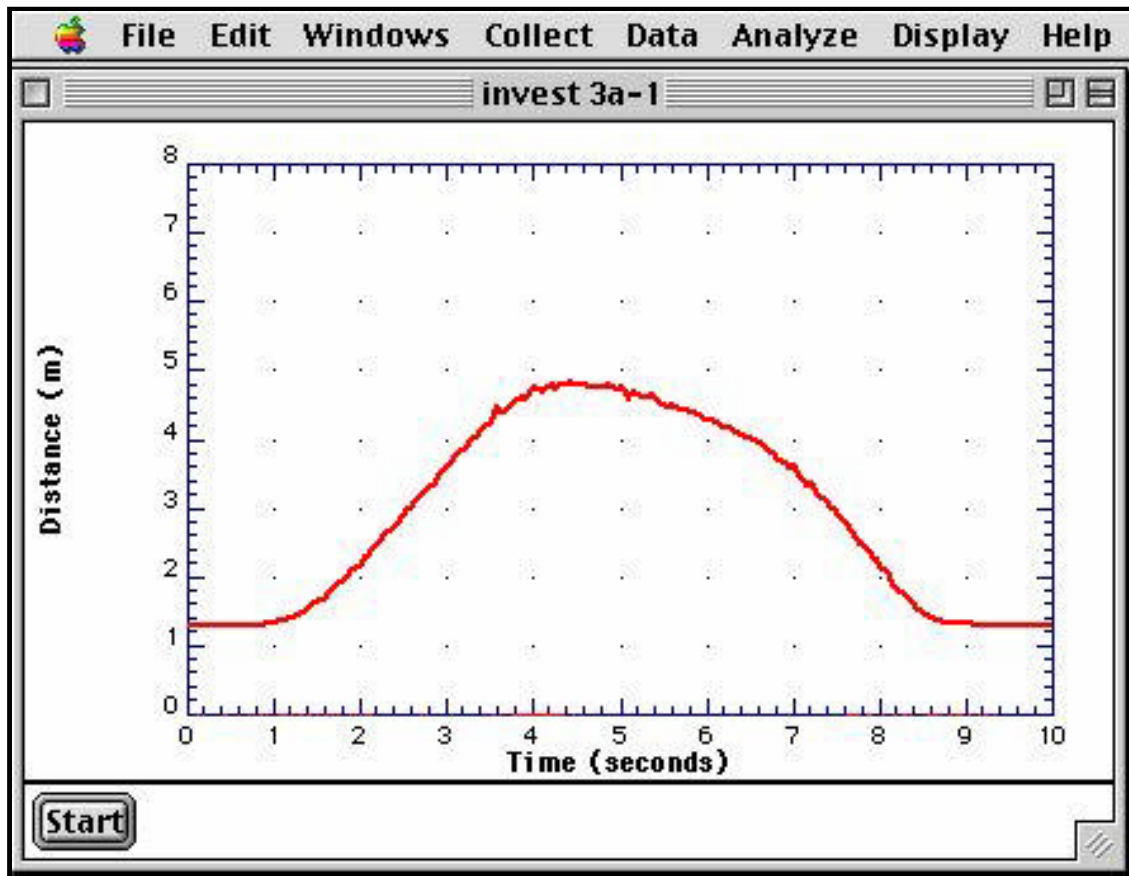
If more than one sonar ranger (ultrasonic motion detector) is used in a classroom, separate each probe by at least two meters to prevent measurement interference. To prevent tripping, make sure the area that you are walking is clear.



Displaying Velocity Investigation I

Moving at the same speed...

1. Observe, analyze, and discuss with your partner(s) the following distance-time graph for motion. Draw the graph on paper and explain the motion on the graph.

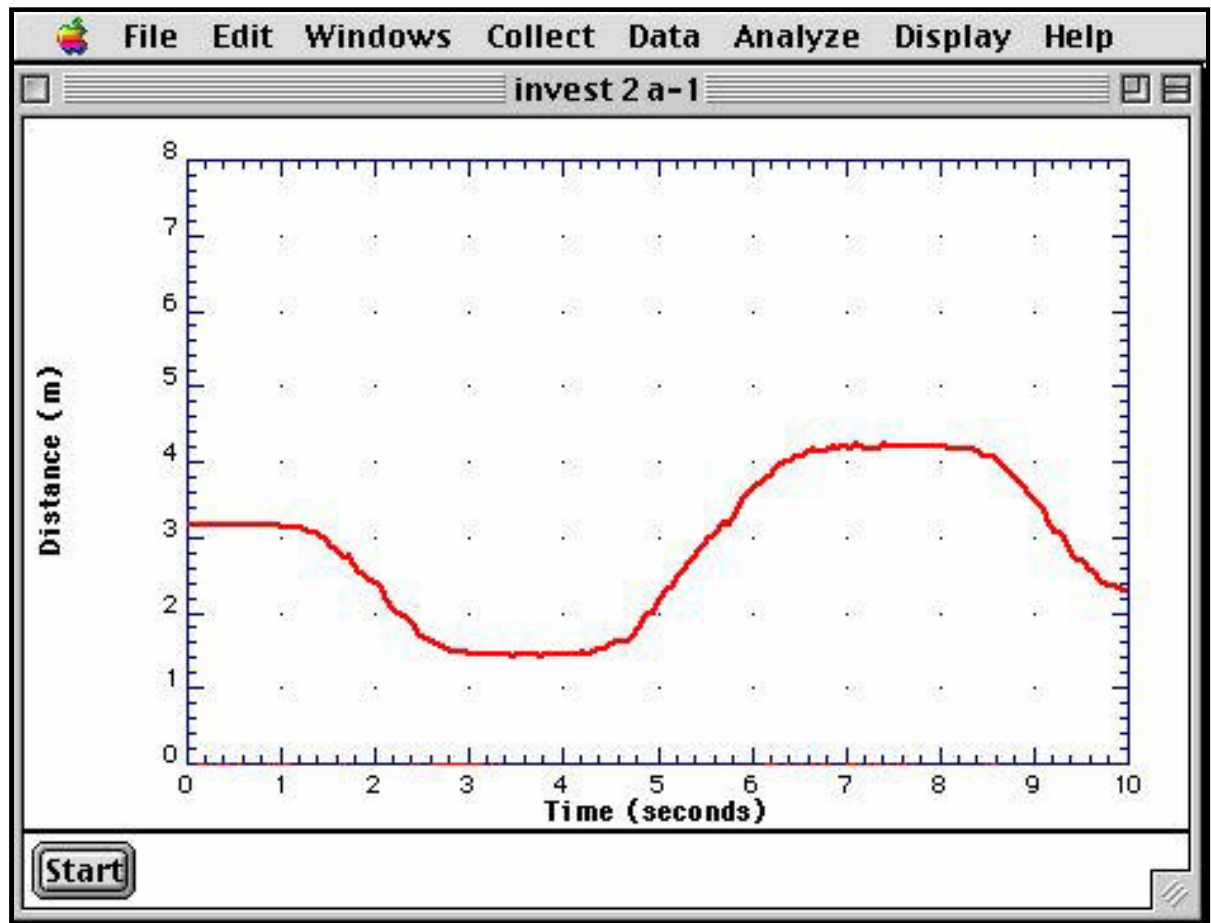


2. Refer to [Technical Hints](#) to see how to set up the walking track.
3. When you are ready, refer to [Technical Hints](#) to open and run CCSR (sonar ranger) software. Walk the motion while the CCSR program is activated.
4. Repeat the process until a similar graph to that shown above is achieved. Print out your best trial. Refer to [Technical Hints](#) to see how to print from the CCSR program.
5. Answer Questions 1 and 2 in "Analysis".

Displaying Velocity Investigation II

Am I coming or going?

1. Observe, analyze, and discuss with your partner(s) the following distance-time graph for motion. Draw the graph on paper and explain the motion on the graph.

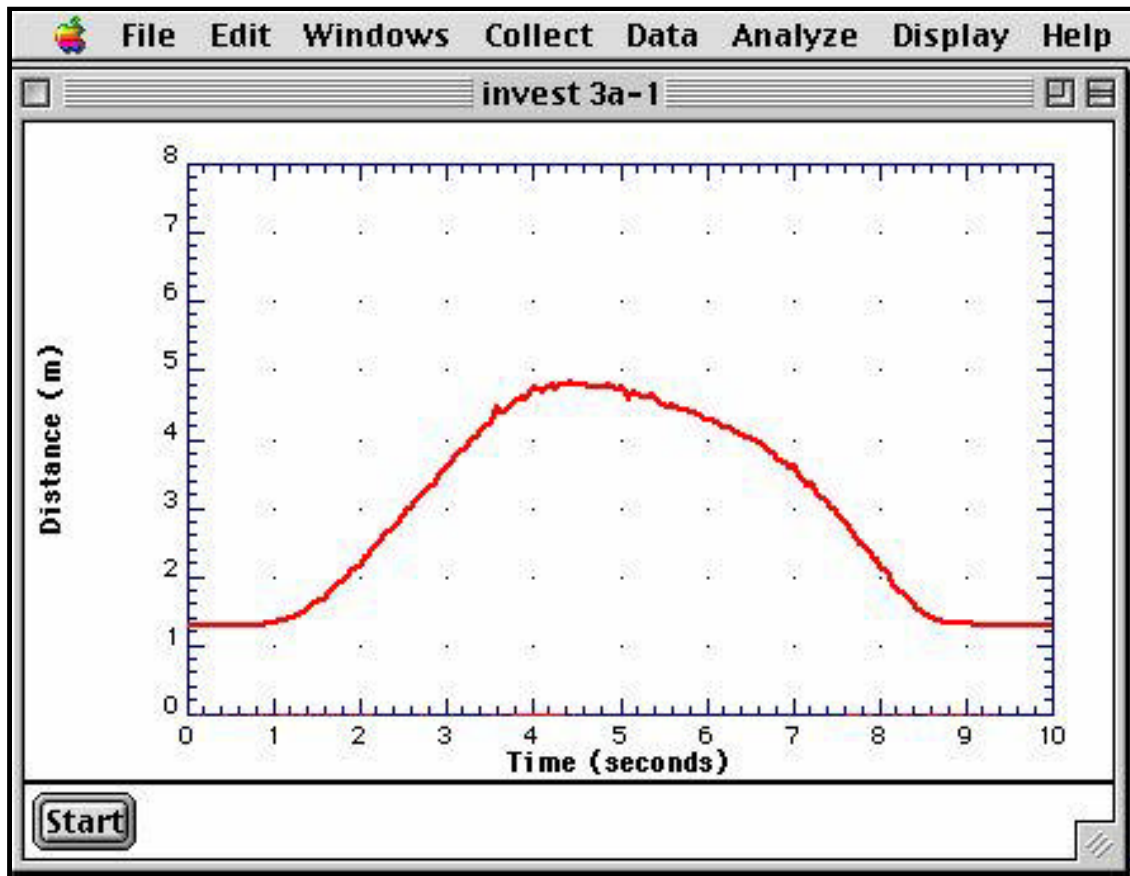


2. Refer to [Technical Hints](#) to see how to set up the walking track.
3. When you are ready, refer to [Technical Hints](#) to open and run CCSR (sonar ranger) software. Walk the motion while the CCSR program is activated.
4. Repeat the process until a similar graph to that shown above is achieved. Print out your best trial. Refer to [Technical Hints](#) to see how to print from the CCSR program.
5. Answer Questions 3 and 4 in "Analysis".

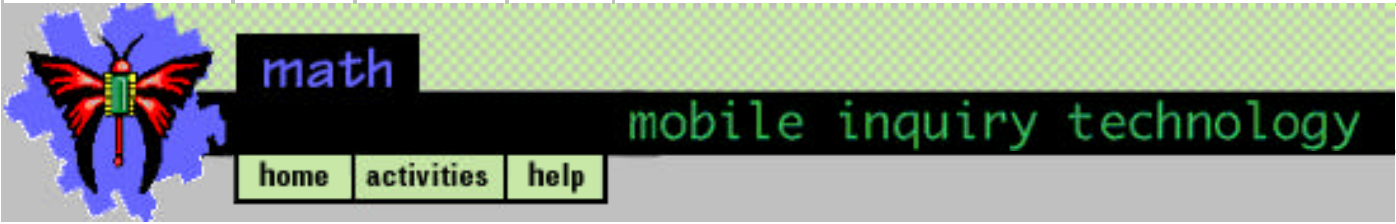
Displaying Velocity Investigation III

Speeding up!

1. Observe, analyze, and discuss with your partner(s) the following distance-time graph for motion. Draw the graph on paper and explain the motion on the graph.

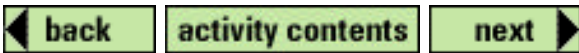


2. Refer to [Technical Hints](#) to see how to set up the walking track.
3. When you are ready, refer to [Technical Hints](#) to open and run CCSR (sonar ranger) software. Walk the motion while the CCSR program is activated.
4. Repeat the process until a similar graph to that shown above is achieved. Print out your best trial. Refer to [Technical Hints](#) to see how to print from the CCSR program.
5. Answer Questions 5, 6, and 7 in "Analysis".



Displaying Velocity Technical Hints

- [Setting up the walking track](#)
- [Opening and running CCSR \(sonar ranger\) software](#)
- [Printing the graph](#)

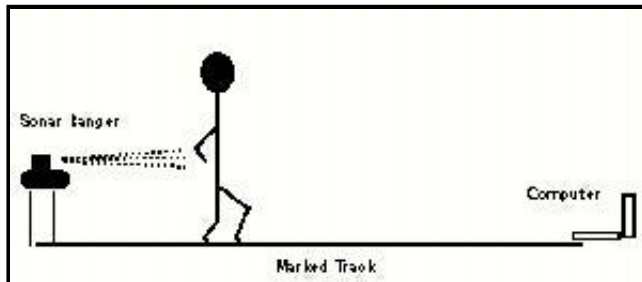




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Displaying Velocity Technical Hints

To set up the walking track:

1. Find an open distance around 1 meter wide and 10 to 15 meters long (possibly in a hallway).
2. Using masking tape, mark off the straight line distance with half meter divisions.
3. Set the computer at one end of the masking tape pointed in the direction that you will be walking. You should be able to view the screen while you are walking. Using the long serial cord, place the sonar ranger on a stool at the other end of the marked tape. Make sure the sonar ranger is aligned with the tape.



4. Before you start moving down the track with your **back** facing the probe, a group member will need to trigger the probe and say "GO" before you start moving along the line.

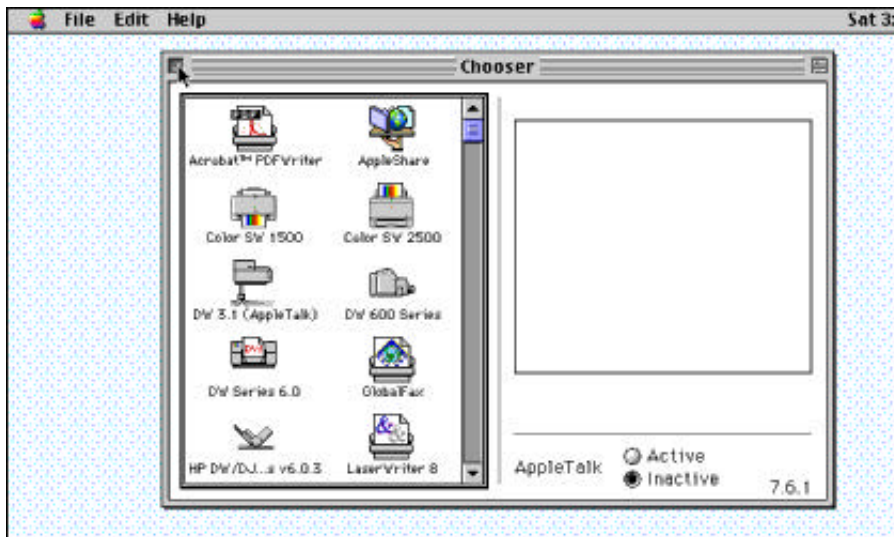
CLOSE



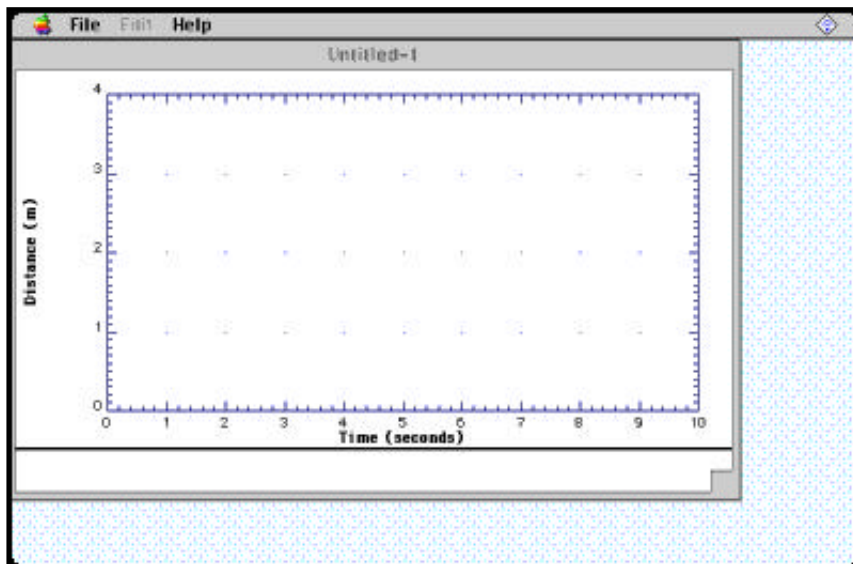
mobile inquiry technology Displaying Velocity Technical Hints

To open and run CCSR (sonar ranger) software:

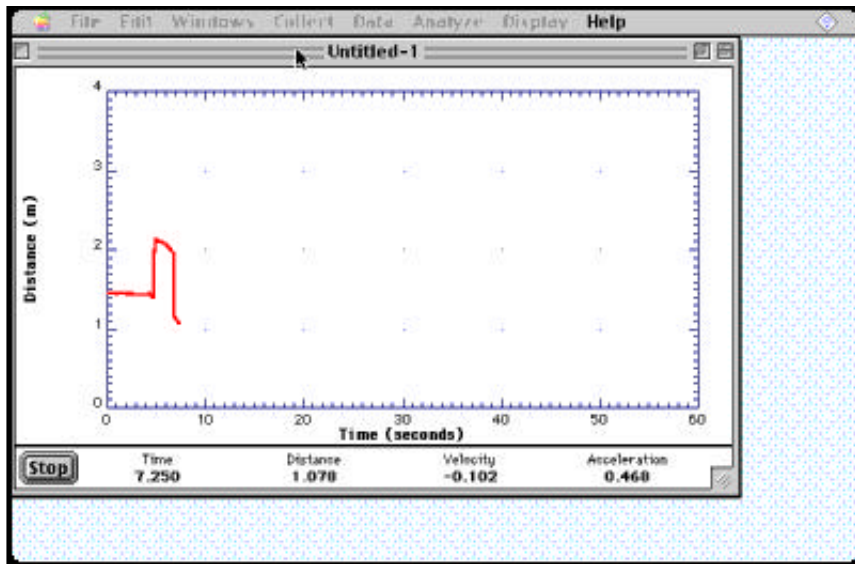
1. Make sure that AppleTalk is turned **off** by selecting the Chooser from the Control Panel from below the Apple menu.



2. Start CCSR by double clicking on its icon.



3. After the CCSR opens, open the Display menu and click on Set all Min, Max. Change 10 seconds to 60 seconds. You may not use all the time, but it will be available if needed.
4. Open Collect menu, and click on Start (either under the Collect menu or on the sonar detector).



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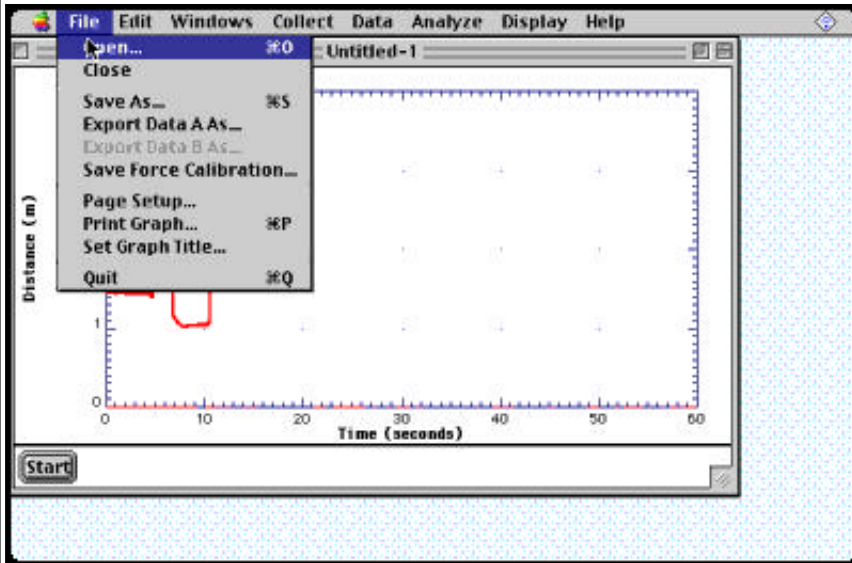


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Displaying Velocity Technical Hints

To print the graph:

1. Once your graph is finished, select Save As under File menu and name your graph. Say yes to saving calibration.
2. Open File menu, and click on Print Graph.



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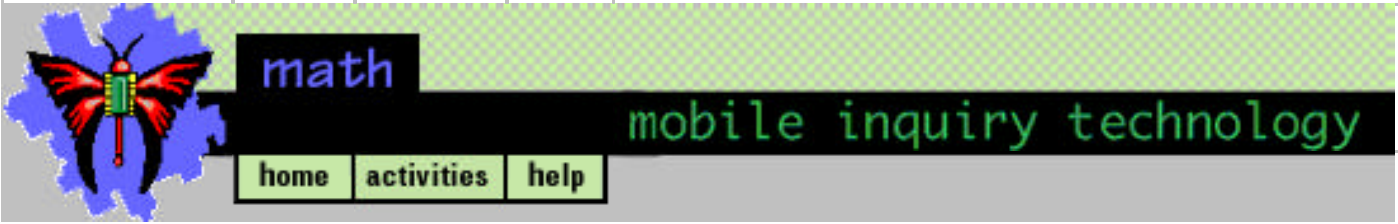
Displaying Velocity Analysis

1. Work with your partner(s) to explain in a paragraph the motion needed to reproduce the graph that represents movement at the same speed. Present your description to the class.
2. What would the graph look like if you were moving at a faster but steady speed?
3. Work with your partner(s) to explain in a paragraph on paper the motion needed to reproduce the graph that represents movement at the same speed but in opposite. Present your description to the class.
4. Are you accelerating if you change directions?
5. Work with your partner(s) to explain in a paragraph on paper the motion needed to reproduce the graph that represents movement at a changing speed. Present your description to the class.
6. Are you accelerating if you are increasing or decreasing speed?
7. Work within your groups to label the sonar ranger print outs for:
 - Where were you standing still "S"?
 - Where were you moving backward "B"?
 - Where were you moving forward "F"?
 - Where were you accelerating "A"?

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Displaying Velocity Further Investigation

- Draw your own distance versus time graph showing accelerated motion. Challenge another student to walk off your distance versus time graph while using the sonar ranger.
- Draw a distance versus time graph that represents the motion of a ball dropped on the floor. Test your prediction with the sonar ranger.

