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**Walking Off Distances**

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## Walking Off Distances Introduction

**Discovery Question:** What type of motions do I make when I walk?

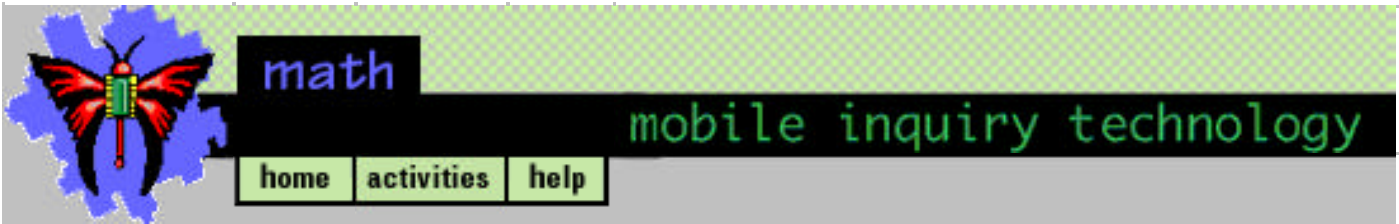


This activity will help you investigate simple, straight-line motions by using a sonar ranger.

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## Thinking About the Question

### What type of motions do I make when I walk?

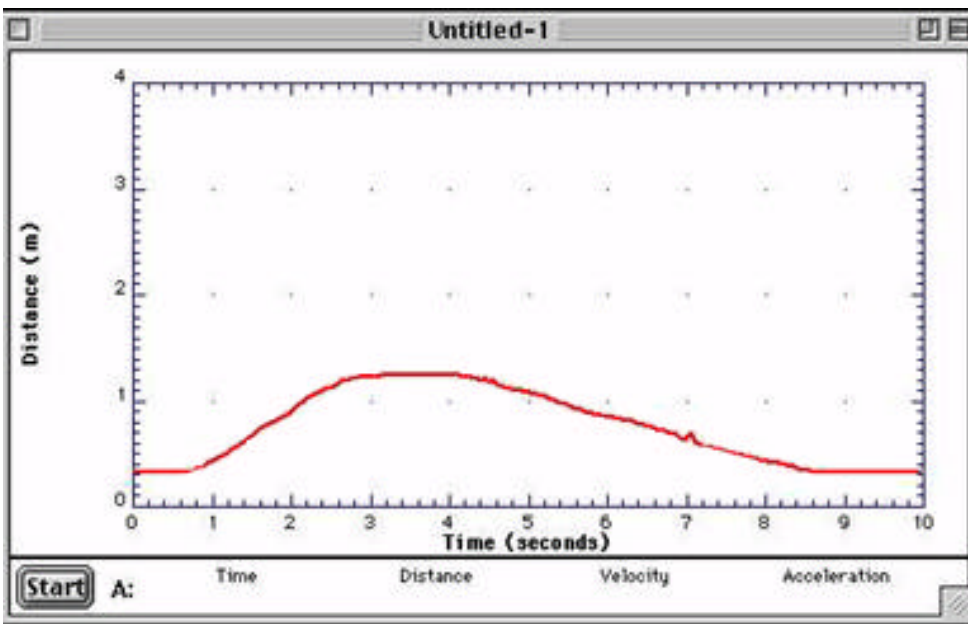
Can you tell exactly how far someone is away from you without using a meter stick or tape measure? How would you do this? If someone is running toward you or away from you, how could you find out how far away he or she is at any moment? Discuss these questions with your group and write down some of your ideas to share with the class.

Long distance runners vary their speed when they run a race. How could you determine how fast they were going at different points in the race? Discuss this question with your group and write down some of your ideas to share with the class.

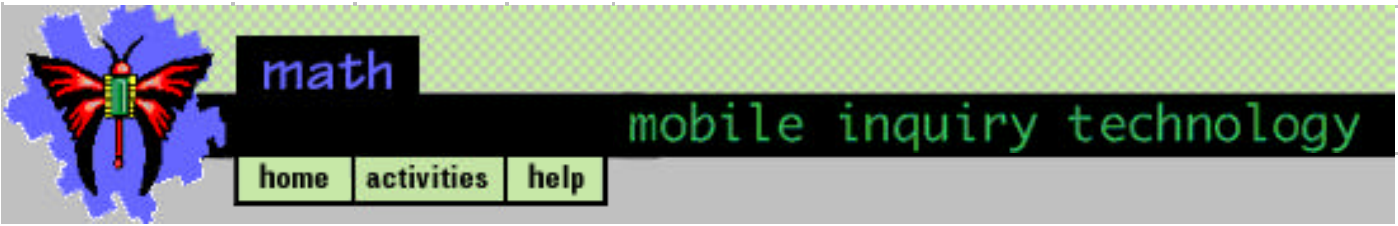
You've had some experience using a sonar ranger to represent different kinds of motion one kind of graph that shows changes over time, a distance-time graph. You can also use a sonar ranger to collect data about people moving.

Remember that a sonar ranger uses a motion detector that sends out high frequency sound waves to a target object and waits for it to come back. The sonar ranger measures the time needed for the wave to leave and return to the detector. The software determines and displays the distance the pulse covered based on the speed of sound.

The following motion graph of a person walking was made with a sonar ranger. Discuss the motions shown with your group. When does the person move forward? How close to the sonar ranger did the student start? Did the student change speeds?

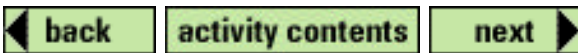


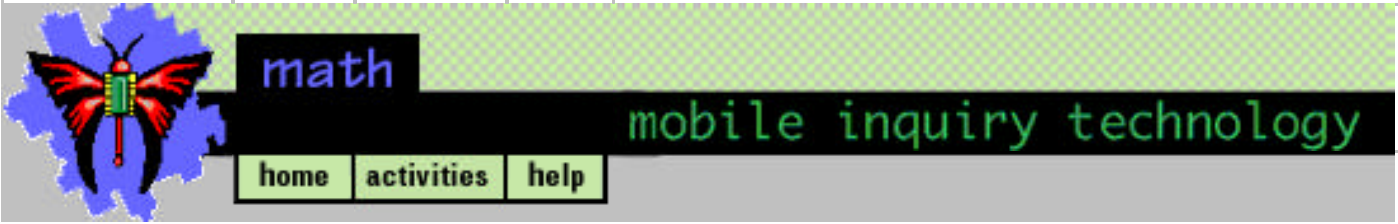
Try it out for yourself with the sonar ranger! Go to the "Investigation" to find out how.



## Walking Off Distances Materials

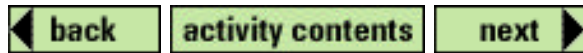
- sonar ranger
- stool
- masking tape
- meter stick
- pen
- long serial cord (3-5 meters)
- CCSR (sonar ranger) software

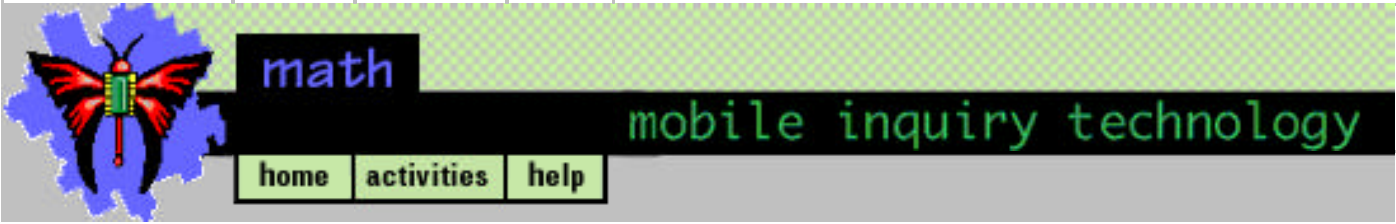




## **Walking Off Distances Safety**

If more than one sonar ranger 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.





## Walking Off Distances Investigation I

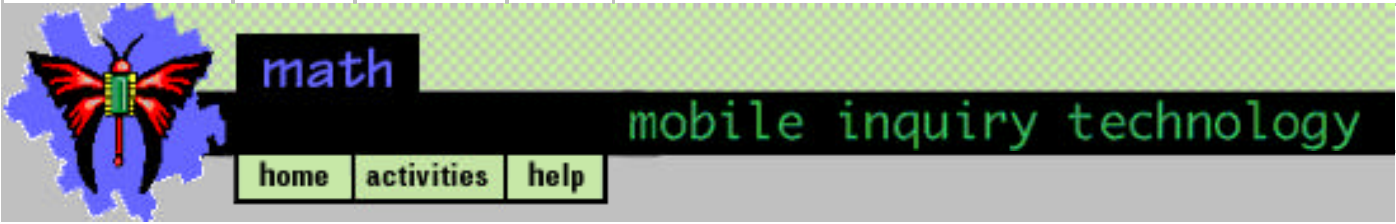
### Messing around

Refer to [Technical Hints](#) to see how to set up the walking track. Make sure your back is to the sonar ranger as you move along a straight path marked on the floor.

Investigate several different motions on your track with the sonar ranger displaying real time graphs. Refer to [Technical Hints](#) on how to run the sonar ranger software.

Discuss the results with your partners.





## Walking Off Distances Investigation II

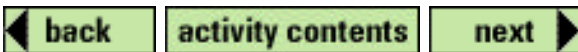
### Predicting

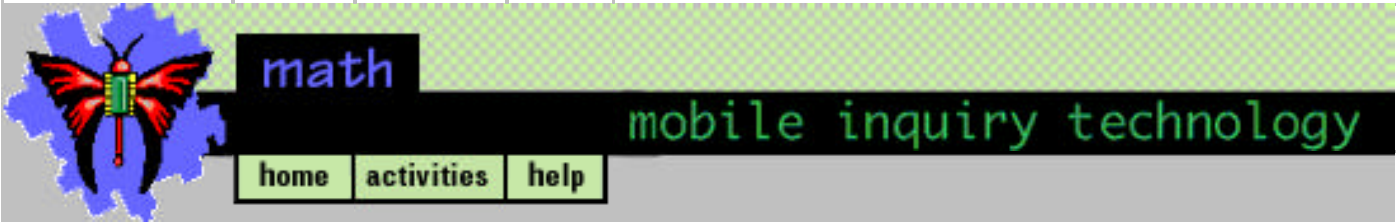
With your partner use the draw program on your computer to create a distance-time graph that shows your prediction for a graph that represents each of the following motions. Refer to Technical Hints on how to use the draw program.

1. Draw a graph that shows someone walking toward the CCSR and back. Why did you draw the graph this way?
2. Draw a graph that shows someone walking quickly toward the sonar ranger for the first half of the track and then slowly for the second half. Why did you draw this way?
3. Draw a graph that shows someone walking toward the CCSR for 20 seconds, stopping for 20 seconds, and continuing toward the CCSR for another 20 seconds. Why did you draw this way?
4. Draw a graph that shows someone starting to walk toward the CCSR halfway down the track instead of at the beginning. Why did you draw this way?

On your own, answer questions 1-4 in the Analysis section.

When you are done discuss your answers with your partner. Be ready to share your answers to the predictions and the answers to the questions with the class.





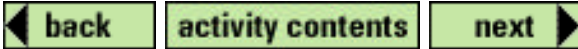
## Walking Off Distances Investigation III

### Testing your predictions

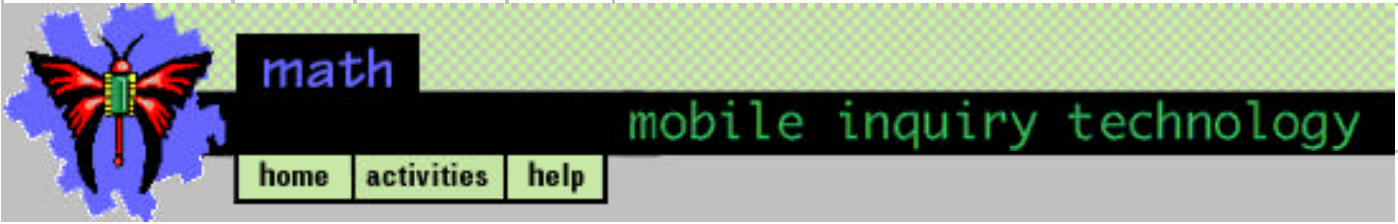
After you have discussed your predictions with your class, use the sonar ranger to display a distance-time graph of your motion. Refer to Technical Hints on how to run the sonar ranger software.

Save and print each real time graph after the trial. Refer to [Technical Hints](#) to see how to save and print graphs.

Discuss the results with your partners.







## **Walking Off Distances Technical Hints**

- [Setting up the walking track](#)
- [Opening CCSR \(sonar ranger\) software](#)
- [Running CCSR \(sonar ranger\) software](#)
- [Printing the graph](#)
- [Opening draw program](#)
- [Creating a drawing](#)
- [Creating a prediction](#)
- [Writing on a draw program](#)



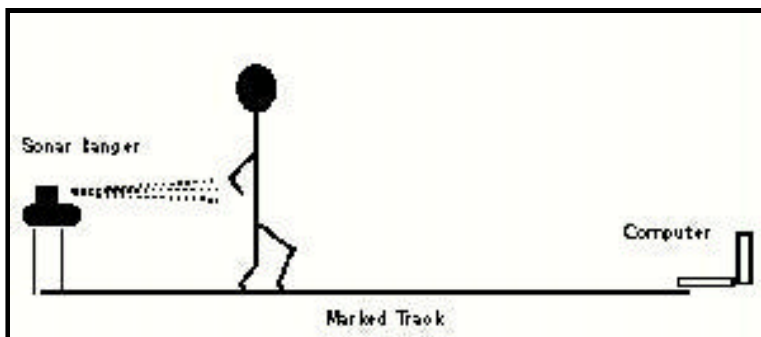


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### Walking Off Distances Technical Hints

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

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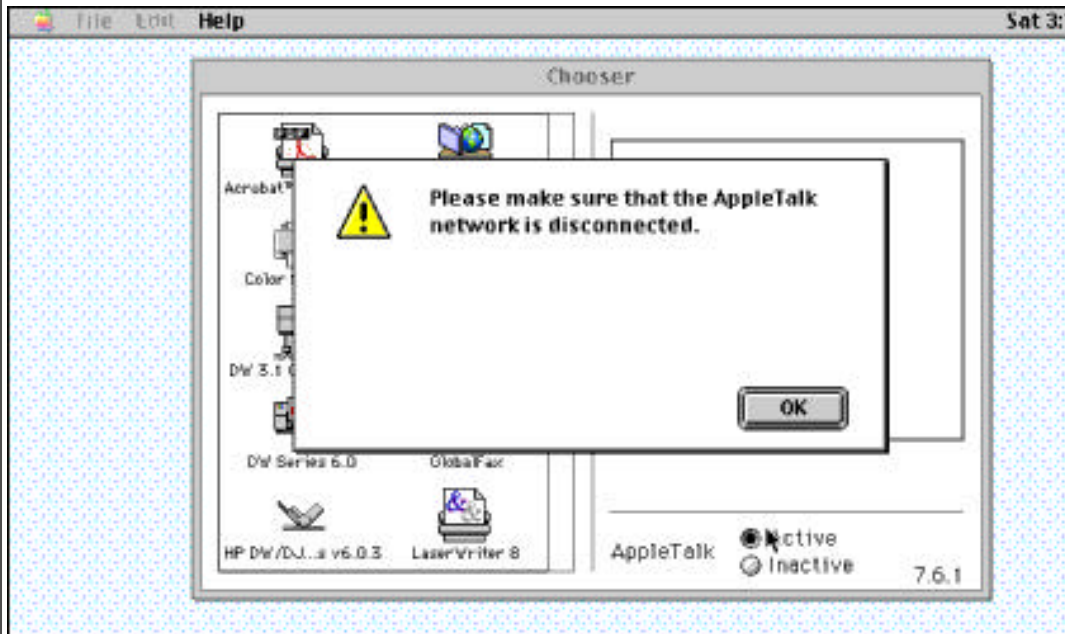


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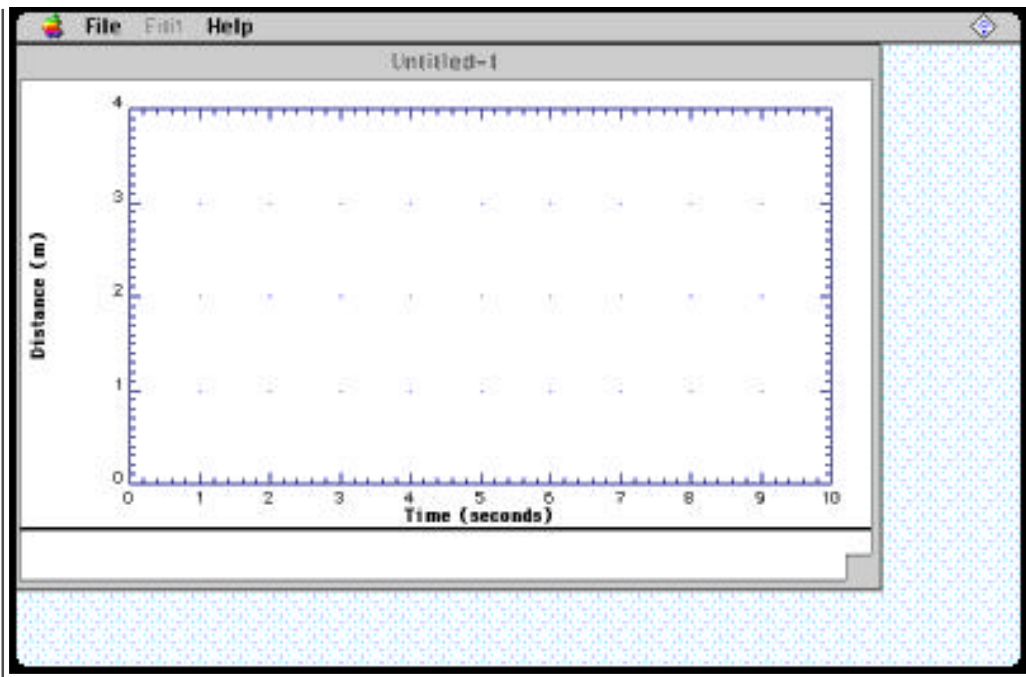
### Walking Off Distances Technical Hints

#### To open CCSR (sonar ranger) software:

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



Start CCSR by double clicking on its icon.



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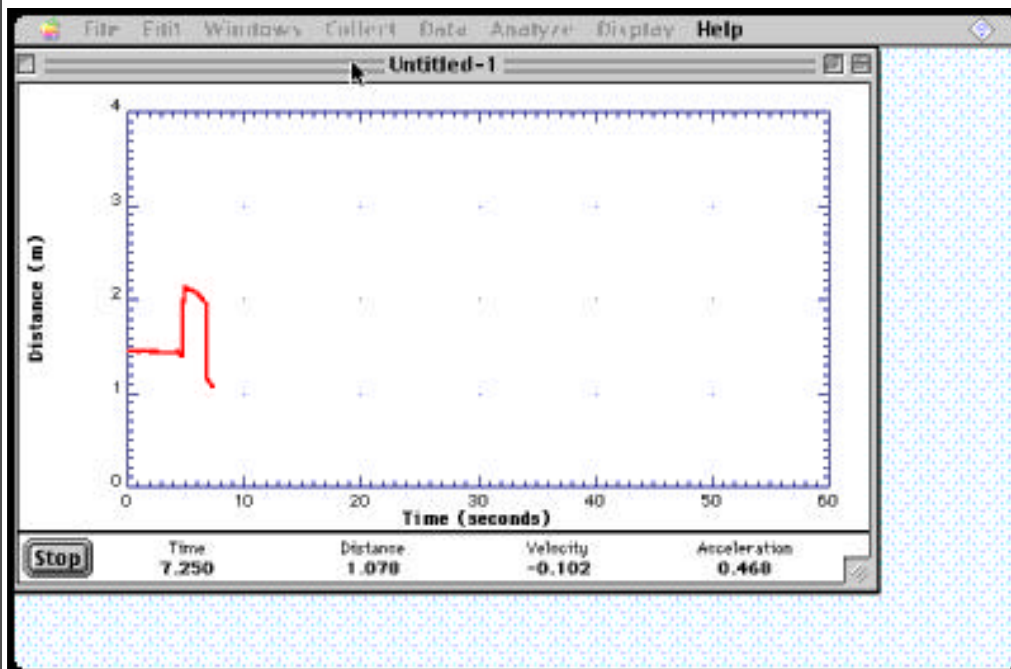


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### Walking Off Distances Technical Hints

#### To run CCSR (sonar ranger) software:

1. 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.
2. Open Collect menu, and click on Start (either under the Collect menu or on the sonar detector).



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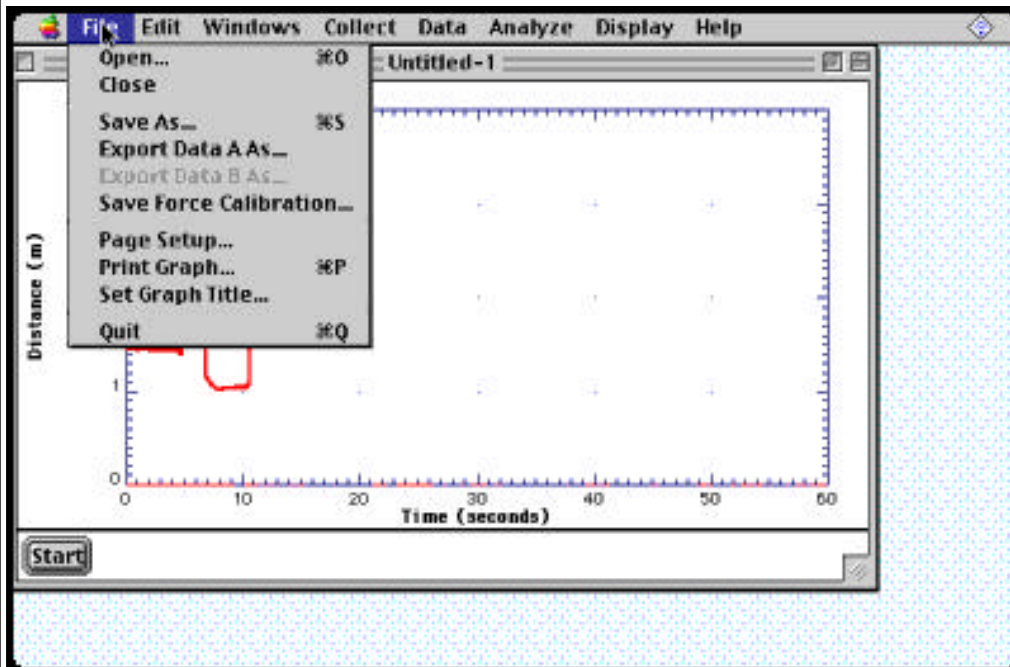


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### Walking Off Distances Technical Hints

#### 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.



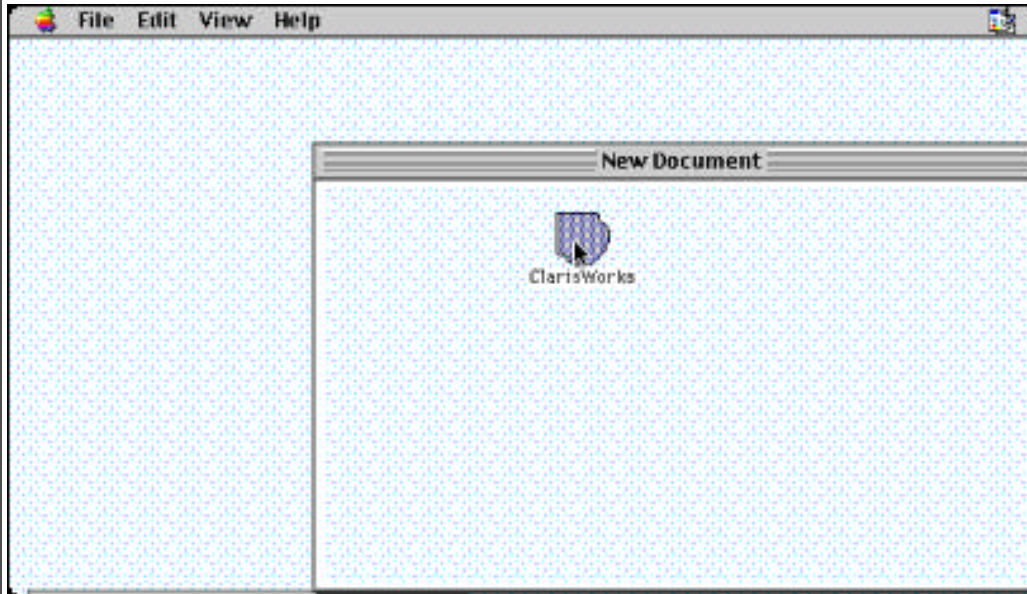
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**Walking Off Distances Technical Hints**

**To open a draw program:**

Open the ClarisWorks draw program by selecting it from the opening menu.



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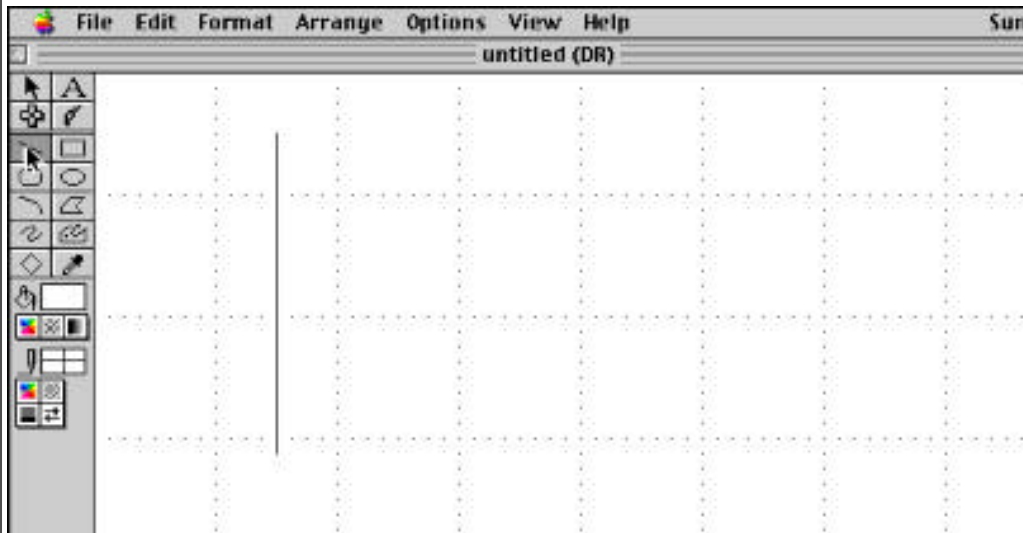


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### Walking Off Distances Technical Hints

#### To create a drawing:

1. Select the Line tool from the left menu (Tool panel) by clicking on the button.
2. Draw a pair of distance-time axis. Select the A (Text tool) to label the axes. You must click off of each item after drawing and reselect the tool you need before drawing the next item.





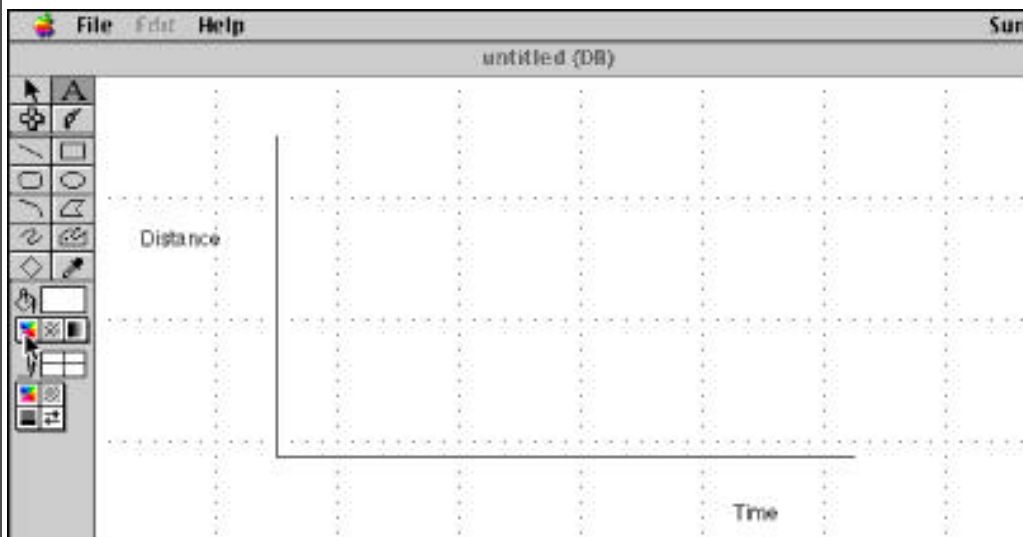


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### Walking Off Distances Technical Hints

#### To draw your prediction:

1. Select the Line tool.
2. From the Pen color pallete select a red color. This will make the cross bars red on the screen.
3. Draw your prediction inside the axes.



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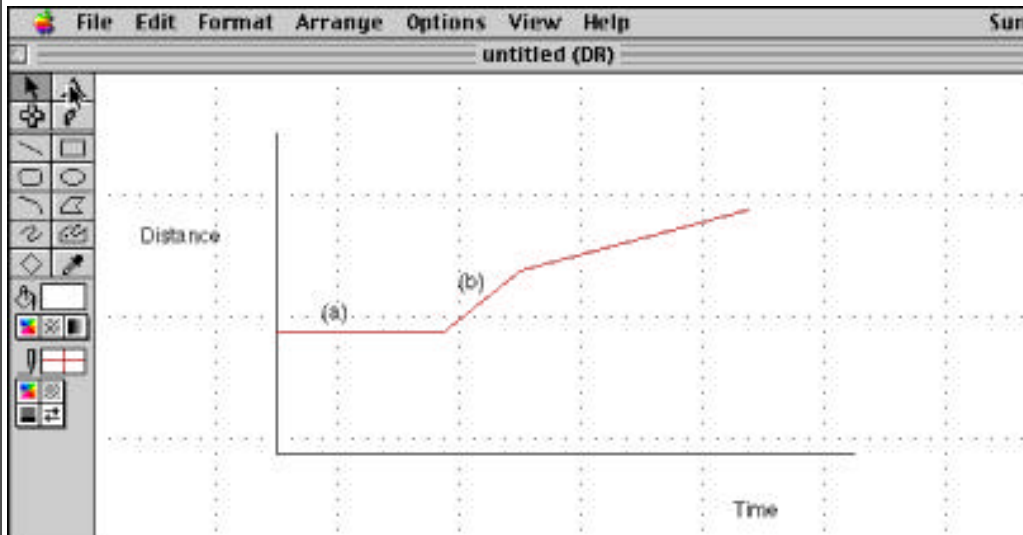


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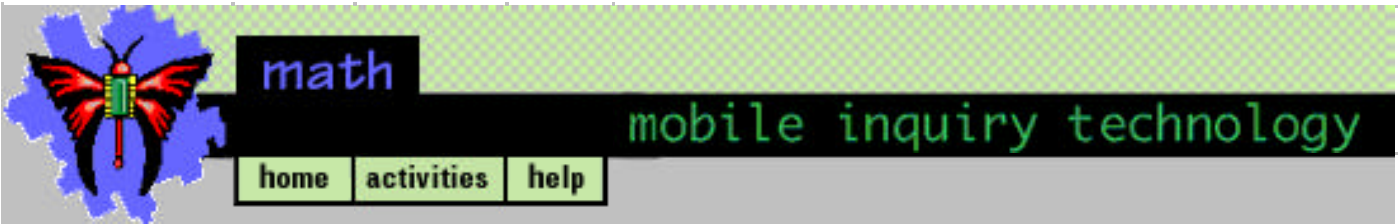
### Walking Off Distances Technical Hints

#### To write on your drawing:

1. Use the A (Text tool) to write your description of the movement.
2. Save and name your prediction under the File menu.



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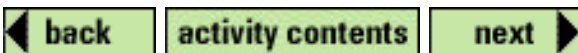
## Walking Off Distances Analysis

Using your predictions, answer the following questions on paper:

1. On each of your predictions, label clearly the location on each graph that:
  - shows forward ("F") motion
  - shows backward ("B") motion
  - shows no ("N") movement
2. On each prediction label the starting location.
3. On each prediction label when you would change directions.
4. On your second prediction label the part that shows when you would be walking quickly and when you would be walking slowly.

Using the tests of your predictions, answer the following questions:

5. On each print out of your sonar ranger graphs, describe clearly the location on each graph that:
  - shows forward ("F") motion
  - shows backward ("B") motion
  - shows no ("N") movement
6. On each sonar ranger graph label the starting location.
7. On each print out of your sonar ranger graphs, mark when you changed directions.
8. On your second sonar ranger graph label the part that shows when you were walking quickly and when you were walking slowly.
9. Compare your predictions with the sonar ranger graph for each trial. On the same graphs that you made your predictions redraw the graph in a different color if differences exist between your prediction graph and the real time graph.
10. Explain how your thinking has changed about how to draw each graph now that you have had a chance to try each motion.
11. Which was the hardest to reproduce? Why?





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## **Walking Off Distances Further Investigation**

Work with your team to create a motion graph of your own using the CCSR software and the sonar ranger. This could include change in direction, starting position, and speed. Challenge the other group to reproduce your wave with the sonar ranger. Write a story in words to illustrate what your graph represents.

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