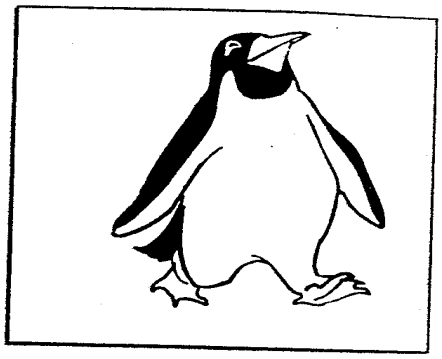
COMING AND GOING

INTRODUCTION TO THE EXPERIMENT



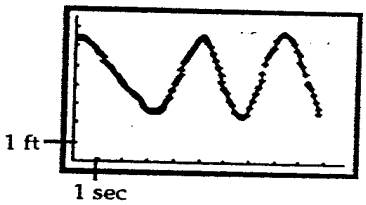
Has anybody ever told you that you are so confused that you don't know whether you are coming or going? In this experiment, you'll be investigating exactly how fast and how far someone is coming and going.

The experiment consists of recording a student walking back and forth, several times, in front of the motion detector.

BEFORE YOU START

Looking at Sample Data

The data you will collect may look like the points show on the screen at the right.



Interpreting the Sample Data

Refer to the sample graph above. If you want to generate the graph on your calculator, you will need to download and run the program COGODATA.

1. At what time did the first change of direction occur?
2. At the 6-second mark, what direction was the walker going?
3. At the first turn, how close was the walker to the motion detector?
4. Do the results in the sample data graph indicate that the walker increased his speed after the first turn? Give a reason for your answer.

COLLECTING YOUR DATA

What You Need

Electronic data-collection device, motion detector, yardstick or measuring tape, calculator with the program COMEGO, link cable.

What You Do

Step 1 Be sure to measure any distances that might affect the experiment results.

Step 2 Connect the motion detector to the sonic port on the electronic data collection device.

Step 3 Connect the calculator to the electronic data-collection device; turn on the electronic data-collection device; turn on the calculator.

Step 4 Place the motion detector so that it will measure the distance to a student walking in a straight line toward it and away from it. Be sure to make a wide, clear path so that the motion detector does not record any stray objects.

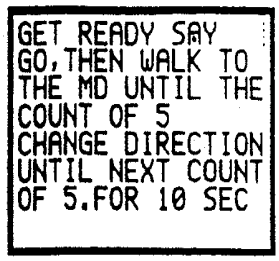
[Source: Transforming Functions to Fit Data, Key Curriculum Press, 1150 65th Street, Emeryville, CA 94608, 1-800-995-MATH; http://www.keypress.com/catalog/products/supplementals/Prod_TransFunc.html]

Step 5 Choose a "Walker" and a "Counter" for your group.

Step 6 The Walker will start anywhere between 5 and 15 ft away from the motion detector.

Step 7 The Counter's job is to count to 5 at a steady pace. At the count of "5", the Walker changes direction and the Counter starts over again.

Step 8 Run the program COMEGO. The program is set to record data every 0.1 second for 10 seconds. The screen should appear like the one at the right.

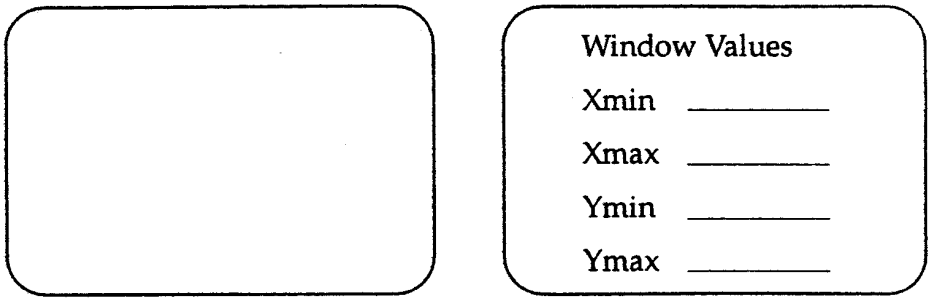


Step 9 The Walker starts walking toward the motion detector, turns and walks away, turns again and walks towards it, turns again and walks away.

When the experiment is finished, and your group is satisfied with the data, use the link cable to send lists L1 and L2, as well as Xmax and Ymax, to all the calculators in your group. To ensure that the screen on each calculator will display the same graph, set Xmin = 0 and Ymin = 0. Graph (L1, L2) using a scatter plot.

INTERPRETING YOUR FINDINGS

1. Copy the graph on the calculator display to the screen diagram below, and record the window data. (You may use a printed copy if you have access to a computer, printer, and the appropriate link software.)



2. There may be some points in your data plot that you think don't belong to the experiment. Circle these points.
3. Estimate the coordinates of the peaks and valleys, both for the sample plot and for your plot. For your plot, looking at your data or using a calculator TRACE function might help. Record these points below. Round the *x*- and *y*- values to the nearest tenth.

	Sample Plot	**Your Plot**
Start of movement	(0, 6.4)	
1st valley		
1st peak		
2nd valley		
2nd peak (or stop)	(8.3, 6.8)	

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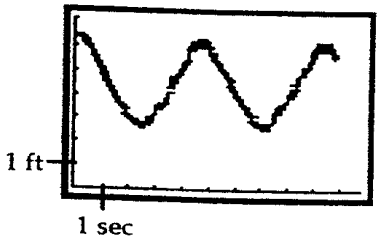
Answer Questions 4-7 for your data and for the sample data.

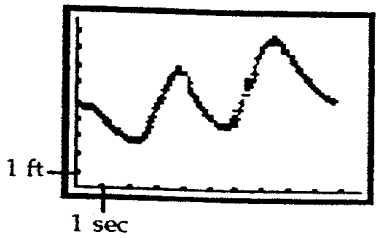
4. How long did the entire experiment last?
5. What was the total length of time that the Walker was walking away from the motion detector?
6. What was the total length of time that the Walker was walking toward the motion detector?
7. What was the total distance covered by the Walker?
8. For your walk, when was the Walker moving the fastest? How can you tell?
9. For your walk, when was the Walker moving the slowest? How can you tell?

EXPLORING FURTHER

1. Suppose the graph had looked like the one shown at the right. Describe the walk.



2. Describe what was happening in the walk shown at the right.



3. Try to reproduce the walk in Question 2. Use the electronic data-collection device and motion detector to record your results.

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MATERIALS NEEDED

Electronic data-collection device, motion detector, yardstick or measuring tape, calculator with the programs COMEGO and COGODATA (optional), link cable.

INTRODUCING THE EXPERIMENT

Describe the experiment and elicit student predictions: "He is going to walk toward the motion detector until the count of 5 and then change direction and walk away from the motion detector for a count of 5 and continue going back and forth. What do you think the graph of his distance from the motion detector will look like?" Have the students draw the expected graph. Ask several students to draw their graphs on the overhead projector.

In the sample data graph, the Walker started about 6.5 feet from the motion detector and finished about 2.5 feet away from it. The slopes also indicate that the Walker increases his pace. The difference in speeds as the Walker approached the motion detector is quite apparent. One question the students will consider is, did the Walker speed up at the first turnaround?

If your students want to use the actual sample data on their calculators, use the link to send the program COGODATA to their calculator. The program for this activity, COGODATA, can be found on the disk.

ORGANIZING THE DATA COLLECTION

Have the students work in groups of two or three. Pass around a calculator (with link cable) that has the program COMEGO. Have each group copy the program to one calculator; if they want, they can transfer it to the other calculators in the group later. Each group should do its own experiment collecting its own data.

For Question 3 in the Exploring Further section, students are asked to reproduce a walk. They must match, as closely as possible, both distance and time. This problem may take some time, and assigning it is optional.

Doing the Experiment		Teacher Tips
Step 1	Be sure to measure any distances that might affect the experiment results.	If the distance where the walker turns is recorded it will help the group interpret their graph.
Step 2	Connect the motion detector to the sonic port on the the electronic data-collection device.	
Step 3	Connect the calculator to the electronic data-collection device; turn on the electronic data-collection device; turn on the calculator.	Remember to turn on the calculator and data-collection device.
Step 4	Place the motion detector so that it will measure the distance to a student walking in a straight line toward it and away from it. Be sure to make a wide, clear path so that the motion detector does not record any stray objects.	The range for the motion detector is from 2 to 18 feet, but as the distance increases the beam seems to be wider.
Step 5	Choose a "Walker" and a "Counter" for your group.	

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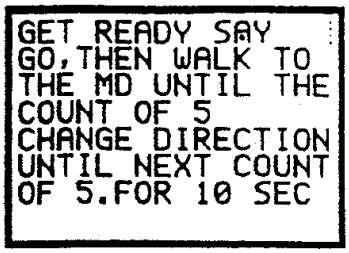
Step 6 The walker will start anywhere between 5 and 15 ft away from the motion detector.

Step 7 The Counter's job is to count to 5 at a steady pace. At the count of "5", the Walker changes direction and the Counter starts over again.

Step 8 Run the program COMEGO. The program is set to record data every 0.1 second for 10 seconds. The screen should appear like the one at the right.

Step 9 The Walker starts walking toward the motion detector, turns and walks away, turns again and walks toward it, turns again, and walks away.

Different starting locations and walking speeds will provide a unique graph for each group.



EXPECTED RESPONSES

Interpreting the Sample Data

1. The first change of direction was at 3.2 seconds.
2. At 6 seconds the walker was moving toward the motion detector.
3. The walker was 2.6 feet away from the motion detector at the first turn.
4. Yes, because the slope is steeper.

Interpreting Your Findings

1.-2. Answers will vary.

3.

	Sample Data	Student Data
Start of movement	(0, 6.4)	Answers will vary
1st valley	(3.2, 2.6)	
1st peak	(5.1, 6.6)	
2nd valley	(6.7, 2.4)	
2nd peak (or stop)	(8.3, 6.8)	

4. 10 seconds
5. For the sample data, the walker was walking toward the motion detector for 3.2 + 1.6 + 1.7 = 6.5 seconds. Answers will vary for student-collected data.
6. For the sample data, the walker was walking away from the motion detector for 1.9 + 1.6 = 3.5 seconds. Answers will vary for student-collected data.
7. For the sample data, the walker walked a total of 3.8 + 4 + 4.2 + 4.4 + 4.1 = 20.5 feet. Answers will vary for student-collected data.

8-9. Answers will vary. You can tell by looking at the steepness of the slope.

EXPLORING FURTHER

1. The walker walked at a constant speed and always turned at the same points.
2. At each turn the walker seems to be alternating speeds between fast and slow. Also at each turn the walker is not getting as close to the motion detector and is going farther away at each turn.
3. Students' graphs will vary.

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