

About the Lesson

This activity introduces students to the interpretation of distance-time plots. As a result, students will be able to:

- interpret positive and negative slope of a distance-time plot as increasing or decreasing distance.
- interpret a steeper line as a faster rate of motion
- interpret a horizontal line as no motion

Vocabulary

- rate
- distance-time plot
- steepness

Teacher Preparation and Notes

- Students may work in pairs with one student holding the CBR2 pointed toward a wall or flat surface and the other student holding the calculator. They walk together toward and away from the wall and can take turns holding the CBR2.
- Arrange the room so that each group of students have about 8 to 10 feet of walking space.
- Students will be using the EasyData App in this activity. See the additional information in the Teaching Notes.

Activity Materials

- Compatible TI Technologies:

TI-84 Plus*

TI-84 Plus Silver Edition*

 TI-84 Plus C Silver Edition

 TI-84 Plus CE

* with the latest operating system (2.55MP) featuring MathPrint™ functionality.

- CBR 2™ motion sensor unit with mini-USB connecting cable
- Vernier EasyData® App



Tech Tips:

- This activity includes screen captures taken from the TI-84 Plus CE. It is also appropriate for use with the rest of the TI-84 Plus family. Slight variations to these directions may be required if using other calculator models.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at <http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials>
- Any required calculator files can be distributed to students via handheld-to-handheld transfer.

Lesson Files:

- Match_Me_Student.pdf
- Match_Me_Student.doc



Tech Tip: While using the EasyData app, the tabs at the bottom of the screen indicate menus that are accessed by pressing the key directly below it. A frequent example is shown below:

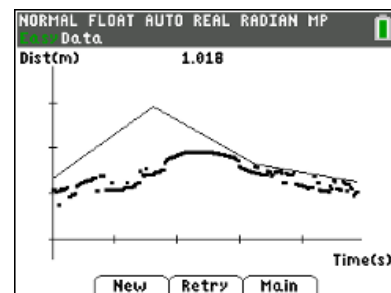
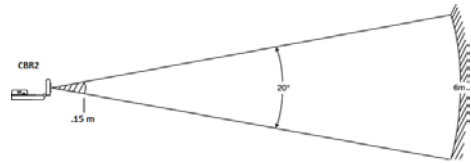


Introduction

In this activity, students will explore absolute value inequalities graphically and numerically. **Example 1** describes how students would graphically solve the equation $|x| < 5$. This may be a different approach than your students have seen, but it helps them visualize what is going on.

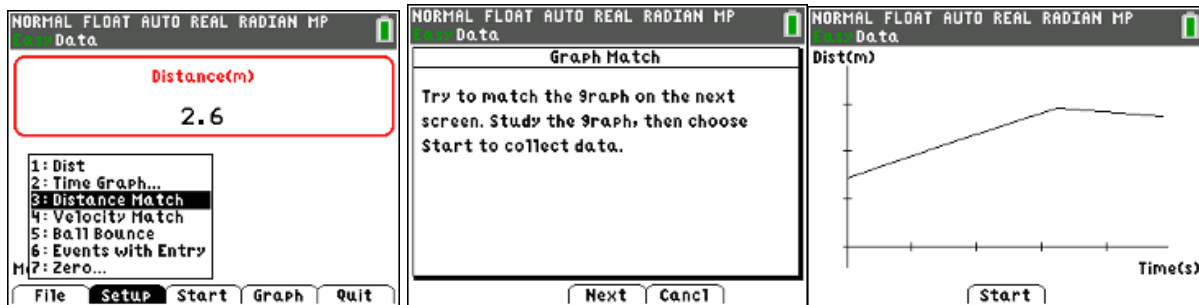
Teaching Notes:

- The path of the CBR 2 beam is not a narrow, pencil-like beam, but fans out in all directions up to 10° in a cone-shaped beam.
- To avoid interference from other objects in the vicinity, try to establish a clear zone in the path of the CBR 2 beam. This helps ensure that objects other than the target are not recorded by the CBR 2. The CBR 2 records the closest object in the clear zone
- Be sure that students stay within the range of the CBR 2 (0.15 – 6 meters).
- Instruct students to be sure to hold the CBR 2 parallel to the wall or target. The graph to the right demonstrates the appearance of the plot if the CBR 2 is not held parallel and pointed at the wall during the walk.



Collecting the Data

In the EasyData app, this activity uses *the Distance Match* setup. When Distance Match is selected, students will be prompted to study the next screen which will be a graph in either two to four segments with different slopes. The scale on the time axis is marked every two seconds for a total of 10 seconds. The scale on the distance axis is marked at every meter, so the tape on the floor at every meter should help students.



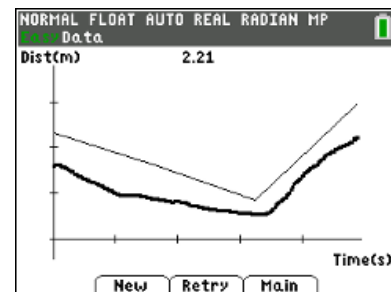
If students do not like their results, selecting **Retry** will clear off the data and leave the same graph for students to match. Selecting **New** will also clear the data and generate a different graph to match.

Looking at the Results

1. Describe the way you had to move in order to match each segment of the graph. Mention rate and direction.

Student answers will vary.

Sample response: In Trial 1, I walked toward the wall for about 6 seconds at a moderate rate. I quickly reversed direction and walked away from the wall at a faster speed for the rest of the time.



2. How well did you match the given graph? Describe how you could improve each segment of your match plot. Be specific.

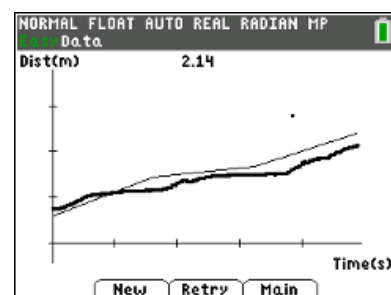
Student answers will vary.

Sample response: Trial 1- I did not start far enough away from the wall. My rate was close as I walked toward the wall, but I did not change direction soon enough. My rate was close as I walked away from the wall.

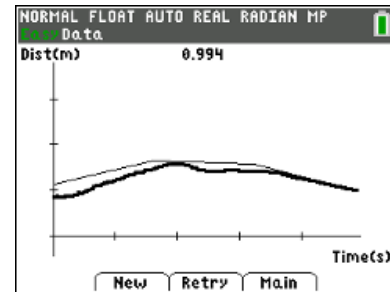
3. For each trial, describe how you walked to match the given graph. If your plot did not match well, tell how you could make it better.

Student answers will vary.

Sample response: Trial 2- In the first 1.5 seconds, I did not maintain a constant speed. In the middle segment, my speed matched the graph very well but I did not increase my rate soon enough.



Sample response: Trial 3- I started a little bit too close to the wall for the first segment. For the middle segment, I did not maintain a constant rate very well and was a few inches too close. The last 3 seconds I matched the rate and the distance very well.



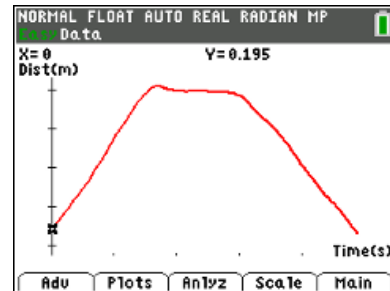
4. Complete the statements to make some conclusions about the types of motion needed to make specific plots.
 - a. The steepness of the line segments is affected by the rate of the walker.
 - b. The slant (upward or downward) of the line segments is affected by the direction of the walker.
 - c. A person standing still in front of the CBR 2 is represented by a horizontal line segment on the plot.

Going Further

1. Write a few sentences to tell a short story explaining the kind of motion the plot shown might represent. Be creative.

Student answers will vary.

Sample response: My sister and I made a string phone out of two cans and a connecting string. She walked at a steady rate away from me and stopped when the string became taut. She said, “Knock, Knock.” I said, “Who’s there?” “Arthur.” “Arthur who?” Then my sister walked back to me at the same steady rate and said, “Arthur-mometer is broken. What’s the temperature?”



2. Draw a possible motion plot for the story described below.

Stacy walks at a constant rate from her house to the school bus stop. With about a quarter of the distance left, she sees the bus coming, so she runs at a constant rate to try to catch it. She gets to the bus stop, but misses the bus. After a short rest, Stacy turns around and walks back home at a constant rate.

Student answers will vary.

Sample response: Possible answers will resemble the graph at the right.

