Distance Match
Instructor Guide

Adapted from Texas Instruments, Inc.

Objectives:

- Given a graph of distance vs. time on a graphing calculator, students will perform the actions necessary to obtain the graph by walking in front of a motion detector
- Given a graph of distance vs. time, students will be able to write the appropriate actions necessary to obtain the graph, supposing the use of a motion detector.
- Given 2 different graphs of distance vs. time, students will discuss and compare the qualitative features of the graphs.

Set-Up

1. Connect your calculator to the viewscreen.

2. Attach the CBR2 to the arm of the document camera, with the receiver pointing out to an area large enough in which students can walk. The CBR will be showing a graph and students will try to walk in such a fashion as to recreate a duplicate (identical) graph on the screen.

3. Be sure your calculator has the EasyData App. Click on the APPS key to check. The APPS (Applications) are listed in alphabetical order. If EasyData is not there, you will need to install it. For directions on how to do this, please see the Instructor site.

4. Connect the Calculator to the CBR2 with the Standard-B to Mini-A cable (unit-to-CBR2). Be sure to push firmly at both ends to make a secure connection.

5. This connection provides for an automatic launching of the EasyData App. As soon as you turn your calculator on, this App will run (as long as the cable is connected to the CBR2 and the TI*84).

6. Press Setup (the WINDOW key), then 1: Dist. Be sure your units are in "feet." If not, press Units and change to (ft). Click OK.

7. Press Setup (the WINDOW key), then 3: Distance Match…

8. Your equipment is now ready for our experiment. To begin the activity, press Start (the zoom key). Read the directions there with your students. Tell them that you will be showing a graph of distance vs. time. They are to discuss in their groups how a person needs to walk in order to obtain the given graph. Press Next (the zoom key) and give students a few minutes to study the graph.

9. Ask for a volunteer to come up and do the walk. Be sure the CBR2 is in good position to collect data from the walker. Press Start. When 10 seconds have passed, the CBR2 will automatically stop collecting data.

10. If the walker was accurate, discuss why. If not, discuss why not. If the walker was not accurate, you can give him a second chance by pressing Retry.

11. Repeat the experiment with a different graph and a different walker. You can obtain a new graph by pressing New. Repeat the experiment 5 or 6 times, each time using a different graph.

12. Be sure to discuss with students sometime during the experiments, such qualitative features of the graphs as:

    - What does the horizontal axis represent?
    - What does the vertical axis represent?
    - Which of these variables should we call the dependent variable? Independent?
    - What type of motion causes the graph to increase with time?
    - What type of motion causes the graph to decrease with time?
    - What type of motion causes the graph to remain as a horizontal line with time?
    - Is it possible to produce a vertical graph?
    - What type of motion causes the graph to be very steep?
    - What type of motion causes the graph to be very shallow?

    You might also point out that all the graphs are (piecewise) linear, then ask
    - Why are the graphs all straight lines?
    - What type of motion causes the graph to be linear? To be NON-linear?

13. Time permitting, you might experiment by asking students to conjecture about non-linear motion, then ask for a volunteer walker to produce such a graph.