

ACTIVITY 5

Shape Up!



The direction you move, the speed you travel, and the rate at which you change your direction and speed all have an effect on the shape of a Distance-Time plot. Would it be possible to use these factors to plot specific shapes on the calculator while moving in front of the CBR? Is it possible to plot any shape you desire on the screen? What determines if a shape can be plotted by your motion in front of the CBR?

Objectives

In this activity you will:

- ◆ Discover what type of shapes can be plotted as a result of your motion in front of the CBR.
- ◆ Observe which shapes can and cannot be made with a Distance-Time plot.
- ◆ Determine a rule for which shapes can be made by walking in front of the CBR.

You'll Need

- ◆ CBR unit
- ◆ TI-82 or TI-83 and calculator-to-CBR cable

CBR Setup

1. Connect the CBR to the calculator using the link cable.
2. Turn on your calculator. If you have not already loaded the RANGER program into your calculator, follow these steps:
 - a. Press $\boxed{2\text{nd}}$ $\boxed{[\text{LINK}]}$ $\boxed{\blacktriangleright}$ $\boxed{[\text{ENTER}]}$. The calculator displays **Waiting ...**
 - b. Press the $\boxed{82/83}$ transfer button on the CBR.
3. Run the RANGER program on your calculator:
 - a. Press $\boxed{[\text{PRGM}]}$.
 - b. Choose RANGER.
 - c. Press $\boxed{[\text{ENTER}]}$.

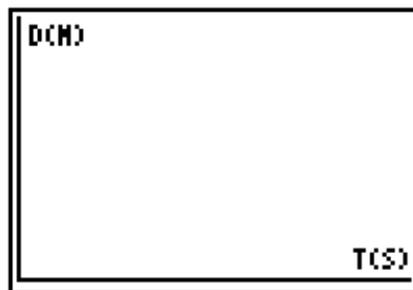
4. From the MAIN MENU, select 2: SET DEFAULTS.
5. With the selector arrow (▶) at START NOW, press **[ENTER]**.

Collecting the Data and Looking at the Results

In this activity you will move in front of the CBR applying what you know about Distance-Time plots to create different shapes. You must take care only to move back and forth in front of the CBR and never to the side. This ensures that the CBR will record your motion.

1. Describe how you would have to move in front of the CBR in order to create a plot that resembles a mountain with a plateau on top.

2. Create the plot described above by walking in front of the CBR as described in your answer to number 1. Press **[ENTER]** to start. As you walk, you should try to match the plot. If you are satisfied with the resulting plot, sketch it on the axes to the right. If not, press **[ENTER]**, choose 3: REPEAT SAMPLE, and then repeat the trial.

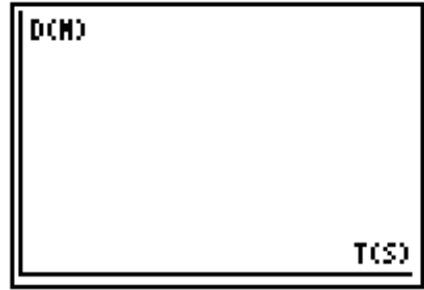


3. Did the plot in number 2 produce the desired shape? Describe any problems that you encountered while trying to make the plot and whether or not the problems could be eliminated in another trial.

4. Describe the way you would move to create a mountain with a sharp peak. How could your motion make the sides of the mountain steeper?

5. Press **[ENTER]**, choose 3: REPEAT SAMPLE. Using the method described in number 4, walk in front of the CBR and create a mountain range consisting of at least two mountains, both with sharp peaks of equal heights. Make the sides of the second mountain steeper than those of the first.

Press **ENTER** when you are ready to begin. If you are satisfied with the resulting plot, sketch it on the axes to the right. If not, press **ENTER**, choose **3: REPEAT SAMPLE**, and then repeat the trial.

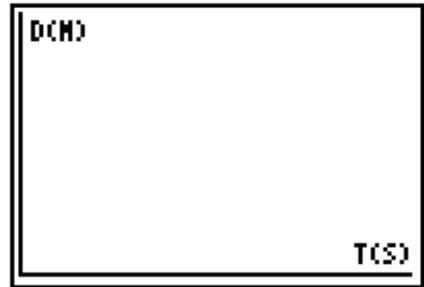


6. How would your motion change if you wanted the second peak to be only half as high as the first peak?

7. Suppose you wanted to make a plot of the uppercase letter V. Describe how you would walk to create this plot.

8. Press **ENTER** and choose **3: REPEAT SAMPLE**. Walk in the way you described above to create the uppercase letter V.

Press **ENTER** when you are ready to begin. If you are satisfied with the resulting plot, sketch it on the axes to the right. If not, press **ENTER**, choose **3: REPEAT SAMPLE**, and then repeat the trial.

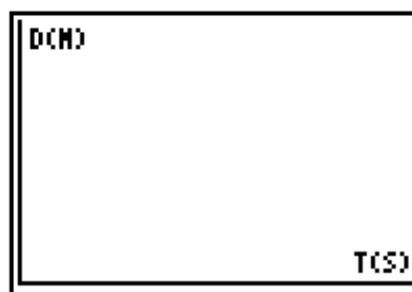


9. What change in your motion would result in a U rather than a V?

10. Suppose you wanted to make the lowercase letter m. Describe how you would walk to create this plot. Be sure to discuss the speed as well as the direction of your motion.

11. Press **ENTER** and choose **3: REPEAT SAMPLE**. Walk in the way you described above to create the lowercase letter m.

Press **ENTER** when you are ready to begin. If you are satisfied with the resulting plot, sketch it on the axes to the right. If not, press **ENTER**, choose **3: REPEAT SAMPLE**, and then repeat the trial.



12. How could you change your motion in number 11 to produce a W rather than an M?

Going Further

Answer these questions on a separate sheet of paper. Show all work.

- Some of the figures you plotted had sharp corners and others had rounded edges. What was the key factor in your movement that determined which type was plotted? Explain why this factor affects the plot in this way. (Be sure to use the word “rate” in your answer.)
- Would it be possible to move in such a way as to create a plot of a circle? Explain whether or not this can be done. If you feel that you can make a circle, press **ENTER** on your calculator, choose **3: REPEAT SAMPLE**, press **ENTER**, and attempt to do so. Discuss what happened and why.
- List all uppercase and lowercase letters that you believe you could make a plot of by moving in front of the CBR.
- List five letters that you would not be able to make by moving in front of the CBR. What is it about these letters that makes them impossible to plot?
- What was the determining factor in both the shapes and the letters that made something impossible to plot by moving in front of the CBR? (Be sure to use the word “time” when discussing the motion involved.)

Choose other letters or shapes that can be made by walking in front of the CBR. Write down directions for creating each plot and then have a classmate try to guess the shape after reading your directions. Finally, allow your classmate to check the answer by walking in front of the CBR.