Name _____

Date _____

EXPLORATIONS

ACTIVITY 4

Slow Down – Speed Up

As you move in front of the CBR your motion can be recorded using the CBR. A plot of this motion can easily be seen on your TI graphing calculator. Speeding up, slowing down, or moving at a constant rate are some of the factors that can affect a plot. In this activity, you will explore the effects those factors have on a plot.

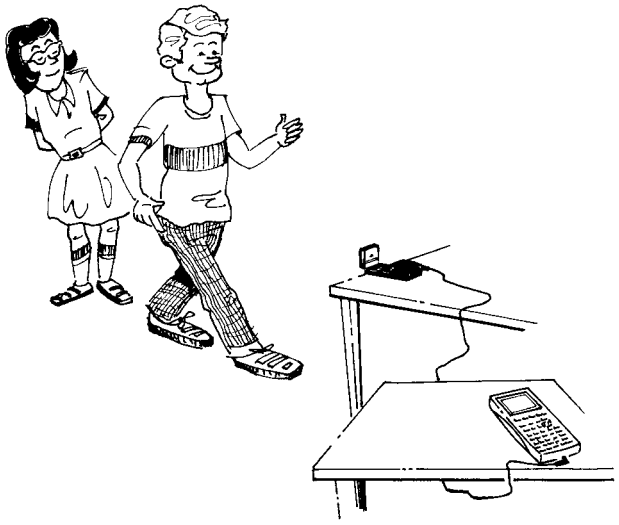
Objectives

In this activity you will walk away from the CBR to:

- Observe the effect *speeding up* has on a Distance-Time plot.
- Observe the effect *slowing down* has on a Distance-Time plot.
- Observe the effect moving at a *constant rate* has on a Distance-Time plot.

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 2nd [LINK] ▶ ENTER. The calculator displays **Waiting ...**
   b. Press the 82/83 transfer button on the CBR.
3. Run the **RANGER** program on your calculator:
   a. Press PRGM.
   b. Choose **RANGER**.
   c. Press ENTER.
4. From the **MAIN MENU** select **2: SET DEFAULTS**.
5. With the selector arrow (▶) at **START NOW** press ENTER.

Collecting the Data

During these observations you will explore the effects that gradually speeding up and gradually slowing down the rate at which you walk have on a Distance-Time plot. Time will be plotted on the horizontal axis, and the distance from the CBR to the walker (in meters) will be plotted on the vertical axis. When collecting data in these observations, be sure that you never come closer than 0.5 meters to the CBR and never move farther away than 6 meters from the CBR. Remember to always stay in front of the CBR and not to move to the side.

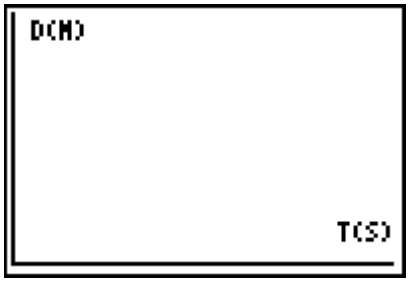
Trial 1

1. Stand approximately 0.5 meter directly in front of the CBR.

   Prepare to move in the following way when data collections begins. For the first 5 seconds, move away from the CBR at a steady, medium pace. During the next five seconds, this rate should slow down gradually until you have stopped moving completely. Then remain motionless until the CBR has stopped collecting data.

2. When you are ready to begin, press ENTER and collect the data. The plot should begin with a linear segment rising from left to right and then slowly level off until it becomes horizontal.

3. If you are satisfied with your results, sketch your plot to the right and move on to Trial 2. If not, press ENTER, choose **3: REPEAT SAMPLE**, and begin again with step 1.

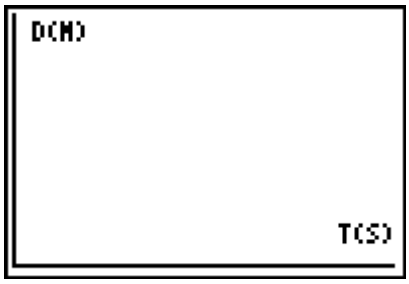


Trial 2

1. Press ENTER and choose **3: REPEAT SAMPLE**.
2. Stand at a point approximately 0.5 meter directly in front of the CBR.

   Prepare to move in the following way when data collection begins. For the first 4 seconds, remain motionless. Next, begin moving slowly away from the CBR. Continuously increase the speed over the next 10 seconds, then move at a fast walk when data collection ends.
3. When you are ready to begin, press ENTER and collect your data.

   The plot should start off flat, then begin rising slowly, and steadily become steeper. Do not worry if your plot goes out of the top of the viewing window.
4. If you are satisfied with your results, sketch your plot to the right and move to the next section. If not, press ENTER, choose **3: REPEAT SAMPLE**, and begin again with step 2.



Looking at the Results

1. Each plot in the preceding trials contains a section that is level or flat in appearance. What were you doing during this part of each plot?

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   _____

   _____
2. In Trial 1, you began moving at a constant rate. What did you notice about the plot during this time?

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3. Discuss the similarities between the two trials. What causes them to round off so smoothly? (Be sure to use the words “time” and “distance” in your answer.)

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4. Summarize the effects that speeding up, slowing down, or moving at a constant rate while walking away from the CBR have on the shape of a Distance-Time plot of the motion.

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5. Describe in words how the plots above would have looked if you started from across the room and moved toward the CBR with the same variations in speed as in Trials 1 and 2.

Trial 1:

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Trial 2:

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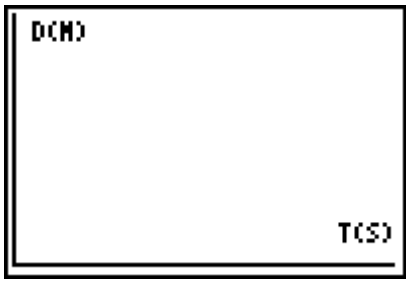
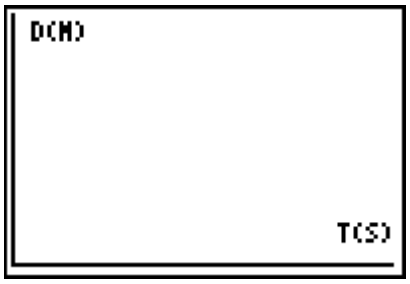
6. What would Trials 1 and 2 have looked like if the motion had been toward rather than away from the CBR? Sketch your predictions below.

Trial 1

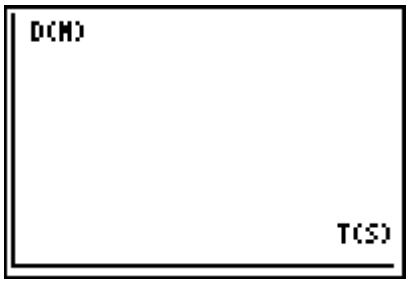


Trial 2



7. Press ENTER and select **3: REPEAT SAMPLE**. Repeat Trial 1 beginning about 5 meters from the CBR and moving toward rather than away from the CBR as described in number 5.

If you are satisfied with your data, sketch your plot on the axes to the right. If you wish to take another sample, press ENTER, select **3: REPEAT SAMPLE**, and collect another data set.



Discuss any differences between your plot and the prediction you made in number 6 on the lines below.

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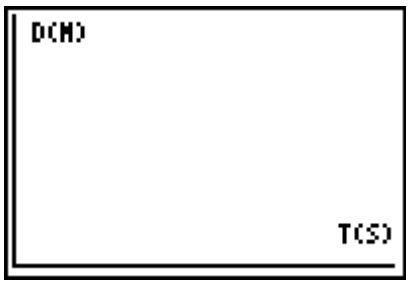
8. Repeat number 7 for Trial 2.



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Going Further

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

1. Describe what a plot of the following motion would look like. Stand approximately 5 meters from the CBR. When data collection begins, move toward the CBR at a medium pace but then slow down until you come to a stop about 0.5 meters from the CBR. This motion should take about 7 seconds. After a 0.5 second pause begin slowly moving away from the CBR. Then steadily increase speed until moving at the same medium rate that you began with. The total collection time will be about 15 seconds.

2. Make a sketch of your prediction in 1 on a set of axes. Next, try it. Make a sketch of the plot you created on a second set of axes.

3. Discuss any differences between your prediction in number 1 and your plot in number 2 and why the differences occurred.