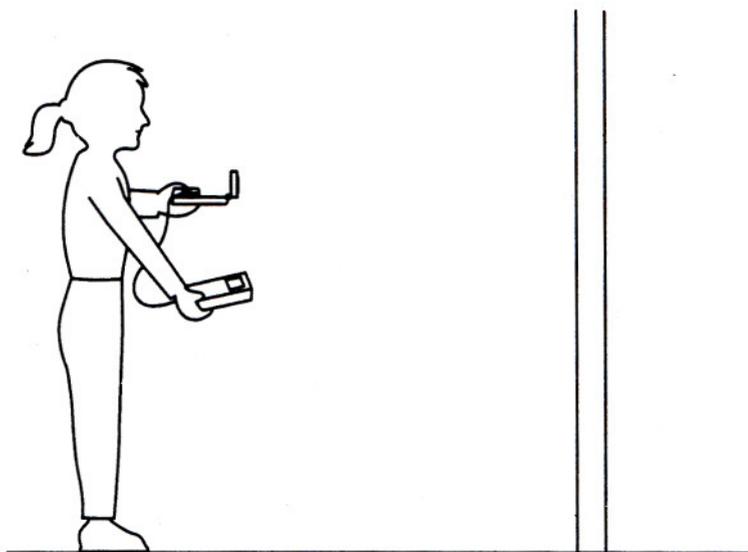## Data collection

❶ Hold the CBR in one hand, and the calculator in the other. Aim the sensor directly at a wall.

Hints: The maximum distance of any graph is 4 meters (12 feet) from the CBR. The minimum range is 0.5 meters (1.5 feet). Make sure that there is nothing in the *clear zone* (see page 7).

❷ Run the RANGER program (see page 5 for keystrokes for each calculator).

❸ From the MAIN MENU choose APPLICATIONS. Choose METERS.

❹ From the APPLICATIONS menu choose DISTANCE MATCH. General instructions are displayed. DISTANCE MATCH automatically takes care of the settings.

❺ Press ENTER to display the graph to match. Take a moment to study the graph. *Answer questions 1 and 2 on the activity sheet.*

❻ Position yourself where you think the graph begins. Press ENTER to begin data collection. You can hear a clicking sound and see the green light as the data is collected.

❼ Walk backward and forward, and try to match the graph. Your position is plotted on the screen.

❽ When the sample is finished, examine how well your "walk" matched the graph, and then *answer question 3*.

❾ Press ENTER to display the OPTIONS menu and choose SAME MATCH. Try to improve your walking technique, and then *answer questions 4, 5, and 6*.

Explorations

In DISTANCE MATCH, all graphs are comprised of three straight-line segments.

❶ Press ENTER to display the OPTIONS menu and choose NEW MATCH. Study the first segment and *answer questions 7 and 8*.

❷ Study the entire graph and *answer questions 9 and 10*.

❸ Position yourself where you think the graph begins, press ENTER to begin data collection, and try to match the graph.

❹ When the sampling stops, *answer questions 11 and 12*.

❺ Press ENTER to display the OPTIONS menu and choose NEW MATCH.

❻ Study the graph and *answer questions 13, 14, and 15*.

❼ Press ENTER to display the OPTIONS menu. Repeat the activity if desired, or return to the MAIN MENU, and then choose QUIT to exit the RANGER program.

Advanced explorations

The graphs generated by DISTANCE MATCH were all straight lines. Now try VELOCITY MATCH, in which you must match a Velocity-Time plot. This one's tough!

MATCH is a very popular program. Additional versions that explore more complicated graphs may be available (see page 36).

Activity 1—Match the graph

Name _____

Data collection

1. What physical property is represented along the x-axis? _____

   What are the units? _____ How far apart are the tick marks? _____

   What physical property is represented along the y-axis? _____

   What are the units? _____ How far apart are the tick marks? _____

2. How far from the CBR do you think you should stand to begin? _____

3. Did you begin too close, too far, or just right? _____

4. Should you walk forward or backward for a segment that slopes up? _____

   Why? _____

5. Should you walk forward or backward for a segment that slopes down? _____

   Why? _____

6. What should you do for a segment that is flat? _____

   Why? _____

Explorations

7. If you take one step every second, how long should that step be? _____

8. If, instead, you take steps of 1 meter (or 1 foot) in length, how many steps must you take? _____

9. For which segment will you have to move the fastest? _____

   Why? _____

10. For which segment will you have to move the slowest? _____

    Why? _____

11. In addition to choosing whether to move forward or backward, what other factors entered into matching the graph exactly? _____

    _____

12. What physical property does the slope, or steepness of the line segment, represent? _____

13. For the first line segment, how many meters must you walk in how many seconds? _____

14. Convert the value in question 13 (the velocity) to meters/1 second: _____

    Convert to meters/minute: _____

    Convert to meters/hour: _____

    Convert to kilometers/hour: _____

15. How far did you actually walk? _____