

Activity 4: Motion

- Objective:** The student will be able to determine:
- When a walker was moving toward or away from the CBR from the graph of the walk.
 - When the walker was moving quickly and slowly from the graph of the walk.

Materials: CBRs (1 per group of 3), calculators for CBRs

- Procedure:**
1. Explain to students what a CBR does. The CBR can tell how far away something is from it.
 2. Set up the CBR for 15 seconds and real time. Pick a student to stand somewhere in front of the CBR. Discuss the range (1.5 to 15 feet) in which the CBR collects good data. Have the whole class guess to the nearest foot how far away the student is from the CBR. Run the CBR. Use the graph of the horizontal line to show how far the student is from the CBR.
 3. While the graph is showing, discuss the variables. The vertical or y-axis shows the distance from the CBR in feet or meters. Ask why the graph remains constant. It remains constant because the walker did not change his or her distance from the CBR. Ask students what the other variable is. The horizontal or x-axis shows the time in seconds. The ticking the CBR makes when it sends out a pulse reminds one of the ticking of time like a watch.
 4. Have a student chosen at random walk in front of the CBR. Elicit whole group responses to the graph. Ask questions about distance from the CBR and time. Use language like away from the CBR, toward the CBR, quickly, slowly, faster, slower, direction, and starting point. Possible questions include:
 - How far from the CBR did the walker start? Stop?
 - Was the walker going toward or away from the CBR here?
 - Was the walker's distance from the CBR increasing or decreasing?
 - How can you tell if the walker is moving toward or away from the CBR?
 - Where do you think the walker was going the fastest? The slowest?

- How can you tell when the walker was going faster?
Slower?
 - Did the walker stand still at any point?
5. Continue having students walk and discuss to get the ideas of distance, time, rate, and direction. Ask students how they can determine the direction and the speed from the graph. Make sure the following points are made:
1. When the walker is walking away, the line is increasing because the distance from the CBR is increasing.
 2. When the walker is walking toward the CBR, the line is decreasing because the distance is decreasing.
 3. The steeper the line, the faster the walker is moving because his or her distance over time is changing more rapidly.

Give all students the opportunity to walk. With each graph discuss the walker's speed and direction according to the graph.

Extensions: Have students sketch the graph of a walker walking toward and away from the CBR. The walker should go different speeds as well. Then have them explain the graph using the words away, toward, slow, and fast.