# Motion Lab Activity: Part One

Procedure

1. Place 7 pieces of tape—or tape 7 sheets of paper—at carefully-measured 1-meter increments on the floor.
2. Designate the **middle** piece of tape—or paper—to have a location of **0 meters**.
3. Make a 0-meter marker from an index card—it should look something like your nameplate—and place the 0-meter marker on the middle piece of tape (at the location of 0 meters).
4. Assign a positive direction along your pieces of tape—or paper—and assign the opposite direction to be negative. So, for instance, you can say that the pieces of tape to the right of the 0-meter marker are in positive positions, and the pieces of tape to the left of your 0-meter marker have negative positions.
5. Which direction did you assign as the positive direction? Show your answer to Ms. Clanton.
6. Turn on a netbook and open the netbook's video camera.
7. Set the netbook on a desk or table so that **ALL** of the pieces of tape—or paper—on the floor are visible to the netbook's video camera at the same time. In other words, you should be able to see all of your pieces of tape on the floor without moving the video camera. In addition, the 0-meter marker should be clearly visible to the camera.
8. Designate one teammate as walker #1, one teammate as walker #2, and one teammate as the camera operator. If you have only two team members, you can alternate as walker and camera operator.

Now, it's time to start moving.

Motion Number One

9. Walker #1: First stand at your team's 0-meter marker.
10. Camera operator: Begin recording using the netbook's video camera.
11. Walker #1: As soon as the recording begins, start walking **slowly and at a steady speed** in the positive direction.
12. Walker #1: Stop moving when you reach the last piece of tape—or paper.
13. Camera operator: Stop the recording as soon as Walker #1 stops walking.
14. Save the recording as "Motion Number One."

15. Using the recording, and on your own sheet of paper, draw a motion diagram representing the motion of Walker #1 as precisely as you can. Include accurate positions and times for each dot on your motion diagram; review your video to ensure that you **label each dot on the diagram with the correct position (in meters) and time (in seconds)**. Title the drawing "Motion Diagram Number One." Show your motion diagram to Ms. Clanton.

16. Point-plot to make a Position Versus Time graph for the motion of the walker. The time and position label for each dot on the motion diagram should be the x- and y-coordinates for a single point on the Position Versus Time graph. Set up the axes for your Position Versus Time graph like the axes shown below. When you are finished making your graph, your graph and diagram should have the **same** number of points. Show your Position Versus Time graph to Ms. Clanton.

Position Versus Time

Position (meters)

Time (seconds)
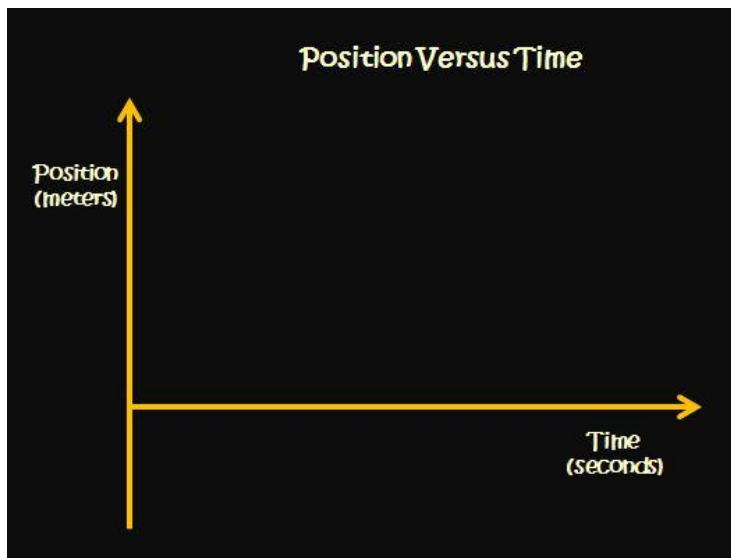
17. Draw a best-fit line for the Position Versus Time graph. In other words, draw a straight line on your Position Versus Time graph which represents the average of the points you plotted. Show your best-fit line to Ms. Clanton.

18. Calculate the slope of your best-fit line using the slope formula shown below. Show your slope to Ms. Clanton.

$$slope = \frac{y_f - y_i}{x_f - x_i}$$

19. What are the units of the best-fit line for your Position Versus Time graph? <mark>Show your answer to Ms. Clanton.</mark>

Motion Number Two

20. Walker #2: First stand at your team's +2-meter marker.
21. Camera operator: Begin recording using the netbook's video camera.
22. Walker #2: As soon as the recording begins, start walking at a **moderate pace and at a steady rate of speed** in the negative direction.
23. Walker #2: Stop moving when you reach the last piece of tape—or paper.
24. Camera operator: Stop the recording as soon as Walker #2 stops walking.
25. Save the recording as "Motion Number Two.
26. Using the recording, and on your own sheet of paper, draw a motion diagram representing the motion of Walker #2 as precisely as you can. Include accurate positions and times for each dot on your motion diagram; review your video to ensure that you **label each dot on the diagram with the correct position (in meters) and time (in seconds).** Title the drawing "Motion Diagram Number Two."
27. Point-plot to make a Position Versus Time graph for the motion of the walker. The time and position label for each dot on the motion diagram should be the x- and y-coordinates for a single point on the Position Versus Time graph. When you are finished making your graph, your graph and diagram should have the **same** number of points.
28. Draw a best-fit line for the Position Versus Time graph. In other words, draw a straight line on your Position Versus Time graph which represents the average of the points you plotted. <mark>Show your best-fit line to Ms. Clanton.</mark>
29. Calculate the slope of your best-fit line using the slope formula shown below. <mark>Show your slope to Ms. Clanton.</mark>

$$slope = \frac{y_f - y_i}{x_f - x_i}$$

Motion Number Three

30. Walker #1: First stand at your team's +3-meter mark.
31. Camera operator: Begin recording using the netbook's video camera.
32. Walker #1: Three seconds after the recording begins, start walking **slowly at a steady rate of speed** in the negative direction.

33. Walker #1: Stop when you reach your team's -1-meter mark. Stay at rest at the -1-meter mark for 8 seconds. Then, begin walking at a **moderate pace and at a steady rate of speed** in the negative direction.

34. Walker #1: Stop moving when you reach the last piece of tape—or paper.

35. Camera operator: Stop the recording 6 seconds after Walker #1 stops walking.

36. Save the recording as "Motion Number Three."

37. Using the recording, and on your own sheet of paper, draw a motion diagram representing the motion of Walker #1 as precisely as you can. Include accurate positions and times for each dot on your motion diagram; review your video to ensure that you label each dot on the diagram with the correct position and time. Title the drawing "Motion Diagram Number Three."

38. Point-plot to make a Position Versus Time graph for the motion of the walker. The time and position label for each dot on the motion diagram should be the x- and y-coordinates for a single point on the Position Versus Time graph. When you are finished making your graph, your graph and diagram should have the **same** number of points.

39. Divide the Position Versus Time graph into 5 logical sections, and label the sections I, II, III, IV, and V on the graph.

40. Draw best-fit lines for each of the five sections.

41. Calculate the slope for each of the five best-fit lines.

Motion Number Four

42. Walker #2: First stand at your team's -3-meter mark.

43. Camera operator: Begin recording using the netbook's video camera.

44. Walker #2: Four seconds after the recording begins, start walking very slowly in the positive direction. **Increase your speed at a slow, steady pace.**

45. Walker #2: Stop moving when you reach the last piece of tape—or paper.

46. Camera operator: Stop the recording 6 seconds after Walker #2 stops walking.

47. Save the recording as "Motion Number Four."

48. Using the recording, and on your own sheet of paper, draw a motion diagram representing the motion of Walker #2 as precisely as you can. Include accurate positions and times for each dot on your motion diagram; review your video to ensure that you label each dot on the diagram with the correct position and time. Title the drawing "Motion Diagram Number Four."

49. Point-plot to make a Position Versus Time graph for the motion of the walker. The time and position label for each dot on the motion diagram should be the x- and y-

coordinates for a single point on the Position Versus Time graph. When you are finished making your graph, your graph and diagram should have the **same** number of points.

50. This Position Versus Time graph should not be linear. What does the graph look like?