Name _____   Hour _____

Lab Partners _____

Purpose:

Analyze relationships between time, distance, and velocity.
Practice using the graphing calculator and the Calculator Based Ranger (CBR) system.

Equipment:

- CBR and linking cord
- TI-83, TI-83 Plus, or TI-84 calculator

Preparation (TI-83):

- connect the CBR to the TI-83 with a linking cord
- press 2ND, LINK
- select RECEIVE
- press ENTER
- press the 82/83 button on the CBR
- press PROGRAM
- select "*Ranger*"
- press ENTER twice
- press 3 for "*Applications*"
- press 1 for "*Meters*"
- press 1 for "*Distance Match*"

Preparation (TI-83 Plus or TI-84):

- connect the CBR to the calculator with a linking cord
- press APPS
- select "*CBL/CBR*"
- press ENTER
- press 3 for "*Ranger*"
- press ENTER
- press 3 for "*Applications*"
- press 1 for "*Meters*"
- press 1 for "*Distance Match*"

Procedures:

1. Hold the CBR in one hand, and the calculator in the other. Aim the CBR sensor directly at a wall. (*HINT: The maximum distance of the CBR graph is 5 meters from the wall. The minimum distance is ½ meter. Make sure that there are no people or objects standing between you and the wall.*)

2. The calculator will show you a graph of "Distance vs. Time." Study the graph to decide approximately how far from the wall you should begin.

3. When you are ready, press ENTER. Walk forwards and backwards to try to match the graph. Your position is plotted on the screen.

4. When the sample is finished, examine how well your walk matched the graph. To try the graph again, press ENTER, and 1 for "*Same Match*."

5. When you are satisfied with your walk, sketch the graph given by the calculator, and the graph of your motion, in the space below. Next to the graph, describe in detail what motions you used to match the calculator's graph.
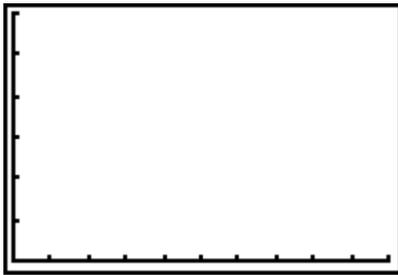
Plot A: Distance vs. Time

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6. Repeat Steps #1 – 5 for two more graphs of Distance vs. Time below.
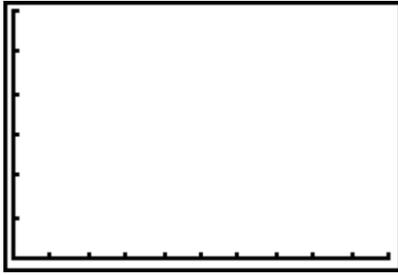
<u>Plot B: Distance vs. Time</u>

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<u>Plot C: Distance vs. Time</u>

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7. Press 3 to return to the "*Applications*" menu. Continue to use "Meters" as the units. Press 2 to try a "*Velocity Match*." When you are satisfied with your velocity match walk, sketch the graph given by the calculator, and the graph of your motion, in Plot D below. Next to the graph, describe in detail what motions you used to match the calculator's graph. Then press ENTER, and 2 for "*New Match*." Repeat the "*Velocity Match*" for a different Velocity vs. Time graph, recording your results in Plot E below.

<u>Plot D: Velocity vs. Time</u>

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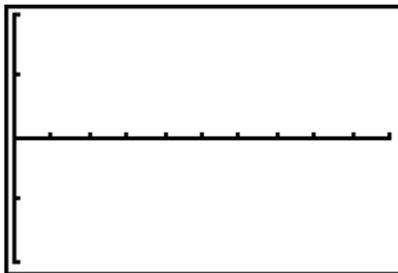
<u>Plot E: Velocity vs. Time</u>

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Summary Questions:

1. In a Distance vs. Time graph, what physical property is represented on the *x*-axis? _____
What units are used to measure this property? _____

2. In a Distance vs. Time graph, what physical property is represented on the *y*-axis? _____
What units are used to measure this property? _____

3. In a Velocity vs. Time graph, what physical property is represented on the *x*-axis? _____
What units are used to measure this property? _____

4. In a Velocity vs. Time graph, what physical property is represented on the *y*-axis? _____
What units are used to measure this property? _____

5. Should you walk forward or backward to match the Distance vs. Time graph at right? Why?

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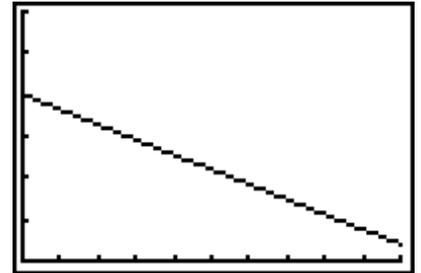
6. For which Distance vs. Time graph at right would you have to walk the fastest? How do you know?

GRAPH A

GRAPH B

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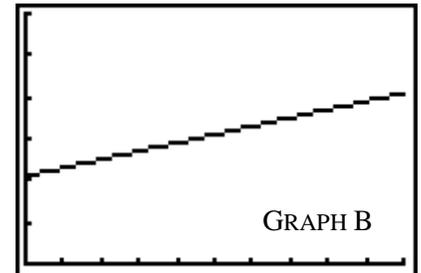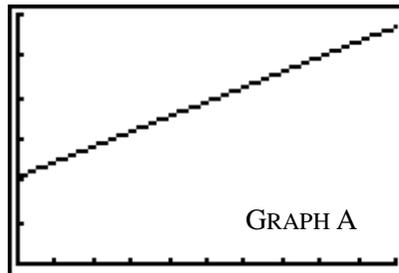
7. Sketch a Distance vs. Time graph which would require you to walk slowly away from the wall, then stop, then walk quickly back towards the wall.

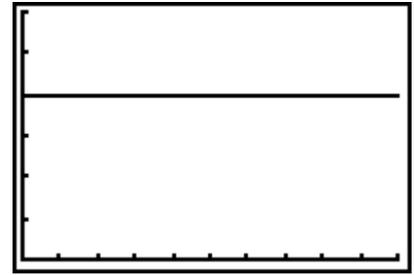8. Sketch a Distance vs. Time graph which would require you to walk quickly away from the wall, then stop, then walk slowly back towards the wall.
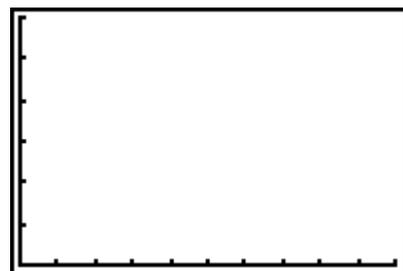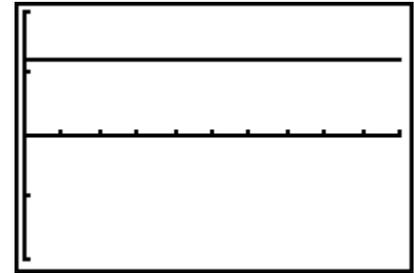
Summary Questions: *(cont)*

9. Describe the motion you would use to match the Distance vs. Time graph at right.

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10. Describe the motion you would use to match the Velocity vs. Time graph at right. How is it different from your answer to Question #9 above?

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11. Why does a Distance vs. Time graph include only positive numbers, while a Velocity vs. Time graph includes both positive and negative numbers?

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12. What type of motion do you think you would use to match the Distance vs. Time graph at right? How would this motion be different from a Distance vs. Time graph with straight lines only?

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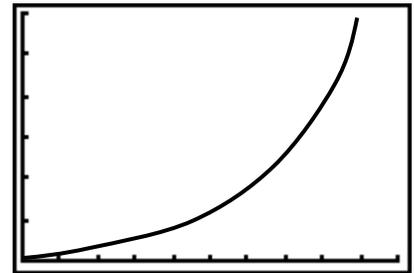
13. Suppose you were given the Distance vs. Time graph at right. What would you expect the matching Velocity vs. Time graph to look like? Sketch your estimate in the graph at right. (*HINT: First, decide whether each section of the Distance vs. Time graph has positive, negative, or zero velocity. Then, sketch positive, negative, or zero velocities in three sections on the Velocity vs. Time graph.*)