Motion Graphs 2012

Names _____ _____

Date _____ _____ _____

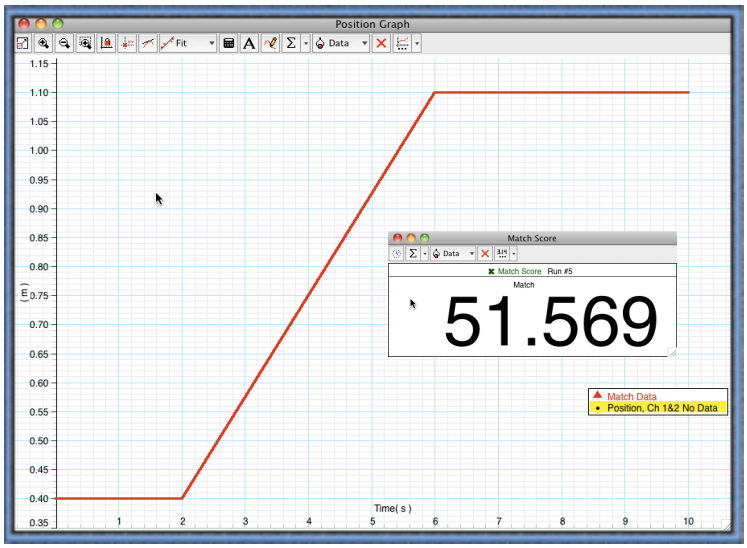
THEORY

When describing the motion of an object, knowing where it is relative to a reference point, how fast and in what direction it is moving, and how it is accelerating (changing its rate of motion) is essential. A sonar ranging device such as the Motion Sensor uses pulses of ultrasound that reflect from an object to determine the position of the object. As the object moves, the change in its position is measured many times each second. The change in position from moment to moment is expressed as a velocity (meters per second). The change in velocity from moment to moment is expressed as an acceleration (meters per second per second). The position of an object at a particular time can be plotted on a graph. You can also graph the velocity and acceleration of the object versus time. A graph is a mathematical picture of the motion of an object. For this reason, it is important to understand how to interpret a graph of position, velocity, or acceleration versus time. In this activity you will plot a graph in real-time, that is, as the motion is happening.

PROCEDURE

For this activity, you will be the object in motion. The Motion Sensor will measure your position as you move in a straight line at different speeds. The *Data Studio* program will plot your motion on a graph of position and time. The challenge in this activity is to move in such a way that a plot of your motion on the same graph will "match" the line that is already there.

Activity 1. Position



Position Graph

Try to think about what this picture of motion is telling you to do. An "A" will require a score *under* 1.5

Directions

For this part of the activity the software gives you two seconds to find your location on the graph. Move back and forth a little to find your icon along the Y axis.

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Position Graph Results

Student Name	Best Score	Run Number

Be sure to save your data files in case confirmation is requested.

Questions

What "tricks" did you learn that helped you score your best trials?

What parts of the experiment were challenging for you?

What does the slope of each line segment represent?

Imagine you are asked to start this trial again. Instead of standing still near the end, you return to the original position at a rate faster than you had as you moved away from the sensor. Draw a graph that shows this new challenge.

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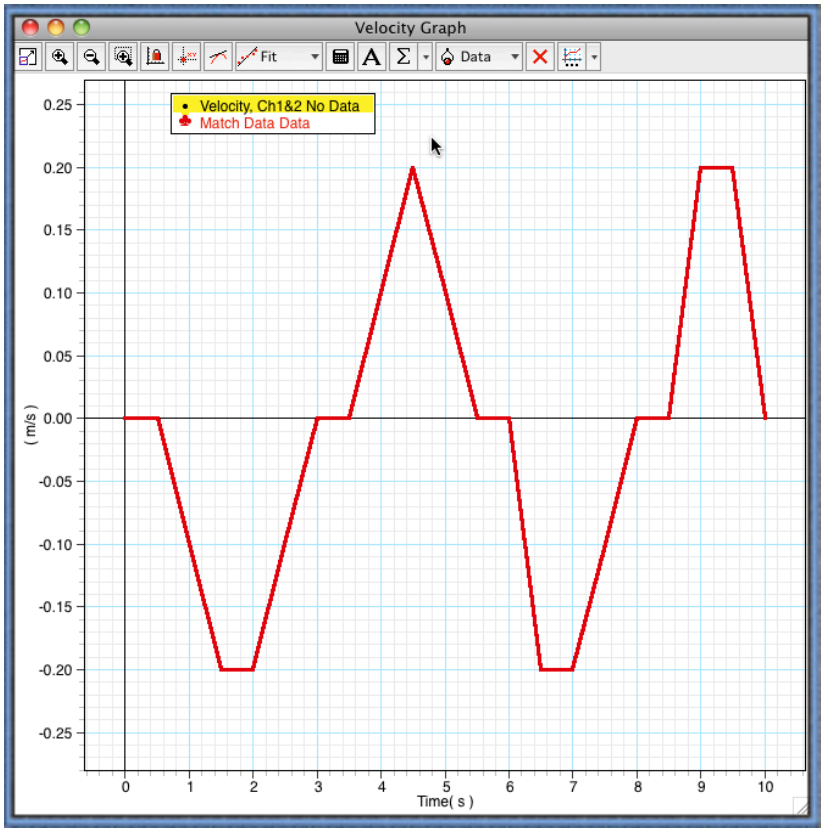
Activity 2. Velocity

Directions

While this graph always scares students a little, you will soon figure out how to match this velocity graph as well. In this activity there is no need to find your position at the beginning of each trial, there will **not** be a time delay when you start.

Hints: Take a careful look at the *maximum* speeds that you will have in either direction. You will not have to move very quickly. Some students find the timing of changing directions to be the most challenging part of the activity.



Velocity Graph

Try to think about what this picture of motion is telling you to do. An "A" will require a score *under* 5.0

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Names _____ _____

Date _____ _____ _____

Velocity Graph Results

Student Name	Best Score	Run Number

Be sure to save your data files if confirmation is requested.

Questions

What methods helped you obtain your best trials with the velocity graph?

What were 2 things about the graph that surprised you, or were not easy to understand?

What do you think the slope of each line segment represents?