LAB #1 - Distance – Time Graphs LAB

One of the most effective methods of describing motion is to plot graphs of distance, velocity, and acceleration *vs*. time. From such a graphical representation, it is possible to determine in what direction an object is going, how fast it is moving, how far it traveled, and whether it is speeding up or slowing down. In this experiment, you will use a Motion Detector to determine this information by plotting a real time graph of *your* motion as you move across the classroom.

The Motion Detector measures the time it takes for a high frequency sound pulse to travel from the detector to an object and back. Using this round-trip time and the speed of sound, you can determine the distance to the object; that is, its position. Logger *Pro* will perform this calculation for you. It can then use the change in position to calculate the object's velocity and acceleration. All of this information can be displayed either as a table or a graph. A qualitative analysis of the graphs of your motion will help you develop an understanding of the concepts of kinematics.

Purpose

- Analyze the motion of a student walking across the room.
- Predict, sketch, and test distance *vs*. time kinematics graphs.
- Predict, sketch, and test velocity *vs*. time kinematics graphs.

PART 1

1. PREDICTIONS: Use the graph grids on the attached page to sketch the distance *vs*. time graph that demonstrates each of the following situations:

   A. you are at rest at a position of 1 m from the motion detector
   B. walking with a slow, constant speed
   C. walking with a fast, constant pace
   D. walking so that you are speeding up as you go
   E. walking quickly at the start, then get slower and slower
   F. walking slowly at first, stop for at least 2 seconds, then walking quickly
   G. walk quickly for the first 5 seconds, turn around and return, walking slowly for the last 5 seconds
   H. start at the 2 m position, walking slowly for 5 seconds, turn around and walking back quickly for the last 5 seconds

2. TEST #1: Now, use the motion detector to test your predictions. (Instructions are placed at each station). Then I will come and "sign" your observation sheet, to show that your graph is correct.

ANALYSIS OF DISTANCE *VS*. TIME GRAPH

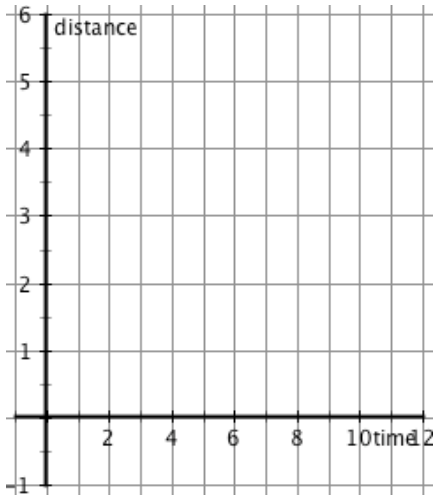
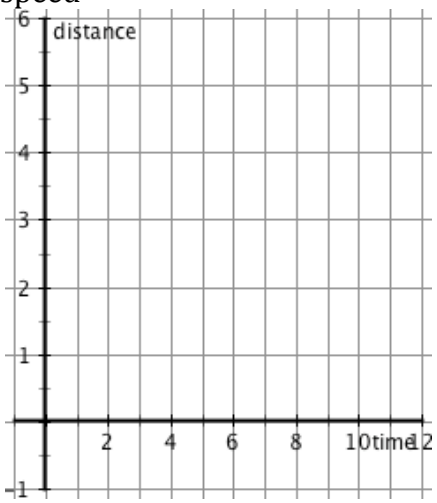
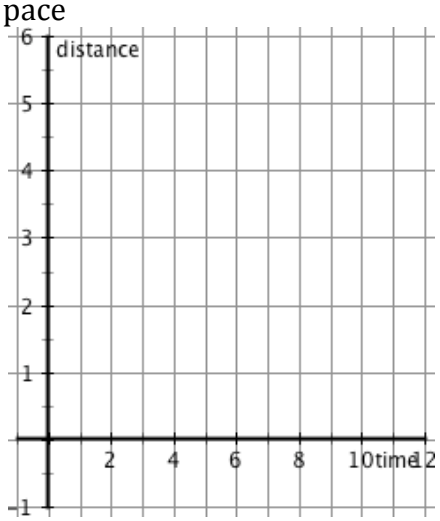
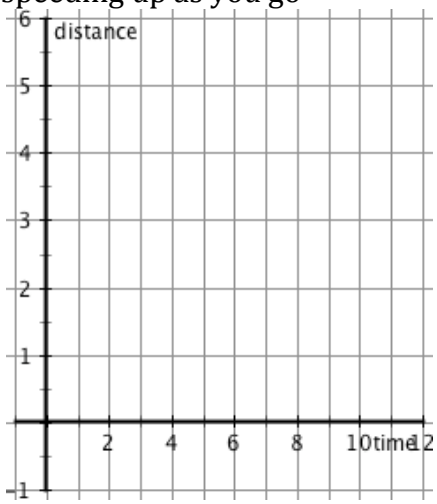
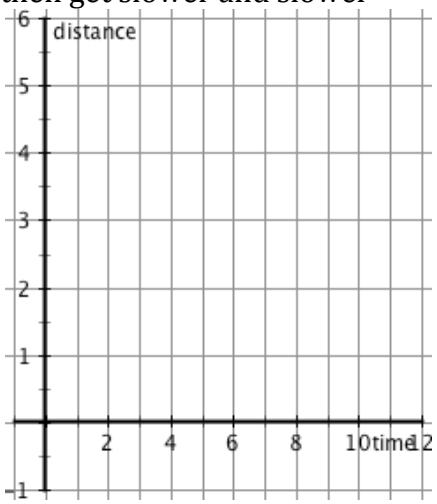
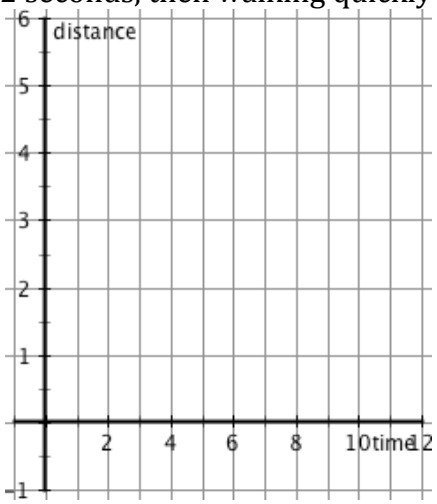
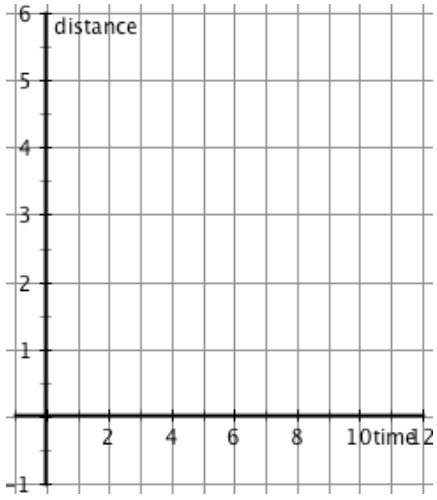
1. Explain the significance of the slope of a distance *vs*. time graph. Include a discussion of positive and negative slope.

2. What type of motion is occurring when the slope of a distance *vs*. time graph is zero?

3. What type of motion is occurring when the slope of a distance *vs*. time graph is constant?

4. What type of motion is occurring when the slope of a distance *vs*. time graph is changing? Test your answer to this question using the Motion Detector.

Observation/Data Sheet

you are at rest at 1 m away from the motion detector 	walking with a slow, constant speed 	walking with a fast, constant pace 
walking so that you are speeding up as you go 	walking quickly at the start, then get slower and slower 	walking slowly at first, stop for 2 seconds, then walking quickly 
walk quickly for the first 5 seconds, turn around and return, walking slowly for the last 5 seconds 	start at the 2 m position, walking slowly for 5 seconds, turn around and walking back quickly for the last 5 seconds