

## WALK THE LINE LAB – KINEMATICS AND MOTION GRAPHS

**Purpose:** The purpose of this lab is to understand and create velocity and acceleration motions graphs. In addition kinematic calculations will be practiced as well using the distance and time data collected in the lab activity.

**Materials:** The materials for this lab are meter sticks, timer, and masking tape.

**Procedure:** The procedure for this lab begins with placing marks at 1 meter intervals down the hallway or across the classroom starting at zero and going to 10 meters. Each student will move along the path and record the time at each point. Each person will have 2 trials. For the first trial, the rate of motion should be as constant as possible. For the second trial, the student should start off speeding up for the first 5 meters and then slow down for the last 5 meters. Record the data for each student in your group (at least 3 people, which means 6 sets of data). Create a data chart to record all data. Use this data to create a distance vs time graph. Then, calculate the velocity at each point. Use this data to create a velocity vs. time graph. When graphing, use a different color to represent each person. Each person will have 2 lines on each graph (so if there are 3 people, 3 different colors will be used and a total of 6 lines per graph). Finally, discuss the relationship between the variables and how it relates to each student's motion.

**Data Collection:**

DISTANCE (meters)	A Constant Rate	A Changing Rate	B Constant Rate	B Changing Rate	C Constant Rate	C Changing Rate
1m						
2m						
3m						
4m						
5m						
6m						
7m						
8m						
9m						
10m						

**Analysis (Calculations):  $V=d/t$**

**SAMPLE**

**Position 1:**  $v=1/1.3 = 0.76 \text{ m/s}$

**Position 2:**  $v=2/2.5 = 0.8 \text{ m/s}$

**PERSON A: (constant rate)**

Position 1m:  $v=$

Position 2m:  $v=$

Position 3m:  $v=$

Position 4m:  $v=$

Position 5m:  $v=$

Position 6m:  $v=$

Position 7m:  $v=$

Position 8m:  $v=$

Position 9m:  $v=$

Position 10m:  $v=$

**PERSON C: (constant rate)**

Position 1m:  $v=$

Position 2m:  $v=$

Position 3m:  $v=$

Position 4m:  $v=$

Position 5m:  $v=$

Position 6m:  $v=$

Position 7m:  $v=$

Position 8m:  $v=$

Position 9m:  $v=$

Position 10m:  $v=$

**PERSON B: (constant rate)**

Position 1m:  $v=$

Position 2m:  $v=$

Position 3m:  $v=$

Position 4m:  $v=$

Position 5m:  $v=$

Position 6m:  $v=$

Position 7m:  $v=$

Position 8m:  $v=$

Position 9m:  $v=$

Position 10m:  $v=$

**PERSON D: (constant rate)**

Position 1m:  $v=$

Position 2m:  $v=$

Position 3m:  $v=$

Position 4m:  $v=$

Position 5m:  $v=$

Position 6m:  $v=$

Position 7m:  $v=$

Position 8m:  $v=$

Position 9m:  $v=$

Position 10m:  $v=$

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**PERSON A: (changing rate)**

Position 1m:  $v=$

Position 2m:  $v=$

Position 3m:  $v=$

Position 4m:  $v=$

Position 5m:  $v=$

Position 6m:  $v=$

Position 7m:  $v=$

Position 8m:  $v=$

Position 9m:  $v=$

Position 10m:  $v=$

**PERSON B: (changing rate)**

Position 1m:  $v=$

Position 2m:  $v=$

Position 3m:  $v=$

Position 4m:  $v=$

Position 5m:  $v=$

Position 6m:  $v=$

Position 7m:  $v=$

Position 8m:  $v=$

Position 9m:  $v=$

Position 10m:  $v=$

**PERSON C: (changing rate)**

Position 1m:  $v=$

Position 2m:  $v=$

Position 3m:  $v=$

Position 4m:  $v=$

Position 5m:  $v=$

Position 6m:  $v=$

Position 7m:  $v=$

Position 8m:  $v=$

Position 9m:  $v=$

Position 10m:  $v=$

**PERSON D: (changing rate)**

Position 1m:  $v=$

Position 2m:  $v=$

Position 3m:  $v=$

Position 4m:  $v=$

Position 5m:  $v=$

Position 6m:  $v=$

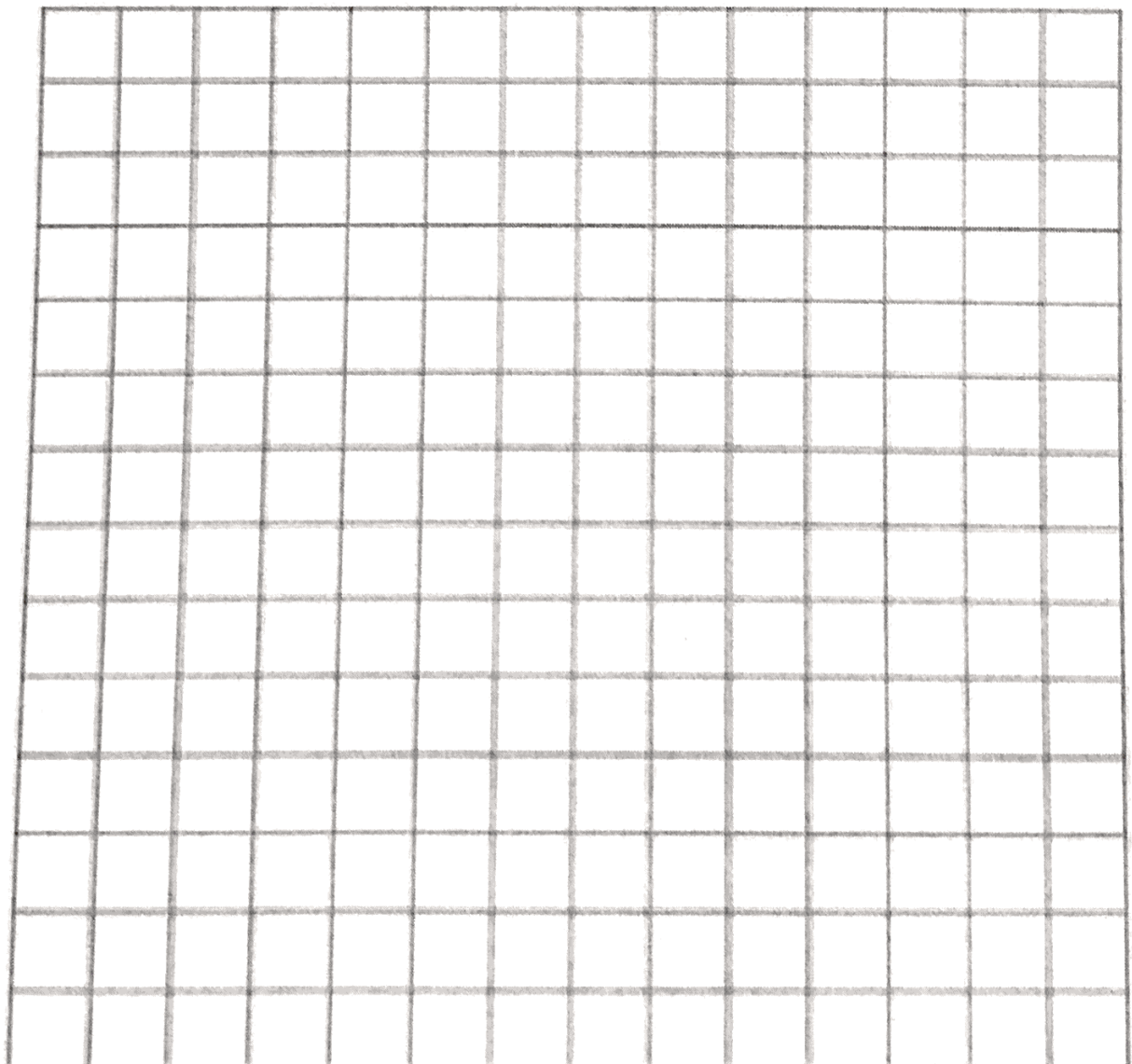
Position 7m:  $v=$

Position 8m:  $v=$

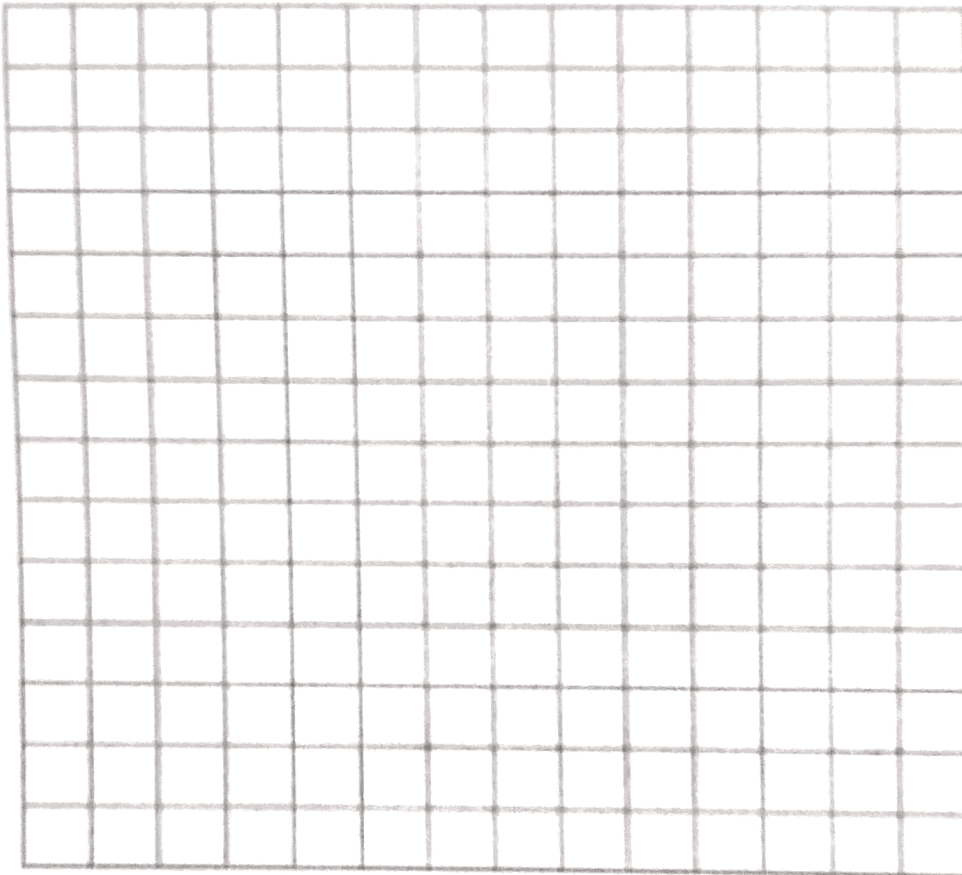
Position 9m:  $v=$

Position 10m:  $v=$

**Graph:** *Distance verses Time (thus showing velocity) – USE DATA CHART TO COMPLETE*



**Graph:** Velocity versus Time (thus showing acceleration) – USE CALCULATIONS TO COMPLETE



**Conclusions / Discussion:** Describe the relationship between the variables and how it relates to each student's motion. How is each different type of motion – being at rest, speeding up, slowing down, traveling at a constant speed - represented on a distance vs time graph (representing VELOCITY) and a velocity vs time graph (representing ACCELERATION)?