Motion 2 - Graph Matching

Graphs are most common way of representing motion. To help you develop a feel for how graphs represent motion you are going to match your motions with a graph. We will use SONAR to measure your position relative to a sensor that connects to your computer.

SONAR most commonly refers to the detection of objects under water using sound, however in your case you will use a sensor that connects to your computer. The sensor 'clicks', sending out a sound wave then waits for the echo to come back. Based on how long the echo takes, the sensor knows how far away you are.

Notes - copy into your labbook

Motion Definitions

	Unit	**Definition**
Distance	meters (m)	how far
Velocity	meters per second $\left(\frac{m}{s}\right)$	how fast
Acceleration	meters per second squared $\left(\frac{m}{s^2}\right)$	speeding up & slowing down
Time	seconds (s)	how long
Slope	$\frac{\text{Change in (something)}}{\text{Change in (something else)}}$	

Standards

Distance: 1m (1 meter) is about the distance between your face and your hand when you hold out your hand.

Velocity: 1 m/s (1 meter per second) is how fast people walk. 10 m /s is the fastest humans can run.

Acceleration: 10 m/s^2 (10 meters per second squared) is about the acceleration due to gravity.

Time: 1s (1 second) is about how long it takes to say 'Mississippi'.

Examples

Distance:

Velocity:

Acceleration:

Time:

Instructions for Notes

What you need to fill out are examples of each unit that you find interesting to you. But first, I should explain the standards section.

Anytime you encounter a new word, or in the case of physics, unit, you should have a standard that you always keep in mind. When I say 'cookie', you probably think of chocolate chip cookies independent of whether or not they are your favorite type of cookie. That means that chocolate chip are your standard for cookies.

Same is true for units, you should have something in mind that you can always think of. When I say gallon, you automatically think of a gallon of milk. A liter should also be common anymore because many water bottles are now available in a one liter size.

For the examples I want you to fill in examples of distance velocity, acceleration, and time. The only requirement is that you use the metric units for each of them. If you can think of an example, but you do not know the metric units, use `https://wolframalpha.com`. Wolframalpha.com is the free web version of a powerful mathematics software that will pull information from various sources to try and provide you with accurate answers.

Activity

The goal is to develop a sense for how a motion graph represents motion by using a SONAR sensor moving yourself back and forth in front of the SONAR sensor.

Setup - Procedure

- Get a sonic sensor from your teacher, ask your teacher for a demonstration of its proper use. You will use ’Logger Pro’ on your computer to connect to the sensor.
- There is a starting template for ’Logger Pro’ on Schoology in the folder for this activity.
- To start data collection press the green ’Collect’ around the top center of the ’Logger Pro’ window. Once data collection begins, the sensor will click indicating that it is collecting data. The graph the indicates your distance away from the sensor.
- Once you have played around with the graph and are comfortable with the programs operation, click the ’Graph Match’ button that is just to the left of the green ’Collect’ button. This will make a line appear on the distance versus time plot.

Notes

The sensor only works in a narrow beam straight in-front of it. This means that if you stand off to the side, it won’t pick you up. The sensor also picks up whatever is closest to it, meaning that if you swing your arms in-front of you as you move, it will pick up the movement of your arms. To prevent this being a problem, keep your arms either in your pockets or behind your back.

Questions for Labbook

- What does the x-axis of the graph represent?
- What does the y-axis of the graph represent?
- What does the graph look like if just stand in front of the sensor?
- What happens to the graph as you get farther away from the sensor?
- What happens to the graph as you get closer to the sensor?
- What does a constant distance look like on the graph?
- What does a constant velocity walk look like?
- What do you have to do to get a steep slope on the graph?
- What happens if you speed up as you walk towards or away from the sensor?