Measuring Motion

Olympic College Phys 110

For this lab, you will make use of a few simulations and take some real data of your own. You will need a computer with Internet access, and a program that can make graphs, such as LoggerPro or Excel.

# **Describing motion**

1. Go to <https://www.physicsclassroom.com/Concept-Builders/Kinematics/Name-That-Motion/Concept-Builder>. You can adjust the size of the interactive, or set it to display fullscreen.
2. Enter your first and last name, and click start.
3. Click “begin apprentice level”
4. You will be shown animations of a car moving. The box below contains a description of the motion. If you click the box, it will cycle through different possible descriptions. When you see the description that matches the motion, click check answer.
5. When you have worked through all 6 exercises at the apprentice level, click “Return to Main Menu.”
6. When you return to the main menu, the icon for apprentice level will now say “Apprentice level completed.” *Take a screenshot of this and insert it below:*

I encourage you to work on the Master and Wizard levels, but it is not required for this lab.

# Motion in 2D

1. Go to <https://www.physicsclassroom.com/Physics-Interactives/Circular-and-Satellite-Motion/Uniform-Circular-Motion/Uniform-Circular-Motion-Interactive>. You can adjust the size of the interactive, or set it to display fullscreen.
2. Click start in the upper right, and click to display both velocity and acceleration vectors.
3. Answer the following:
   1. *Relative to the circular path, what is the direction of the velocity vector?*
   2. *Relative to the circular path, what is the direction of the acceleration vector?*
   3. *If you increase the speed (but keep radius the same), what happens to the acceleration?*
   4. *If you increase the radius (but keep the speed the same), what happens to the acceleration?*
4. Two variables are *directly related* to one another if increasing one increases the other. Two variables are *inversely related* if increasing one decreases the other.
   1. *Are acceleration and speed directly, or inversely, related?*
   2. *Are acceleration and radius directly, or inversely, related?*

# Collecting your own data

For this activity, you will need a stopwatch, and something that can measure distances. It will be easiest to use a tape measure.

Find a long, open space. Being outside would be great, but you could also use a long room or a hallway. Mark a staring point, and mark off three-foot increments up to 15 feet from your starting point. That is, mark three feet from your starting point, six feet, nine feet, 12 feet, and 15 feet. (If you’re limited for space, you can adjust this accordingly; for example, you may only be able to mark off two-foot increments. Whatever you do, you’ll need five distances.) To indicate each distance, you can use a book, lay pencil down, have a well-behaved child sit in the same place, etc.

Start at the starting point, and time how long it takes you to walk the first three feet. Record this time. Return to the starting point, and record how long it takes you to walk six feet. Return to the starting point and record how long it takes you to walk nine feet. Continue until you’ve covered all length measurements; you should have five measurements total.

*Time it took you to walk three feet:*

*Time it took you to walk six feet:*

*Time it took you to walk nine feet:*

*Time it took you to walk 12 feet:*

*Time it took you to walk 15 feet:*

Now, make a graph of position vs. time. You should have the distance on the vertical axis and the corresponding time on the horizontal axis. Don’t forget to label your axes with appropriate names and units! Determine a linear line of best fit. Display this line and the corresponding equation on your graph.

*Insert your graph in the space below.* Using Excel, you can insert a graph directly into a Word document. You can also take a screenshot of your graph and paste it here.

As discussed in class, velocity is the rate of change of position—for a position vs. time graph, this means velocity is the *slope* of the graph. Use your graph and the linear trendline to determine your walking speed.

*Write your walking speed here:*