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 that can run Java applications, and a program that can make graphs, such as LoggerPro or Excel.

# Maze game

1. Go to <http://phet.colorado.edu/en/simulation/maze-game> and click download
2. The goal of this game is to have the red ball hit the blue finish circle. Observe the arrows representing position, velocity and acceleration as you play this game. You can control the movement of the ball by changing the size and direction of either position, velocity, or acceleration at the bottom right.
3. Click Level One, reset the clock, and click Start. Play a couple of times while controlling each of the position, velocity and acceleration
   1. *Level One position best time:*
   2. *Level One velocity best time:*
   3. *Level One acceleration best time:*
4. Click Level Two, and play again
   1. *Level One position best time:*
   2. *Level One velocity best time:*
   3. *Level One acceleration best time:*
5. Try playing Certain Death
6. *Why is it so much more difficult to control the ball when you are only controlling acceleration?*

# Motion in 2D

1. Go to <http://phet.colorado.edu/en/simulation/motion-2d> and click download
2. Click “Show both” at the top
3. Drag the ball around the screen, and select all the different controls at the bottom
   1. *Which arrow (blue or green) represents velocity? How do you know?*
   2. *Which arrow represents acceleration? How do you know?*

# 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:*