As always, you must have created a separate directory with the appropriate name, loaded your data files in that directory, and started a new script. You need to load the data. See that you load two txt files. Since the data has a little overlap (20 weeks mark), for ease of graphing, we need to put them together in a single data file to plot. In both weeks and mass, we take all of 'toRump' and don't include the first value of toHeel. We then convert the mass from grams to pounds.

Now we want to determine how much the values change each week, so we take the difference of each week and divide that by the weeks. It doesn't make that much of difference here, since we have a data value for each week, but it is good discipline to do it.

I open up the variable with the rate of change per week, and notice that the numbers are small in the beginning, and increase to a max of about a half pound for several weeks near rows 26-29, which correspond to weeks 33-37.

Now let's plot the actual weights and the differences on a graph. We're doing a new graph type, called a plotyy, where we use both left and right sides of the figure as separate y axis. In the results, the blue line on the graph corresponds to the blue axis, on the left. The red line corresponds to the right y axis, which in this case is the change by week.

Note that the largest change is the half pound increments, and those weeks can be found on the blue line by the steepest slope, but are easier to find on the red line as the peak. In calculus, the red line is the derivative of the blue line.

Now let's find the rate of change in the length of the fetus. We do that by converting the lengths to inches and then we find the differences, again dividing by the number of weeks between measurements.

Opening up InchesPerWeekRump shows the change is largest (0.7in) around the 5^{th} value.

In the next example, we find the midpoints on the weeks to make good graphs.

To graph, we do a subplot for the overall length and the growth rate. The growth rate for length is fairly consistent, even though we switched what we were

measuring at week 20. Finding the difference allows us to work through this type of challenge.

We've looked at the raw numbers, now let's look at these changes as percentages. Do the diff, just like before, but now dividing by the total weight, to get the percentages.

I open up the percent change variable and notice that the numbers start at 100% and rapidly decrease. From a scientific standpoint, do these numbers make sense?

And in the last example, we're going to graph these changes on a plotyy. Again, the blue line references the blue y axis, and the red line the right y axis. Does the graph make sense to you?

Change, and hence rates of change, are important scientific indicators and graphs are great ways to view these, so this is a critical skill to have.