Lab 1: Intro to Excel, Part 2

This lab exercise picks up, appropriately, where Part 1 left off. At the end of Part 1 you created a graph of data, *velocity vs. time*, from a fictional scenario in which a rock was tossed into the air (on a distant planet.) We know from our study of Chapter 2 concepts that the slope of our graph (which looks to be fairly constant, i.e. a straight line) represents the acceleration of the rock, i.e. the change in velocity over time, due to the influence of gravity (on the "distant planet".)

(Note: we inherently defined the positive direction as "up" in our data by using "height" for position... so the acceleration of the rock, i.e. the slope, is negative… because gravity pulls things down!)

Frequently this semester we will measure data that we will graph in an xy-scatter format and we will expect that the data should form a straight line. The slope of this line will have some quantitative meaning for our lab objective; that is, we will be interested in two things:

1. *Does the plot of our data form a straight line? Is it perfectly straight or not?*
2. *What is the value of the slope of the best-fit straight line?*

In the case of the plot from Part 1, the value of the slope represents the magnitude of the acceleration due to gravity on the distant planet. While the data does not form a perfectly straight line, we can calculate the ***best-fit straight line*** to our data, using a process called ***linear regression***, or "***least-squares fit***."

Today's lab includes two tasks:

1. Add a *best-fit straight line* to your data and display the equation of the line.

2. Create a data table with four columns by 20 rows of data; use the data in this table to calculate the slope and intercept of the best-fit straight line to your data.

In other words, Task 1 allows Excel to do the calculations instantly and display the result on the graph. Task 2 requires you to create another data table (*it's good practice!*) and show all the details of the calculations... to get the same result!

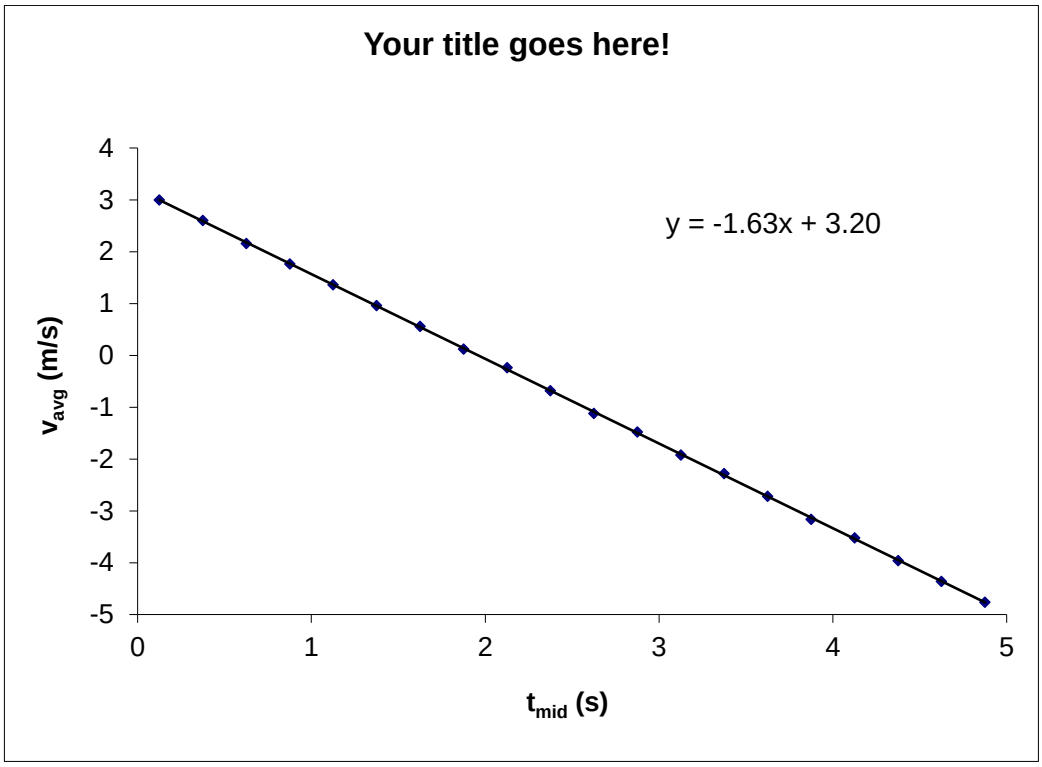
The idea is that the results from Task 1 and Task 2 should match exactly. If they do not, find the mistake and fix it!

Task 1

- Add a "trendline" to your data by right-clicking on any data point and choosing "Add Trendline" from the resulting pop-up menu.

- Choose Linear (it should be the default) and click OK.
- Excel should have added a straight line through your data. Carefully right-click anywhere on the line and choose “Format Trendline”. Use the options in the menu to make the line thinner (so that it does not obscure your data points) and to display the equation on the graph.
- Right-click on the equation to format its font size and decimal places.

When you are finished, your graph should look like this:



Task 2

Excel internally calculates the slope and intercept of the best-fit line using the method explained in the video; i.e. Excel calculates the slope and intercept of the line that *minimizes* the sum of the squares of the distance between each data point and the line. You can now perform this calculation in detail and verify that your results match what Excel displays on the graph.

This calculation requires four values that you must create from your data: the sum of “x”, the sum of “y”, the sum of “xy” and the sum of “x^2.” To create these sums, you will need a data table with four columns.

- In Part 1 you created a properly formatted data table with four columns of data. *Use this to your advantage!* Highlight the rows (on the left of the screen...) that include your data table (i.e. rows 5 through 30) from last week and either press Ctrl and “c” or right-click and choose “Copy.”

- Click **row 43** at the left side of the screen, then press Ctrl and "v" or right-click and choose "Paste." You should now have an exact duplicate of last week's data table directly below the original. *Note that the cell heights that you formatted in the first table are also copied.*

- Delete the data, title and column headers from the new table so that only the borders and empty cells remain.

- Add two rows to the data table by highlighting any two rows in the middle of the data table (again, highlight the rows at the left of the screen), then right-clicking on either row number of the two that you highlighted, and choosing "Insert" from the pop-up menu.

- Enter a new title and column labels. Your column labels should be:

  t_{mid} (s) **v_{avg} (m/s)** **$t_{mid}v_{avg}$ (m)** **t_{mid}^2 (s^2)**

  Note that the first two of these labels are your "x" and "y" data from the graph you created last week. The remaining two labels are "xy" and "x^2".

- Fill in the data for the first two columns by "mirroring" the last two columns in your first data table. (*I will explain this on the board*.)

- Fill in the third and fourth columns by using an equation that includes the data from the first two columns.

- Add a ***Bottom Double Border*** to the last data cell in each column.

- For each of the four data columns, in the cell under the *double bottom border,* use Excel's "sum" function to calculate the sum of the column.

- Format all data to the appropriate number of decimal places.

- In the cell under each sum, add the appropriate label for each data column: **A B C** or **D**.

- In the cell under the **A B C** or **D** label, add the appropriate descriptor: **x y xy x^2**

Calculations Section

Now you have the data you need, i.e. the values of "A B C and D", to calculate the slope and intercept of the best-fit line. You can now create a *Calculations* section using my sample in the *Formatting for Calculations* document as a guide.

Use the yellow block of cells between rows 32 and 41.

- Highlight this block of cells and add a border around the outside (in the same way that you started last week's lab by adding a border around the gray block of cells.) Then remove the yellow highlighting (again, same way that you did last week.)

> *It is best if your C*alculations *section does not share rows or columns with your data tables. This allows you to customize the size of the cells in your data table and your calculations section independent of each other.*

- Resize the rows and columns to approximately match the sample shown in the *Formatting for Calculations* guide.
- Merge cells where necessary, as shown in the sample.
- Add a brief description of your calculations. Again, use the sample as a guide.
- Type the algebraic equation and the equation showing numbers with units into the appropriate cells.
- Use an equation to calculate each answer; have Excel use the values at the bottom of the columns in your data table for **A B C** and **D**.
- Include units of the answer in a separate cell, to the right of the calculated answer.

The result of your calculations should match the value (and units) of the slope and intercept given by Excel in the equation on your graph. If they match, call me over for final approval. If they do not match, carefully check your work to find your mistake.