


## Graphing and Curve Analysis Using Microsoft Excel<sup>®</sup>

The following instructions guide you through the process of creating a graph (called a “chart” in Excel) from a set of data, and using Excel to calculate and draw a line that best fits your data (called a “trendline” in Excel). The information determined from this best-fit line will be used to analyze your data. These graphing techniques will be used in most of the labs this semester, so it is important that you understand them. You will also find that these graphing techniques are useful for analyzing data from other disciplines.

### Creating A Graph

1. Set up columns for data in the spreadsheet, *making sure that the first column contains the values to be plotted along the 'X' axis*. Include a title for each column, including the units. Generally, you will only need to include the data that will actually be plotted, not your raw measurements - unless you wish to check your calculations. Be sure to save your work!
2. Click the left mouse button and drag the mouse over the data to be plotted. In most of our cases, you will not need to include the column title.
3. Click the **ChartWizard** button in the tool bar (see example to the right). When you have released the mouse button, the first step of the Chart Wizard appears. 
4. *ChartWizard Step 1 - Chart Type:* You must select the type of graph to use. The style you will use for all your graphs is the “XY (Scatter)” Chart Type. You should also make sure that the first Chart sub-type is selected; this is the one you will always choose. If you click and hold the “Press and hold to view sample” button, you will see a preview of your graph. Click the **Next>** button.
5. *ChartWizard Step 2 - Chart Source Data:* This step shows you the range of cells that you have selected for your graph. Generally, you will not have to change anything here. Note that there is a **<Back** button at the bottom of the dialog box; if you change your mind during any step, you can back up and choose another option. Click the **Next>** button.
6. *ChartWizard Step 3 - Chart Options:* A preview of your graph is displayed. You can add a title to the graph, and label the axes. Click in the white box below “Chart title”, and type a descriptive title, **but do not press the Enter key!!** Your title should be descriptive; “Period as a function of Pendulum Length” is much better than “T vs. L”. Click in the “Value (X) Axis” and the “Value (Y) Axis” boxes to label the X and Y axes, again remembering **not to press the Enter key!!** Your axis titles should include the units used. As you type each label, it will appear in the preview graph. When you are satisfied with the results, click the **Next>** button.
7. *ChartWizard Step 4 - Chart Location:* In this final step, you decide on the location of the completed graph. You can choose **As New Sheet:**, and the graph will be placed on a separate page; or, you can choose **As Object In:**, and the graph will be inserted on the same page as the data used to create it. Select one of the options, and click the **Finish** button. Each choice for the graph location has an advantage. Including the graph on the same sheet allows you to see the data and the graph at the same time. However, the printout of this graph doesn't look great. Putting the graph on a separate sheet produces a full screen graph that prints very nicely. If you decide to put the graph on the same sheet as the data, you can always move it to another sheet before printing by selecting the graph, and choosing **Location...** from the **Chart** menu. Try each method; you'll see the difference. Check with your instructor to find out the preferred method.

### Analyzing The Graph

8. Now that your graph is created, you'll need to analyze it. The first step is to add a best-fit line. Click the graph *once* to select it for editing. Click *once* on any one of your data points, then from the “Chart” menu, choose “Add Trendline...” (*shortcut: Right-click on any data point, and choose*

“Add Trendline...” ). There are 6 possible best-fit “trendlines”, also known as regressions; Excel will determine which of the six can be used for your data (*but it doesn't pick the correct regression for you!*). We will be using “Linear” for straight-line data (in the form of  $y = mx + b$ ), and “Power” ( $y = ax^b$ ), “Exponential” ( $y = ae^{bx}$ ), or “Polynomial” (of 2<sup>nd</sup> order:  $y = ax^2 + bx + c$ ) for curvilinear data. Select the appropriate regression (your instructor can offer suggestions if necessary), and then click the **Options** tab (don't click OK yet!). You can later change the type of fitting if you choose.

9. In the Options dialog, click the box next to “Display Equation on Chart”, then click the **OK** button. You are then returned to your graph; the best-fit line is included, as well as the appropriate equation for the line chosen. Excel calculates the values of the appropriate coefficients  $a$ ,  $b$ ,  $c$ , and  $m$ . You will note that more significant figures are presented than may be dictated by the accuracy of your measurements. It is from these coefficients that you will be performing your analysis.
10. At this point your graph is complete. Your instructor can show you how to edit portions of the graph if they need to be changed. If you find that a data point is incorrect, change the number, or delete the point, and the graph will update automatically. Double-clicking on the trendline, and choosing a different regression can change the type chosen.


### Graph “Embellishments”

Before your graph is printed, you might need to change a few options that will make your printed graph easier to view and analyze.

11. Double-click the best-fit line you created (*not* on the data points); this will bring up the “Format Trendline” dialog box. Click the down-arrow next to the “Weight” option to change the line thickness; the next thinner size works nicely, and looks better when printed. *Note that this is the same method you would use to change the regression type for your best-fit line!* You can change the color of the line if you wish, but don't waste a lot of time “decorating” your graph. Click **OK** to accept the changes.

### Add Your Names, And Print The Graph

Since all the groups in your lab section will collect similar data for a particular experiment, it's important to add your names to the graph to distinguish it from the others in the printer.

13. Click the graph once to select it. Click the “Print Preview” button (the magnifying glass – see sample at right) to make sure you are printing the graph, and not your data (not necessary, since your lab report contains a data table). Here you will see how the graph will print; if there's something you wish to change, click the **Close** button, and make your modifications. 
14. Add your name – and your lab partners' – to the header as follows: in the Print Preview window, click the **Setup...** button, then the **Header/Footer** tab. Next click the **Custom Header...** button, and type your names in the “Center Section” box.
15. If you wish to add the date to the graph, click the “Right Section” box, then click the “Date” button (the little calendar – see sample at right). This will add  $\&[Date]$  to the right section of the header, and will print the current date on the graph.
16. Click **OK** until you return to the print preview window. When you are ready, click the **Print** button.