Plotting Data and Determining Slope Using EXCEL 2007

Microsoft Excel is a spreadsheet program that allows you to organize data, perform repetitive calculations, and create graphs. It is a very useful program to handle scientific or statistical data, to create databases (lists of information such as an address book or a library catalog) or to do accounting.

This handout is a guide for how to enter data, perform calculations and make graphs with Excel. All tabs and menu selections are shown in **bold italics**. Make sure that “How to Make a Good Graph” is consulted.

1. **Entering the data.**

   1. Start up a computer, log on to the computer as 2105. You may want to bring a USB disk to save your graph. Click on the Microsoft Excel icon. A blank data sheet should now appear on the screen:

   2. It’s helpful to enter the names and units of your data in the cell above the column of data. Columns can be widened with a left click on the line to the right of a column heading, then dragging the line. Or, double left click the right hand line to the right of a column heading.

   3. Enter x,y data side by side columns, with the x axis data in the left hand column and the y data to the right, but this isn’t necessary. Press the “Enter” to move down a cell, or use an arrow key or the mouse to move to a new cell.

   4. You can make Excel calculate values with equations you enter. Start with = in the cell, then use standard arithmetic symbols. You can use SUM, LN or LOG, STDEV, or SQRT (+ others). The cell would read: =SUM(A1:A3) to add numbers in a range of 3 cells (A1+A2+A3). Use lots of brackets (), see the Formulas page, pg. 4.

2. **Graphing the data.**

   5. To select the data to plot, left click on the top left cell and drag to the bottom right cell. All the cells in both columns containing data should now be highlighted.

   6. Click the **Insert** tab and then the **Scatter Chart** button (see below). The type of plot you need is an **XY (scatter)** plot with with only markers (no line).

   ![Scatter Chart](image)

   7. Check your graph carefully to make sure the proper data is on the x axis. If the x data is on the y axis, right click in the chart area and click on **Select Data**. Click the **Edit** button and change the letters in the **series X values** and **series Y values** fields.

   8. **Add Titles and Axis labels:** Click on the chart to outline in blue, and select the **Layout** tab under **Chart Tools**.

      a. Click **Chart Title** and **Above Chart**, then add your descriptive title (not simply y units vs. x units). Highlight the title with the mouse, and reduce the font size to something reasonable (12 or 14 pt).

      b. With the chart selected, under the **Layout tab in Chart Tools**, click **Axis Titles** and enter titles and units for the x (horizontal, title below axis) and the y (vertical, rotated).

3. **Best-fit line and correlation coefficient.**
9. With the chart still selected, click on the Design tab under Chart Tools. Use the left mouse button to select one data point, then right click. Select Add Trendline. Make sure the “linear” box is checked, and check the 2 boxes at the bottom (Display equation on chart, and Display R^2 value on chart). Close the window.

The R value indicated on your graph is the correlation coefficient. The value of R^2 gives an indication of predictive value of your equation, and extent that variance in y depends on x (and not other factors). The closer it is to 1.0 the more predictive value of your data.

10. Select the Legend box and delete.

4. Add tick marks and adjusting the axes.

11. To add minor tick marks, right click a number on an axis, and select Format Axis. Select “Inside” in the menu for Minor tick marks. The scale of the tick marks can also be adjusted to add more or remove some of the marks. The scale of the axis can be adjusted to maximize the space for the actual data in the chart window. The placement of the x axis can be adjusted in the y axis formatting box, useful for graphs with negative y axes.

5. Sharing work

It is expected that you and your lab partner will have identical data (you'd better) and, therefore, have identical graphs. Many of you will work with your lab partner on the graph. This is OK, as long as both of you are actively involved in making the graph. You are NOT LEARNING if your lab partner is creating the graph, printing out two copies and giving one to you. You are paying money to learn, don't waste the opportunity. To encourage the honor system, at the bottom of your graph, write the statement “I actively worked to create this graph” and sign your name. May you be cursed with lousy jobs and sleepless nights if you don't take advantage of your chances to learn.

If your graph is computer generated, you need not recalculate the slope by hand, as most graphing applications will generate a best fit line and equation for you.

There are two sample graphs on the next page.
Sample Graphs

Both graphs should be printed at least ½ page size!

**The good:** The graph above shows a good linear relationship between the data, with a perfectly straight line that fits the data as well as possible. The axes are well labeled, and the scale/tick marks are perfect. Note how the data points take up most of the area of the graph. The equation for the line is printed, and the student provides an explanation in words.

**The bad:** The y axis has too many minor tick marks; they are just a blur.

**The good:** The graph above shows a curve fit for the data, with a smooth curve that fits the data as well as possible. Neither graph is “connect the dots.” The x axis is well labeled, and the scale/tick marks are perfect.

**The bad:** The y axis is not labeled with units for conductivity. The x axis extends too far out.
How to Write Formulas in Microsoft Excel

Excel is a great tool for simplifying difficult mathematical and statistical chores. Using the following data table as an example, several things can be shown.

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.129</td>
<td>3.261</td>
<td>3.67</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2.876</td>
<td>1.839</td>
<td>5.52</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3.573</td>
<td>2.248</td>
<td>8.25</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Beginning a calculation in Excel starts with the equals sign, it’s like telling Excel that \( y = 5 \times 2 \), and Excel will compute ‘10’ in that cell.

If you want to multiply the value in cell A1 by the sum of the values in cells B1 and C1, type \( =A1 \times (C1 - B1) \)

To calculate the sum of column A in cell A4, the text in A4 would read: \( =\text{sum}(A1:A3) \) You can type the cell address or use the mouse to highlight the cells once the first parentheses has been typed.

Type “Enter” after using an equal sign (=) using the mouse to click another cell changes the formula!

To calculate the average of row 1, the text in D1 would read: \( =\text{average}(A1:C1) \)

To calculate the natural log, use: \( =\text{LN}(A1) \), and base ten log is: \( =\text{LOG}(A1) \), and .

The standard deviation of column A is calculated as: \( =\text{stdev}(A1:A3) \).

Enter exponential notation at 2.53E-5 for 0.0000253. Don’t use 2.53*10^-5.