Lab 0

Graphical Analysis – Use of Excel

What You Need To Know:

This lab is to familiarize you with the graphing ability of excels. You will be plotting data set, curve fitting and using error bars on the graphs. In later labs you will be expected to know how to graph your data and hand in a printed graph with a table of results and of course you name.

Each graph should have you name clearly indicated on it, a title, clear x,y labels and units for the measured quantities. If a slope is required then that should be on the graph too along with a fitted straight line "curve" for the data. You may need to add log scale at some point we'll show you how to do that too.

I'm going to show you how to do this: I have copied and pasted this from an excel spreadsheet.

I will show you step by step how to redo it.

Plot 1: Curve fitting

a) One set of data and find slope.

b) Two sets of data points on the same graph.

Plot 1(a): In this data you will be finding the value of $\pi \sim 3.14$ as a slope. Enter this data into excel. This is a bunch or radii and circumferences of circles. You know the formula circumference, $C = 2\pi r$, we will use that to find π.

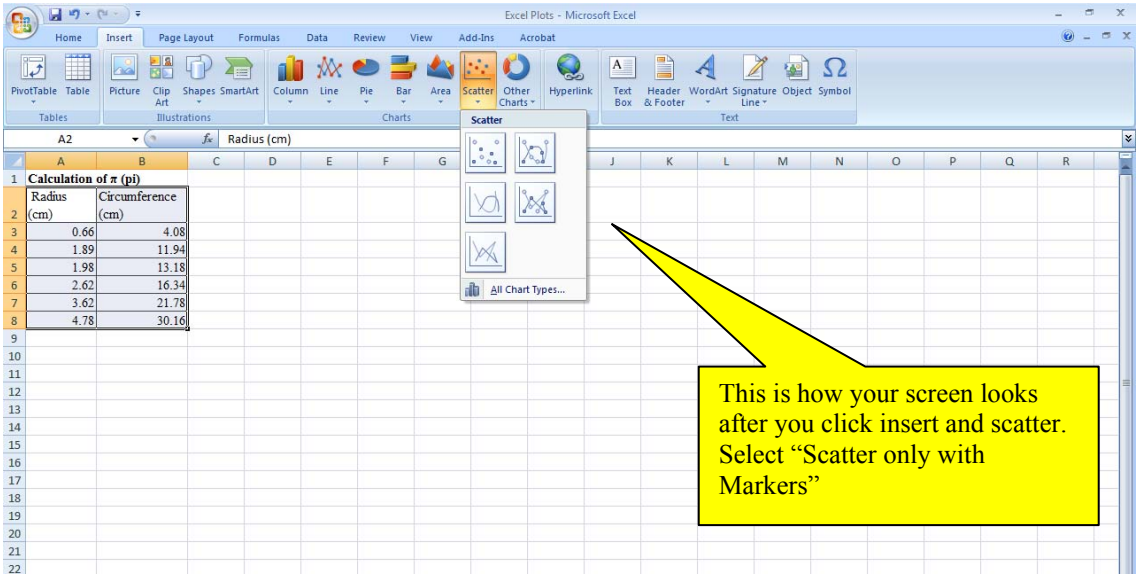
Calculation of π (pi)

Radius (cm)	**Circumference** (cm)
0.66	4.08
1.89	11.94
1.98	13.18
2.62	16.34
3.62	21.78
4.78	30.16

A) Enter above data into excel

B) Click on an empty cell and then click on the insert menu button.

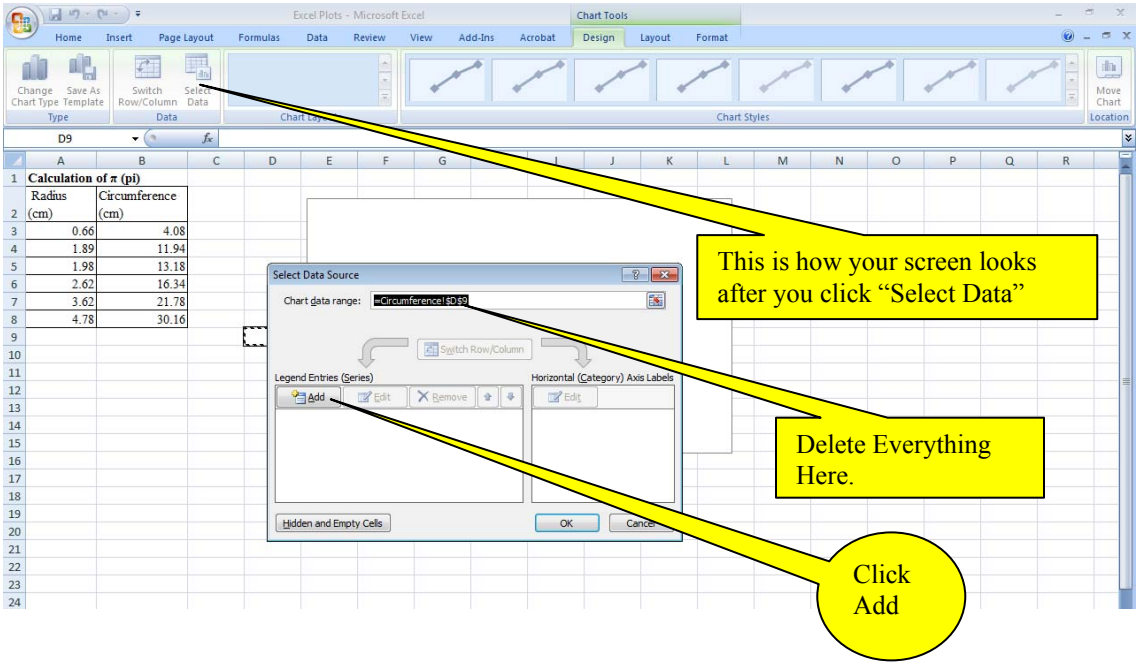
C) Hit scatter plot and top left button. No lines yet please. Delete the series bar. If you selected the data you want to plot it will be draw for you. If not you get a blank plot, select data by left click and drag method.



D) You can hit the plot which has the title and axes labels and edit those.

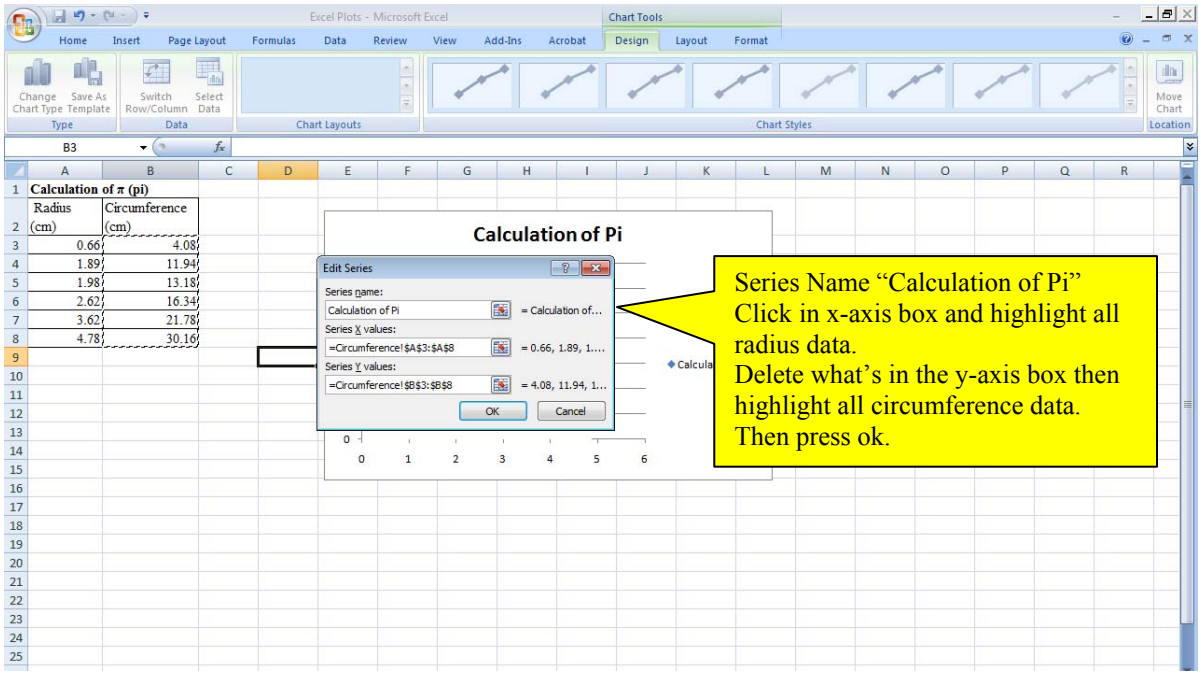
E) Hit the select data button… top menu on the left, if the graph is not being plotted in the right way…

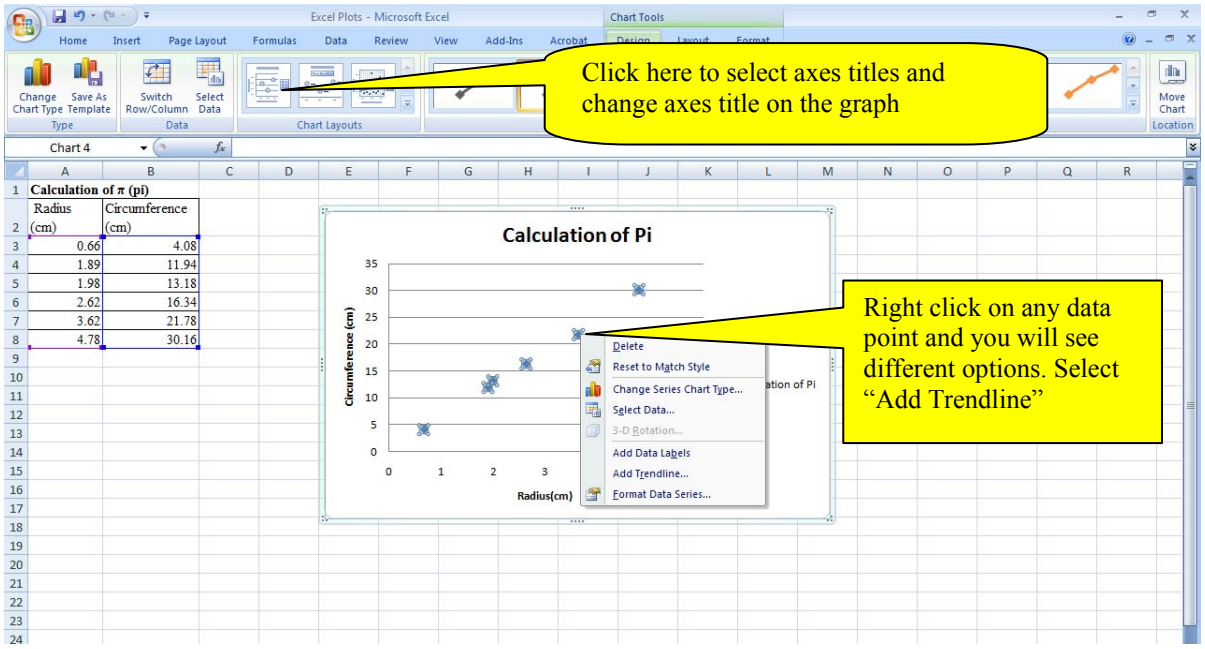
F) Hit the add button and select all the radius data by left clicking and dragging to highlight the column. This goes into the values x-series line (see diagram below).

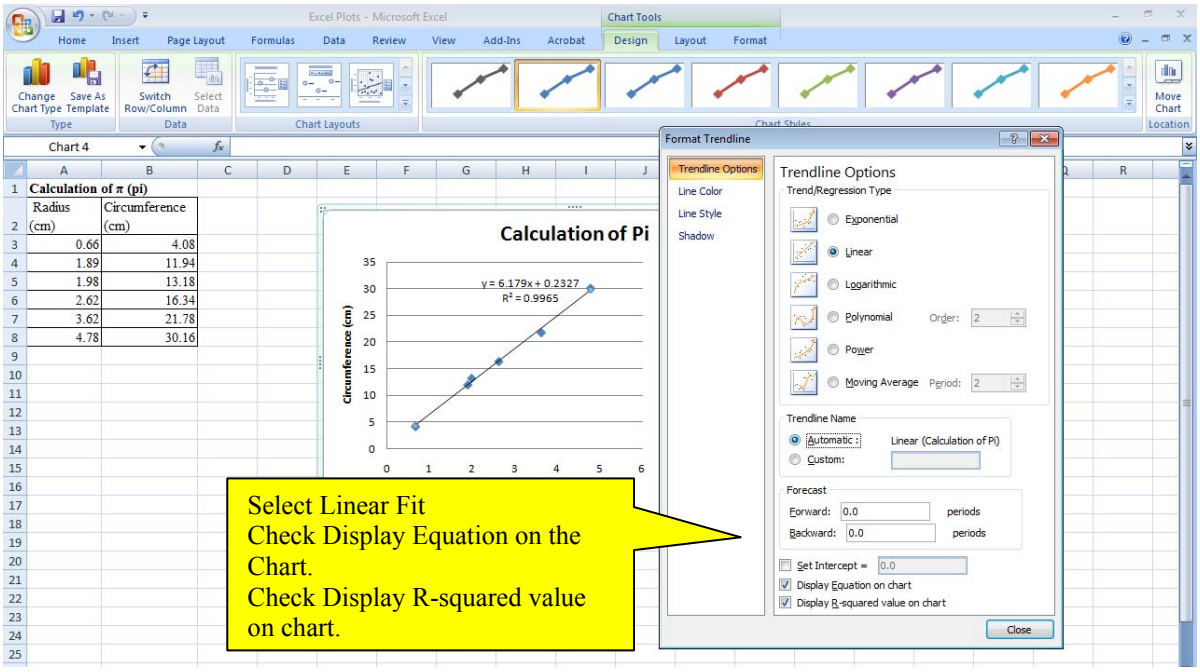


G) Add the title "Calculation on Pi" to the series name.

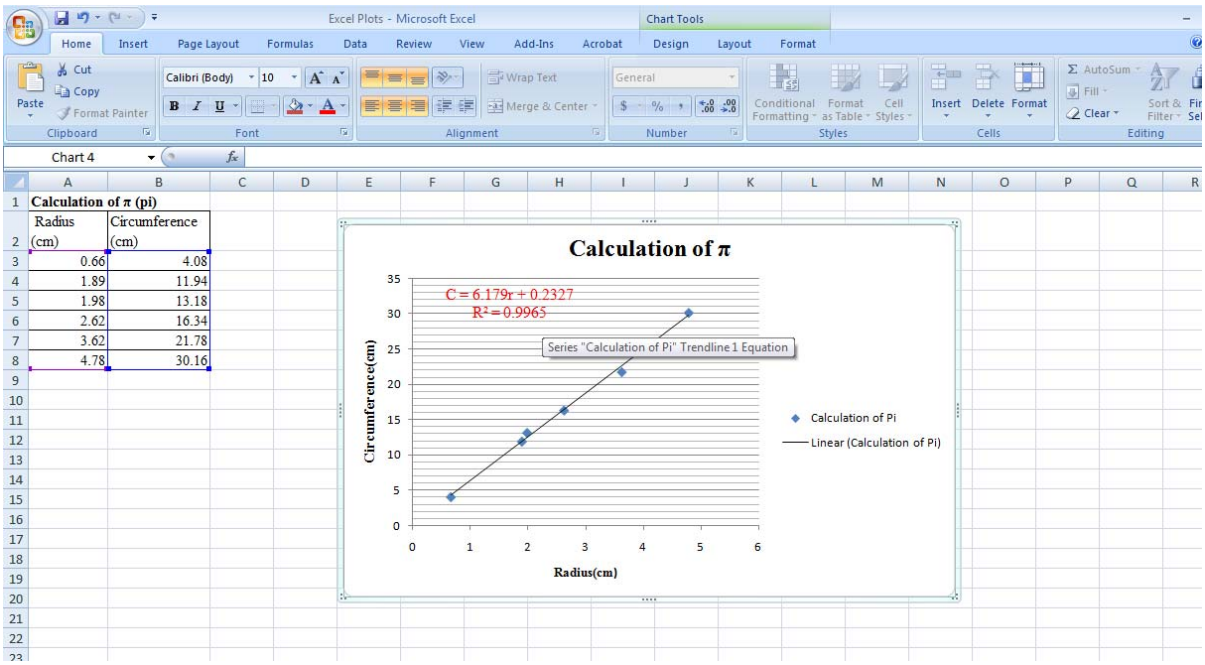
H) Select the y-axis and highlight the circumference data by left click and drag method then click OK.







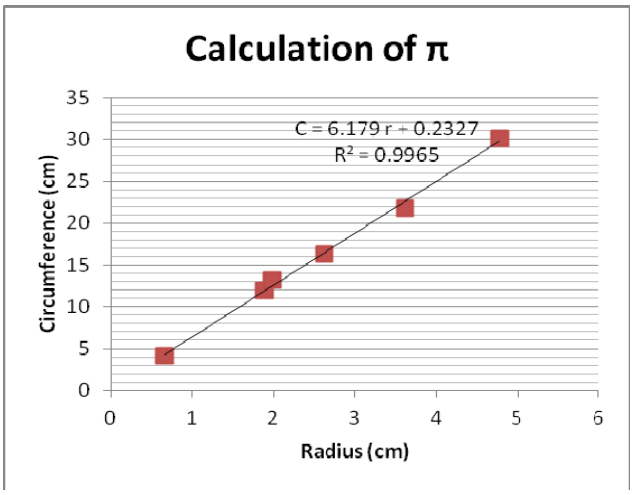
You can play around to change font, text size, and color.



I added the value of π obtained from the straight line plot. The slope is 2π, so divide the slope by 2 and then find the percentage error. To get excel to give the value of π simply type = Pi( ) into a cell and hit enter, the value of π will appear as above to 9 decimal places. To get π chose insert and then symbol.

Calculation of π

Circumference (cm)	Radius (cm)
4.08	0.66
11.94	1.89
13.18	1.98
16.34	2.62
21.78	3.62
30.16	4.78



slope = 6.179

Pi = 6.179/2 = 3.0895

Pi() = 3.141592654

% error = 1.658160664 %

The R^2 value tells how close the line is to a perfect fit. R = 1 indicates a perfect fit.

You can also get help at the site:
http://phoenix.phys.clemson.edu/tutorials/excel/index.html

There are MANY tutorials here, much more than you'll need.

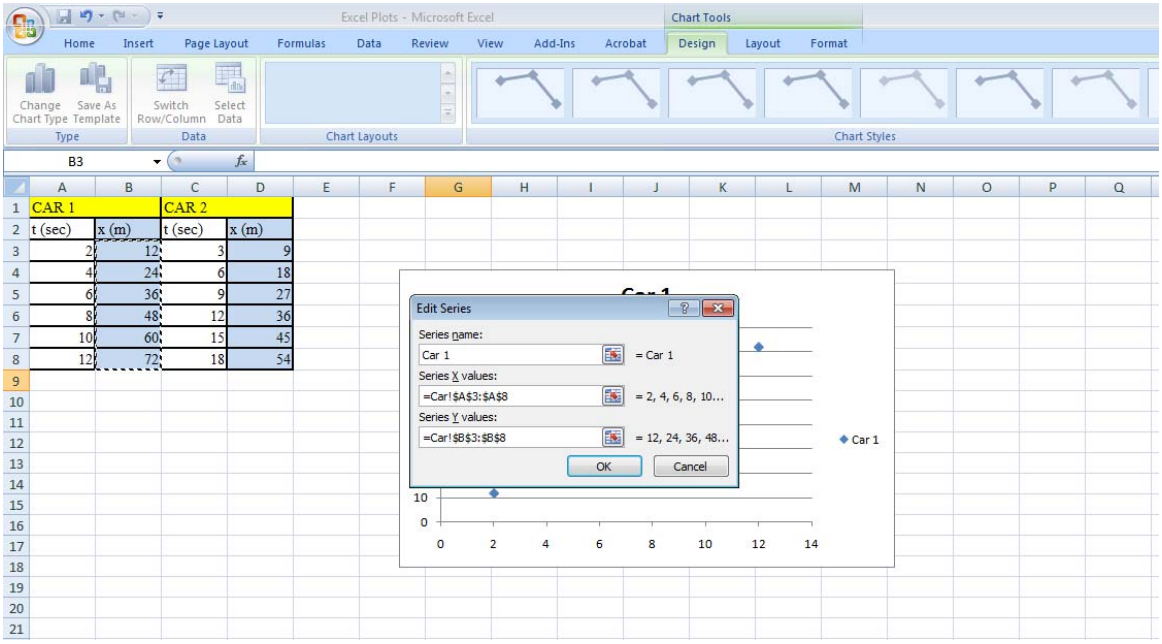
Plot 1(b): Two sets of data points on the same graph.

Car 1		Car 2	
t (sec)	**x** (m)	**t** (sec)	**x** (m)
2	12	3	9
4	24	6	18
6	36	9	27
8	48	12	36
10	60	15	45
12	72	18	54

Position vs. time graph for 2 cars both plotted on the same graph.

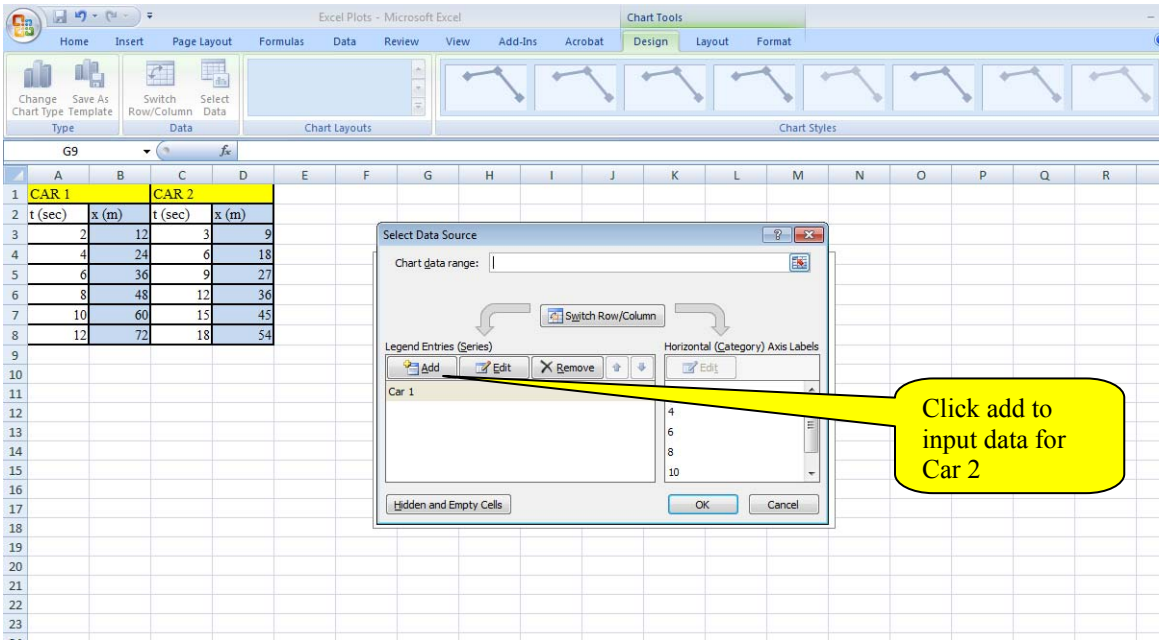
A) Input this data into Excel.

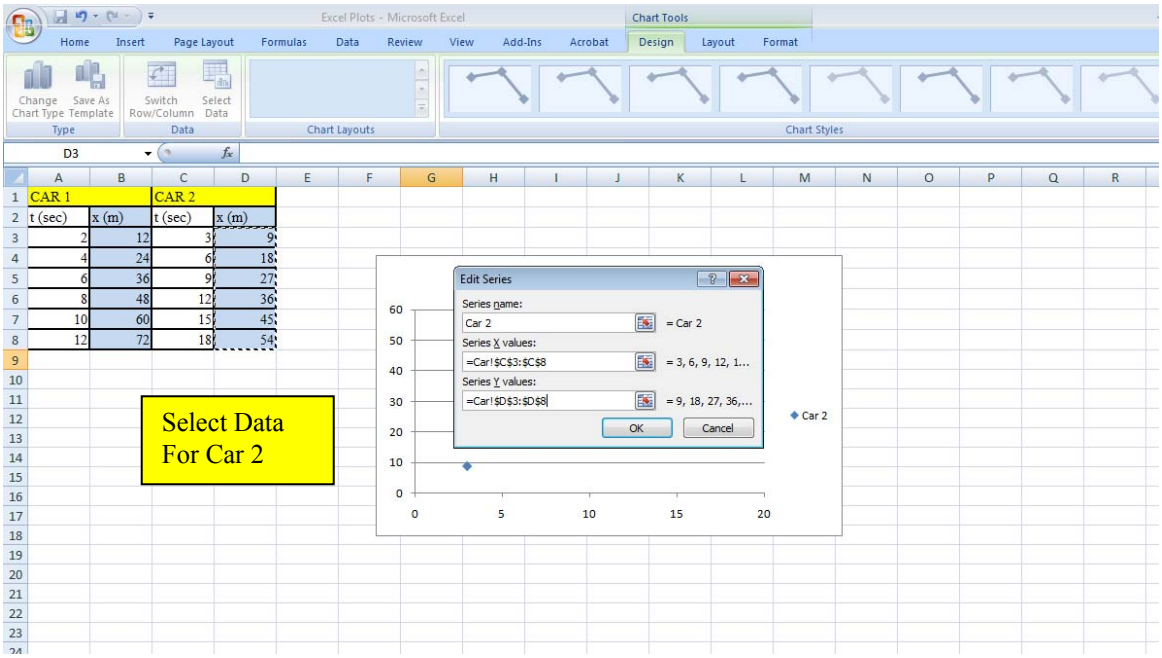
B) Repeat the steps in plot 1a for car 1 and get a graph with titles and axes. Highlight all the car 1 data, x and t values, left click and drag, then hit the scatter plot and the data will be plotted for you. Add titles and axes by choosing the plot with title and axes shown.



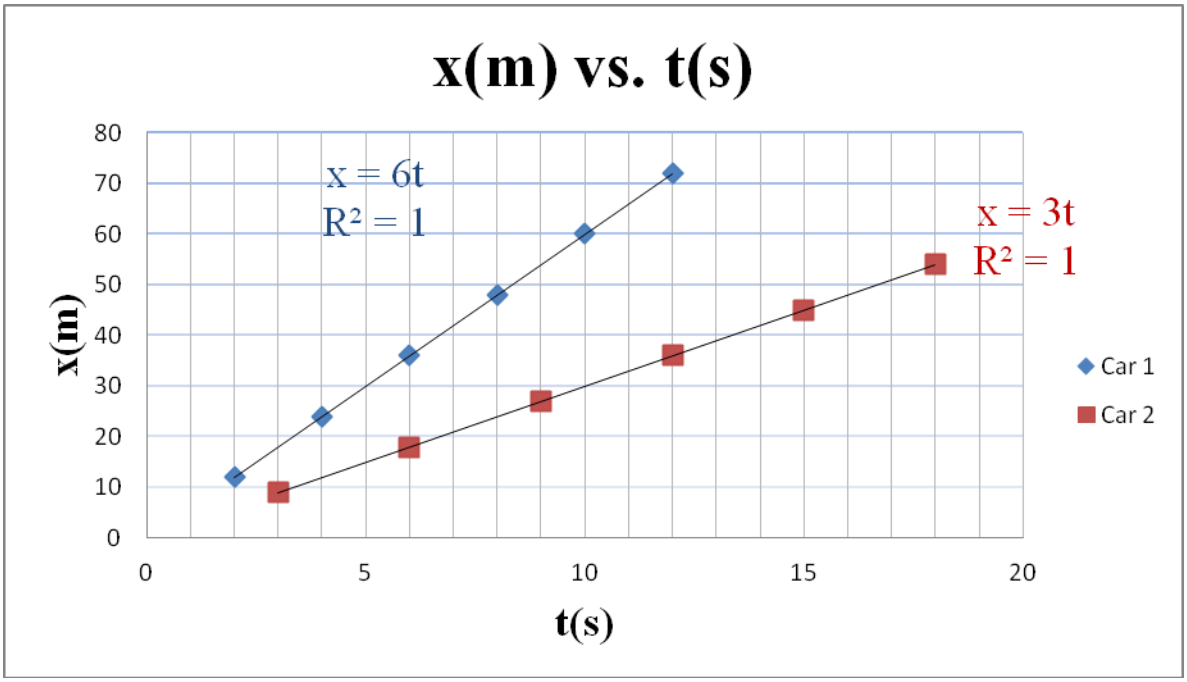
C) Now you're going to add another series, hit the select data menu option and then add. This time highlight the time and distances for car 2, this will add a second graph to the first on the same plot. Click OK when done.

D) If at any point you lose the chart info, just click on the chart (plot in excel) and the Chart Tools tab reappears at the top of the menu, click that and all the tools reappear.





Now you have two data sets on one graph. Find the velocity of each car from the slope and write that somewhere on the graph along with your name. You should now have something like this:



Plot 3: Data points with error bars.

Ok this is the last one folks. You will have to plots error bars from time to time and here's how to do it. The "blobs" triangles, squares or round dots you've been plotting do not convey any information as to how accurate the data points are. If you know the measurement was accurate to within +/– 1cm and the data point is 1000 m then ok you don't need the error bar, it's too small to show up, but what if you were measuring something that was just 8cm, then +/– 1cm would be a much bigger deal.

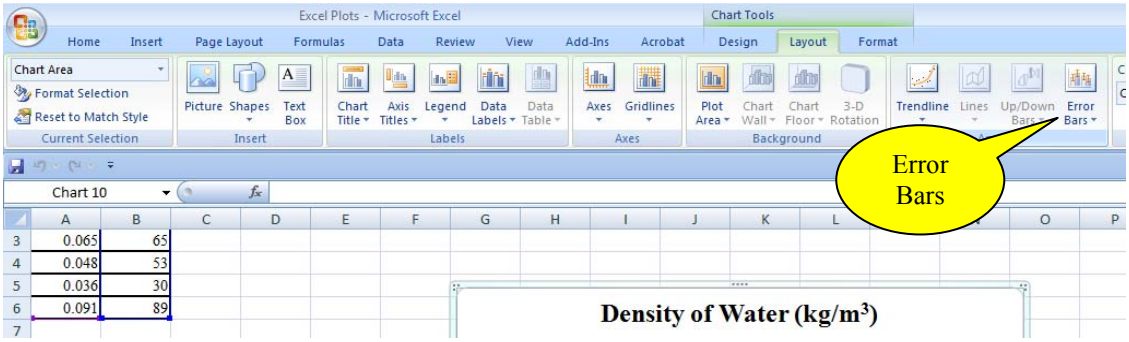
OK to use the error bars we will plot a curve of Mass vs. Volume and get density of water.

A) Input the following data in the chart to the right.

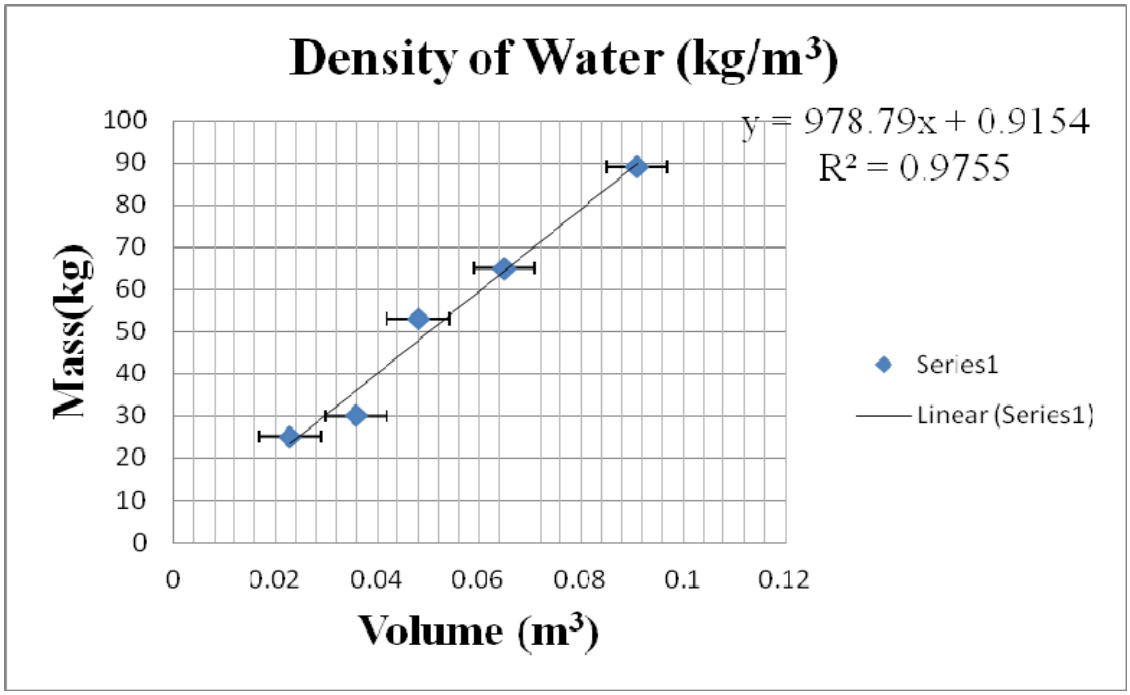
B) Highlight the data mass and volume and then hit the scatter plot again to get a graph.

Mass (kg)	**Volume** (m^3)
25	0.023
65	0.065
53	0.048
30	0.036
89	0.091

C) You can add error bars by using the Chart tools, Layout option and select error bars on the right. The uncertainty in mass is +/– 1kg. The uncertainty in volume is +/– 0.006 m^3. Select more options from the pull down menu, vertical both and put in the value 0.006 instead of 1.0 .



You can change the default boxes to small dots so they don't interfere with the error bars. Not sure how to adjust the horizontal bars at the moment ... but the vertical is easy enough!!



This shows up more easily than the small error in mass. The R^2 looks very close to unity, so we have a very close agreement to the true density of water = 1000 kg/m^3 .