

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 your name.

Each graph should have your 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.

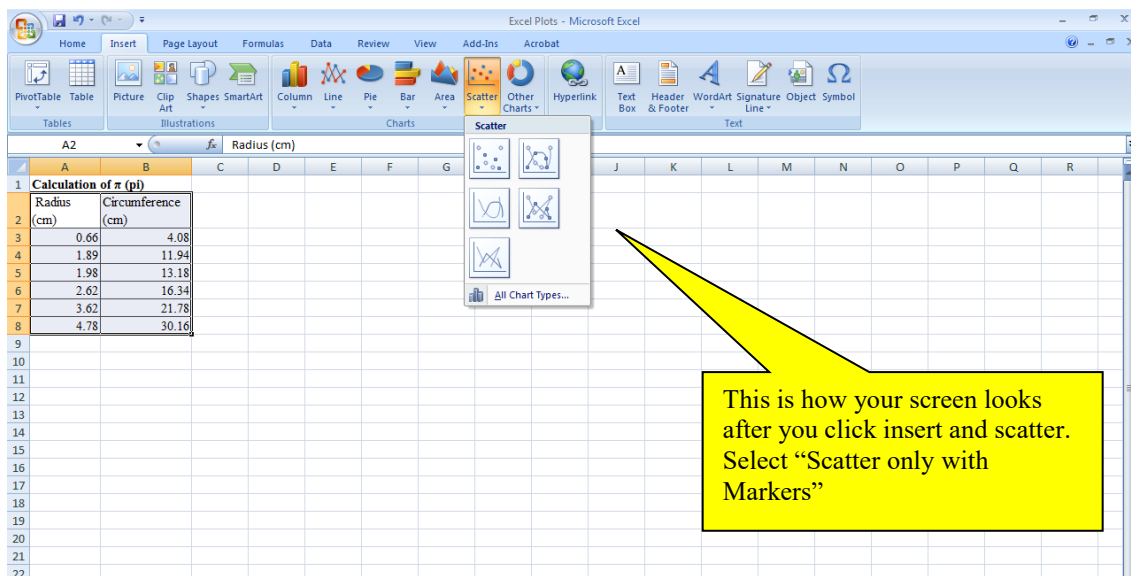
Plot 1(a): In this data you will be finding the value of $\pi \sim 3.14$ as a slope. Enter this data into excel. This is a bunch of radii and circumferences of circles. You know the formula circumference, $C = 2 \pi r$, we will use that to find π .

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.

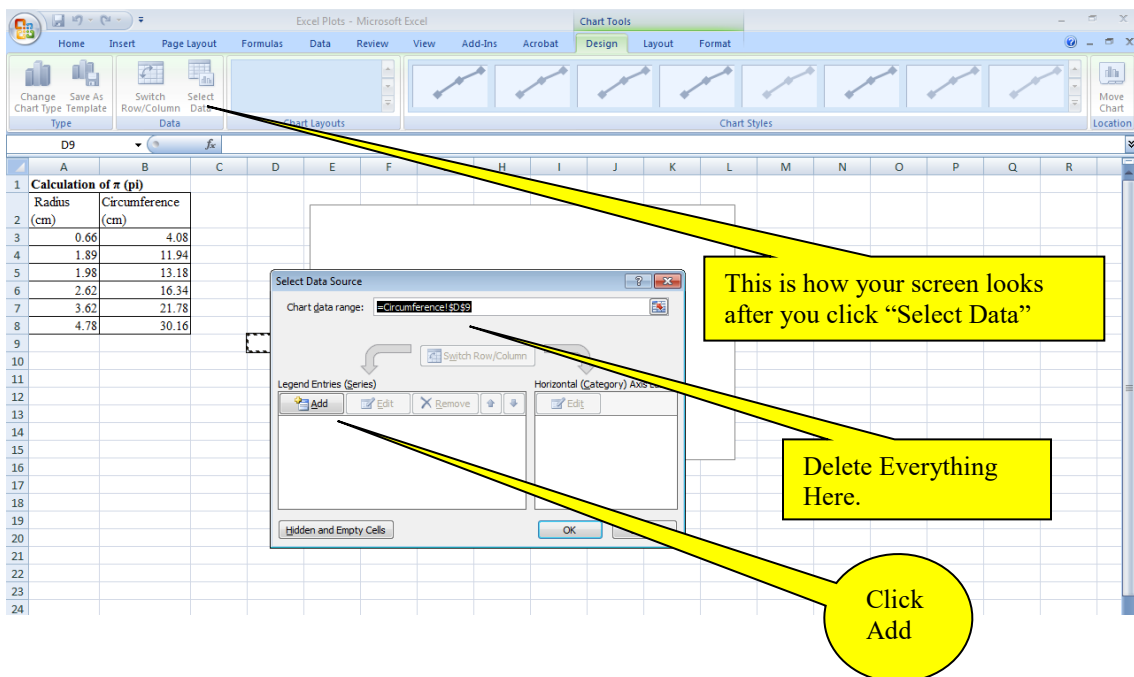
C) Hit scatter plot and top left button. No lines yet please. Delete the series bar. If you selected the data you want to plot it will be draw for you. If not you get a blank plot, select data by left click and drag method.



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.

Calculation of π

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

Series Name "Calculation of Pi"
Click in x-axis box and highlight all radius data.
Delete what's in the y-axis box then highlight all circumference data.
Then press ok.

Calculation of π

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

Click here to select axes titles and change axes title on the graph

Right click on any data point and you will see different options. Select "Add Trendline"

Excel - Microsoft Excel

Chart Tools: Design, Layout, Format

Chart 4

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

Calculation of Pi

$y = 6.179x + 0.2327$
 $R^2 = 0.9965$

Format Trendline

Trendline Options

Trend/Regression Type

- Exponential
- Linear
- Logarithmic
- Polynomial Order: 2
- Power
- Moving Average Period: 2

Trendline Name

- Automatic: Linear (Calculation of Pi)
- Custom:

Forecast

Forward: 0.0 periods
Backward: 0.0 periods

Set Intercept = 0.0

Display Equation on chart

Display R-squared value on chart

Close

Select Linear Fit
Check Display Equation on the Chart.
Check Display R-squared value on chart.

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

Excel - Microsoft Excel

Chart Tools: Design, Layout, Format

Chart 4

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

Calculation of π

$C = 6.179r + 0.2327$
 $R^2 = 0.9965$

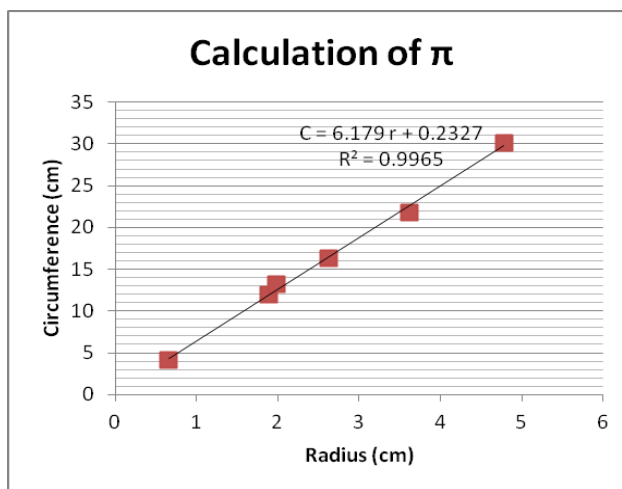
Series "Calculation of Pi" Trendline 1 Equation

- ◆ Calculation of Pi
- Linear (Calculation of Pi)

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



Dr Fearn

slope = 6.179	6.179	
Pi = slope/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 find help online

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.

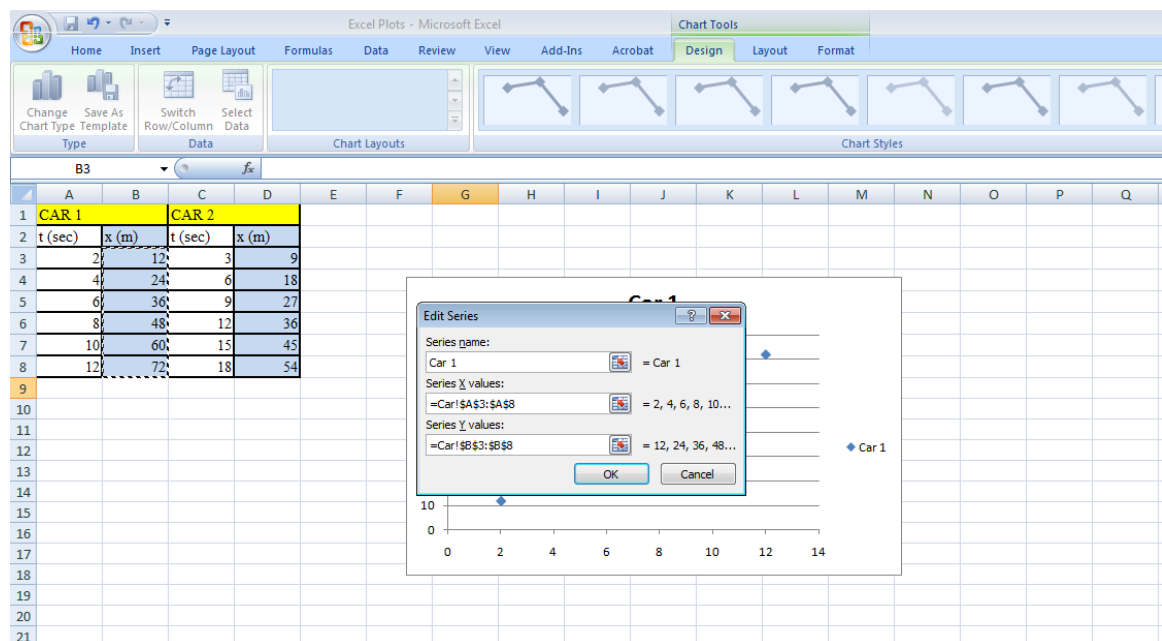
Plot 1(b): Two sets of data points on the same graph.

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.



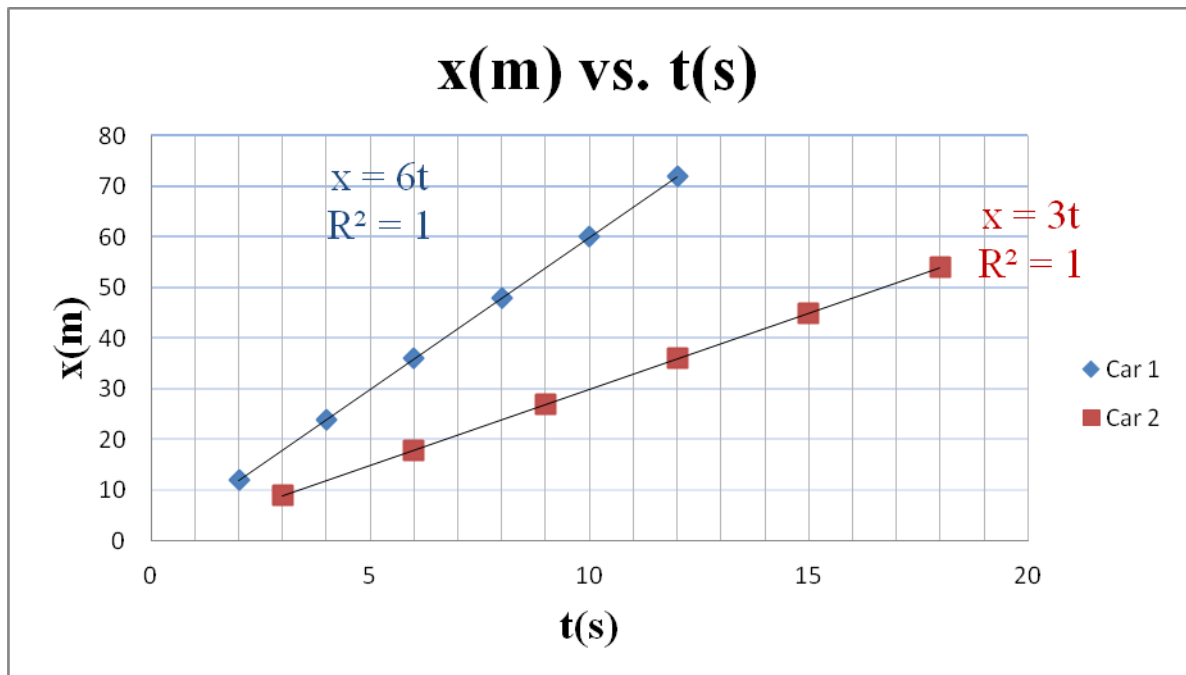
C) Now you're going to add another series, hit the select data menu option and then add. This time highlight the time and distances for car 2, this will add a second graph to the first on the same plot. Click OK when done.

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.

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

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

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 plot 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 ± 1 cm 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 ± 1 cm would be a much bigger deal.

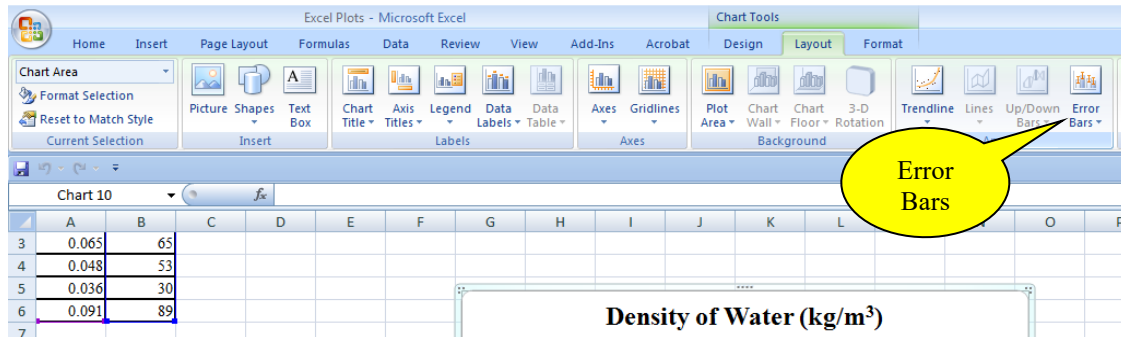
OK to use the error bars we will plot a curve of Mass vs. Volume and get density of water.

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

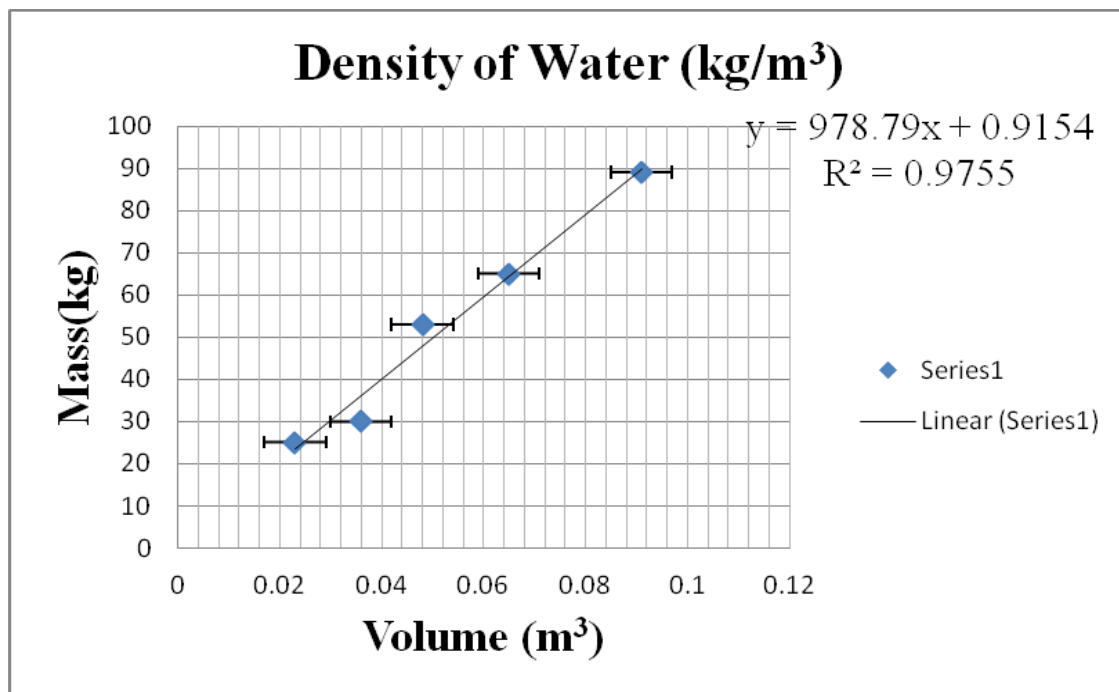
B) Highlight the data mass and volume and then hit the scatter plot again to get a graph.

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 ± 1 kg. The uncertainty in volume is ± 0.006 m³. Select more options from the pull down menu, vertical both and put in the value 0.006 instead of 1.0 .

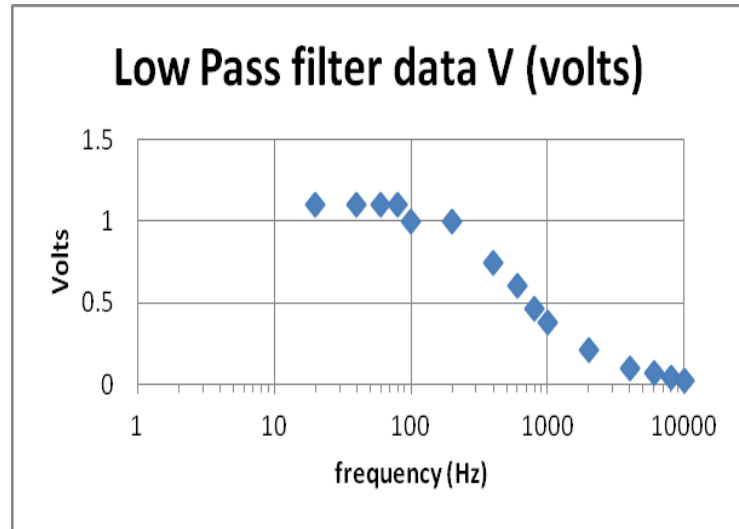


You can change the default boxes to small dots so they don't interfere with the error bars. Not sure how to adjust the horizontal bars at the moment ... but the vertical is easy enough!!



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/m³ .

<u>Low Pass filter data</u>	
Freq (Hz)	V (volts)
20	1.1
40	1.1
60	1.1
80	1.1
100	1
200	1
400	0.75
600	0.6
800	0.46
1000	0.38
2000	0.21
4000	0.1
6000	0.065
8000	0.045
10000	0.02



Open excel and you will see a grid with numbers down the first column and letters across the top.

You can type in a title and use bold and underline just as you would in word, the menu at the top is very similar. Use the first column for one set of inputs (x) volts say and the second column (y) for frequency in this case. These represent matching (x,y) data points that we wish to plot. This is sample data from a low pass filter which comes later in your semester! If you want to make the table look good, click on the grid pattern and chose to show all lines, like I have here.

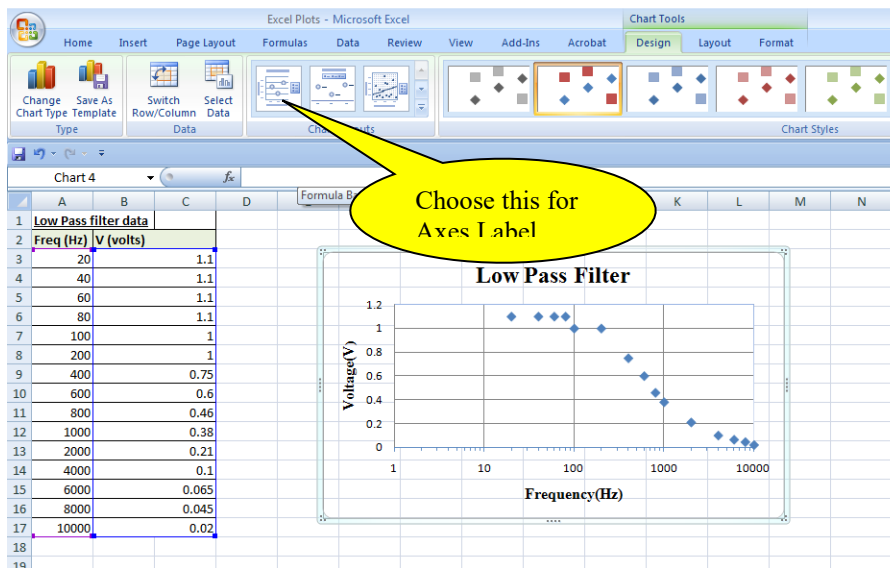
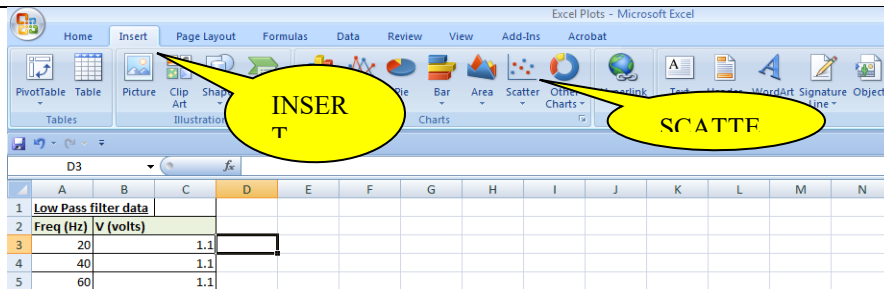
Right, now we have input our data, you might want to save the file as something on the desktop so you can find it again. Save often so you don't lose your work. Give the file a name you can remember.

It will be saved as an excel workbook, with the typical green icon.

Now to plot click on the INSERT menu option on the top row.

Find the scatter plot icon, this will give you a nice x,y plot. Click on that and chose the top left button.

You will immediately get a graph.



Ha you wish... it won't look like this right away. I have altered the title which you can do right away by simply clicking on the title it gives you and altering it. I got rid of the series line by right clicking on it and deleting it. Then I wanted to add axis labels. I clicked on the Button which shows axis labels and then edited the titles given. Then I clicked back on the one showing the title and got something close to the above picture.

Not done yet though. You can click on the axis numbers, along the line and then format the axis numbers, you can say you want log 10 scale and how many ticks major and minor you want shown on the axis. I chose log 10 along the bottom, with both major and minor tick marks outside the line. I also

Chose to show major lines on the graph... you can add more lines and even color/fill the entire plot if you want to try playing with the settings and see what looks good to you.

At some point you will need to write your name on the sheet and print it out. You need to highlight the region you want to print (set print area) and then print it out. You should find that under page layout. You can preview the print out before you send it to the printer. Sometimes you may want landscape instead of portrait with is by default.

This info is for Excel Microsoft office 2007. It should be fine for 2010 also.