How to Use Excel

This is meant only as a quick introduction and reference to using Excel for your physics lab. A quick search of the internet will uncover several very good tutorials on using Excel. Spending a little time doing one of these online tutorials will save you a lot of time latter on and unlock some powerful tools for your use.

Sample computation

> *A baseball is thrown straight down from the top of a very tall building with an initial velocity of 0.8 m/s. What is its position and velocity after several seconds? Make a table showing the position and velocity at one second intervals from zero to 30 seconds. Graph its position and velocity over the time interval.*

This is an example of a task where Excel can be of great use. Imagine having to calculate each step with a calculator (62 answers) and then having to draw two graphs by hand. Well this is what many of us had to do in the past and it was very time consuming. With Excel you can have this task done in just a few minutes.

You can follow along in Excel while reading this if you like. First open Excel. You will have a spreadsheet similar to Figure 1, but blank. Now you click on cell B1 and type "Acceleration (m/s^2)", in cell C1 type "Initial velocity (m/s)", and in cell D1 type "Initial position(m)". These are headings for your constants. Go ahead and enter the constants below the se headings. This will allow you to make changes after you are finished without having to rewrite the whole thing. What if it happens on the Moon? Just change the acceleration. What if the initial velocity is larger or zero? Just change it. Excel will update everything "on the fly" as well as graphs! Keeping things general saves lots of time when you make changes.

Now type in "time (s)", "position (m)", and "velocity (m/s)" and the headings are done. You will have a page that looks like Figure 1.

	A	B	C	D	E	F	G	H	I
1		**Acceleration (m/s^2)**	**Initial velocity (m/s)**	**Initial position(m)**					
2		**9.8**	**0.8**	**0**					
3	**time (s)**	**position (m)**	**velocity (m/s)**						
4									
5									
6									
7									
8									
9									
10									
11									
12									

Figure 1

Now we want to put in the numbers for the time. We could enter each one but there is a faster way. Just type in the first and second values (0 and 1) then highlight them both. This will give you a heavy lined box with a small dark square in the lower right hand corner around the two cells. Place your cursor on the small dark square (the cursor will change) and drag the corner down to A34. Excel will continue the numerical progression for you, easy! (see figure 2).

Next put the equation for the position as a function of time in cell B4. The equation is $x(t) = 1/2at^2 + v_o t + x_o$. How do you do this in Excel? With your cursor on cell B4 type the following: =(.5*B$2*A4^2)+(C$2*A4)+D$2 hit enter and zero will appear. Click back on cell B4 and the heavy lined box with a small dark square in the lower right hand corner will show up. Again place your cursor on the small dark square and drag the corner down. Excel will put the equation in each cell, nice. Now what do all the symbols mean? Functions: the = tells Excel this is a calculation, the * multiplies, and the ^ raises to a power. What about those dollar signs ($)? When the box is dragged down to fill in the lower cells with the formula Excel increments the cell addresses in the formula (i.e. A4 goes to A5). The dollar sign tells Excel not to increment that address, so it always calls out your constants, neat.

Now put in the formula for the velocity as a function of time in cell C4. The equation is $v(t) = at + v_o$. In Excel this is the following: =B$2*A4+C$2 hit enter and 0.8 will appear. Again select and drag this down to fill in the lower cells. Now the table is done and its time to clean it up a bit. Highlight B4 and C4 down to B34 and C34, right click, then select “Format Cells” from the popup menu. Select “Number” from the tabs, and “Number” from the categories. Now set the number of decimal places (one was selected for the example). The first part of the table will look like Figure 2.

	A	B	C	D	E	F	G	H	I
1		**Acceleration (m/s^2)**	**Initial velocity (m/s)**	**Initial position(m)**					
2		**9.8**	**0.8**	**0**					
3	**time (s)**	**position (m)**	**velocity (m/s)**						
4	**0**	**0.0**	**0.8**						
5	**1**	**5.7**	**10.6**						
6	**2**	**21.2**	**20.4**						
7	**3**	**46.5**	**30.2**						
8	**4**	**81.6**	**40.0**						
9	**5**	**126.5**	**49.8**						
10	**6**	**181.2**	**59.6**						
11	**7**	**245.7**	**69.4**						
12	**8**	**320.0**	**79.2**						

Figure 2

Graphs

Now to make a couple of graphs from our table data. Position and velocity graph: Highlight A4 and B4 down to A34 and B34. Click on the Chart Wizard icon at the top of the page (just below and to the right of “Help”). The Chart Wizard will popup, select “XY (scatter)” under chart type and click “Next”. You will now see a preview of the graph, click “Next”. Now you will be able to add a title and label the X and Y axis. Be sure to indicate units on your axis. Click “Finish” and there is the graph. Now to clean it up a bit. Select the “Plot Area” of the graph, right click, then select “Format Plot Area” from the popup menu. To the right under Area select “None” and click “OK”. This will set the plot area background to whit, saving ink and making it easier to read. Click on the ”Series” box and hit delete. The series can be set when you are making the graph (at the same time as making the axis labels) but is only really useful if you are graphing more than one set of data in the same graph. The graph will now look like Figure 3.

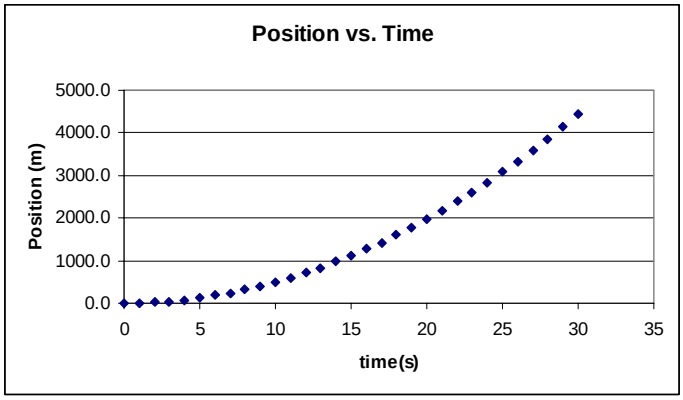

Figure 3

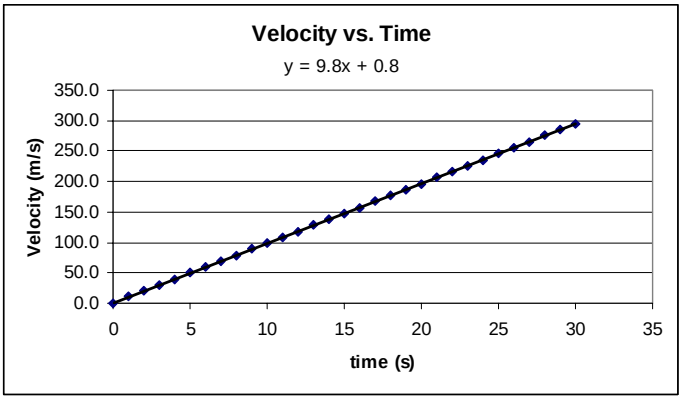

Figure 4

The same procedure was done for the graph in Figure 4 with the following differences:

When the graph preview is displayed (step 2), click on the “Series” tab. The series used for the X and Y axis can now be selected by clicking on the spreadsheet icon to the right of the “X values” or Y values” then highlighting the desired column on the spreadsheet and hitting enter.

A trendline and equation can be added by simply clicking on a data point, right click, then select “Add Trendline” from the popup menu. Select the appropriate trendline, click the “Options” tab, then select “Display Equation on Chart”. This will set a trendline on the graph along with the equation of the line (Y = m X + b). Select the equation on the graph with your cursor and drag it to just below the title.

Using Excel for Data Analysis

Excel can compute many statistical and mathematical functions. This is very useful when dealing with large sets of data. As an example here is a sample population of measurements in cm:

2.3, 2.5, 3.1, 1.9, 2.2, 2.7 and 2.6.

Put these into a spreadsheet then calculate the Sum, Minimum, Maximum, Mean (average), Median, and the Standard Deviation. Each of these was done using the functions in column E. For more functions see Excel “Help” or click on “Insert” then “Function” at the top of the screen.

	A	B	D	E
1	**Data**			**Function**
2	**2.3**	**Sum**	**17.30**	**= SUM(A2:A8)**
3	**2.5**	**Minimum**	**1.90**	**=MIN(A2:A8)**
4	**3.1**	**Maximum**	**3.10**	**=MAX(A2:A8)**
5	**1.9**	**Mean**	**2.47**	**=AVERAGE(A2:A8)**
6	**2.2**	**Median**	**2.50**	**=MEDIAN(A2:A8)**
7	**2.7**	**Std Dev.**	**0.36**	**=STDEVP(A2:A8)**
8	**2.6**			