

A Guide to Using Excel in Physics Lab

	A	B	C	D
1	Distance (m)	Time (s)		
2	0	0		
3	9.8	1		
4	19.6	2		
5	29.4	3		
6	39.2	4		
7	49	5		
8	58.8	6		
9	68.6	7		
10	78.4	8		
11	88.2	9		
12				
13				

Figure 1: Suggested layout for data.

that says “Book1” in the upper left hand corner. Book1 is simply the default filename, which will change once you save and name your file. All Excel files will appear as “Filename.xls”, just as Word documents are “Filename.doc”. Entering data directly into the spreadsheet is fairly straightforward; you pick a column, label it accordingly, and enter your data. So if you had measured, say, the distance an object had traveled x and had 10 data points, you would label column A [x (m)], and enter your data down the column filling up rows until row 11. See Fig. 1 for a visual.

Calculations:

You can also perform calculations in Excel. If, for example, you measured the time it took an object to cover a known distance, and want to know the velocity, you can use Excel to do the calculation. After entering the time and distance data into the spreadsheet, you will have two columns of data, labeled distance and time. You can now make a third column, labeled velocity. In this column you will not enter data, but a function. If distance is in Column A and time is in Column B, then you would put “ $=A2/B2$ ” in the Column you labeled velocity, say

Excel has the potential to be a very useful program that will save you lots of time. Excel is especially useful for making repetitious calculations on large data sets. It keeps track of your numbers, and can do the math for you. It does, however, have a learning curve that can be rather steep. Hopefully, this handout will make Excel more accessible and easier to use. In the meantime, remember the first law of computer use: computers are amazingly powerful, and equally stupid.

Data Entry:

We will begin with how to enter data into an Excel spreadsheet. When you open a new file in Excel, you will see a blank page (spreadsheet) with a lot of little boxes (cells)

	A	B	C	D
1	Distance (m)	Time (s)	Velocity (m/s)	
2	9.8	1	9.8	
3	39.2	2		
4	88.2	3		
5	156.8	4		
6	245	5		
7	352.8	6		
8	480.2	7		
9	627.2	8		
10	793.8	9		
11				
12				
13				

Figure 2: After entering in the first column of numbers, you can perform calculations using those numbers by putting “ $=A2/B2$ ” (or whatever calculation you need to perform on the numbers in Column A) in another column, which is Column C in this case.

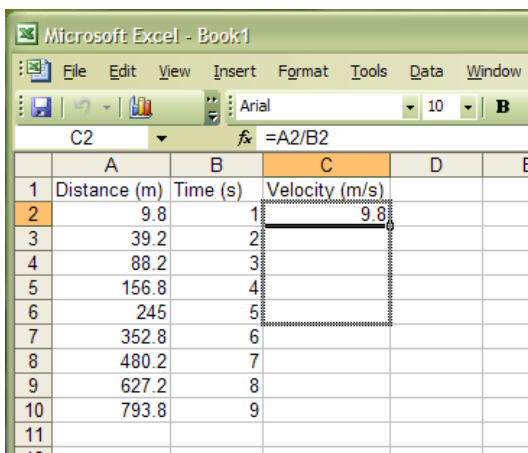


Figure 3: You can avoid having to type in the calculation you performed on column A into every row, by dragging down the one box containing the formula. Put the cursor over the lower right hand corner until you see a small black cross, then drag down until you reach the end of the data you wish perform the calculation on.

Column C. When you hit enter you will see a number in C2, but if you select C2 again then look at the formula bar, you can see what you actually typed. See Fig. 2 for a visual. You only have to type this in once. You can fill in all the other cells below C2 by putting your cursor over the lower right hand corner of C2 until you see a small black cross. When you see this cross, drag the corner of the box down. As you do so you will see the cells you passed become highlighted (see Fig. 3). When you reach the last set of data points that you want to calculate the velocity using, stop dragging. If you had 9 data points of interest, when you highlight the last cell, you will see that it now reads “=A10/B10” in the formula bar.

Plotting

All well and good, but what about plotting your data? There are several ways to begin the plot, and the following is the most general method.

Move the cursor over the button that looks like a 3d bar graph. If you leave your cursor over it, you will see “Chart Wizard” appear (see Fig. 4). You can also go to Insert→Chart if you can’t find the button.

Selecting the Chart Type:

Once you have clicked on either the button or Chart in the insert menu, a window will pop up (see Fig. 5). Select “XY (Scatter)” in the list of chart types on the left, on the right where you see “Chart sub-type:” leave the box of unconnected shapes highlighted (see Fig. 5), then click next.

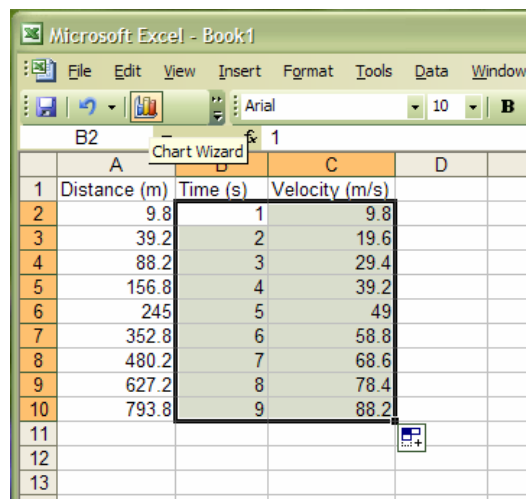


Figure 4: Creating a chart

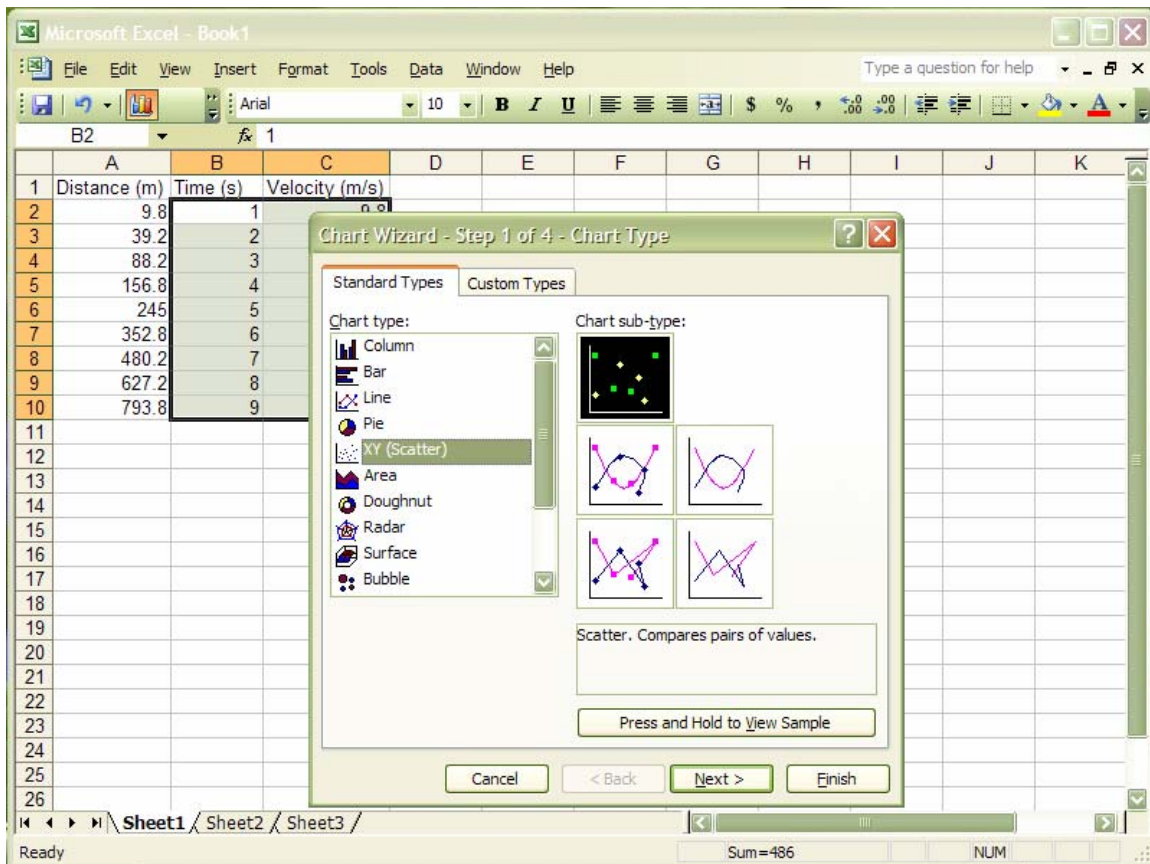


Figure 5: The window where you select the type of chart.

Defining your axes:

Now you should see a window with two tabs, one that says Data Range and one that says Series, click on the series tab. Now, you should see a window that looks like the one in Fig. 6. Your X and Y values are determined by what is written in the boxes next to “X values” and “Y values”. They may have something that looks like “=Sheet1!\$A\$1:\$A\$11” already. The letter tells you what column you are in and the numbers tell you what rows you are using. So in our case, the X values are in column A and the X values come from rows 2 through 11 of that column. If this is not what you want your x values to be, click on the box to the right of where it says X Values or Y Values depending on which you want to change (see the box with an orange line around it in Fig. 6). This will allow you to highlight the column you really want your X or Y values to come from. When you see the screen shown in Fig. 7, delete what it says in the window entitled Source Data Values, and highlight the data you want as your X or Y values. When you are finished highlighting, click on the button on the right side of the Source Data window, this will bring you back to the Series window in Fig. 6. Once your X and Y values are what you want them to be, click next.

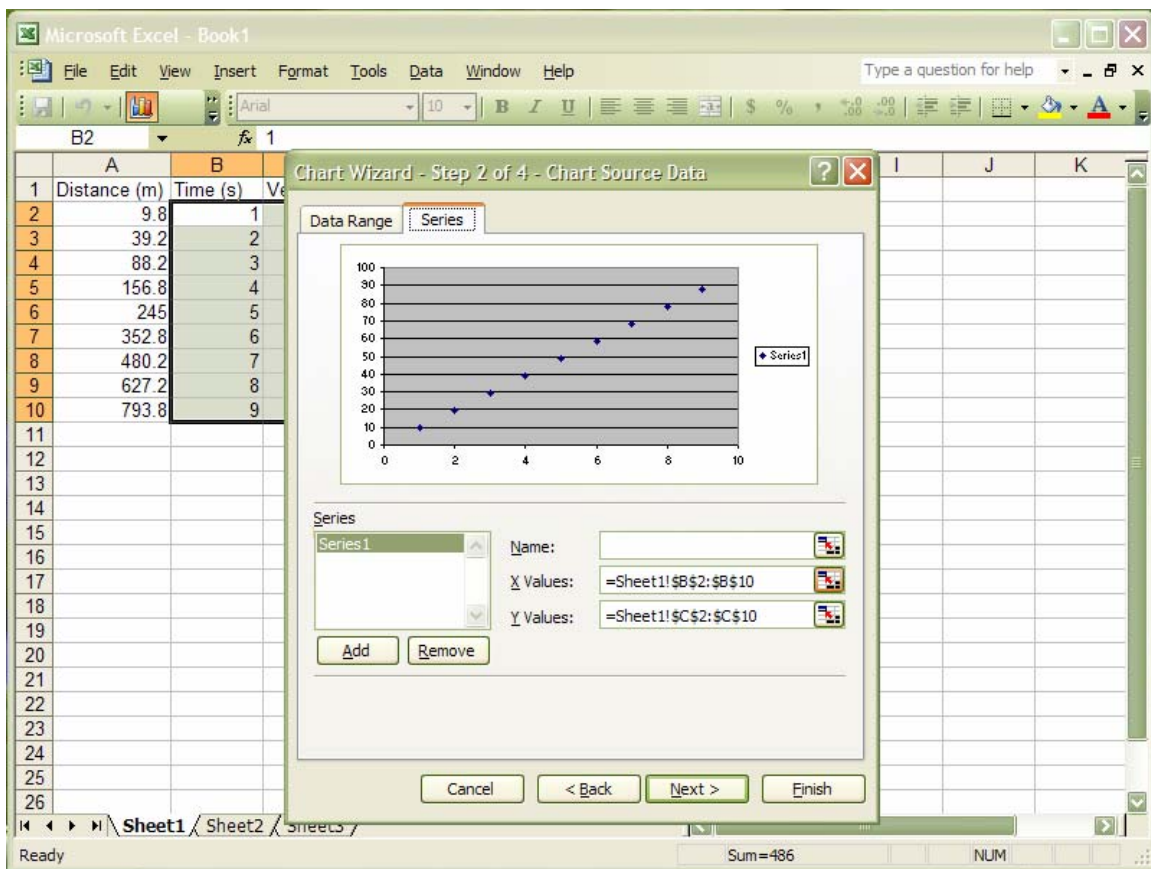


Figure 6:

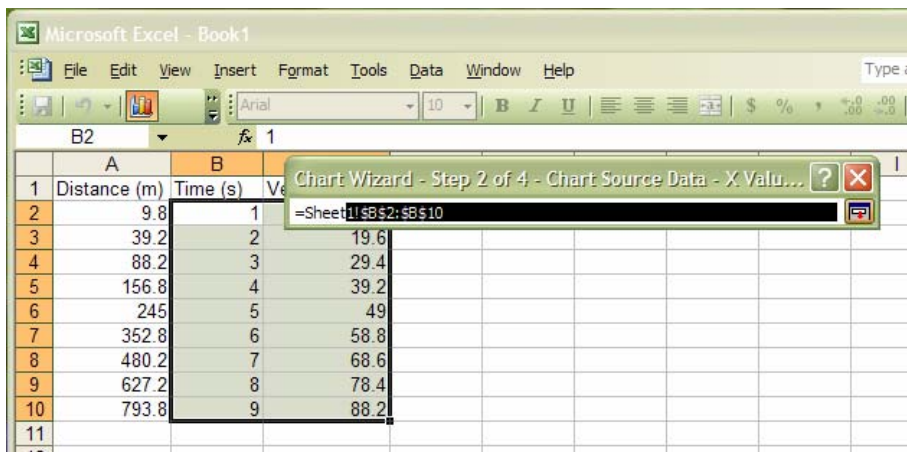


Figure 7:

Labeling your chart:

The new window (Fig. 8) entitled Chart options lets you label your axes and title your chart, and customize the appearance. Remember to include your units when you label your axes. When your chart looks the way you want it to, click next.

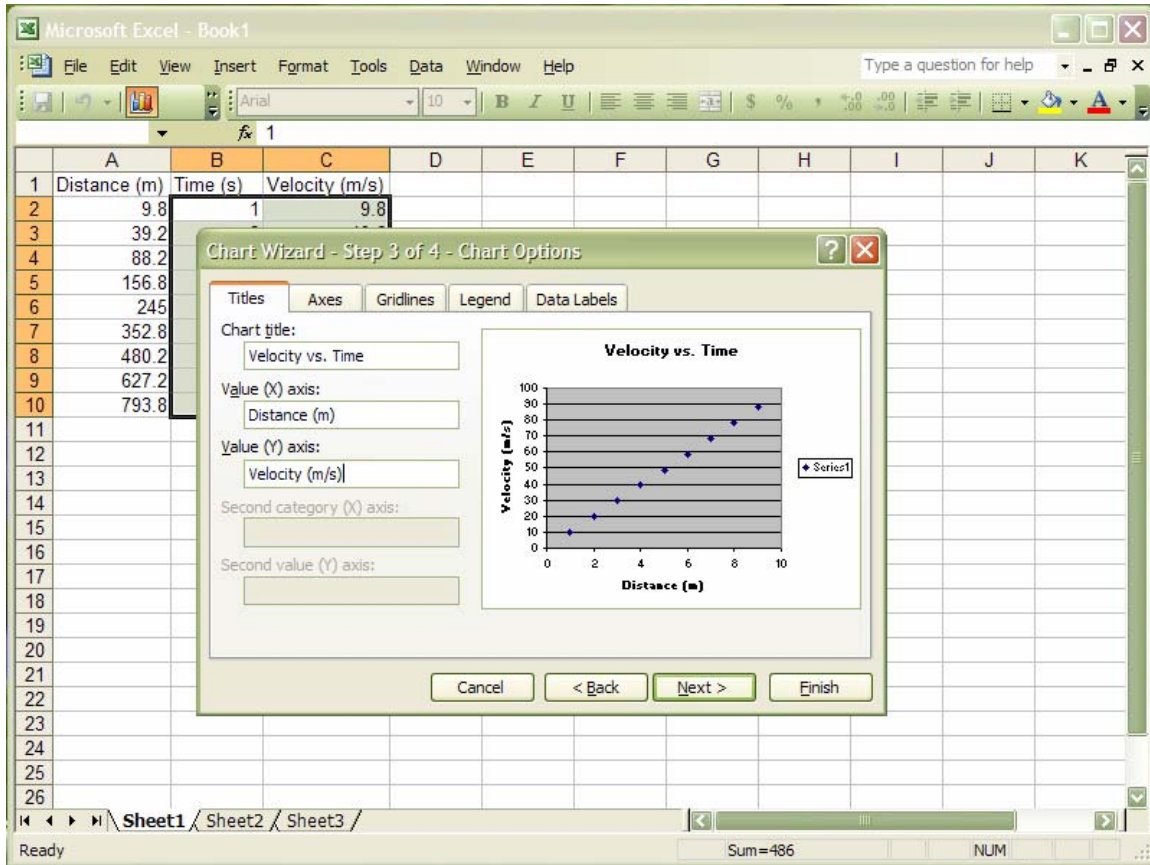


Figure 8:

Finishing up:

The final window is chart location; you can either put the chart in the sheet where your numbers are (as object in Sheet 1), or in separate sheet (as chart in Chart 1). Pick whichever you prefer.

Putting a fit line on your graph:

Now, you have a chart, with your data. The next step is to see what kind of a function fits the data. Does it look like a line? A polynomial? Something you've never seen before? Generally, you will be told what kind of fit to do in the lab manual, and whatever the type of fit, the process is nearly identical for each in Excel.

Creating and choosing the type of fit

Your first step is to right click on any data point in your graph, and select “Add Trendline” from the list that appears (see Fig. 9). You can also add a trendline by right clicking on your plot, going to Chart and choosing add trendline. Once you have chosen to add a Trendline, a window will appear, as shown in Fig. 10. You will see several different types of fit. Choose linear if you want to make a straight line, polynomial if you want something of the form $ax^2 + bx + c$, and power if you want something of the form x^n . The other fits will probably not be necessary in lab.

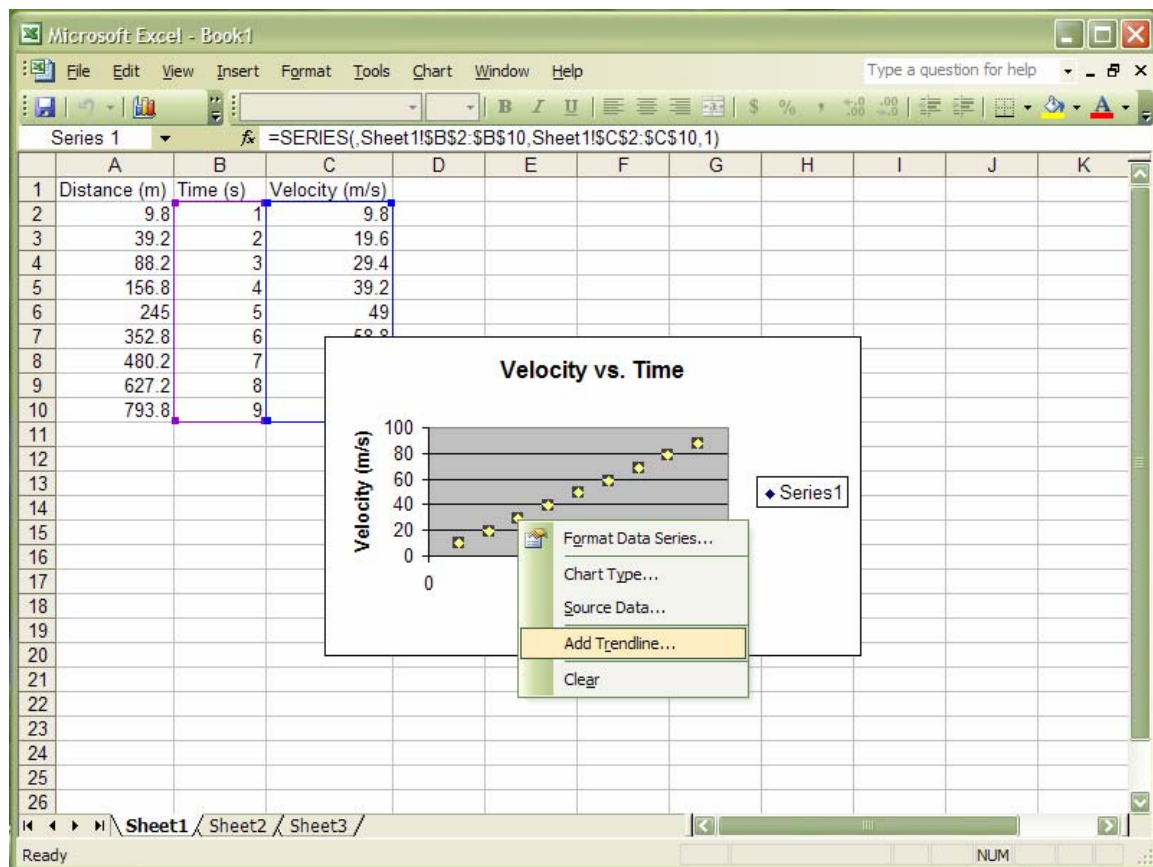


Figure 9:

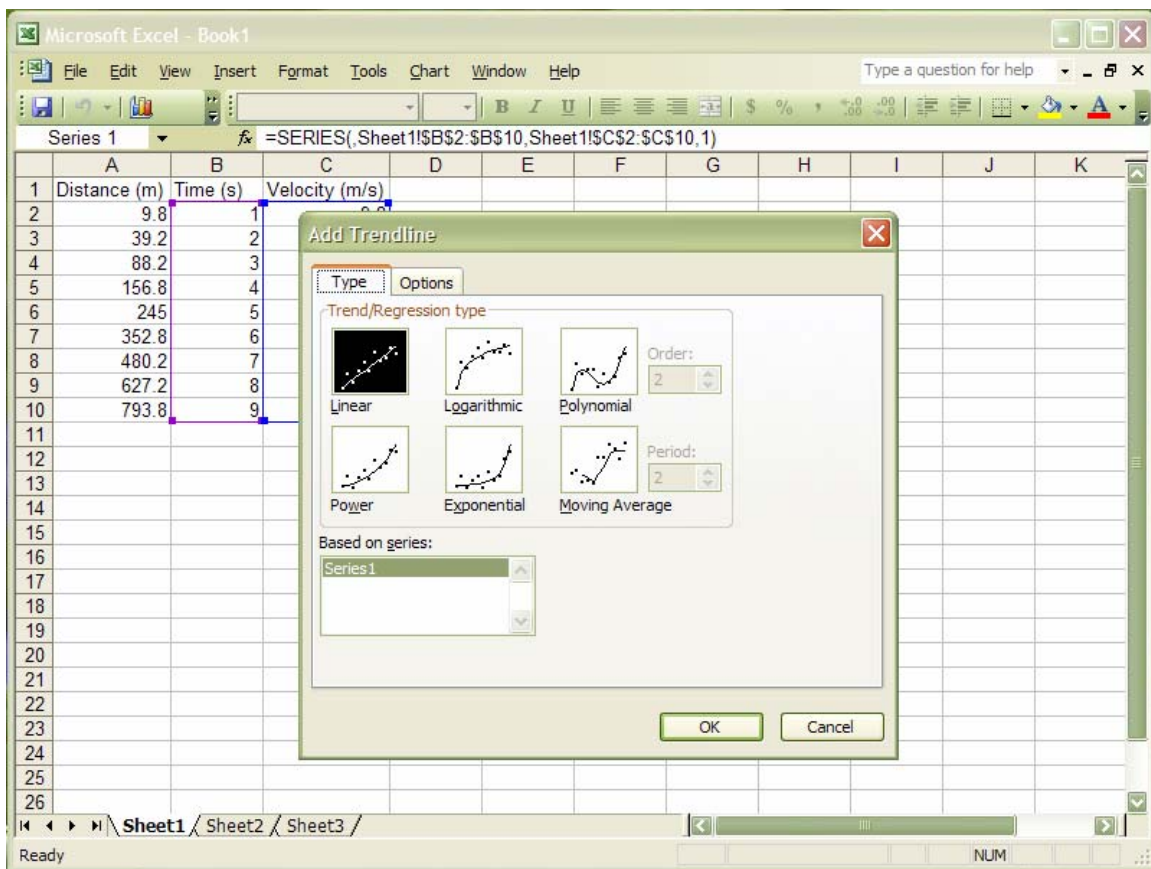


Figure 10:

Displaying the equation of the line

Once you have chosen your type of fit click on the tab labeled options. You will see a screen like the one shown in Fig. 11. Check the boxes to display the equation and R^2 value on the chart. The R^2 value gives you an idea of how good your fit is; the closer that value is to 1, the better the fit is. You may also want to check the box that will force the intercept through 0, such as if you are plotting force versus acceleration because you know that when the acceleration is 0, the force must be 0. Click ok when you are finished. You should see the equation of your line somewhere on the graph; although you may have to hunt for it as it can blend in with the chart (see Fig. 12).

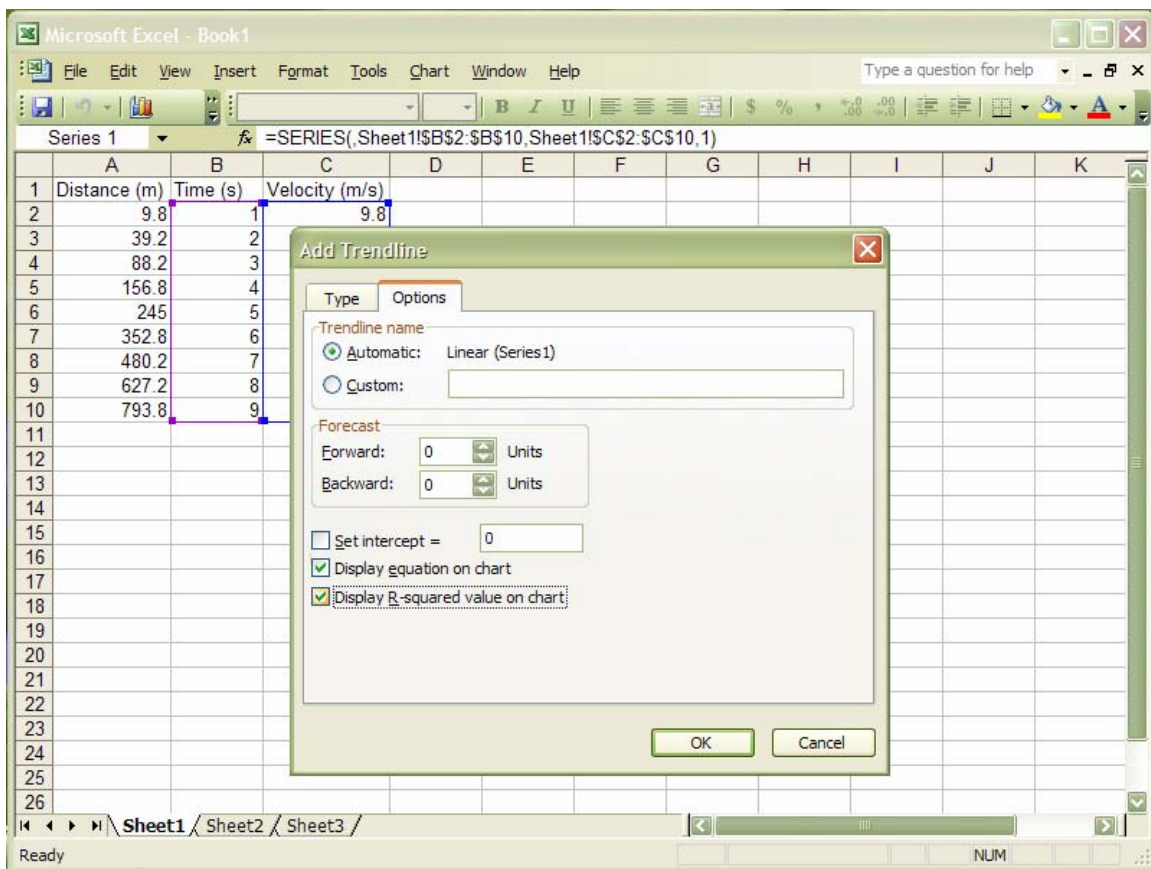


Figure 11:

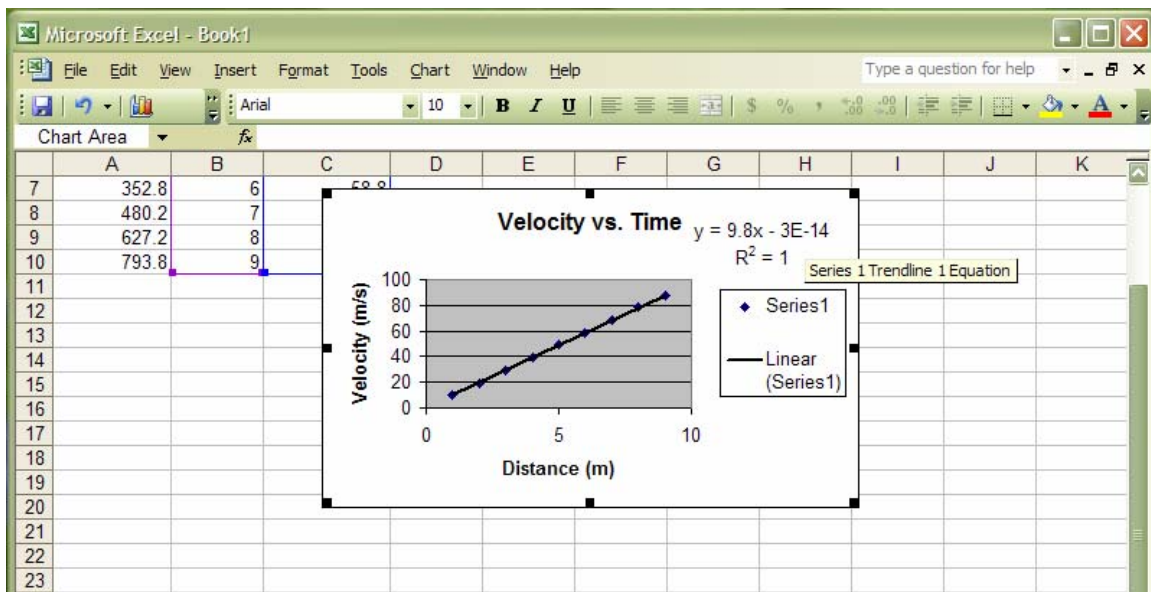


Figure 12: