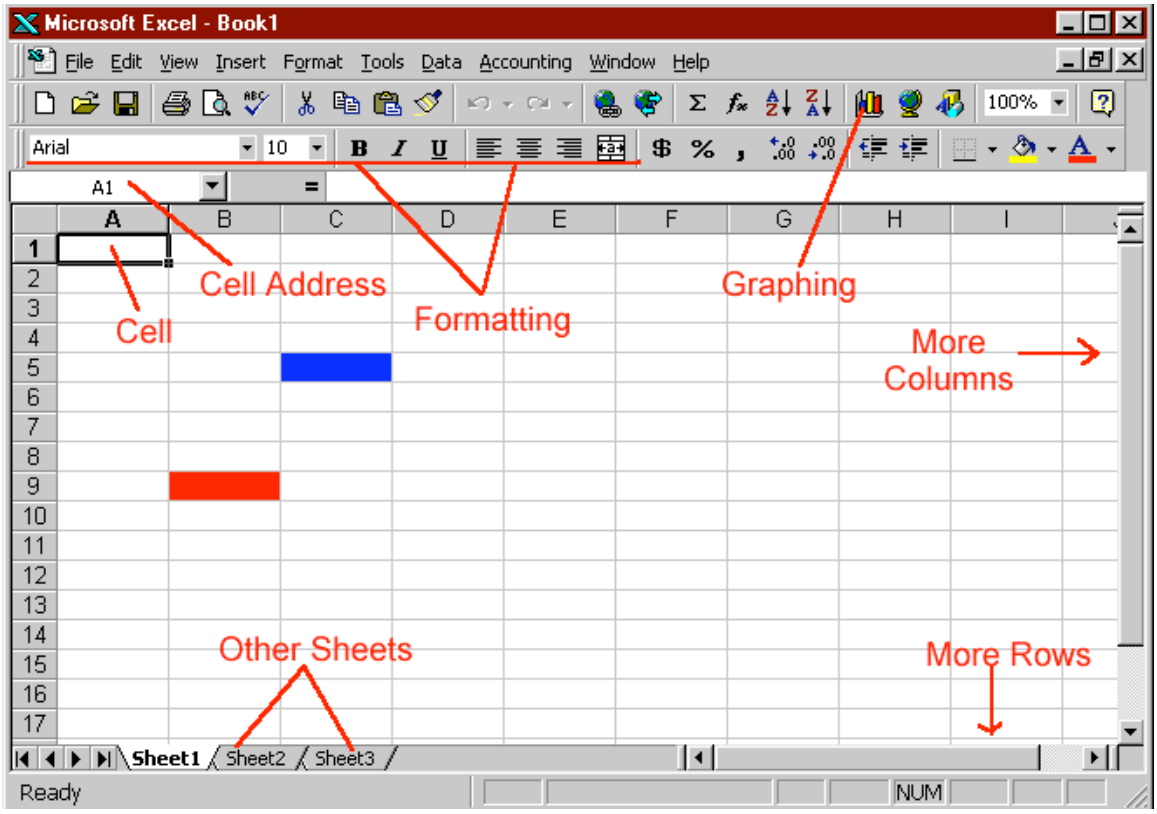
Biology 102 Lab students must complete this tutorial prior to coming to lab the week of January 22, 2006

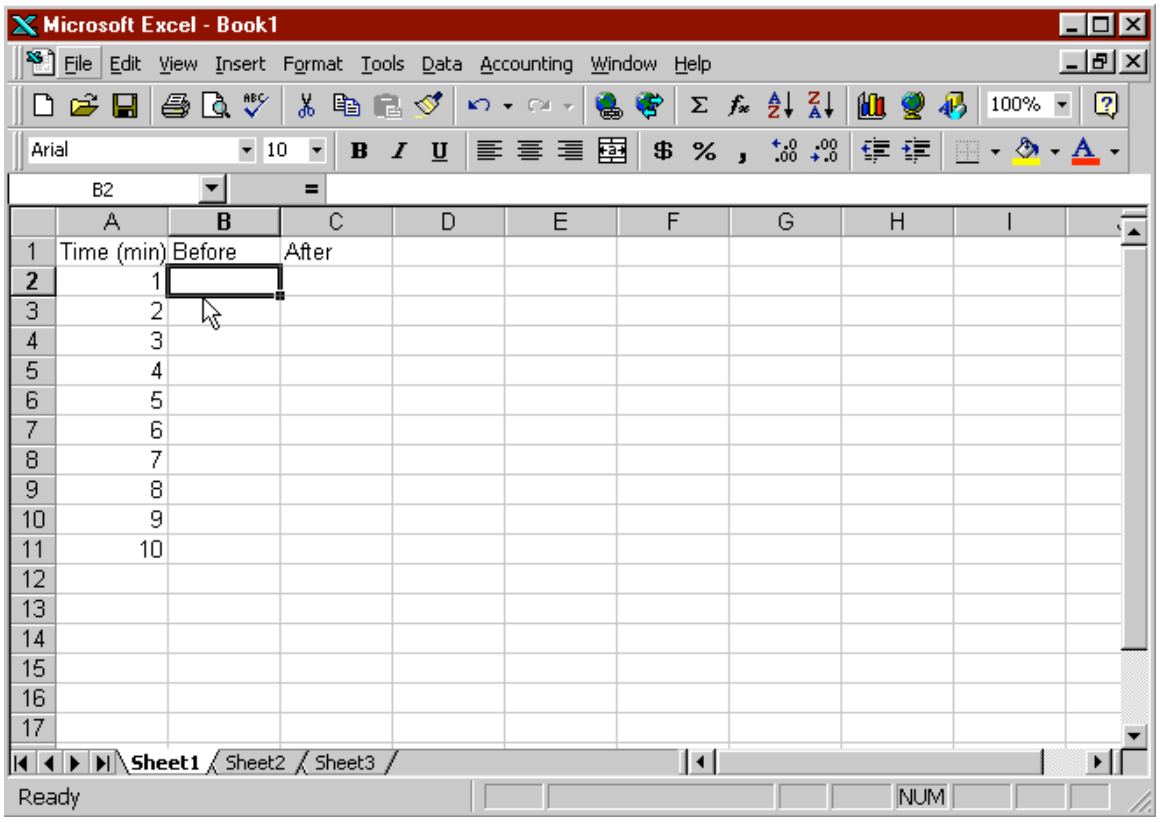
Excel Basics

What follows is a very brief and basic tutorial to get you started using Excel for ecology. A spreadsheet is essentially a word processor for numbers. Many of the functions you are familiar with from Word are available in Excel. Fonts can be changed, bolded, or colored.

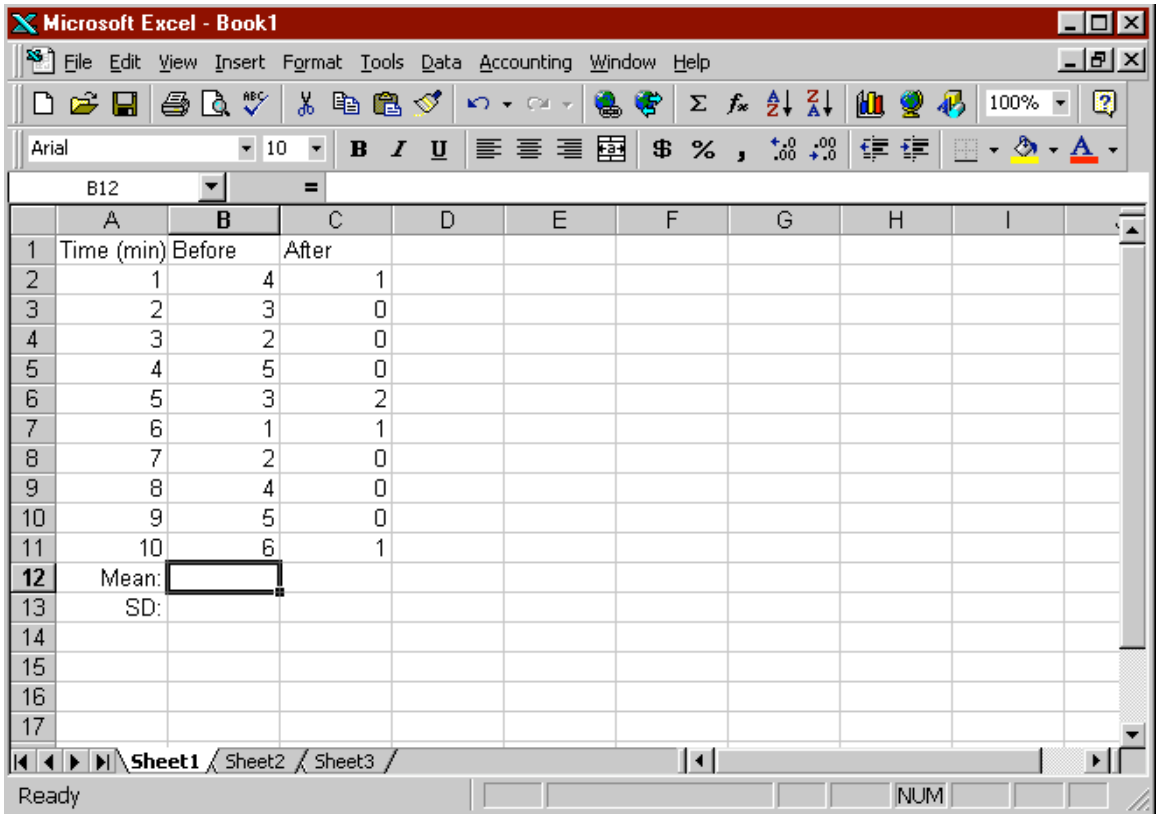


- The spreadsheet is divided into a grid. Each unit of the grid is called a *cell*. Cells may contain text, numbers, formulae, or functions.
- Each cell has an address. The highlighted cell in the upper left-hand corner has the address "A1". The cell highlighted in red has the address B9; the one in blue has the address C5.
- Formatting functions allow you to change the font or center your text or number in a column or row.
- Graphing functions are built-in.

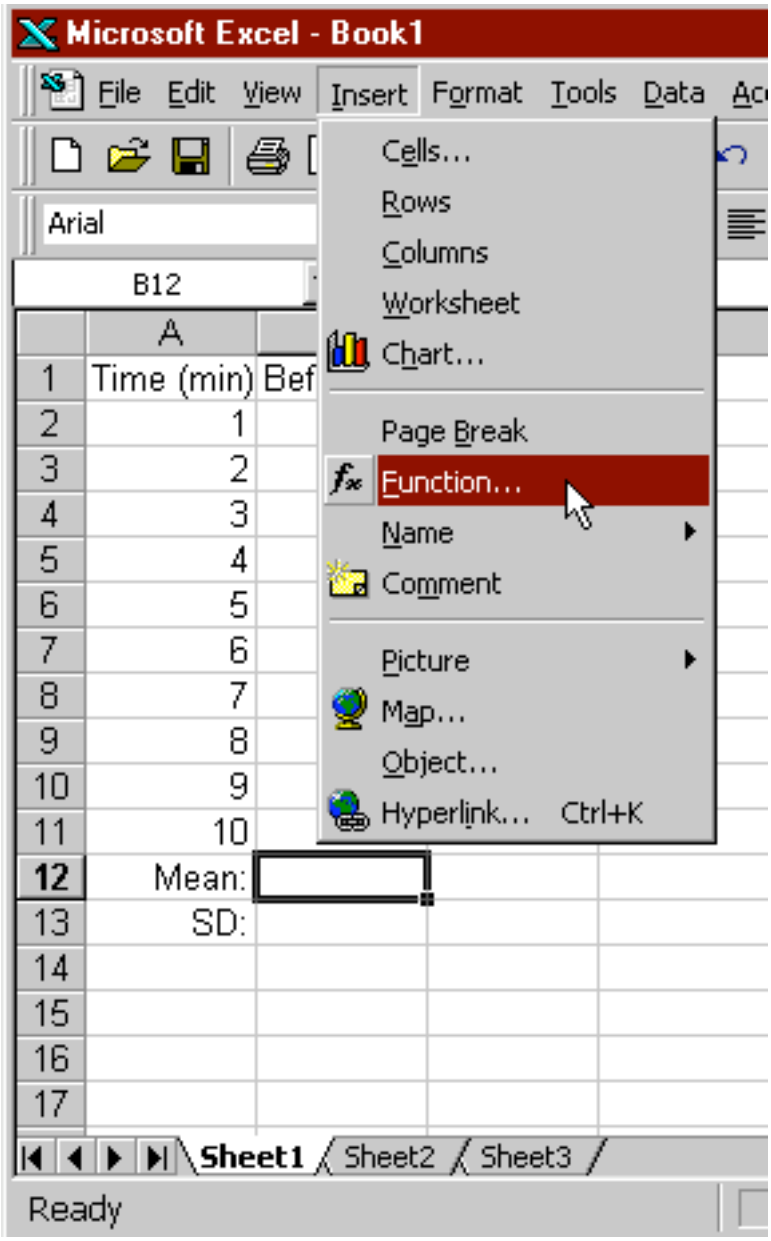
- More columns extend to the right. More rows extend to the bottom of the spreadsheet.
- Other sheets can be used for a 3-D analysis or to hide portions of the spreadsheet.



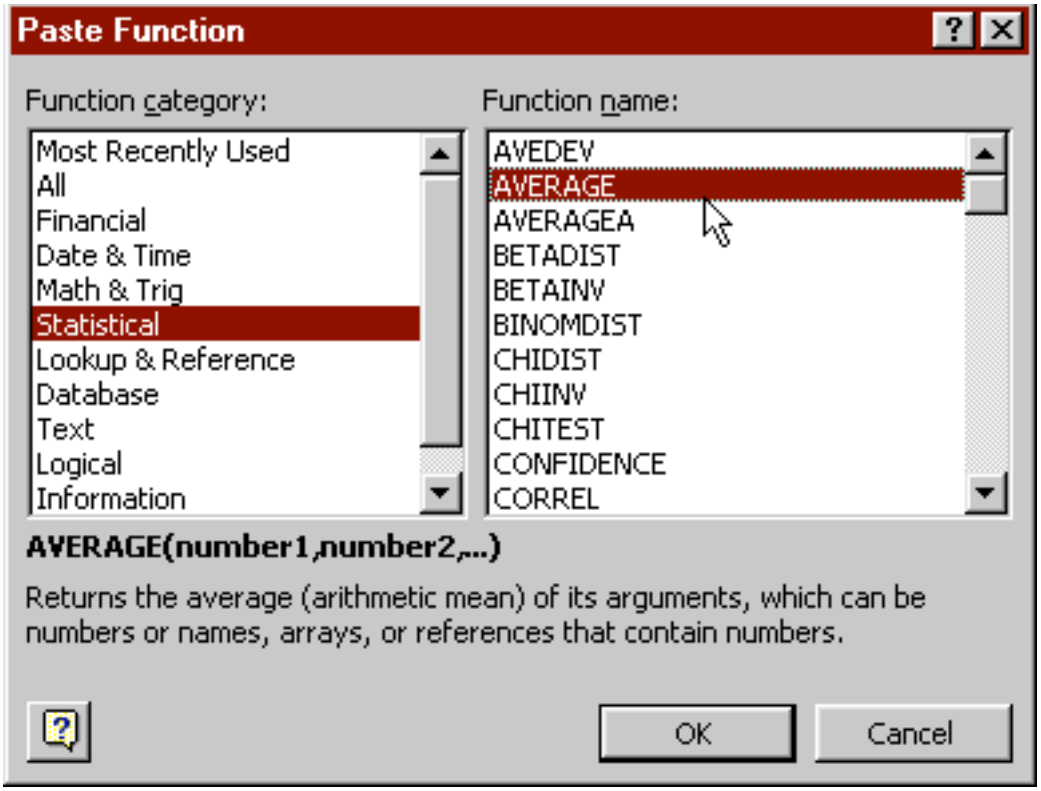
- . For our example, let's take the example of a simple experiment, devised by one of our local biology teachers, to find out whether a new "anti-sniffle" medicine was actually working as promoted. (Biology instructors can be rather annoyingly analytical!) An independent observer (AKA work study student) was enlisted to count the number of times per minute, over a ten minute time period, that the instructor "snuffled" their nose both before and after application of the new anti-sniffle medication. Data have been entered into the above spreadsheet. Under column A we have the time data in minutes. Column B will be used to hold the "before data" while column C will be used for the "after data".



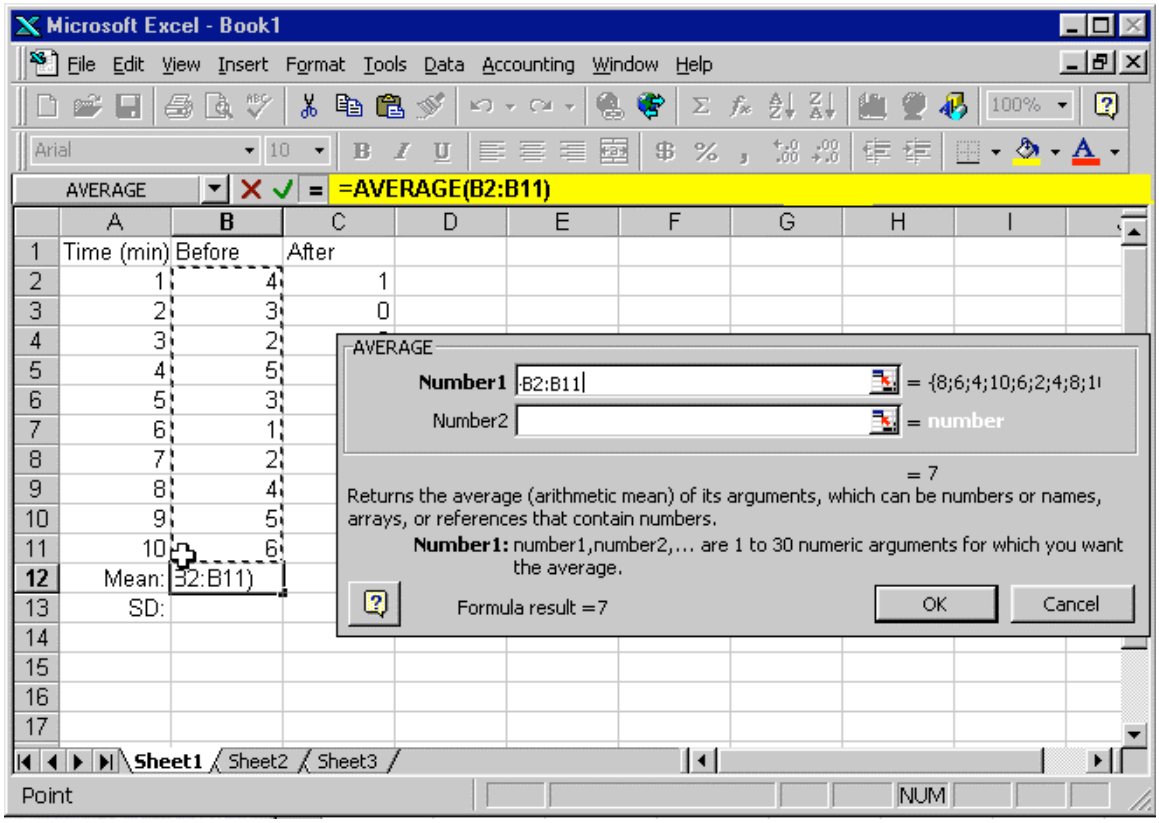
- Here we've entered our data as well as a place to enter the Mean (average) and standard deviation (a measure of the amount of variation in the data set).
- Note also that "mean" and "SD" are right-justified.



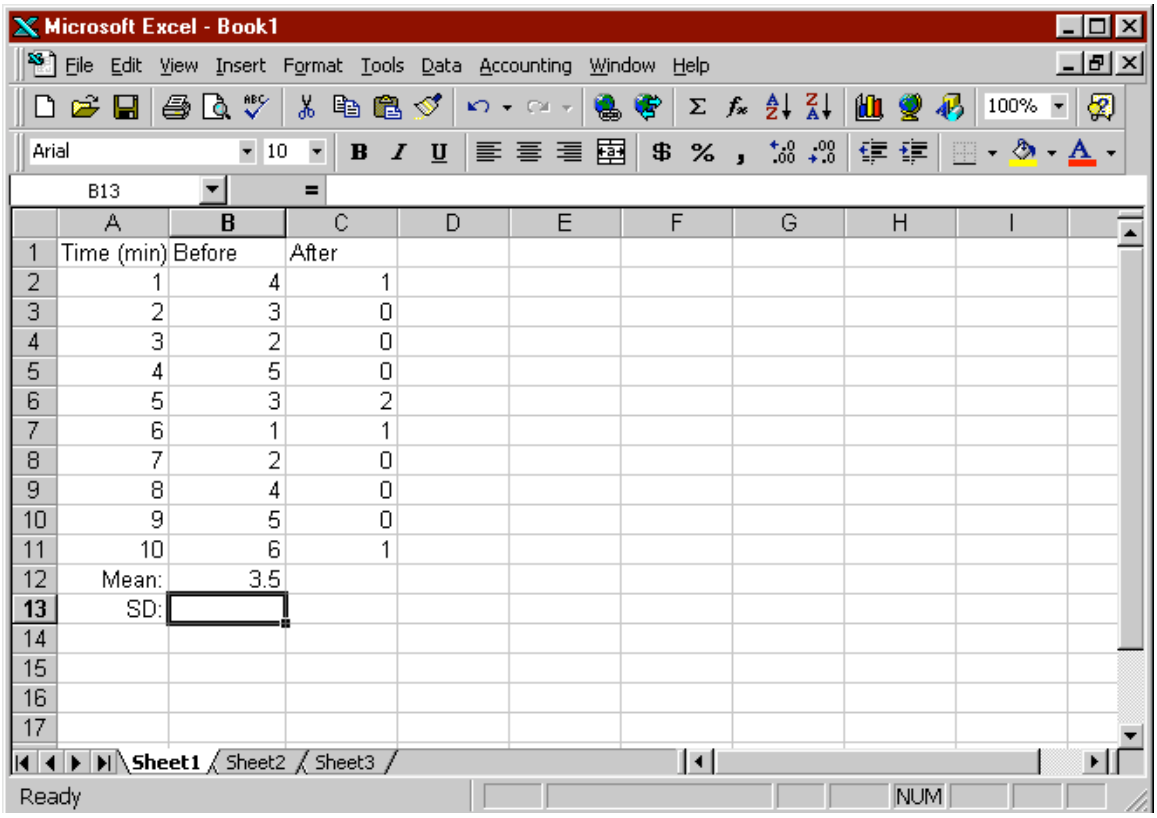
- To enter the mean you could get out your calculator and cipher it out. Instead, we'll use one of Excel's built-in functions.
- To do this make sure the correct cell is highlighted (next to the word "Mean:"). Then select "Insert" from the menu followed by " Function..."



- The "Paste Function" window will open up (right image). Depending upon your version of Excel and whether you are using a PC or a Mac, the window may look slightly different.
- Choose "Statistical" under "Function category", then "AVERAGE" under "Function name". Press the OK button.

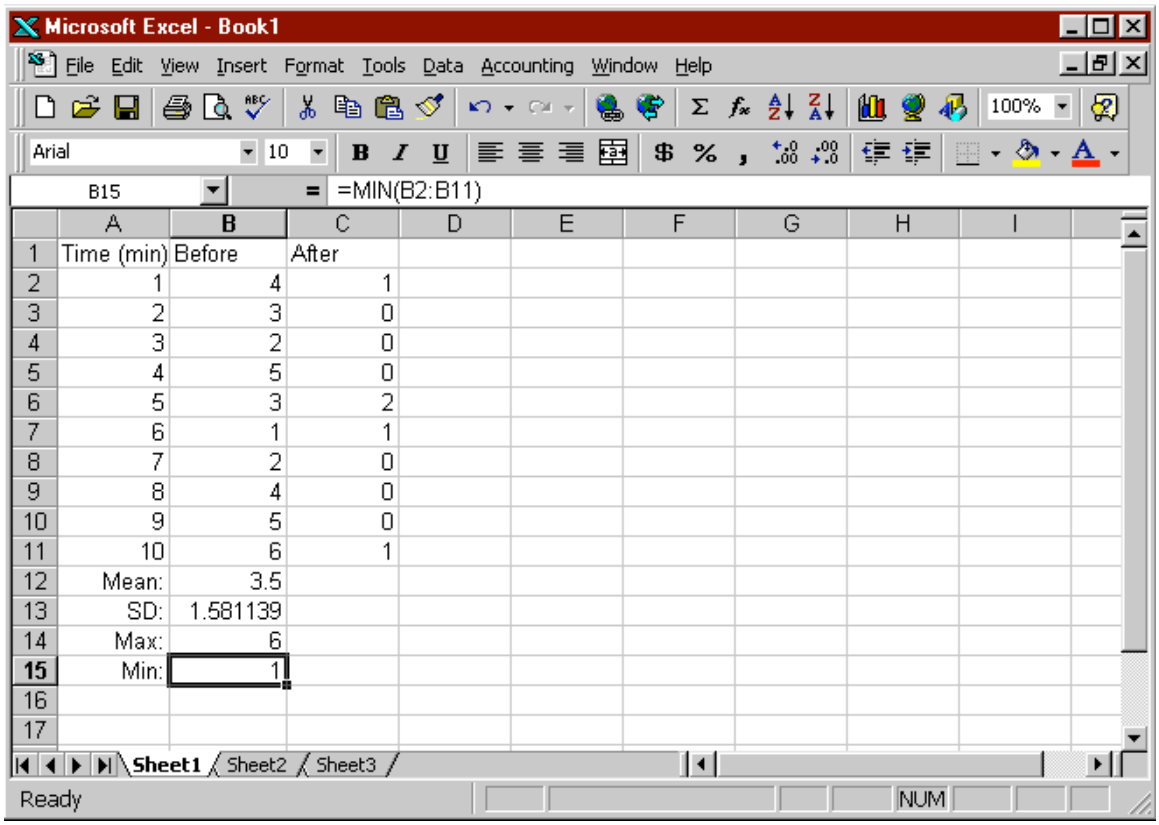


- Next, we need to tell Excel what numbers will be used to calculate the mean. We can specify this by typing the address range into the "Number1" box (B2:B11 means use the numbers in column B, rows 2 through 11.
- Alternately you can use your mouse to highlight and box-in the range (it doesn't matter if you go from top to bottom or bottom up).
- Note that the formula to calculate the mean has been entered into the editing box (highlighted in yellow; **=AVERAGE(B2:B11**).



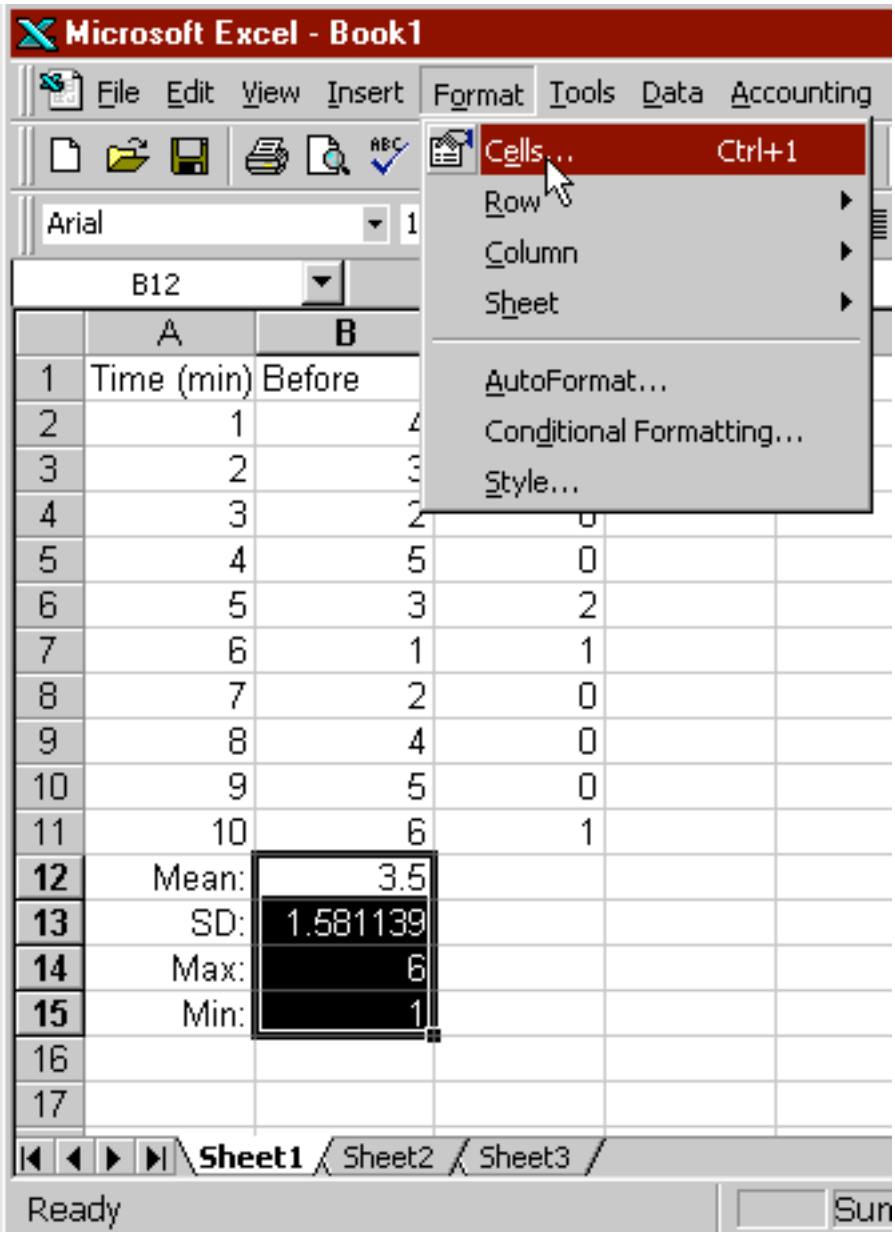
	A	B	C
1	Time (min)	Before	After
2	1	4	1
3	2	3	0
4	3	2	0
5	4	5	0
6	5	3	2
7	6	1	1
8	7	2	0
9	8	4	0
10	9	5	0
11	10	6	1
12	Mean:	3.5	
13	SD:		

- After pressing the OK button, the mean is calculated (3.5) and the selection box moves to the standard deviation cell. The formula for the standard deviation is entered just like the mean. The results are shown below.

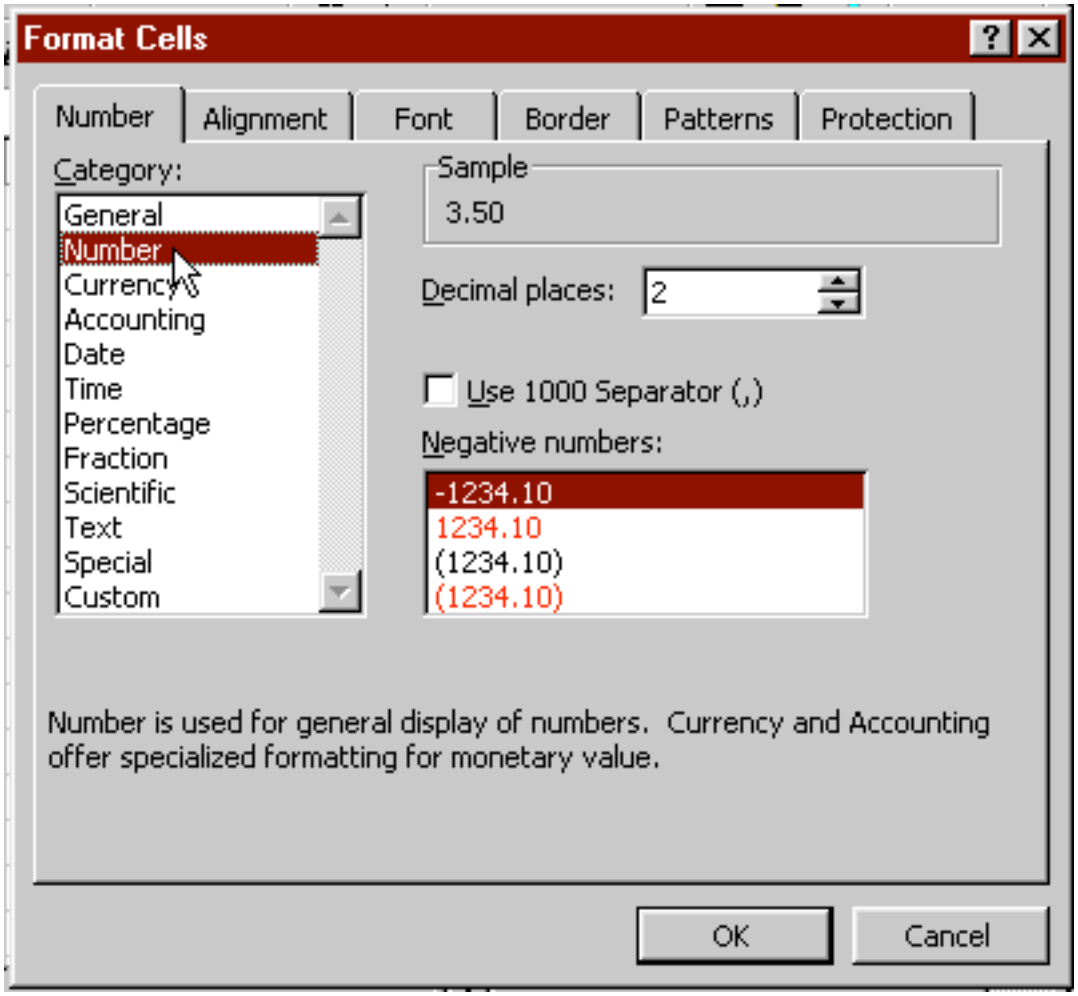


	A	B	C
1	Time (min)	Before	After
2	1	4	1
3	2	3	0
4	3	2	0
5	4	5	0
6	5	3	2
7	6	1	1
8	7	2	0
9	8	4	0
10	9	5	0
11	10	6	1
12	Mean:	3.5	
13	SD:	1.581139	
14	Max:	6	
15	Min:	1	
16			
17			

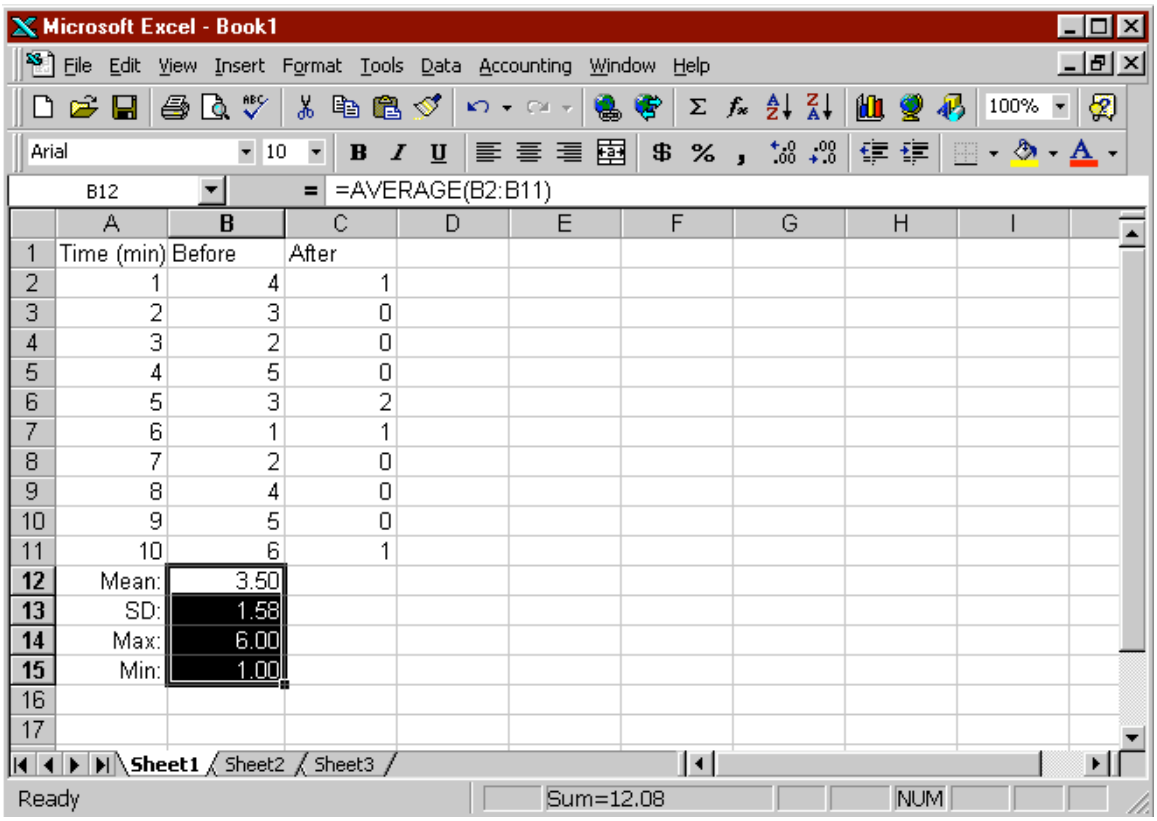
- Here, the function for the standard deviation has been entered, along with two more (one to determine the maximum value, the other for the minimum.
- Taking the standard deviation out to the sixth decimal place is not necessary. Let's set it for a more reasonable 2 decimal places.



- First, I selected all the statistical range. Then on the menu choose Format, then Cells...

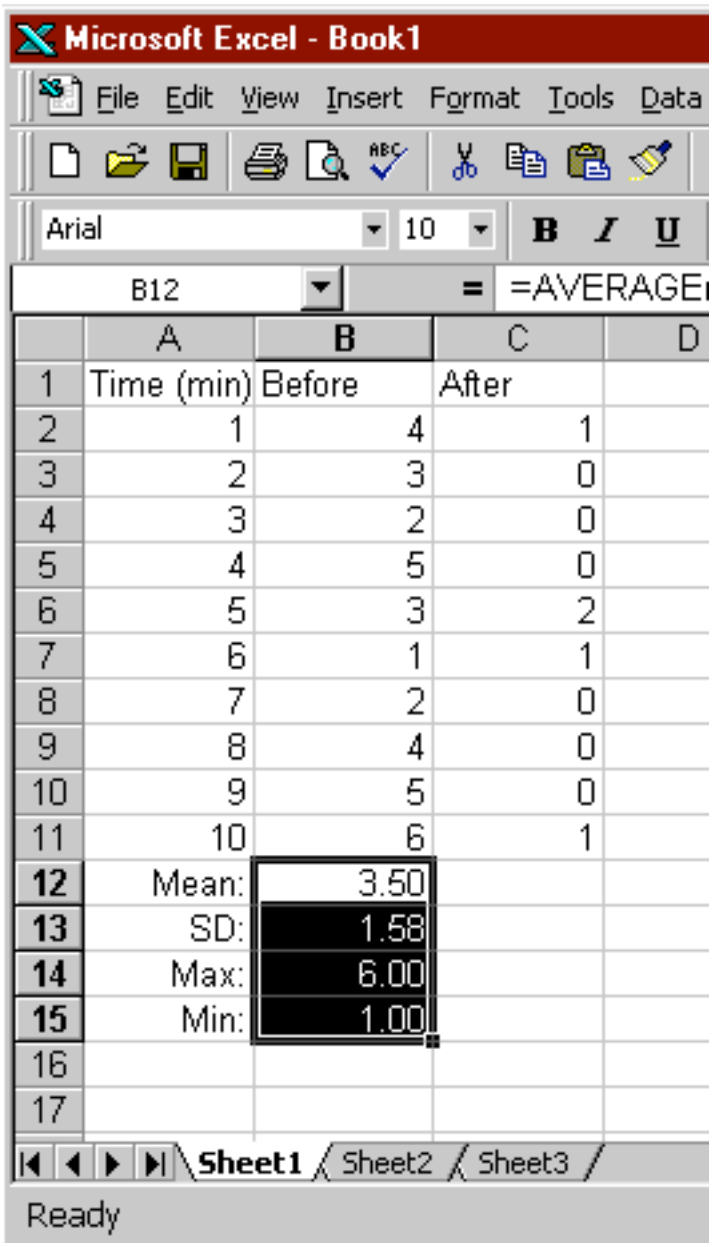


- The "Format Cells" box opens. Choose Number and 2 decimal places. Then press the OK button.



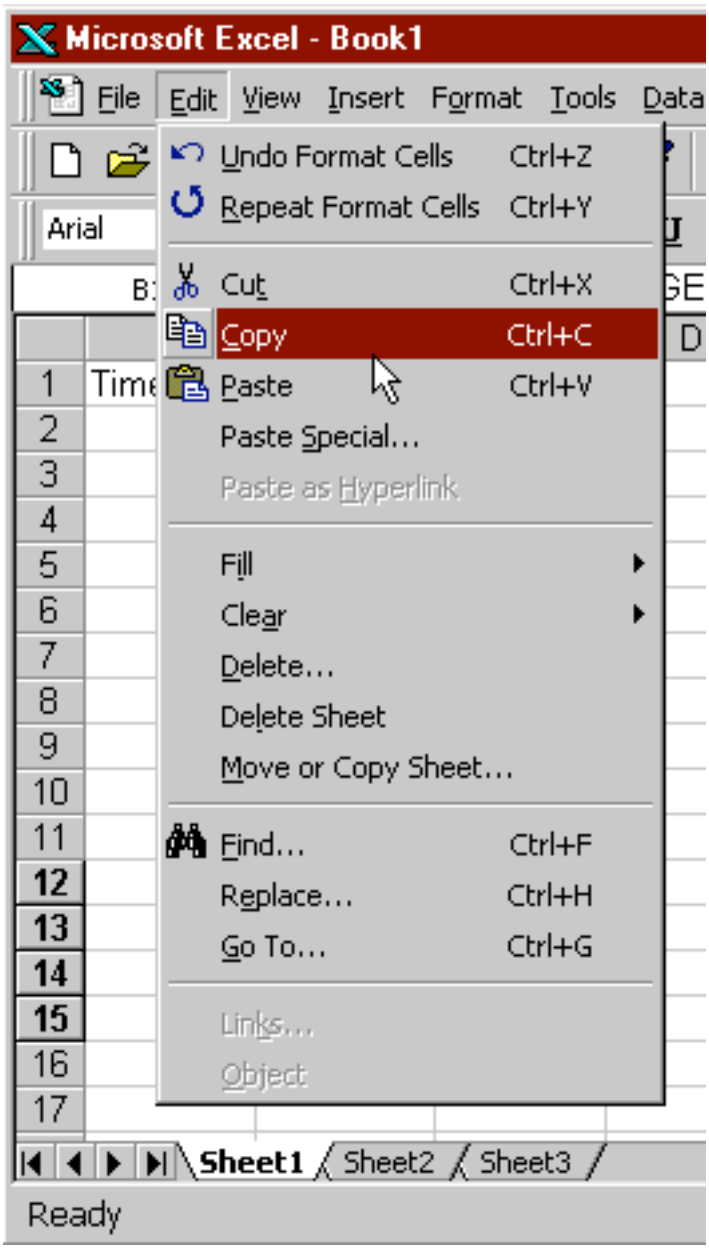
	A	B	C
1	Time (min)	Before	After
2	1	4	1
3	2	3	0
4	3	2	0
5	4	5	0
6	5	3	2
7	6	1	1
8	7	2	0
9	8	4	0
10	9	5	0
11	10	6	1
12	Mean:	3.50	
13	SD:	1.58	
14	Max:	6.00	
15	Min:	1.00	
16			
17			

- OK. Looks much better. Now we need to get the mean, standard deviation, and the rest for the "After" data.
- We could just do everything that we did before, but there's a simpler way.

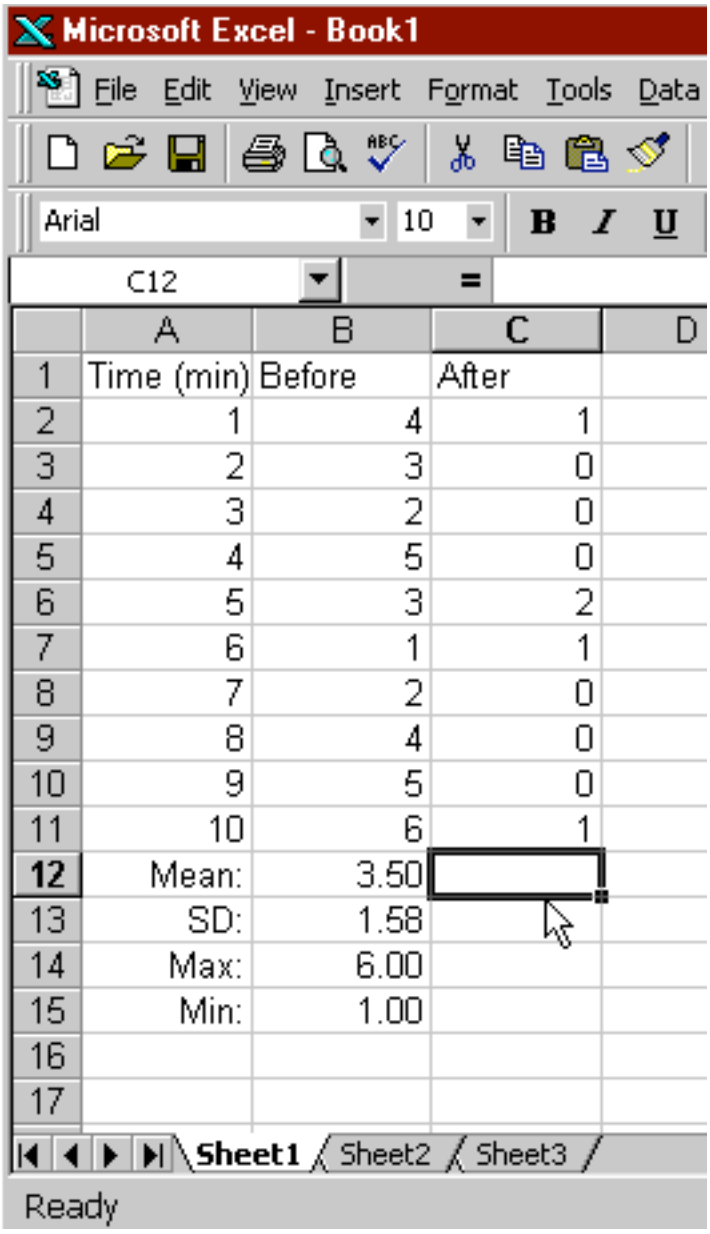


	A	B	C	D
1	Time (min)	Before	After	
2	1	4	1	
3	2	3	0	
4	3	2	0	
5	4	5	0	
6	5	3	2	
7	6	1	1	
8	7	2	0	
9	8	4	0	
10	9	5	0	
11	10	6	1	
12	Mean:	3.50		
13	SD:	1.58		
14	Max:	6.00		
15	Min:	1.00		
16				
17				

- We can just copy the formulae over. First highlight the cells containing the formulae.

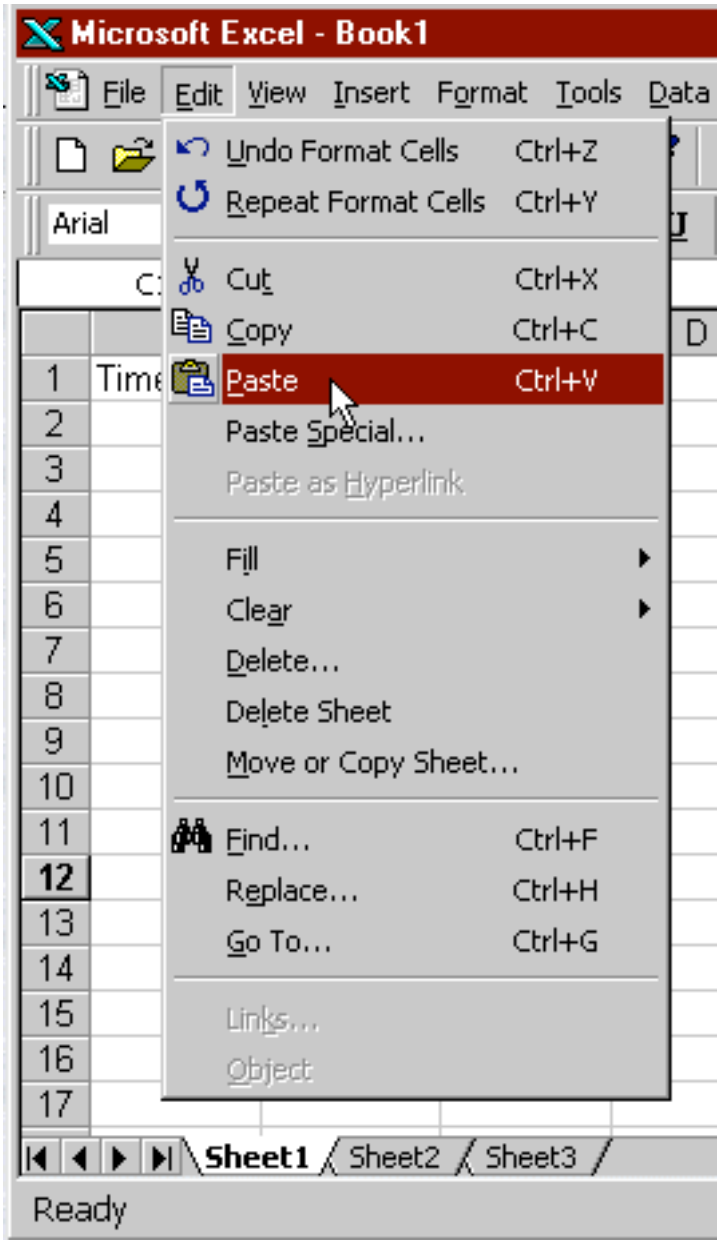


• Then choose Edit, Copy from the menu bar.

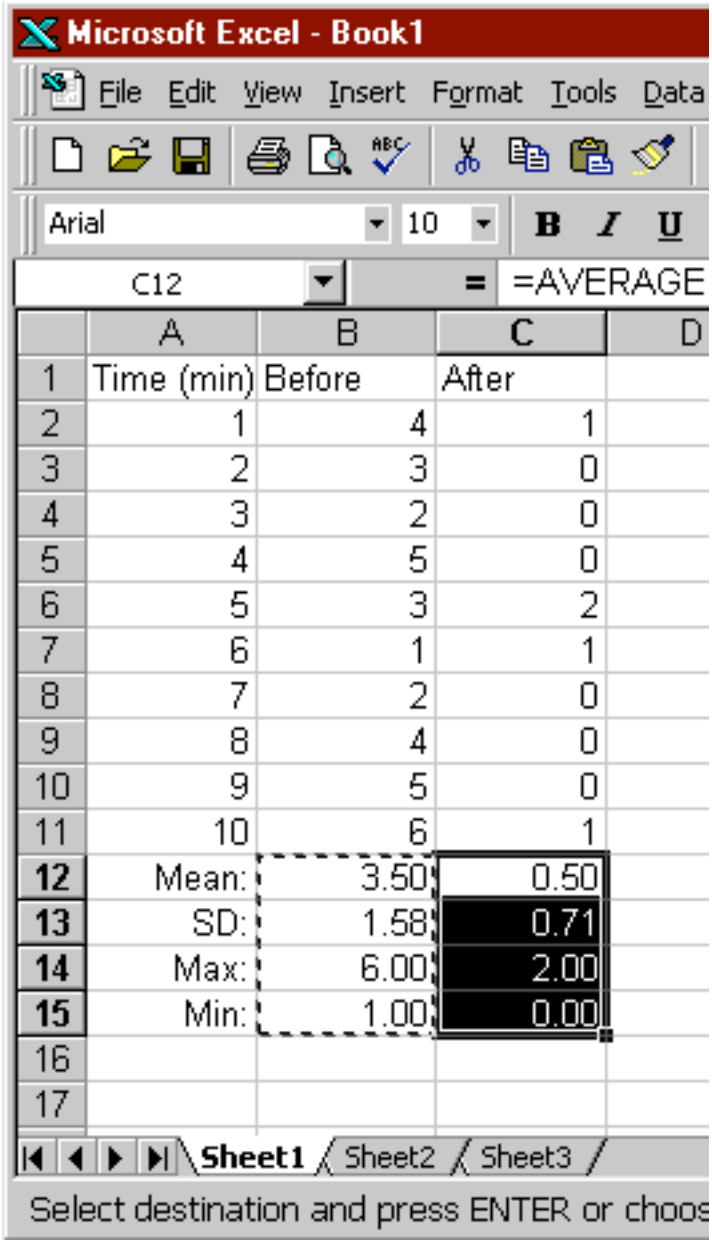


	A	B	C	D
1	Time (min)	Before	After	
2	1	4	1	
3	2	3	0	
4	3	2	0	
5	4	5	0	
6	5	3	2	
7	6	1	1	
8	7	2	0	
9	8	4	0	
10	9	5	0	
11	10	6	1	
12	Mean:	3.50		
13	SD:	1.58		
14	Max:	6.00		
15	Min:	1.00		
16				
17				

- Next, highlight the top cell of the range where you want the data to be copied.

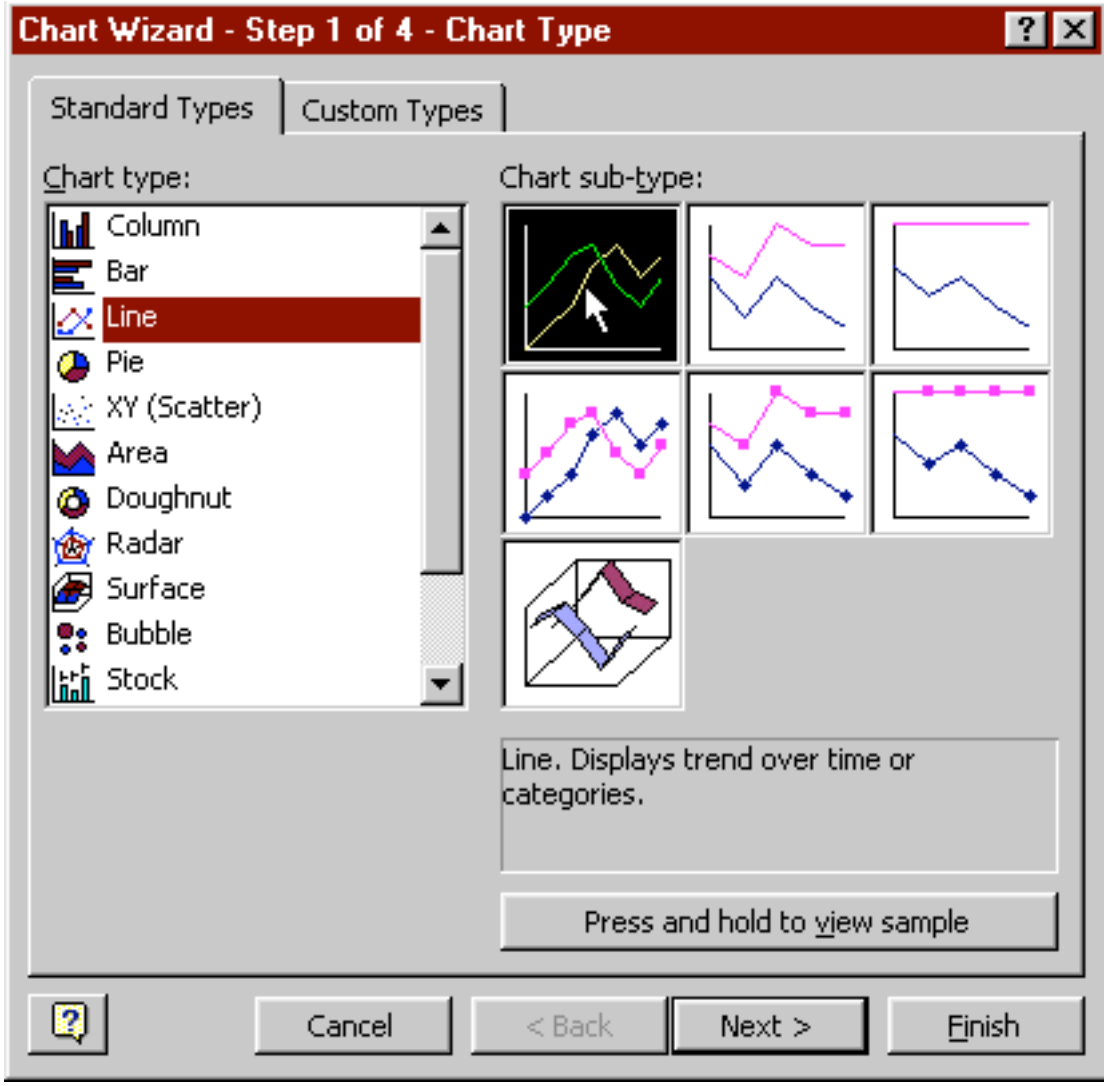


• Next, chose Paste from the Edit menu.

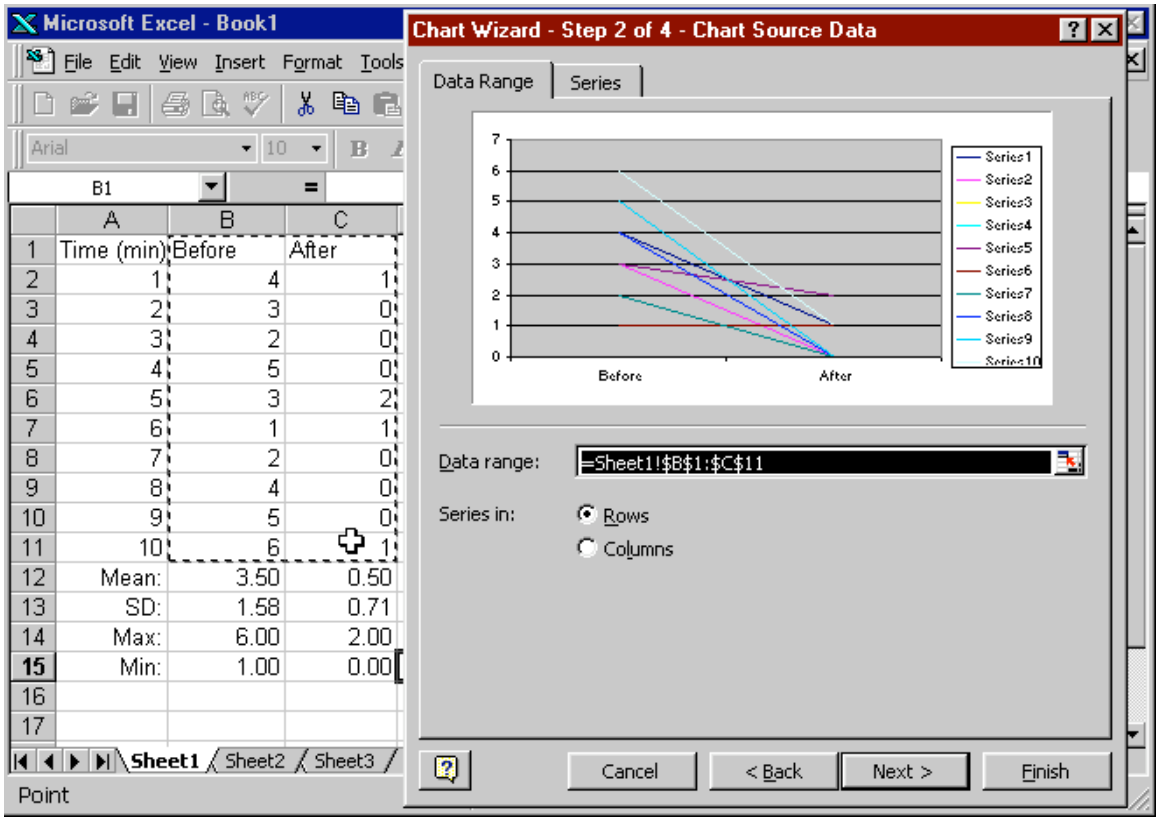


	A	B	C	D
1	Time (min)	Before	After	
2	1	4	1	
3	2	3	0	
4	3	2	0	
5	4	5	0	
6	5	3	2	
7	6	1	1	
8	7	2	0	
9	8	4	0	
10	9	5	0	
11	10	6	1	
12	Mean:	3.50	0.50	
13	SD:	1.58	0.71	
14	Max:	6.00	2.00	
15	Min:	1.00	0.00	
16				
17				

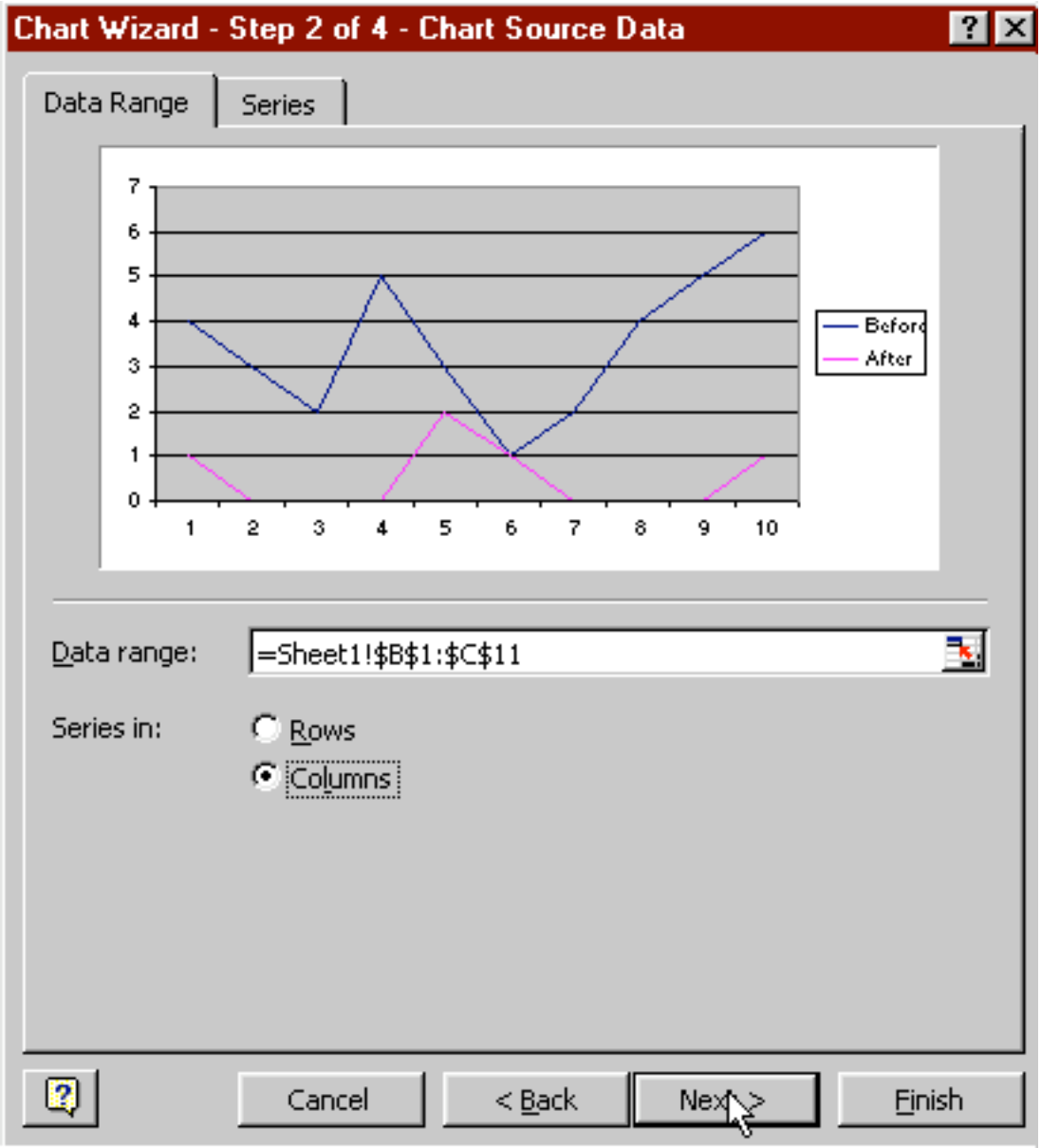
- The new values are now calculated for the "After" data.
- Note that Excel is smart enough that it doesn't calculate the values based on column A, but instead adjusted the formulae so that all the calculations were based on column C.
- Now let's make a chart (graph) of your data. Click on the chart wizard button ( ) on Excel's menu bar. That opens the Chart Wizard window as shown above.
- We'll do a line chart.



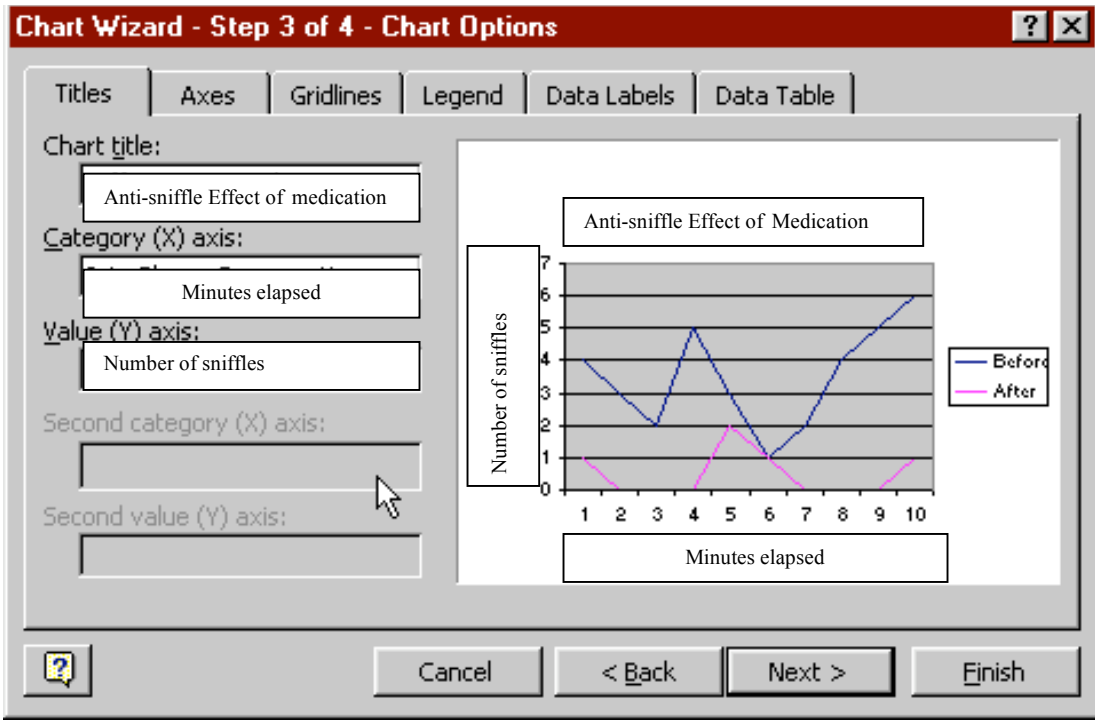
- The first of the Chart sub-type is selected. Then the Next> button is pressed.



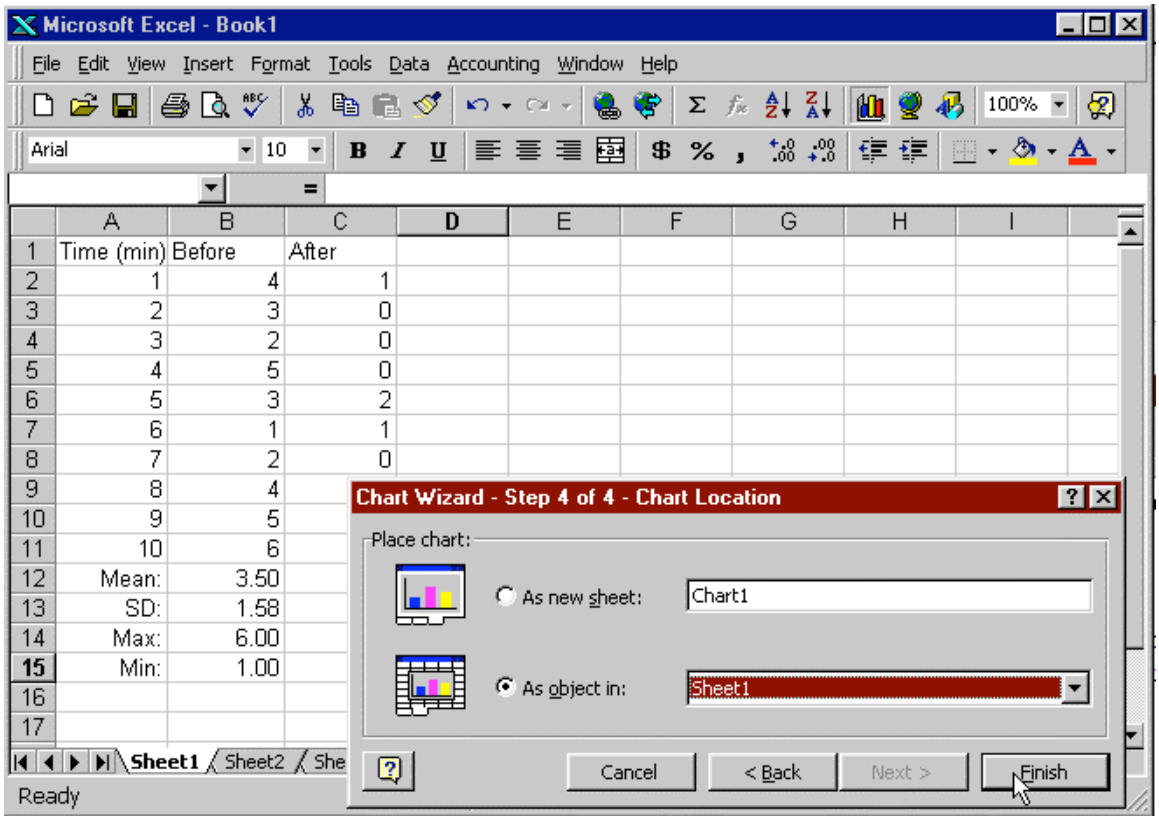
- Next, the chart wizard wants to know what data to plot.
- I've used the mouse to highlight columns B and C from row 1 through row 11 (note the dotted line).
- The example graph shown in the wizard doesn't seem to make any sense. That's because Excel thought that the data were arranged in rows (rather than the variables listed as columns.
- A click on the columns radio button will fix that.



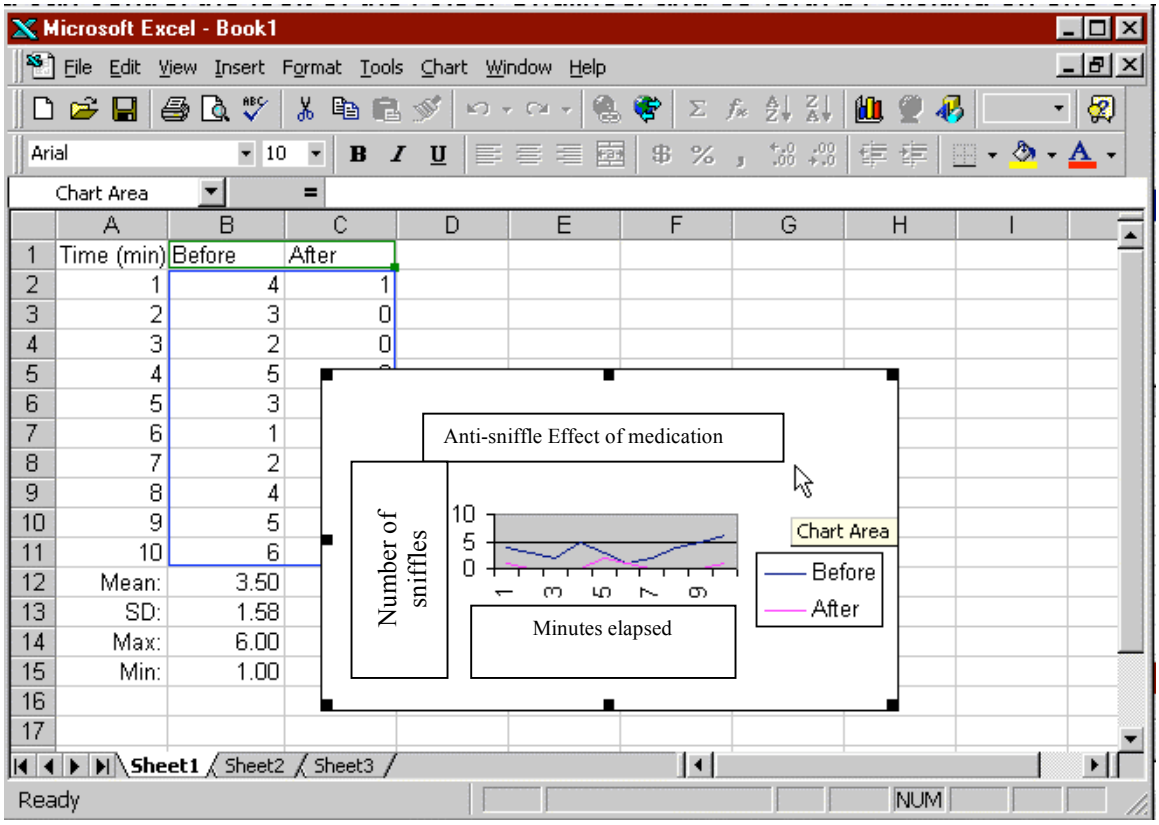
- Now the graph makes sense!
- Note that the lines are labeled too (blue is "Before", violet is "After".
- Click the Next> button to continue.



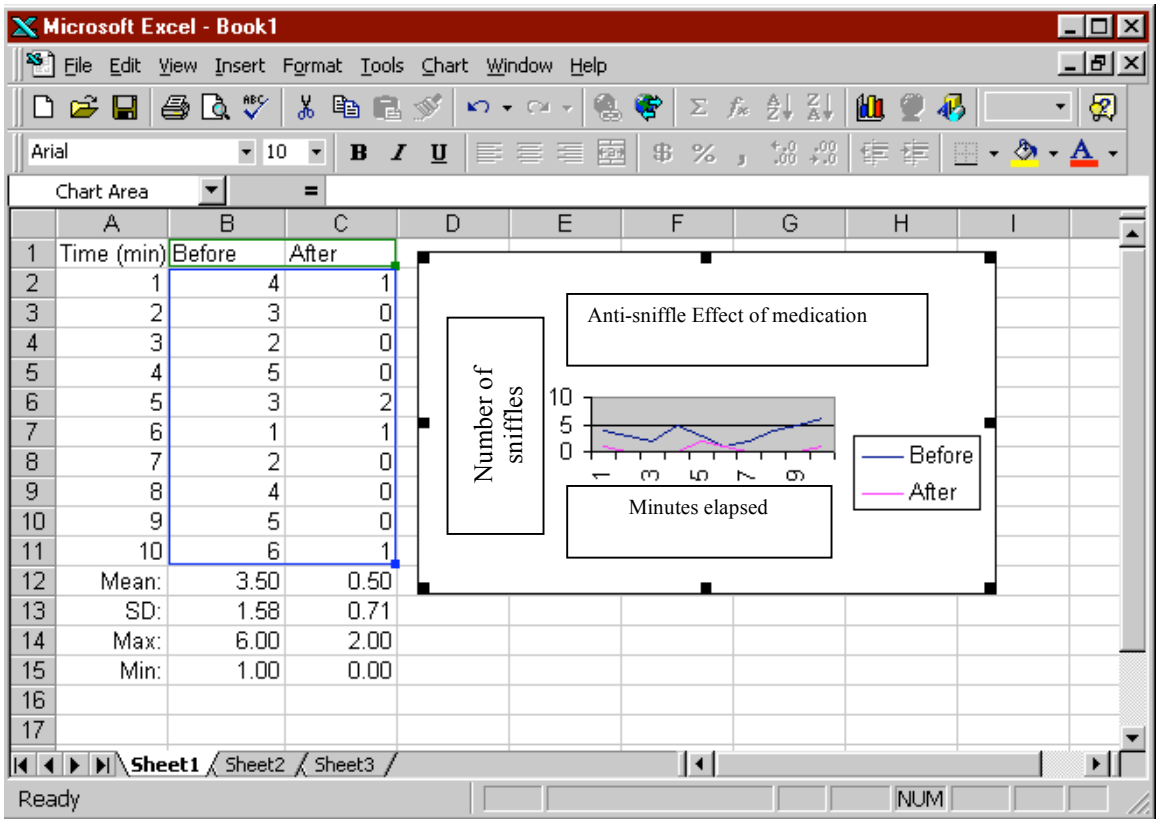
- Now enter the Title for the chart, along with labels for the X and Y axis.
- Note that you can control the look of the Axes, Gridlines, and so forth by clicking on one of the tabs at the top of the chart wizard.
- The labels as shown on these windows look slightly different than they will on your version of Excel. Yours will look better!
- Click the Next> button.



- Excel now wants to know where to put the graph (on a separate sheet or on the same sheet as the data). We'll put it on the same sheet.
- Press the Finish button.

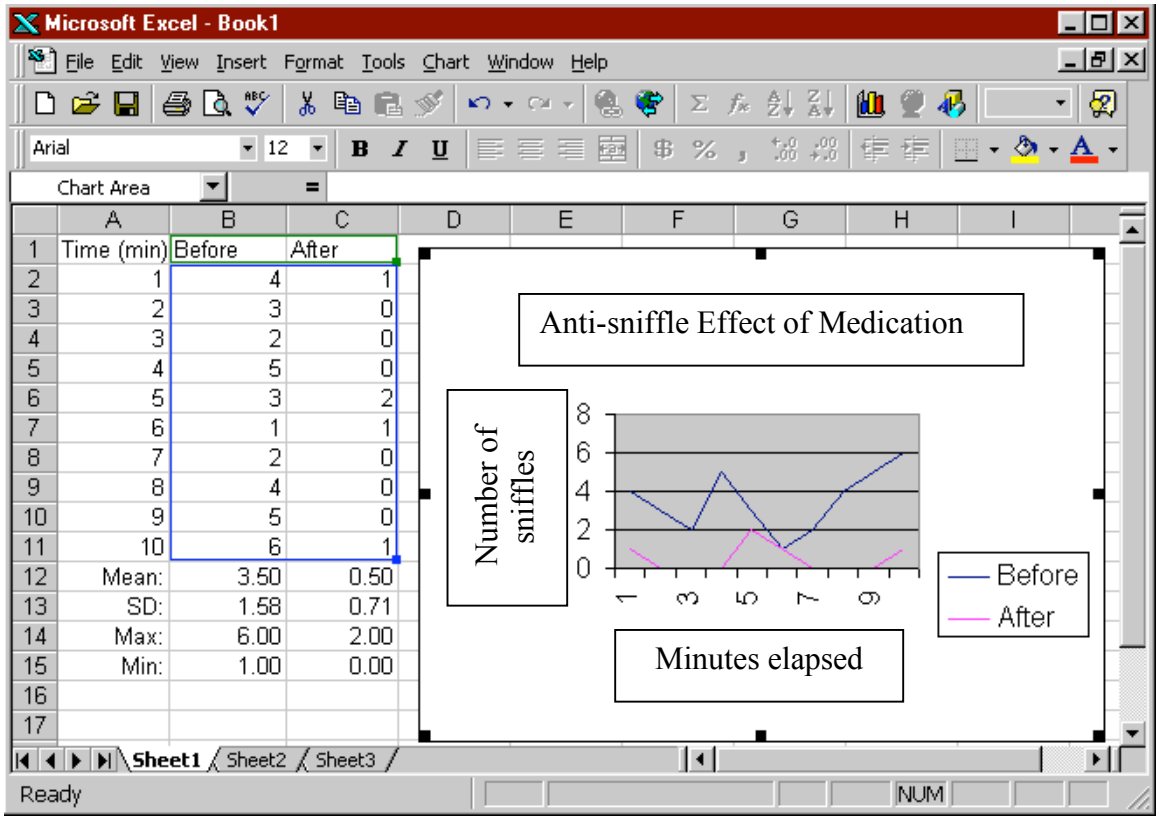


- The chart is inserted into the data sheet. Unfortunately, it's blocking some of the data.
- That's OK. It can be moved with your mouse.

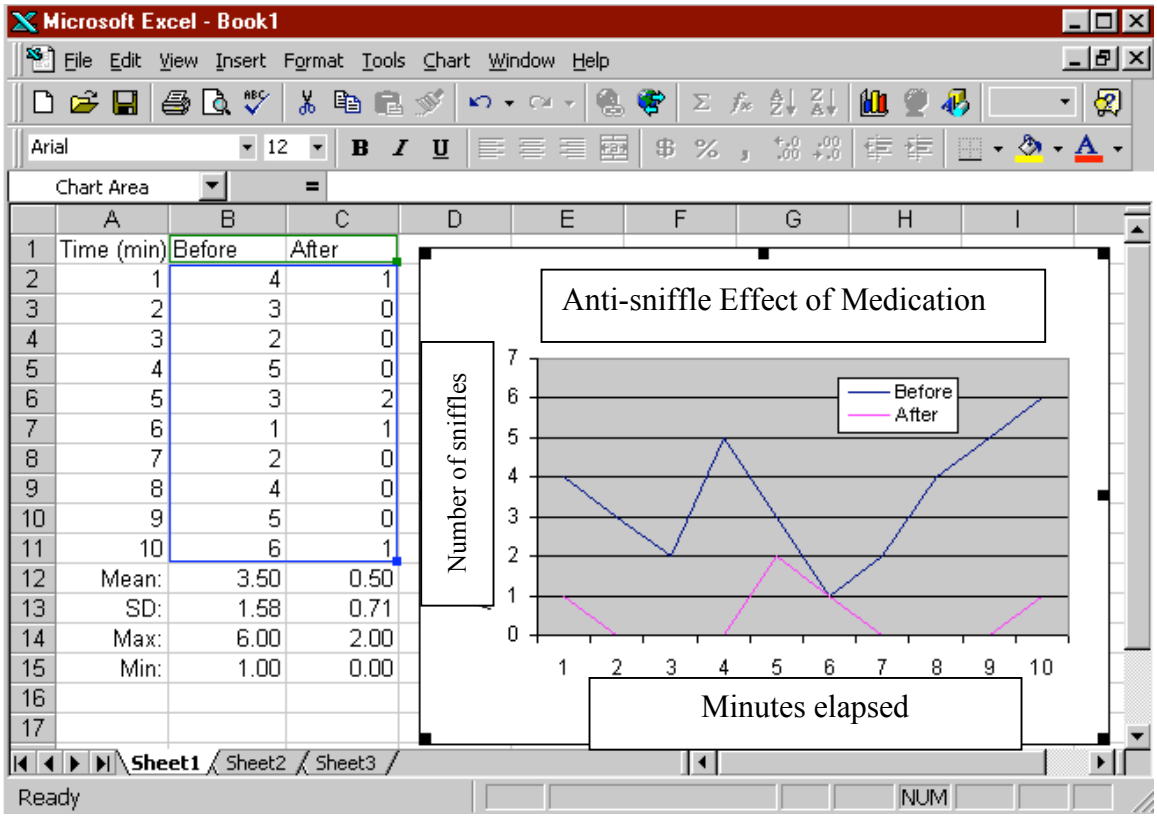


	A	B	C
1	Time (min)	Before	After
2	1	4	1
3	2	3	0
4	3	2	0
5	4	5	0
6	5	3	2
7	6	1	1
8	7	2	0
9	8	4	0
10	9	5	0
11	10	6	1
12	Mean:	3.50	0.50
13	SD:	1.58	0.71
14	Max:	6.00	2.00
15	Min:	1.00	0.00

- And resized.

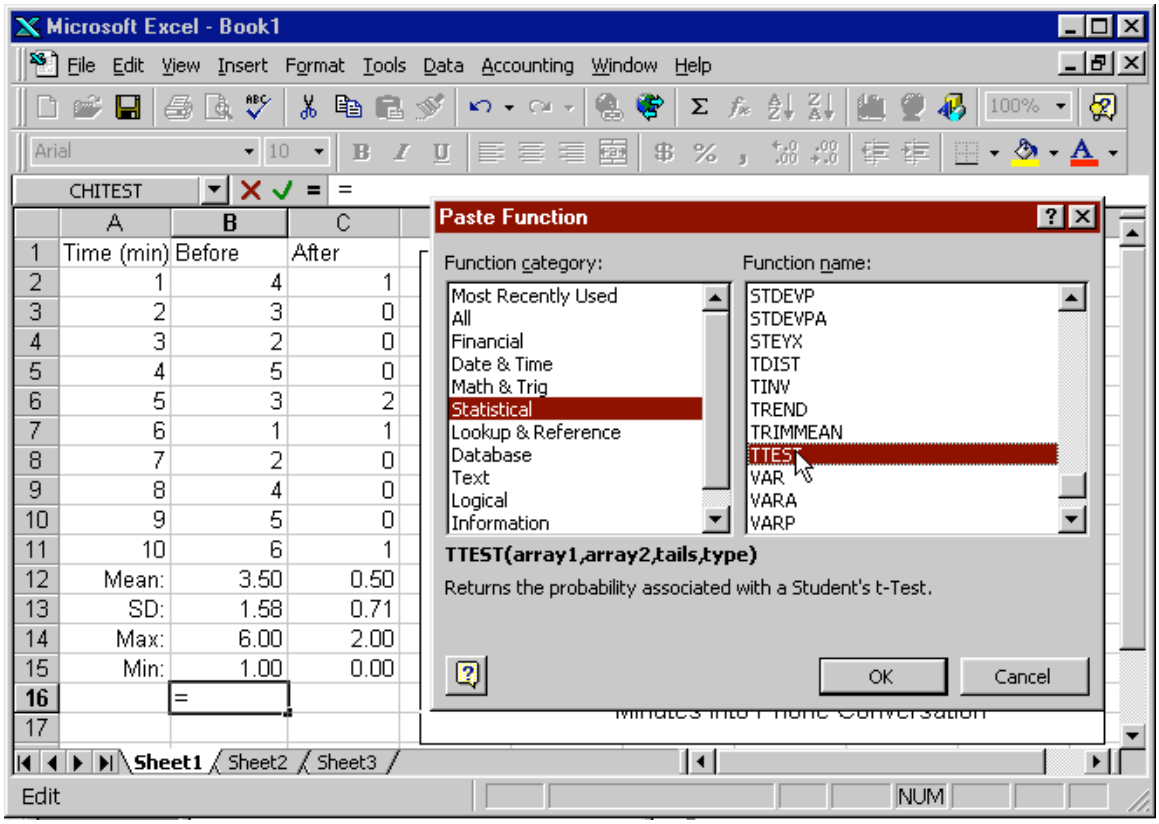


- You can even edit and change the text simply by right-clicking on it.

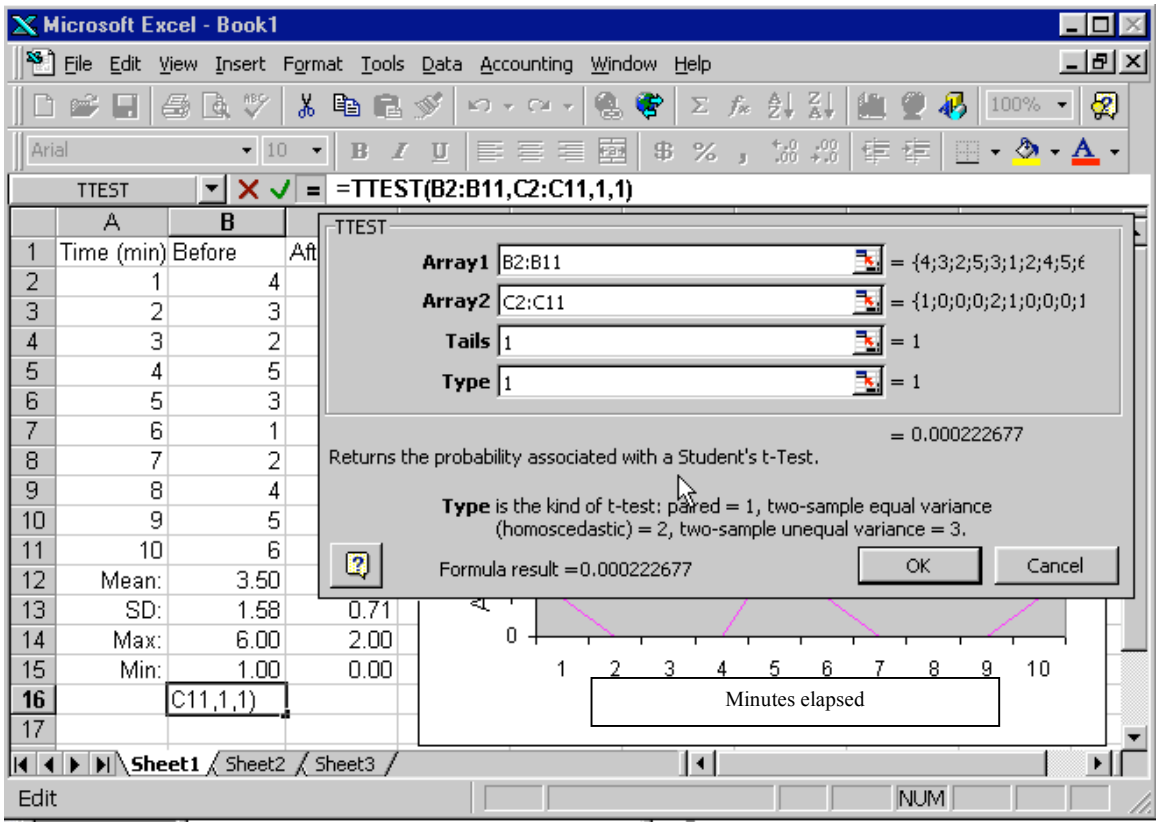


	A	B	C
1	Time (min)	Before	After
2	1	4	1
3	2	3	0
4	3	2	0
5	4	5	0
6	5	3	2
7	6	1	1
8	7	2	0
9	8	4	0
10	9	5	0
11	10	6	1
12	Mean:	3.50	0.50
13	SD:	1.58	0.71
14	Max:	6.00	2.00
15	Min:	1.00	0.00

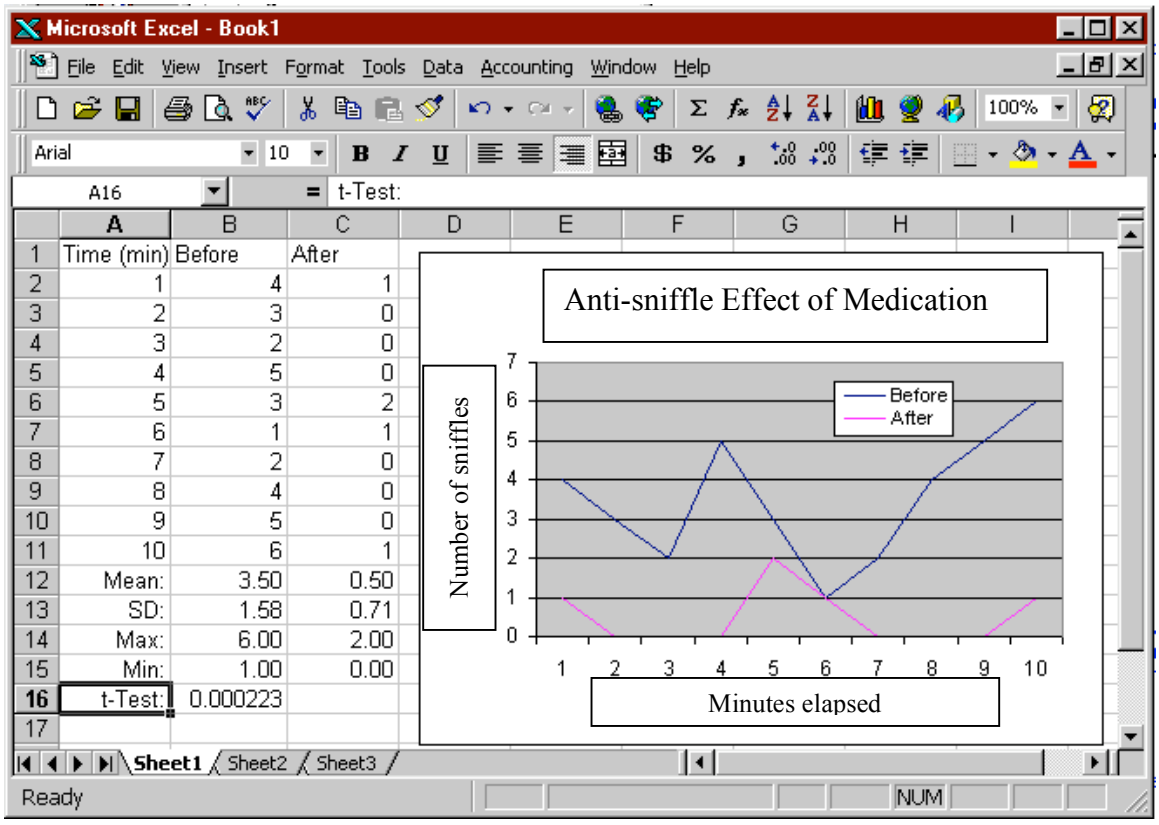
- I've made several changes to the various portions of the chart. Font sizes were reduced by right-clicking on the font and then choosing the format option.
- I enlarged the graph by first selecting it, and the pulling on the selection buttons at the corners.
- I then moved the chart legend into the main body of the chart to save room.



- You can even run some statistical tests on these data. First point to the cell where you want the answer to be returned (B16).
- Then choose Insert Function from the main menu. The Paste Function window opens.
- Select Statistical from the function category and TTEST from the function name column (actually, this data set shouldn't be analyzed with a t-test, but the appropriate test would take too much explanation).
- Click the OK button.



- Excel needs to know where the data are. I told it that the "before" data (B2 though 11) represents array 1.
- Array 2 is the after data (C2 through C11).
- The number of Tails is 1 (Don't worry about what this means right now).
- The type is a paired sample (The codes are at the bottom of the box).
- Click the OK button.



	A	B	C
1	Time (min)	Before	After
2	1	4	1
3	2	3	0
4	3	2	0
5	4	5	0
6	5	3	2
7	6	1	1
8	7	2	0
9	8	4	0
10	9	5	0
11	10	6	1
12	Mean:	3.50	0.50
13	SD:	1.58	0.71
14	Max:	6.00	2.00
15	Min:	1.00	0.00
16	t-Test:	0.000223	
17			

- The probability is much less than .05, so we accept the hypothesis that the amount of sniffling decreased after use of the new medication.
- I added a t-Test label to the sheet.
- The table can be selected and copied to a Word or PowerPoint presentation.
  Likewise, you can copy the graph to either program.

*Now that you have finished this brief tutorial you have an assignment. Find the page titled, "**Biology 102 Lab Assignment Week One Spring 2003".***

The majority of this tutorial was designed by Dr. Tietjen, Bellarmine University. The original tutorial can be found at http://cas.bellarmine.edu/tietjen/Resources/excell_basics.htm