Reference and Style Guide for Microsoft Excel

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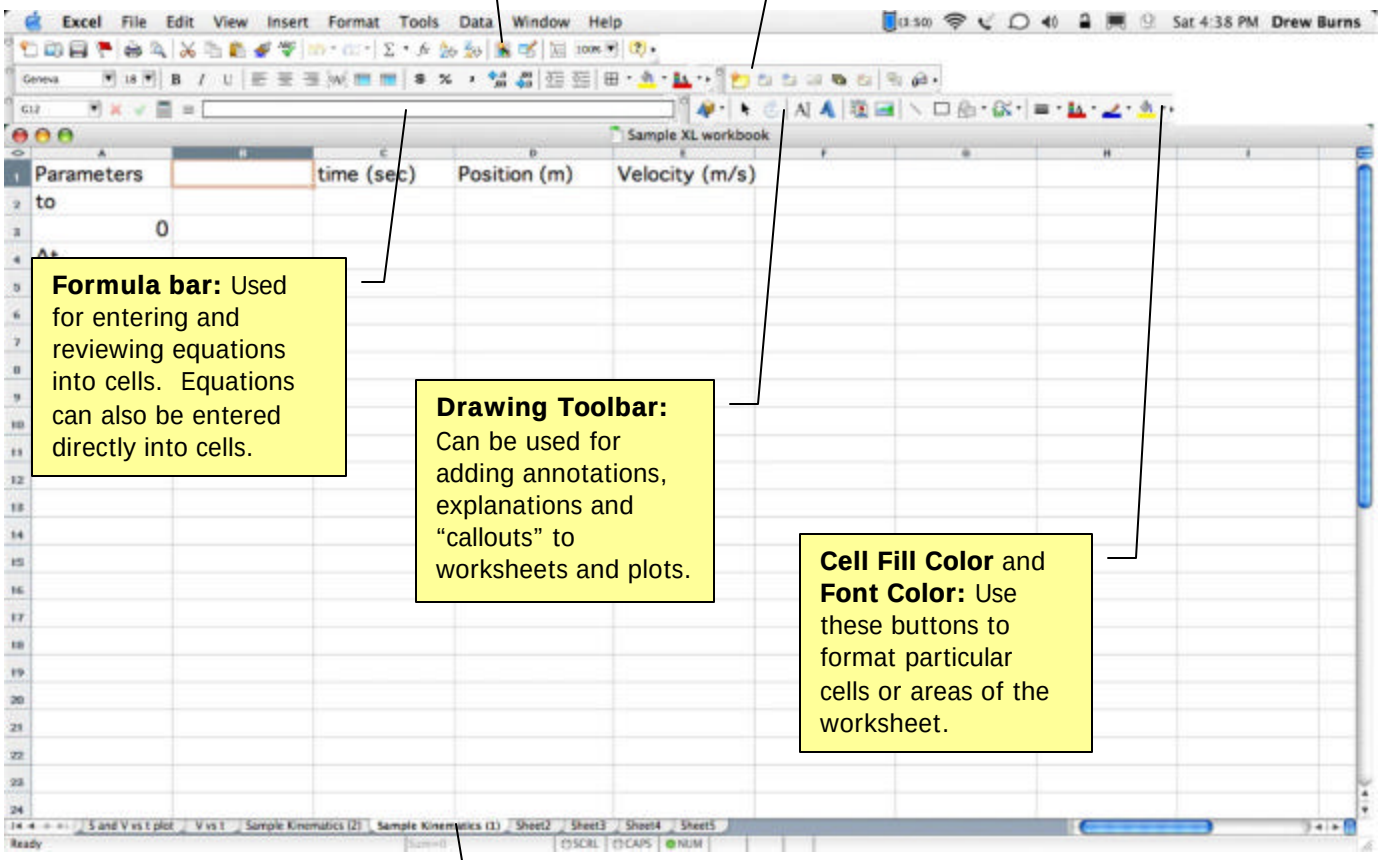
The Pingry School
Martinsville, NJ

Getting Acquainted

Basic Excel Features

Chart Wizard: Used for plotting data.

Reviewing Toolbar: Can be added by using the View: Toolbar:Reviewing menu option. Great for added pop-up "sticky note" comments to cells in a particular worksheet.



Formula bar: Used for entering and reviewing equations into cells. Equations can also be entered directly into cells.

Drawing Toolbar: Can be used for adding annotations, explanations and "callouts" to worksheets and plots.

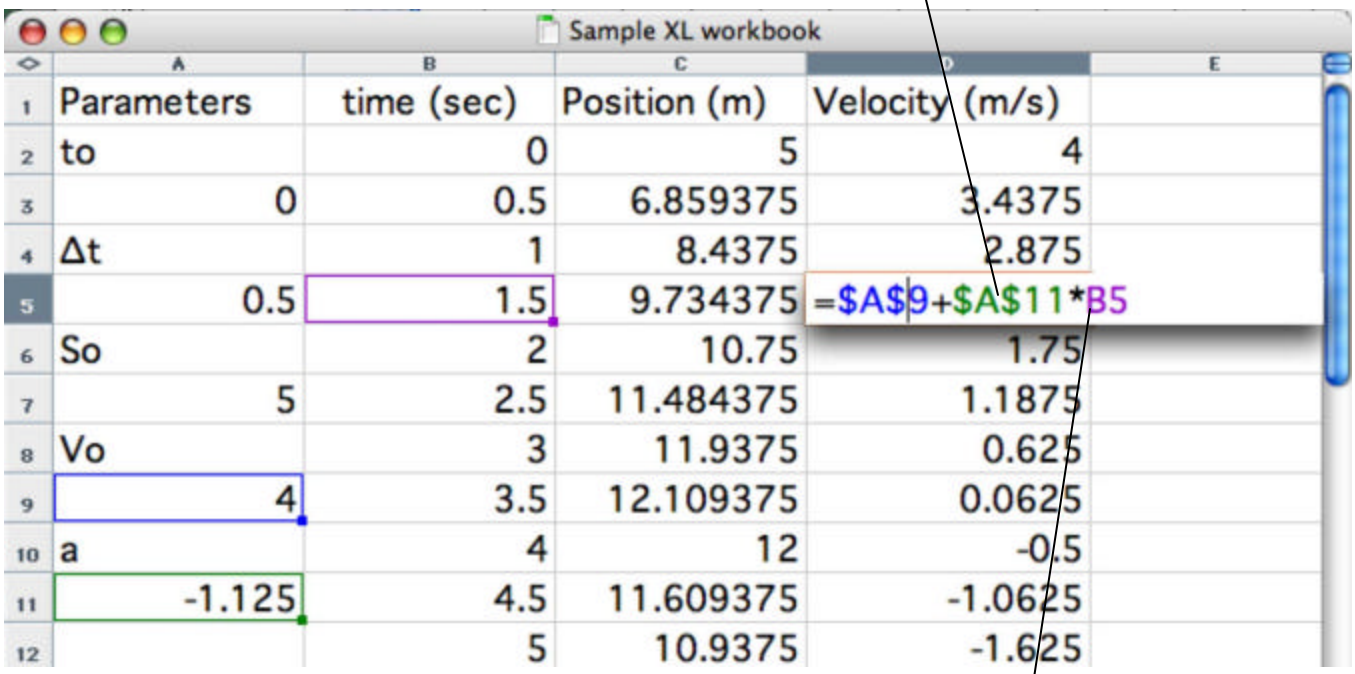
Cell Fill Color and **Font Color:** Use these buttons to format particular cells or areas of the worksheet.

Worksheet tabs: Worksheets can be renamed by double-clicking on the tab. The order in which worksheets appear can be changed by clicking and holding a tab and dragging it to a new location or by using "Edit:Move or Copy sheet…" menu.

Writing Cell Equations — Relative and Absolute Addresses

Checking Equations: Double clicking this cell (D2) reveals the equation as it was typed in the formula bar. Note that the equations must start with an equal sign. Also note that Excel color codes the various cell references as they appear in the equation and highlights the corresponding cells on the worksheet. This is extremely useful when trying to "debug" a series of equations.

Absolute address
The cell location ("$A$9") includes a $ before both the column (A) and row (9) reference. When the equation in cell D2 is "drag copied" (see "Selecting Cells" and "Copying Data and Equations") into other cells, the column and row references will not change and will always refer to the value found in cell A9.



	A	B	C	D	E
1	Parameters	time (sec)	Position (m)	Velocity (m/s)	
2	to	0	5	4	
3	0	0.5	6.859375	3.4375	
4	Δt	1	8.4375	2.875	
5	0.5	1.5	9.734375	=$A$9+$A$11*B5	
6	So	2	10.75	1.75	
7	5	2.5	11.484375	1.1875	
8	Vo	3	11.9375	0.625	
9	4	3.5	12.109375	0.0625	
10	a	4	12	-0.5	
11	-1.125	4.5	11.609375	-1.0625	
12		5	10.9375	-1.625	

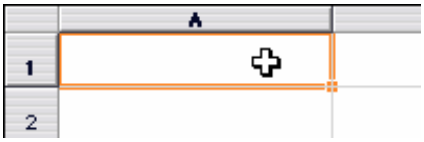
Relative address
The cell location ("B2") is does not include a $ before either the column (B) or row (2) reference. When the equation in cell D2 is "drag copied" into other cells, the both the column and row references will change accordingly so that the equation will always refer to the cell in the same row as the equation but two columns to the left.

Selecting Cells — Highlighting, Moving and Copying Data

Cursor types:

Selection cursor — Click and hold to choose cells to be formatted and/or plotted

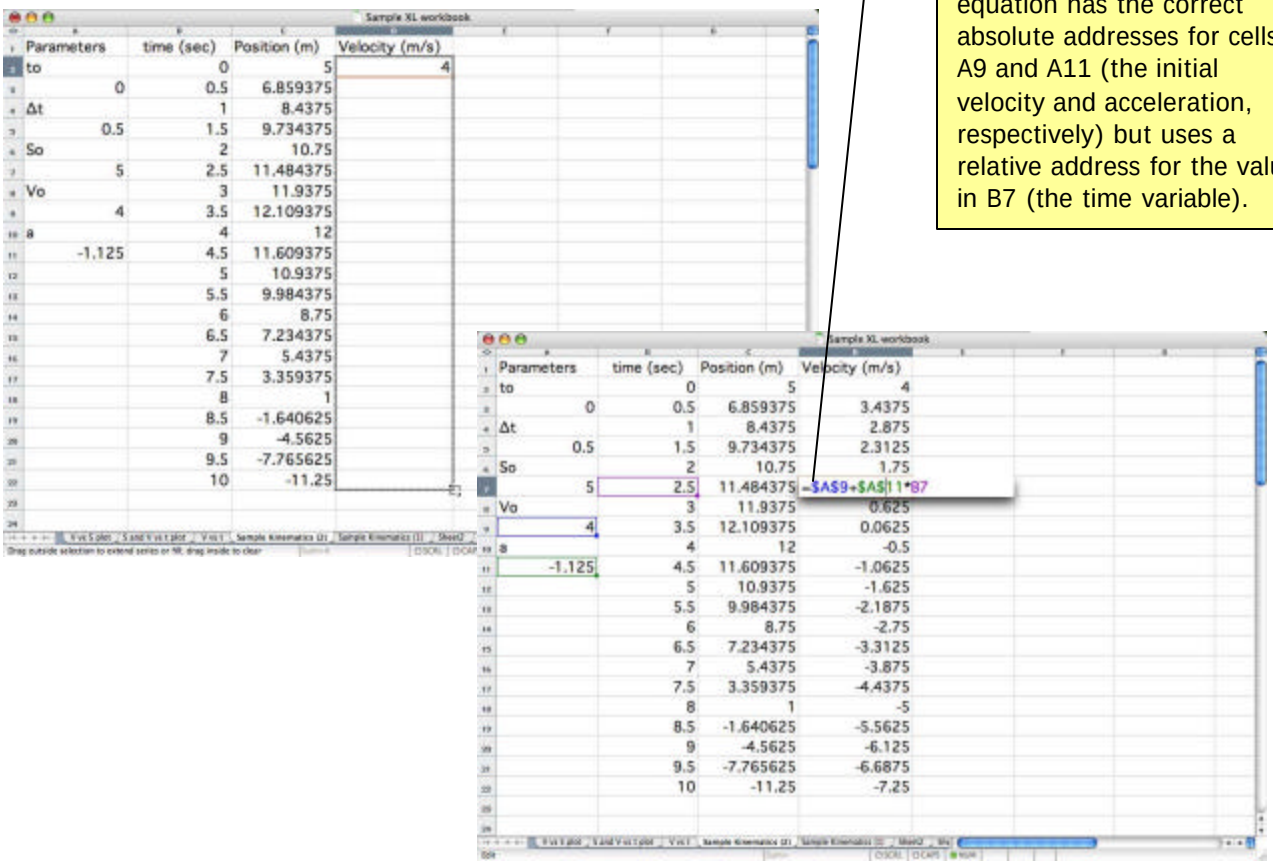
Drag-and-drop cursor — Click and hold to move a group of selected cells to another region of a worksheet



Drag-and-copy cursor — Click, hold and drag in order to copy the contents and format of a cell into other cells. If the cell contains an equation, the equation is copied into the other cells.

Copying Equations and Data

Use the drag-and-copy cursor to reproduce equations. Variables in the equation must have the correct "addressing" (relative, mixed or absolute) to ensure that the values picked up in the new equations do in fact refer to the desired cells.



Parameters		time (sec)	Position (m)	Velocity (m/s)
to		0	5	4
	0	0.5	6.859375	
Δt		1	8.4375	
	0.5	1.5	9.734375	
So		2	10.75	
	5	2.5	11.484375	
Vo		3	11.9375	
	4	3.5	12.109375	
a		4	12	
	-1.125	4.5	11.609375	
		5	10.9375	
		5.5	9.984375	
		6	8.75	
		6.5	7.234375	
		7	5.4375	
		7.5	3.359375	
		8	1	
		8.5	-1.640625	
		9	-4.5625	
		9.5	-7.765625	
		10	-11.25	

Parameters		time (sec)	Position (m)	Velocity (m/s)
to		0	5	4
	0	0.5	6.859375	3.4375
Δt		1	8.4375	2.875
	0.5	1.5	9.734375	2.3125
So		2	10.75	1.75
	5	2.5	11.484375	=$A$9+$A$11*B7
Vo		3	11.9375	0.625
	4	3.5	12.109375	0.0625
a		4	12	-0.5
	-1.125	4.5	11.609375	-1.0625
		5	10.9375	-1.625
		5.5	9.984375	-2.1875
		6	8.75	-2.75
		6.5	7.234375	-3.3125
		7	5.4375	-3.875
		7.5	3.359375	-4.4375
		8	1	-5
		8.5	-1.640625	-5.5625
		9	-4.5625	-6.125
		9.5	-7.765625	-6.6875
		10	-11.25	-7.25

Note that the copied equation has the correct absolute addresses for cells A9 and A11 (the initial velocity and acceleration, respectively) but uses a relative address for the value in B7 (the time variable).

Plotting Data Using Chart Wizard

Selecting Data To Plot

Prior to choosing the Chart Wizard, it will be necessary to select a set of data to be plotted.

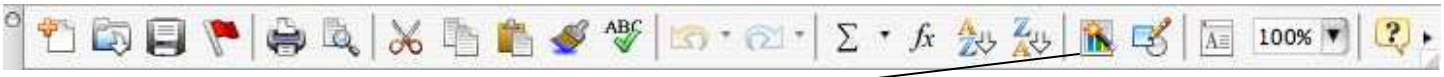


Chart Wizard:

To select data from adjacent columns: Use the "selection" cursor to choose a range of data to be plotted. Excel treats the data in the left-most column as the independent (x) variable.

Sample XL workbook

Parameters	time (sec)	Position (m)	Velocity (m/s)
to	0	5	4
0	0.5	6.859375	3.4375
Δt	1	8.4375	2.875
0.5	1.5	9.734375	2.3125
So	2	10.75	1.75
5	2.5	11.484375	1.1875
Vo	3	11.9375	0.625
4	3.5	12.109375	0.0625
a	4	12	-0.5
-1.125	4.5	11.609375	-1.0625
	5	10.9375	-1.625
	5.5	9.984375	-2.1875
	6	8.75	-2.75
	6.5	7.234375	-3.3125
	7	5.4375	-3.875
	7.5	3.359375	-4.4375
	8	1	-5
	8.5	-1.640625	-5.5625
	9	-4.5625	-6.125
	9.5	-7.765625	-6.6875
	10	-11.25	-7.25

Sample XL workbook

Parameters	time (sec)	Position (m)	Velocity (m/s)
to	0	5	4
0	0.5	6.859375	3.4375
Δt	1	8.4375	2.875
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So	2	10.75	1.75
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-1.125	4.5	11.609375	-1.0625
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	5.5	9.984375	-2.1875
	6	8.75	-2.75
	6.5	7.234375	-3.3125
	7	5.4375	-3.875
	7.5	3.359375	-4.4375
	8	1	-5
	8.5	-1.640625	-5.5625
	9	-4.5625	-6.125
	9.5	-7.765625	-6.6875
	10	-11.25	-7.25

To select data from non-adjacent columns: Select the column of data that contains the independent variable first. Then select the other columns while holding the ⌘ key (ctrl on a PC).

Chart Wizard Style Options

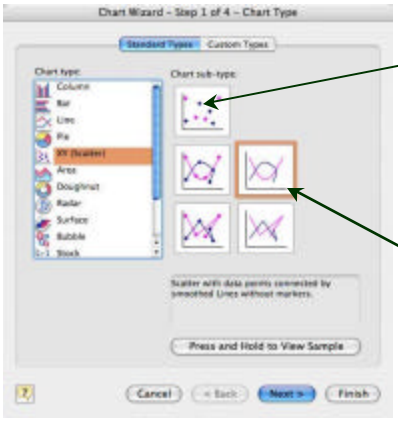
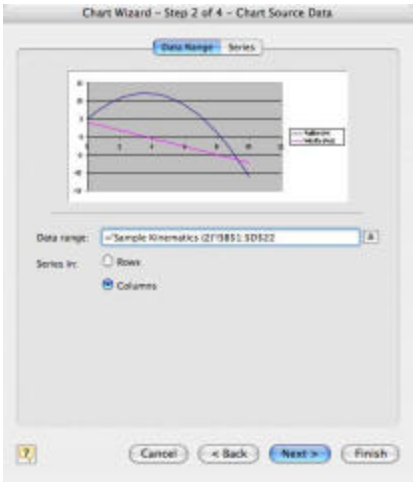
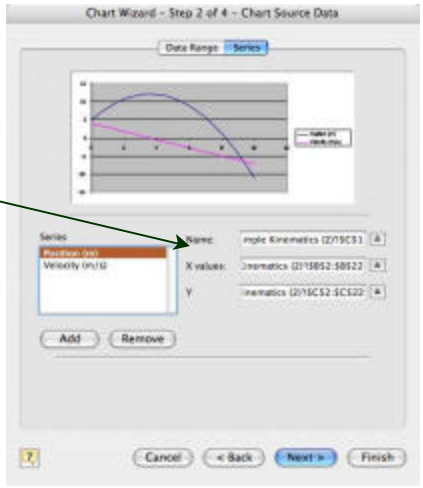


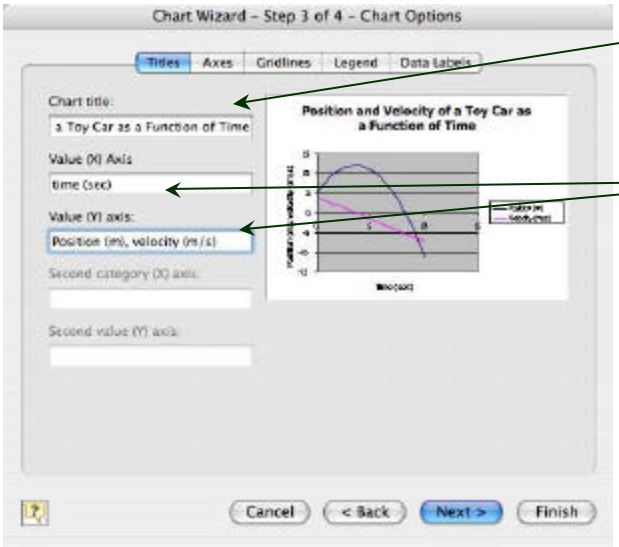
Chart type: Choose "scatter" plot when plotting experimental data points.

Chart type: Choose "smooth curve" option when plotting results of a mathematical model.



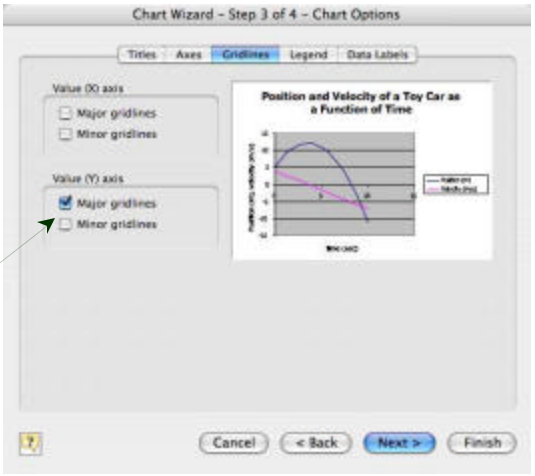
Series: Data series can be renamed. Any change will appear as part of the legend.



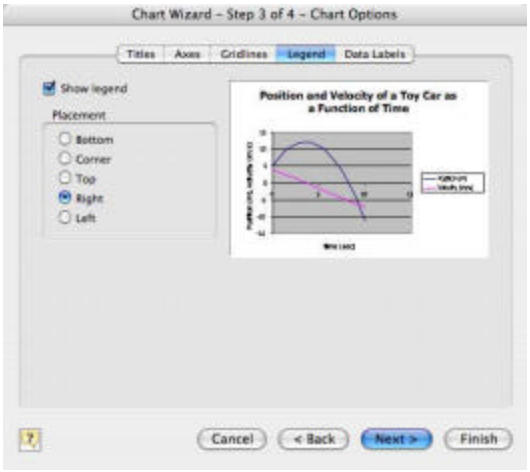


Titles: Include a clear and descriptive title for each plot.

Axes Labels: All axes must be labeled and should include appropriate units.



Gridlines: In most cases, turn off any horizontal or vertical gridlines. Such lines are distracting ("chart junk") and obscure the real data.



Legend: Use this dialog box to change the placement of or to eliminate the legend completely. By selecting the column "headers" when choosing data to be plotted, these names will show up as the names for the data series in the legend. Names for data series can be changed using the "Chart: Source Data…" menu.

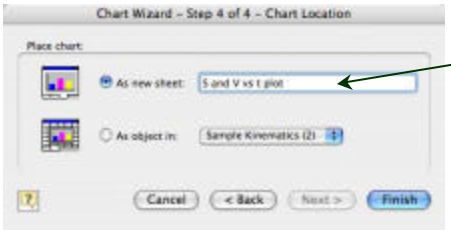
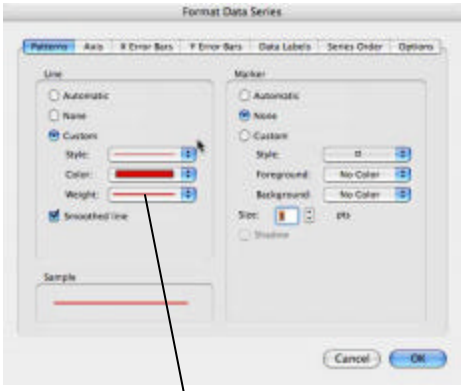


Chart Location: In most cases, it is preferable to create a plot in a new sheet as opposed to imbedding the plot as an object in a worksheet. Give each new sheet a clear, understandable title.

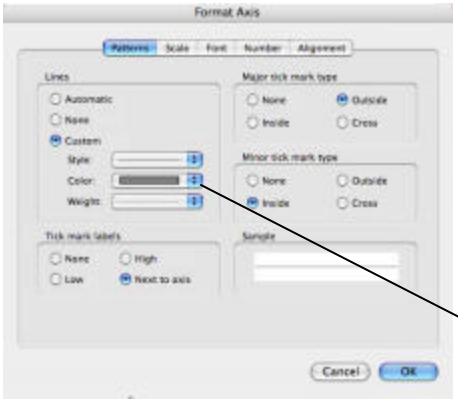
Cleaning Up Backgrounds, Axes and Legends

Double-clicking on any feature of an Excel plot will bring up a dialog box that will enable you to modify the appearance of the plot.

Format Plot Area: Override the Excel default and select no chart area. Gray backgrounds waste printer ink and make it difficult to distinguish data series. In addition, turn off the border for the plot.

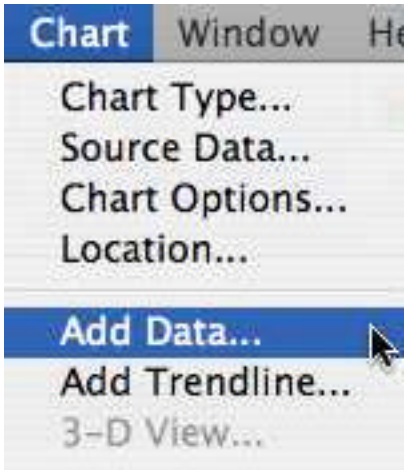


Format Data Series: Increase the weight of the plot lines and choose colors that are easy to see against a white background.



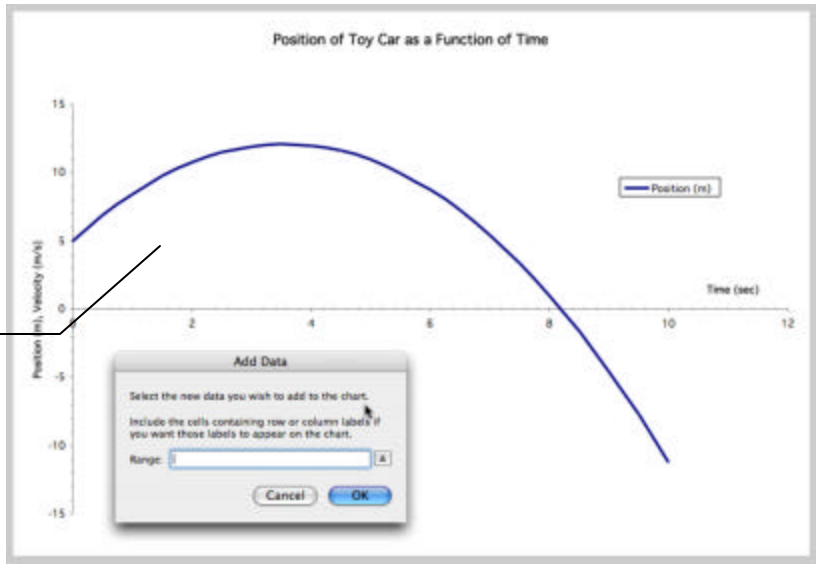
Format Axis: Set axes colors to "gray" as opposed to the default black. Dark, heavy axes are distracting and can obscure the actual data. Do the same for the font color on the axes. Each axis must be done separately.

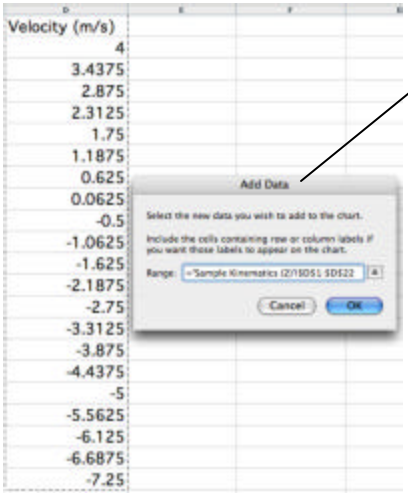
Adding Data to Plots



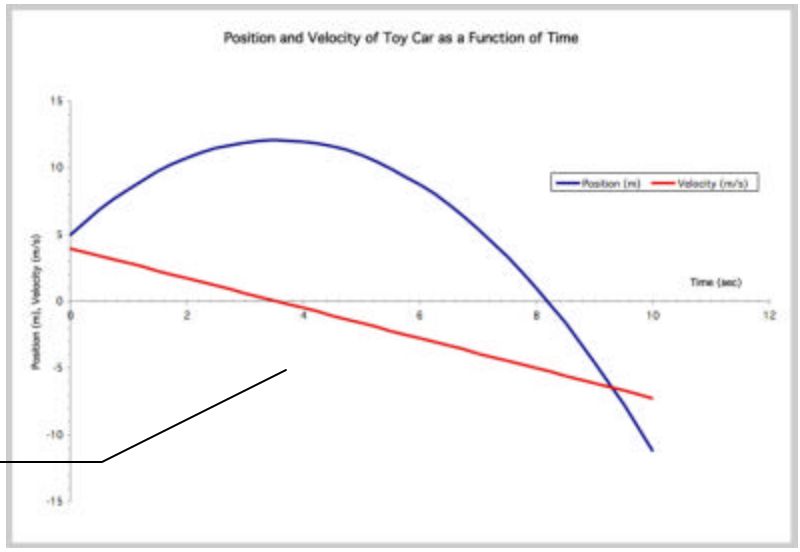
You can additional data series to a plot that you have already produced by using the "Chart: Add Data..." menu.

Go to the plot to which you want to add data. Choose the **Chart: Add Data...** menu to bring up the Add Data dialog box. Use the "folder tabs" at the bottom of the workbook to switch to the appropriate data sheet.





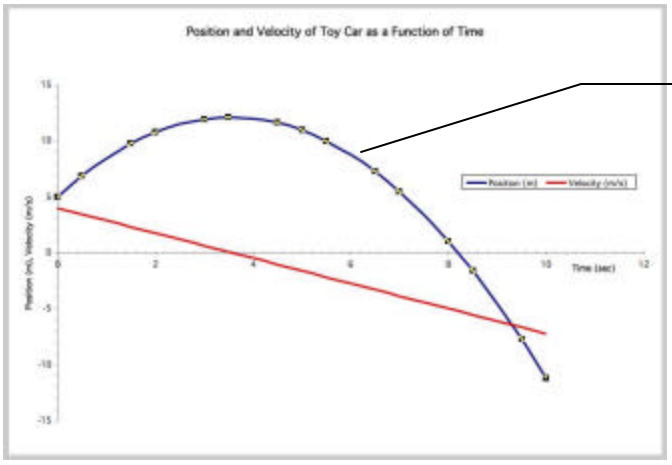
Select the desired data to be added to the plot. You should select the column "header" so that this information ends up in the legend. Be sure that the data range matches the original data range that was plotted.



Edit plot title to reflect addition of new data. Change format of data series as prescribed.

Extending Data Series

At times you may find it helpful or necessary to extend the data beyond the range originally plotted. Rather than created a new plot, it is easy to edit your original plot in the following manner.



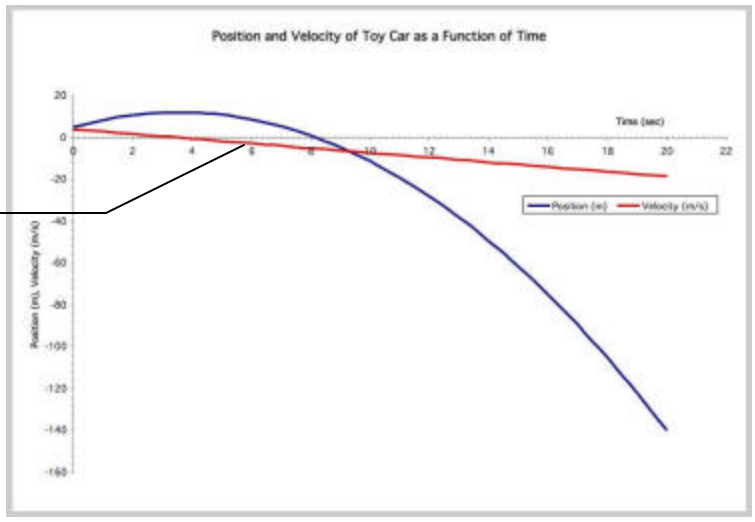
Select the data to be extended by using a single click. A look at the formula bar will reveal an equation **=SERIES(…)** like that found below.

```
=SERIES('Sample Kinematics (2)'!$C$1,'Sample Kinematics (2)'!$B$2:$B$22,
'Sample Kinematics (2)'!$C$2:$C$22,1)
```

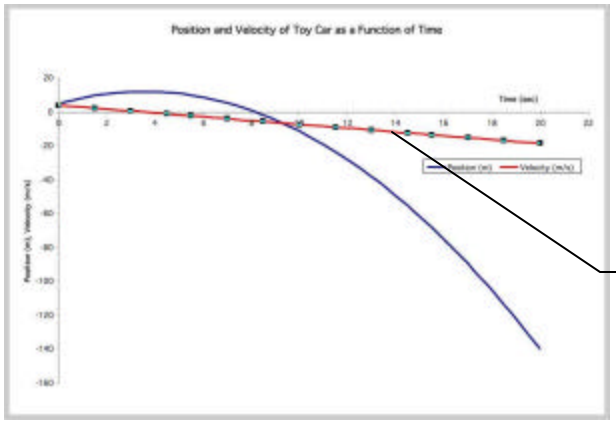
Note: In this case, the plotted data extends down to row 22 in both columns B and C. Edit this series, changing the row value to the desired value as shown below.

```
=SERIES('Sample Kinematics (2)'!$C$1,'Sample Kinematics (2)'!$B$2:$B$42,
'Sample Kinematics (2)'!$C$2:$C$42,1)
```

Repeat this process for the other data series to produce a new plot. Note that the velocity data, given its relatively small range, is now compressed along the time axis. Using a **Secondary Axis** as seen on the next page can remedy this.

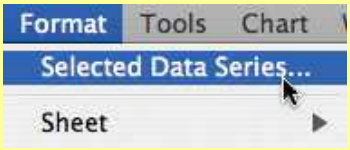


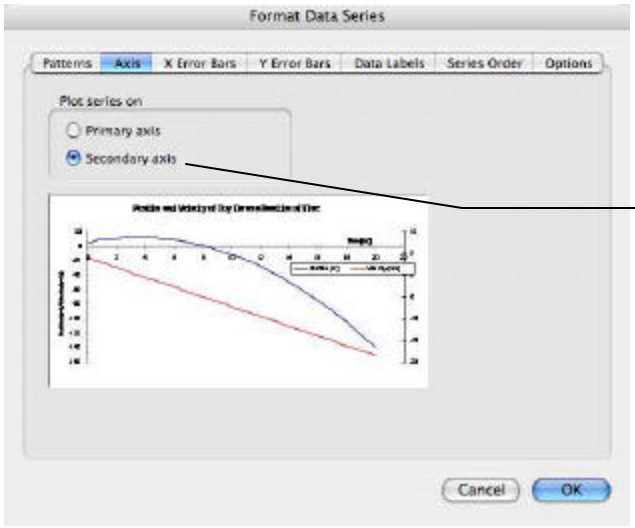
Secondary Axis



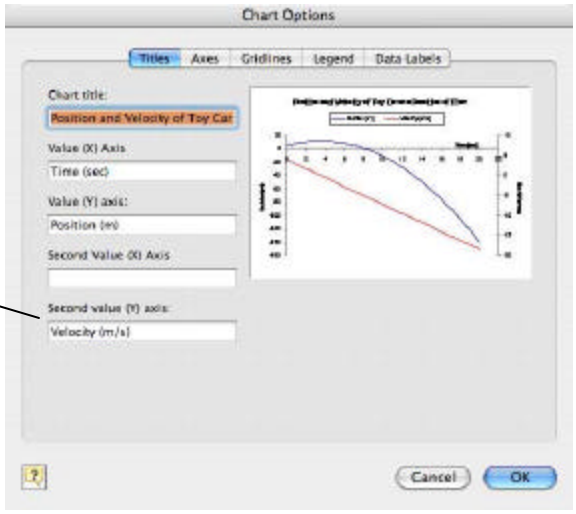
When plotting two or more variables on the same vertical (dependent) axis, one data set may become compressed as the range of values for the other data series sets the scale for the vertical axis. To expand the scale for this first set of data, a secondary axis can be used.

Select the data to be transferred to a secondary axis by single-clicking the data series. Choose the **Format: Selected Data Series...** menu.

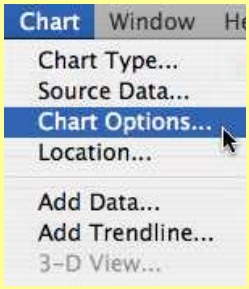




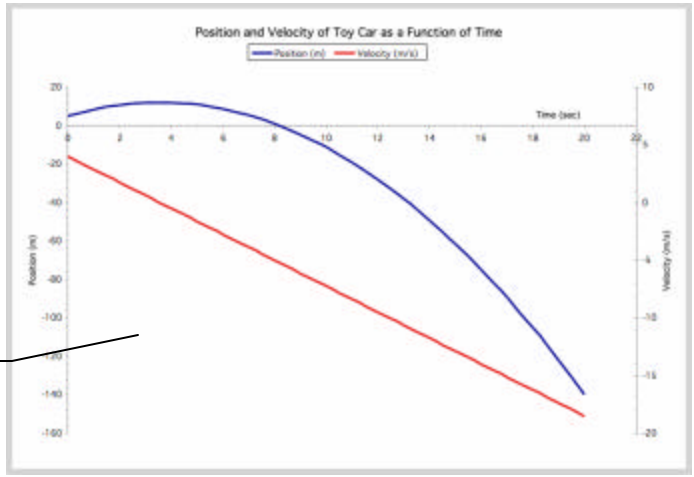
Toggle the **secondary axis** option.



Use the **Chart: Chart options...** menu to relabeled the vertical axes.



Double click on the new secondary axis to add tick-marks and change the axis color from black to gray.



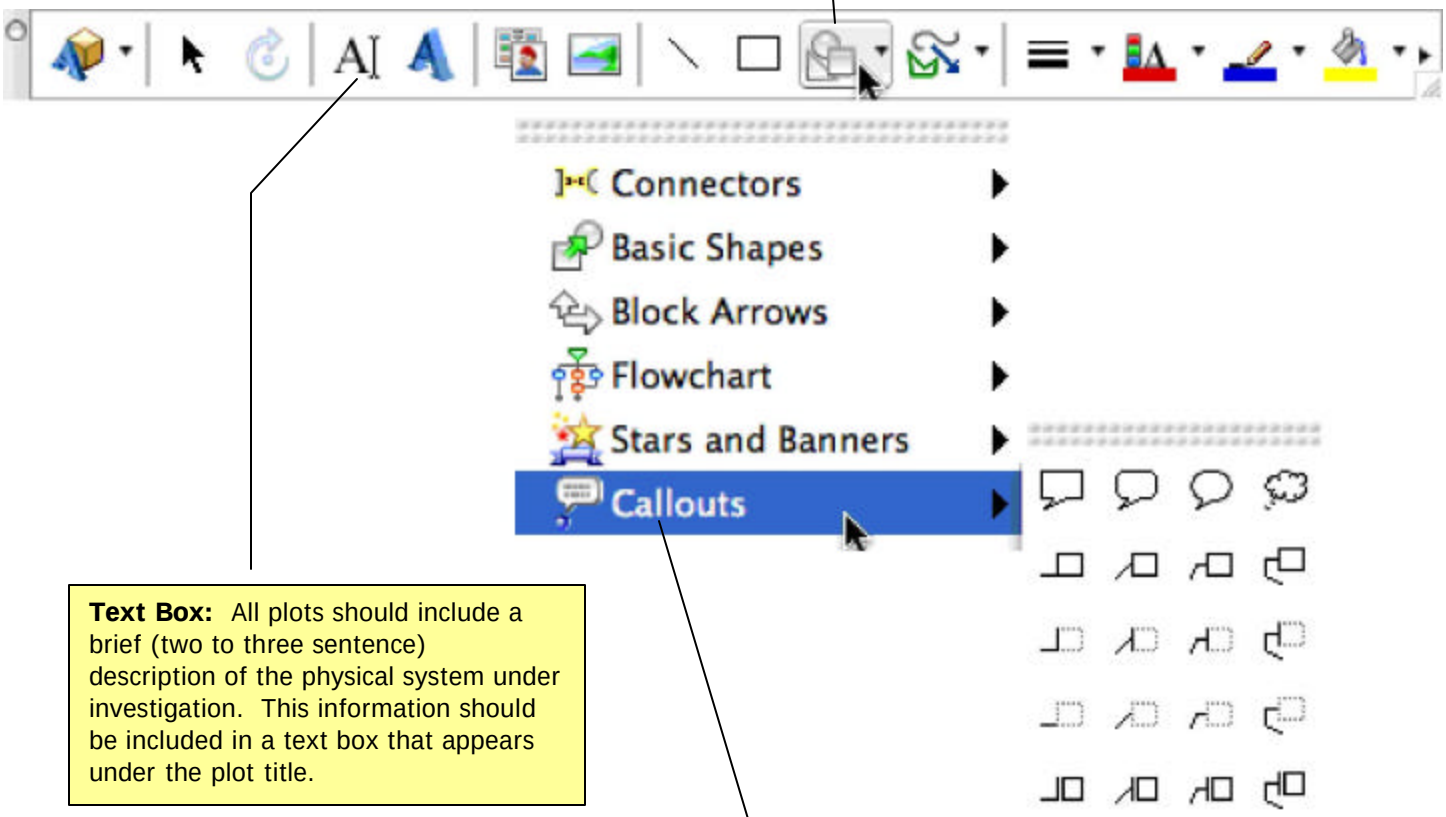
Reformatted plot with secondary axis

Annotating Plots Using Excel's Drawing Features

Drawing Toolbar

To access Excel's drawing features, click the "Drawing" button on the standard toolbar. The "Drawing" toolbar has a number of useful items that can be used to annotate plots.

AutoShapes: Some very useful tools can be found here for adding annotations to plots. In particular, "Lines" may be added to plots to note intersection of two plots or to aid in estimating values on an axis.



Text Box: All plots should include a brief (two to three sentence) description of the physical system under investigation. This information should be included in a text box that appears under the plot title.

Callouts: This text box is an example of a "callout." These are very useful for highlighting a particular feature of a plot or for explaining an observed trend in a data series.

As much as is possible, annotations should be not "distracting." Too much text or too many dark lines on a plot can obscure real data and important trends. In order to avoid annoying "chart junk", annotation lines and the borders around text boxes should be "gray" as opposed to "black" (Excel's default color). In addition, lines that are used to highlight an important point or feature on a plot should be "dotted" (---------- vs. ————) so that the line (like the axes) is more of a background feature.

Special Functions and Spreadsheet Features

Useful Scientific and Statistical Functions

=SQRT()

SQRT(): Will take the square root of the argument in parentheses.

=EXP()

EXP(): Will raise e (=2.71828…; the base of the natural logarithm) to the power of the argument in parentheses.

=SIN()
=COS()
=RADIANS()

SIN() and COS(): Will determine the sine and cosine of the argument in parentheses. Note, however, that these functions presume that the angle is given in radians. The function **RADIANS()** can be nested inside the trig functions in order to convert an angle in degrees to radians before calculating the sine or cosine.

Example: =SIN(RADIANS(36.87)) returns a value of 0.6

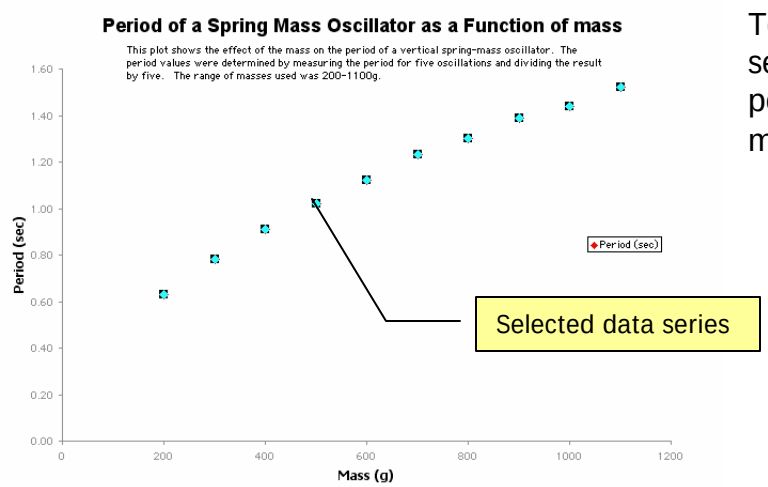
=LOG()
=LN()

LOG() and LN(): Will determine the base-10 logarithm and natural (base-e) logarithm, respectively, of the argument in parentheses.

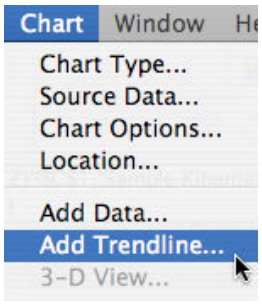
=MIN()
=MAX()
=AVERAGE()

MIN(), MAX() and AVERAGE(): Will determine the minimum, maximum and average of an array of values in parentheses.

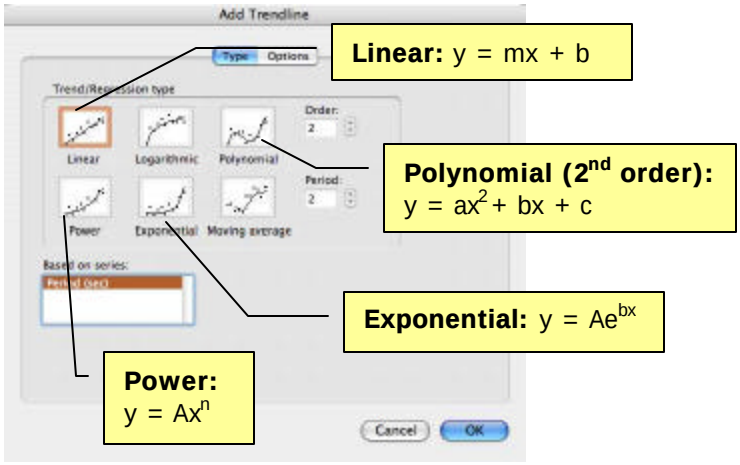
Trendlines

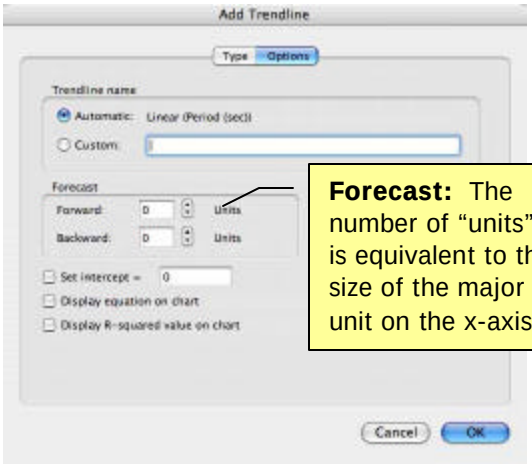


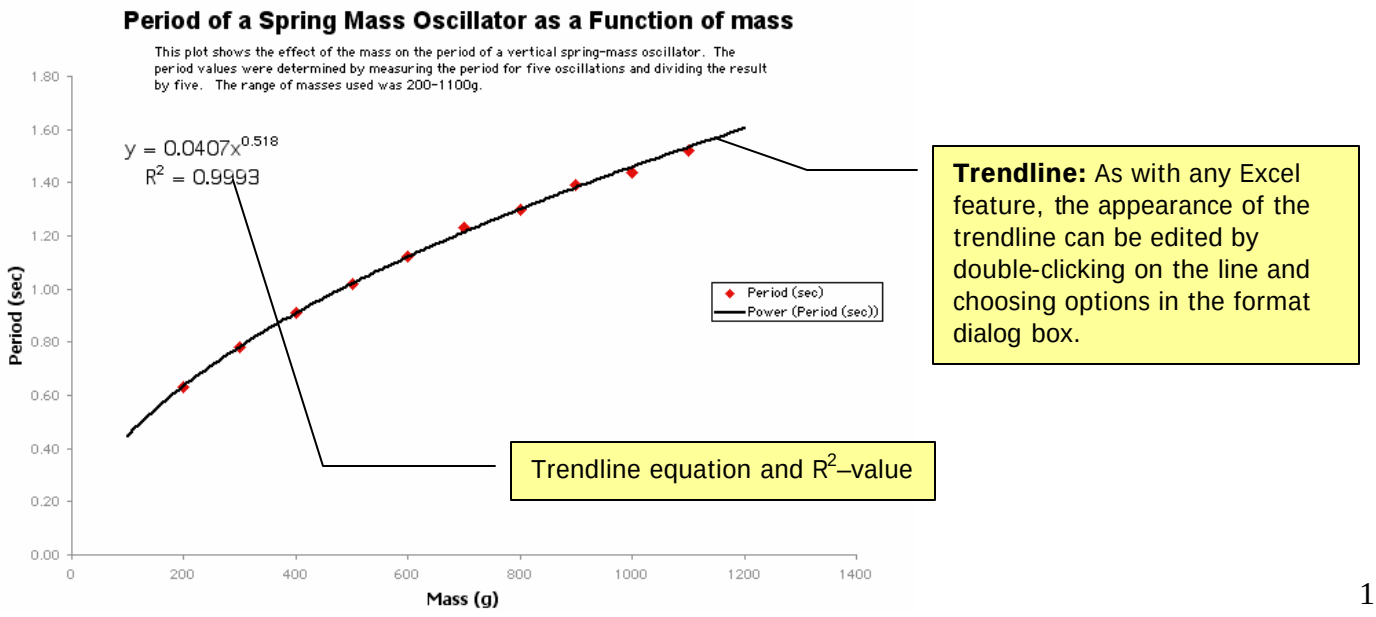
To add a trendline to a plot, select the data series by clicking once on one of the data points. Choose the "Chart: Add Trendline..." menu.



Choose the appropriate trendline from the options available in the "Add Trendline" dialog box. Be sure to select "Options" in order to display the equation and the R^2–value on the plot and to "forecast" (extrapolate) the trendline beyond the range of the data.

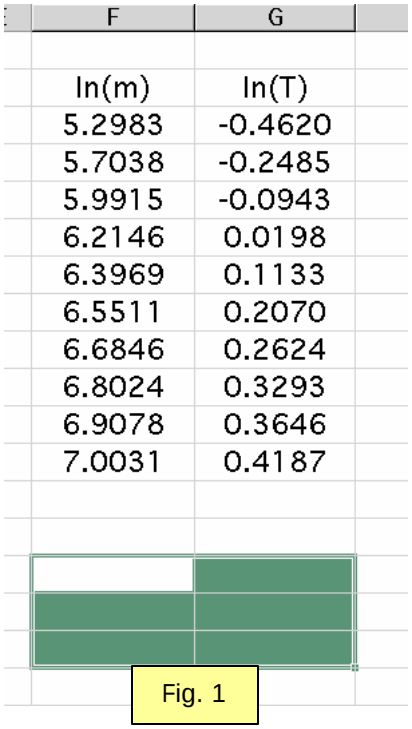






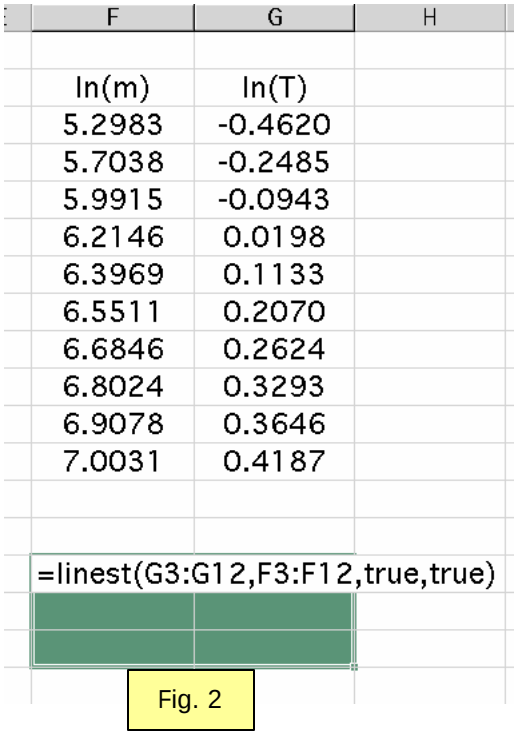
Using "LINEST"

"LINEST" (linear estimation) is an Excel function that enables you to transfer the results of a LINEAR REGRESSION (slope, y-intercept, R^2, etc.) directly to a spreadsheet without having to copy-and-paste these trendline parameters from a plot. To use the LINEST function, select/highlight a 3R:2C array on your spreadsheet beneath the data that you expect to be linear (Fig. 1).



F	G
ln(m)	ln(T)
5.2983	-0.4620
5.7038	-0.2485
5.9915	-0.0943
6.2146	0.0198
6.3969	0.1133
6.5511	0.2070
6.6846	0.2624
6.8024	0.3293
6.9078	0.3646
7.0031	0.4187

Fig. 1



F	G	H
ln(m)	ln(T)	
5.2983	-0.4620	
5.7038	-0.2485	
5.9915	-0.0943	
6.2146	0.0198	
6.3969	0.1133	
6.5511	0.2070	
6.6846	0.2624	
6.8024	0.3293	
6.9078	0.3646	
7.0031	0.4187	
=linest(G3:G12,F3:F12,true,true)		

Fig. 2

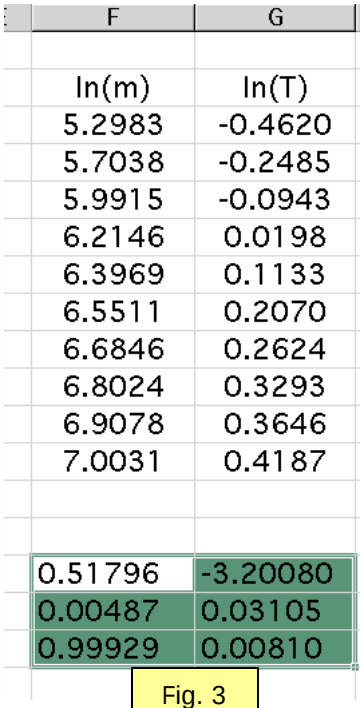
Type the LINEST function into the upper left cell (Fig. 2). The arrays representing the known "y" and known "x" values can either be typed in or selected using the "selection" cursor. The form of the function must be:

=LINEST(known_y's,known_x's,TRUE,TRUE)

Then hit ⌘ + Return (Mac) or Ctrl + Shift + Return (PC).

Excel will return an array with the following information (Fig. 3):

Slope (m)	y-intercept (b)
Std. Error in m	Std. Error in b
R^2	Std. Error in y-estimate

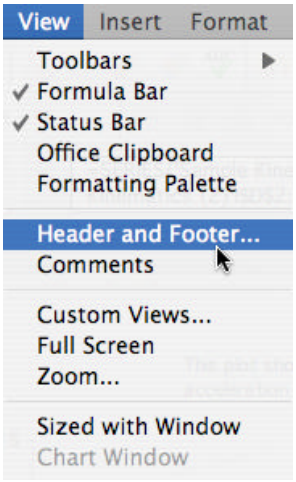


F	G
ln(m)	ln(T)
5.2983	-0.4620
5.7038	-0.2485
5.9915	-0.0943
6.2146	0.0198
6.3969	0.1133
6.5511	0.2070
6.6846	0.2624
6.8024	0.3293
6.9078	0.3646
7.0031	0.4187
0.51796	-3.20080
0.00487	0.03105
0.99929	0.00810

Fig. 3

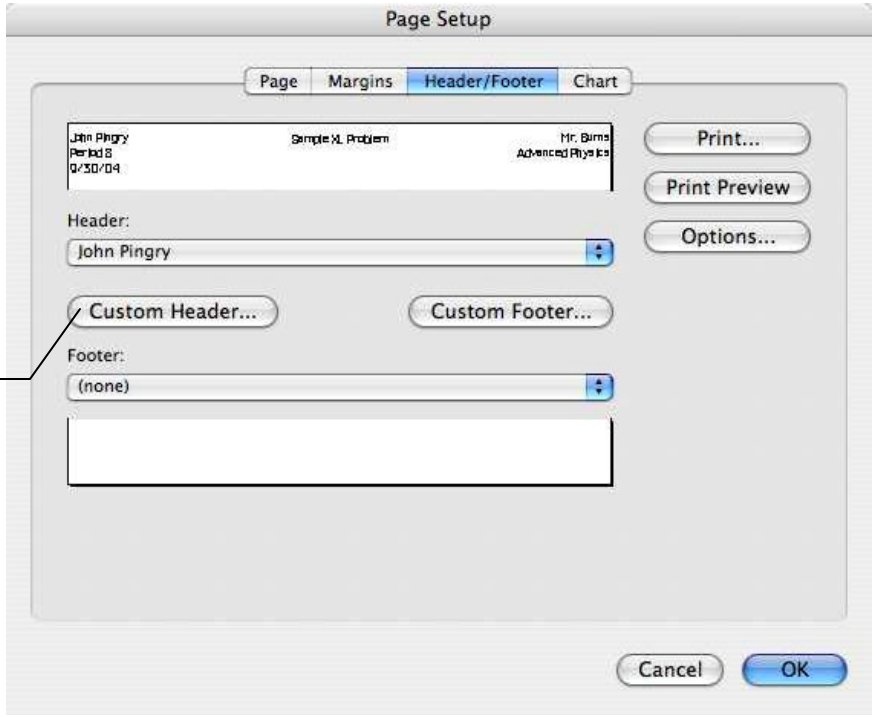
Formatting Plots for Printing

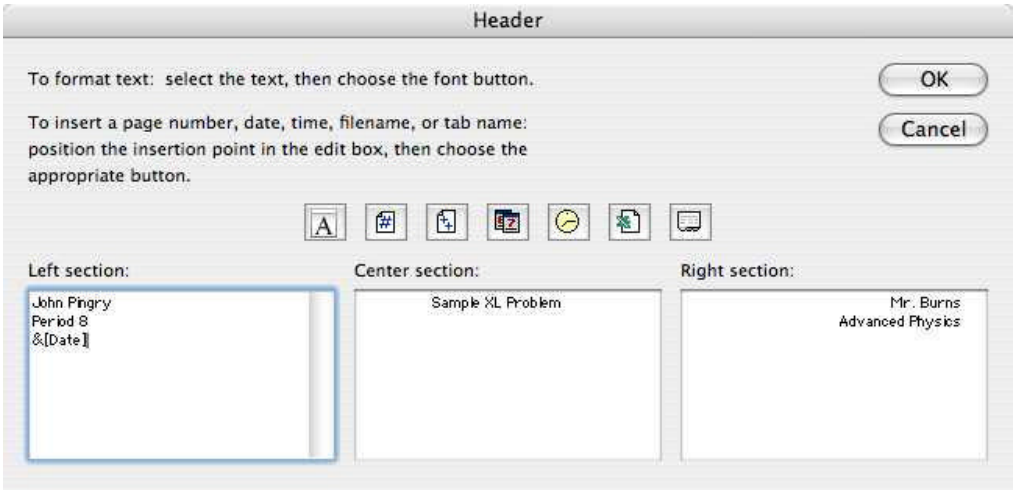
Adding Headers and Footers



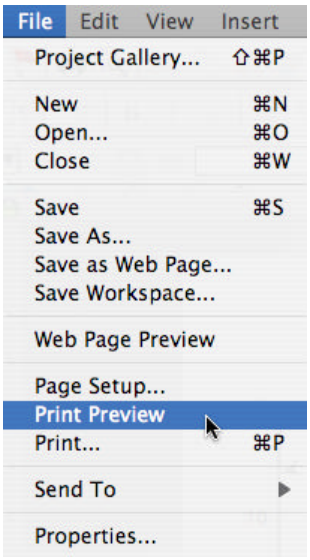
If you intend to print out a plot as a part of a lab report, be sure to use the View menu to add headers and footers to plot. The headers should include your name, the instructor's name, the course title and period, the title of the lab and the date.

Choose **"Custom Header..."** to add pertinent information.





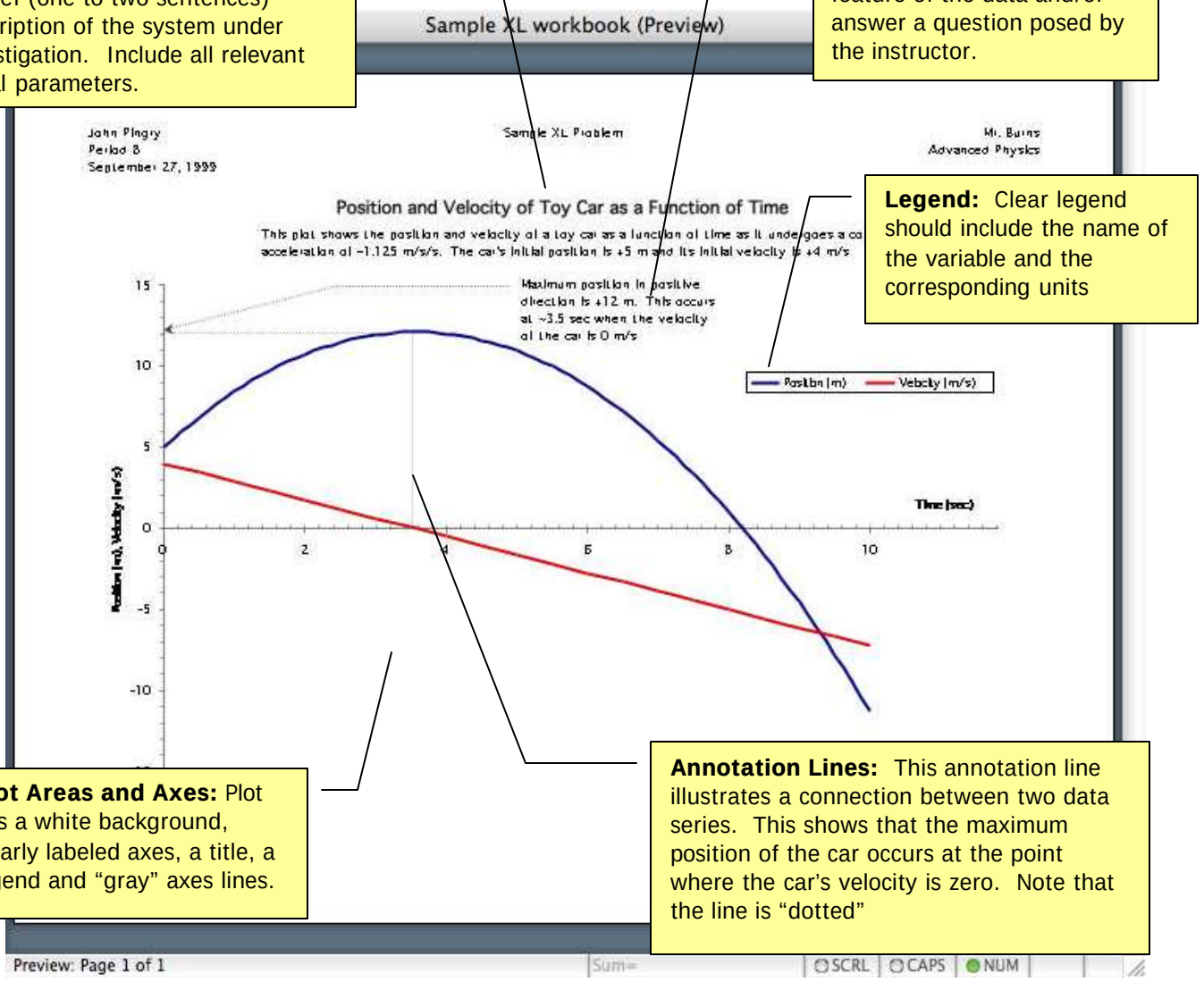
Previewing Your Work Before Printing



In some cases, you may be asked to submit your results electronically. However, in the event that you must submit a hardcopy of your work, you should use the File menu to preview your plot(s) before printing. Take note of some of the drawing and formatting features discussed so far.

Description of Physical System: A brief (one to two sentences) description of the system under investigation. Include all relevant initial parameters.

Annotations: Brief comments on the plot that highlight an important feature of the data and/or answer a question posed by the instructor.

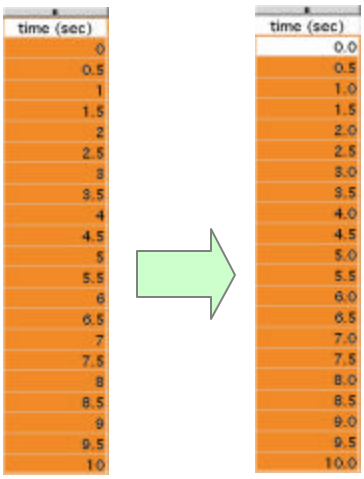


Legend: Clear legend should include the name of the variable and the corresponding units

Plot Areas and Axes: Plot has a white background, clearly labeled axes, a title, a legend and "gray" axes lines.

Annotation Lines: This annotation line illustrates a connection between two data series. This shows that the maximum position of the car occurs at the point where the car's velocity is zero. Note that the line is "dotted"

Formatting Worksheet Data



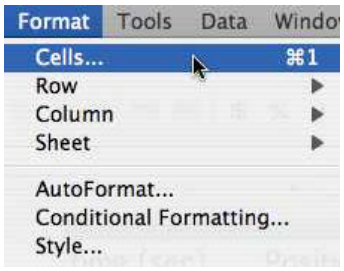
Significant figures and decimal places

All data should ultimately be shown to a correct (or at least reasonable) number of significant figures. This may be done by one of two methods. Select a set of data that you want to reformat.

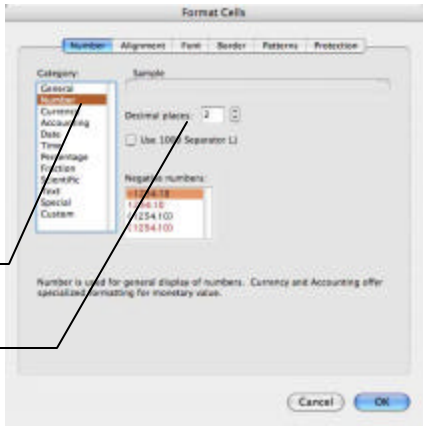
Use the "Increase decimal" button or the "Decrease decimal" button to add or remove decimal places as needed.

Decrease decimal

Increase decimal



Or, after having selected the data, choose the "Format: Cells..." menu. Select the "Number" option and set the number of decimal places to the desired value.



Category: Number

Decimal places

Aligning data in cells

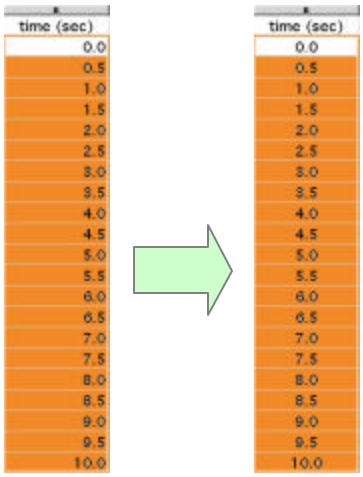
Typically, data should be centered in cells. This may be accomplished in one of two ways. Select a set of data that you want to reformat.

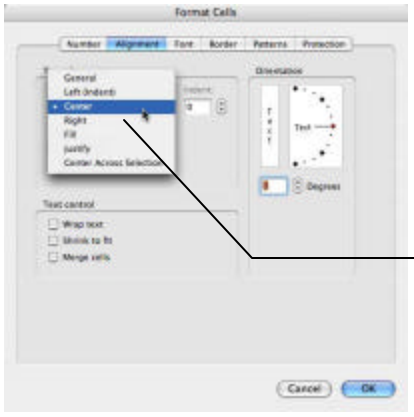
Use the "Center" button to center the values in the column.

Align Left

Center

Align Right





Or, after having selected the data, choose the "Format: Cells..." menu. Select the "Alignment" option and horizontally center the data in the cells.

Text Alignment:
Horizontal: Center