


A Review of Excel Basics



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Introduction

The topics included in this quick guide to Excel Basics are selected specifically for Duke MBA students about to embark on their Decision Models coursework.

Reading about Excel is useful but often the deepest learning takes place by working directly with the software.

The Excel file named BasicsPractice.xls is intended to be an important accompaniment to this quick guide. The BasicsPractice.xls file includes 25 hands-on exercises keyed to task and tool descriptions in the text.

The exercises are all straightforward and short and provide simple but critical hands-on practice.

At the end of this quick guide is a list of references to Excel tutorial and reference books, sources for video and CD-ROM training materials, and the address of my Excel Review website that provides downloads on a wide range of Excel topics, sample Excel files, and links to other, informative Excel sites.

I used Excel XP when preparing this guide and the practice file. Excel 2000 and 2003 users should find few if any differences. While Excel 2007 has a very different look, underneath the hood it remains much the same as 2003.

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Spring 2007

The **BasicsPractice.xls** file introductory worksheet.

	A	B	C	D	E	F	G	H	I	J	K	L
1	Excel Basics Practice											
2	This file provides hands-on exercises to accompany the document named "A Review of Excel Basics".											
3												
4												
5	Naming Ranges											
6		Exercise 1	Name a Range (method 1)			Exercise 2	Name a Range (method 2)					
7		Exercise 3	Name a Range (method 3)			Exercise 4	Display Range Names					
8		Exercise 5	Add a Cell Comment									
9												
10	Formatting											
11		Exercise 6	Merge and Center			Exercise 7	Apply Formatting					
12		Exercise 8	Apply Borders			Exercise 9	Create a Text Box					
13		Exercise 10	Use the Format Painter									
14												
15	Basic Editing											
16		Exercise 11	Edit Fill			Exercise 12	Use Excel Custom Lists					
17		Exercise 13	Copy and Paste a Formula			Exercise 14	Convert Formulas to Values					
18		Exercise 15	Transpose Data									
19												
20	Formulas											
21		Exercise 16	Relative References			Exercise 17	Absolute References					
22		Exercise 18	Use Built-in Functions			Exercise 19	Using Logical Functions					
23		Exercise 20	Using Formula Auditing Tools									
24												
25	Data Tables											
26		Exercise 21	The One-Input Data Table			Exercise 22	The Two-Input Data Table					
27												
28	Charting											
29		Exercise 23	Generate a Quick Chart			Exercise 24	Use the Chart Wizard					
30		Exercise 25	Create an XY Chart									
31												
32												
33												
34	 											
35	Paula Ecklund ❖ 2005-6											
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I. Organization

Organize your spreadsheet model around your data. Start building the model by entering the data you know about. You don't necessarily need to know just how you're going to use all the data before you enter it. At the start, just get the data into the spreadsheet. Excel makes it easy for you to move model elements around later if you need to.

Row-Column Structure

Are there existing row or column structures in the data that you can exploit in your model's layout? For example, the data for the worksheet below was available in a tabular format that translated directly into this useful model layout.

	A	B	C	D	E	F	G	H	I	J	
1	<i>Oak Products, Inc: Optimum Product Mix Finder</i>										
2											
3	Product:	Captain	Mate	AmHi	AmLo	SpanK	SpanQ				
4											
5	Profit/Unit:	\$36	\$40	\$45	\$38	\$35	\$25				
6											
7			Product Resources Requirement							Starting Inventory	
8	Long dowel	8	0	12	0	8	4			1280	
9	Short dowel	4	12	0	12	4	8			1900	
10	Leg	4	4	4	4	4	4			1090	
11	Heavy seat	1	0	0	0	1	1			190	
12	Light seat	0	1	1	1	0	0			170	
13	Heavy rung	6	0	4	0	5	0			1000	
14	Light rung	0	4	0	5	0	6			1000	
15	Captain rail	1	0	0	0	0	0			110	

A Final Report

Give some thought at the start to what you might want a final report or reports to look like. What quantities should be computed and displayed in the reports? What's the most logical way in which to arrange them? What will the reports' readers be looking for? Is there information that should appear together on a single page? Do your readers need the option of seeing underlying formulas?

Constant values

Enter a constant value only once and put it in a convenient location. If possible, keep all constant values together in one area of the worksheet, clearly distinguishing them from decision variables and formulas. One of the most important principles of spreadsheet design is:

**A constant value should be entered only one time in a workbook.
To use a constant value in a formula, reference its cell location.**

For example

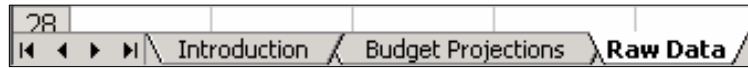
Cell A1 holds the constant value 6% to indicate sales tax. When a formula in the worksheet requires the use of the sales tax value, reference Cell A1 in the formula instead of "hard coding" the 6% value into the formula.

Do: =subtotal*A1
Don't: =subtotal*6%

With this design, if the sales tax value appears in multiple formulas and then must be changed (for example, from 6% to 8%), the value can be changed in *one location*: Cell A1. Excel then automatically updates all the formulas that use sales tax by referencing the value in Cell A1.

General Documentation

In an obvious place in the worksheet include general information that describes what the model is for, where the data is from, who the output is going to, and whatever other information you think might be useful. Replacing the default worksheet tab names (Sheet1, Sheet2, etc.) with meaningful names is also helpful.



Labels

When entering data, use descriptive labels to document data items.

	A	B
1	Sales Tax	6%
2	Inflation	8.20%

Range Names

Another important way to document your worksheet (and make it easier to read) is to assign names to significant ranges. A range can be a worksheet cell, a group of adjoining cells, or any number of adjoining and non-adjoining cells. When you name a range you can use that name in place of cell references in formulas and quickly select the range by choosing its name.

For Example

	A	B
1	Sales Tax	6%
2		
3	Item 1	\$ 100
4	Item 2	\$ 200
5	Item 3	\$ 300
6	Subtotal	\$ 600
7	Total	\$ 636

With ranges named, the formula in Cell B6 reads
=SUM(Item_1:Item_3) instead of
=SUM(B3:B5)

and the formula in Cell B7 reads
=Subtotal+(Subtotal*Sales_Tax) instead of
=B6+(B6*B1)

Assigning Range Names

Three methods are described for naming a range:



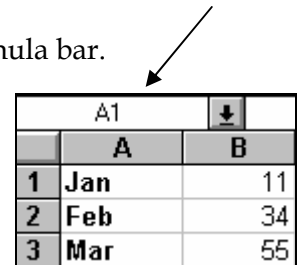
Method One: Select the heading cells and the adjacent data cells and choose the commands *Insert, Name, Create*. In the “Create Names” dialog that displays indicate where Excel should find the names to use. Excel creates names for cells automatically based on their row or column headings. See Exercise 1 in the *BasicsPractice* workbook.

Method Two: Choose the commands *Insert, Name, Define* to create a name for a range you specify. For example, if you select the range A1:B3 in the example at right and issue the *Insert, Name, Define* command, Excel presents a dialog box that assumes you want to name the entire range *Jan*. If this isn’t what you want, you can change the current selection. See Exercise 2 in the *BasicsPractice* workbook.

	A	B
1	Jan	11
2	Feb	34
3	Mar	55

Method Three: Enter a name in the “Name Box” on Excel’s formula bar.

In the example here you might highlight A1:B2, then click in the part of the formula bar that holds the reference A1 in the illustration and replace A1 by entering your own name for the range. Be sure to hit the enter key after typing the name; don’t just click out of the Name Box. See Exercise 3 in the *BasicsPractice* workbook.



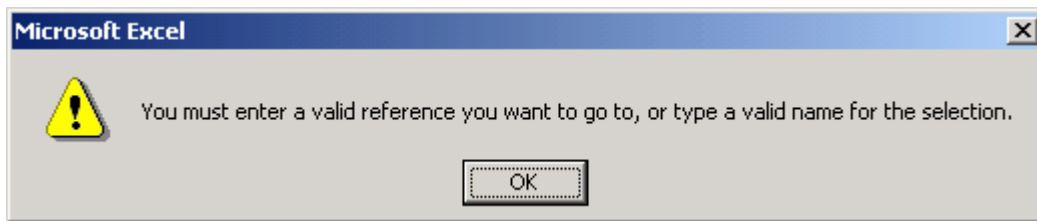
Rules for Naming a Range

- A range name can be of virtually any length but can not contain spaces, commas, hyphens, or special characters (such as “&” and “/”).
- A name must start with an underscore or a letter and can not be the same as an Excel cell reference (e.g., AA31).

Valid Range Names	Invalid Range Names
Cost.of.Goods	Cost-of-Goods
_Old_Data	Old Data

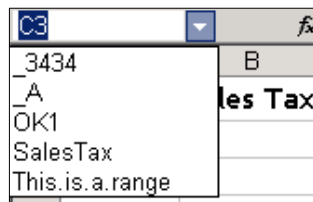
Valid Range Names	Invalid Range Names
OK1	A1
LongName1234	LongName 1 2 3

Excel will let you know if you're attempting to enter an invalid range name.



Viewing Range Names

There are a number of ways to view the range names you have assigned in a workbook. One is to click the drop-down arrow in the "Name Box" on the formula bar. Another is to choose the commands *Insert, Name, Paste, Paste List*.



Range names displayed in the Name Box.

	A	B	C
1	Range Name	Referenced Range	
2	_3434	=Sheet1!\$D\$5	
3	_A	=Sheet1!\$E\$10	
4	OK1	=Sheet1!\$E\$6	
5	SalesTax	=Sheet1!\$A\$1	
6	This.is.a.range	=Sheet1!\$B\$5:\$B\$9	

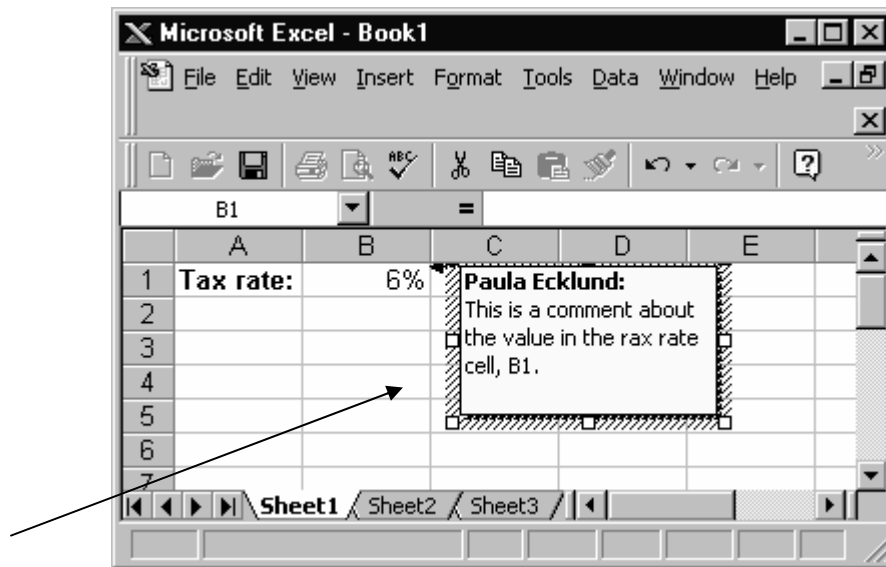
Range names documented with the Paste List command.

See Exercise 4 in the *BasicsPractice* workbook.

Documenting a Single Cell:

If you want to document a cell's contents but don't want to display the documentation directly in a cell of the worksheet, consider using a comment. A comment is associated with a cell, but not part of it.

To create a comment, select the cell in question and enter the commands *Insert, Comment*. Excel displays a small text box in which to enter the comment.



Select *Tools, Options* and then the *View* tab to see the options that show how comments are displayed in your Excel configuration. You can choose to display no comments, the comment indicator only (a red triangle at the upper-right-hand corner of a cell with an associated comment), or both the indicator and its comment.

If you have the first (no comments) option selected, you can still see what cells have comments associated with them by hitting F5 (which opens the *Go To* dialog), hitting the *Special* button, selecting "Comments", and hitting OK. Excel selects every cell that has an associated comment.

If you have the second (comment indicator only) option selected, Excel shows the text of the comment when you position the mouse pointer over the indicator.

The *Sheet* tab on the *Page Setup* dialog lets you select how you want comments printed: Not at all, as displayed on the worksheet, or all together at the end.

See Exercise 5 in the *BasicsPractice* workbook.

II. Basic Formatting

Excel is similar to the other Office products in its formatting features. The tools you'll use most often when formatting your worksheets are located on Excel's Formatting, Drawing, and Borders toolbars. In addition, the Standard toolbar has the invaluable "format painter" tool.

Typeface, Font Size, Aspect, Alignment



The button choices at the left of the Formatting toolbar let you easily control typeface, font size, aspect (bold, italic, underline) and alignment. Cells can be formatted either before or after they have content added.

By default, numbers are aligned at the right of their cell and text values at the left. You can change that arrangement by adding your own explicit alignment formatting to cells.

This is text.		
	45	

	This is text.	
45		

Merge and Center

The "Merge and Center" button on the formatting toolbar can be a timesaver, especially when working with text titles. If you have content that spills beyond one cell, select the content and click this button to have Excel automatically merge the affected cells together and center the content inside the merged cells. Although this button works with numeric content as well as text content, it's most often used for text. *See Exercise 6 in the **BasicsPractice** workbook.*



Number Formatting

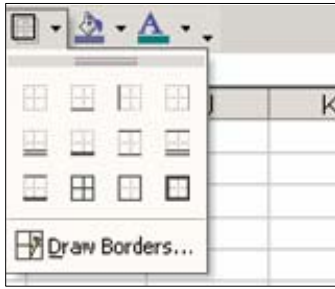
The most frequently-used formatting tools for numbers are located on the Formatting toolbar. Select any cell or range and click one of the appropriate buttons to add currency, percentage, or thousands-comma-separator formatting. Buttons are also available to increase or decrease the number of decimal points displayed. *See Exercise 7 in the **BasicsPractice** workbook.*



Indenting, Borders, Fill, and Text Colors

The right-hand side of Excel's formatting toolbar holds tools to decrease and increase indentation, add borders, control cell fill color, and control cell entry (font) color.



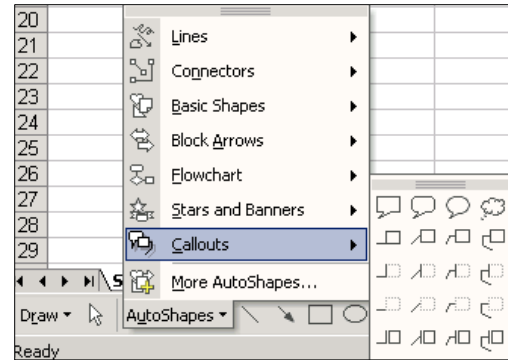


Use the drop-down arrows to the right of a tool button to see the options available. For example, a variety of simple line borders are available for a single cell or a range. Click the “Borders” tool button drop-down to select the option you want. *See Exercise 8 in the **BasicsPractice** workbook.*

Drawing Toolbar Tools

Excel’s Drawing toolbar functions are virtually the same as those available in the MS Office Word and PowerPoint applications. Tools you might find especially useful in Excel include:

- The variety of AutoShapes, including lines, connectors, basic shapes, block arrows, flowchart symbols, stars and banners, and callouts.



- The Text Box tool, especially useful for adding documentation to a worksheet independent of worksheet cells. *See Exercise 9 in the **BasicsPractice** workbook.*



- A variety of lines (widths, styles) and lines with arrows. Click the tool button for the shape you want and drag in the worksheet to draw.



The Format Painter



The “Format Painter” is a formatting tool so useful that it’s located on the Standard toolbar instead of the Formatting toolbar. Use it to quickly copy an existing format to other data.

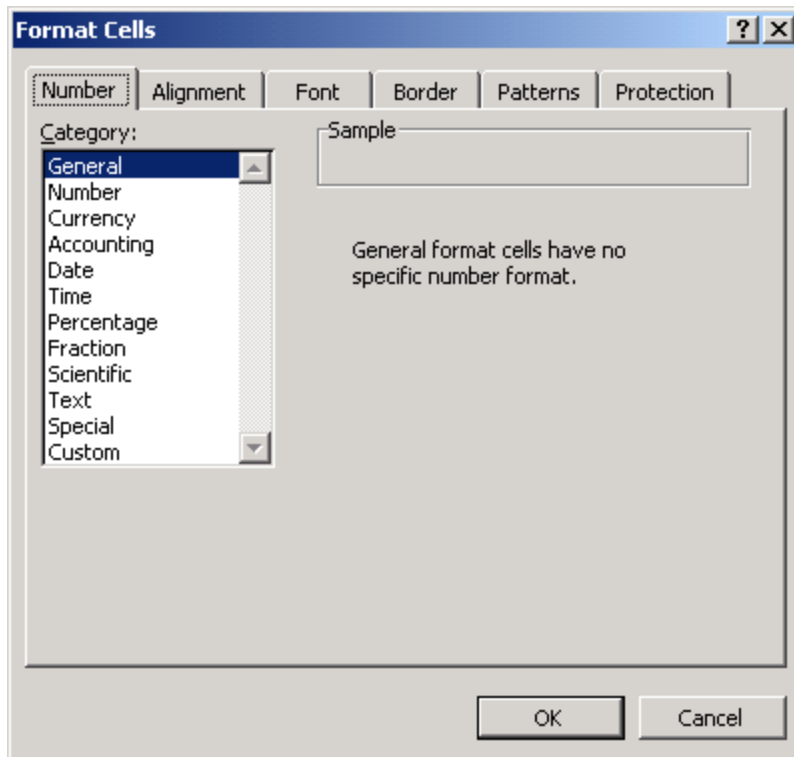
For example, if you’ve elaborately formatted a range with a special typeface, font size, border, alignment, and background color, you can easily transfer that format to data elsewhere in your spreadsheet using the Format Painter button. Click once anywhere in the range that displays the format-to-copy. Click the

Format Painter button. Then drag over the new range you want to apply that format to. *See Exercise 10 in the **BasicsPractice** workbook.*

To apply the same existing format to multiple, discontinuous ranges, click once anywhere in the range that displays the format-to-copy, double-click the Format Painter button, and then drag over the ranges you want to apply that format to. Turn off the Format Painter by clicking the Escape key.

The Universe of Excel Formatting

For a complete look at Excel's formatting options, open the "Format Cells" dialog. This multi-tabbed dialog includes all the options available on the toolbars and more.

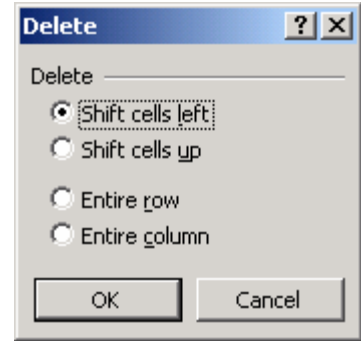


III. Basic Editing

Excel's Delete vs. Clear Options

Excel provides you with two options that are similar but differ in an important way: "Delete" and "Clear".

If you select a range of data, right-click, and choose the delete option from the context menu that displays, Excel displays the dialog at left. From this dialog, choose what to delete and how the data remaining in the dialog should display.



For example, if you select the range C2:C6 below, right-click, and choose *Edit, Delete* and "Shift cells left", Excel eliminates the original data in Column C and then moves the data in the adjoining columns.

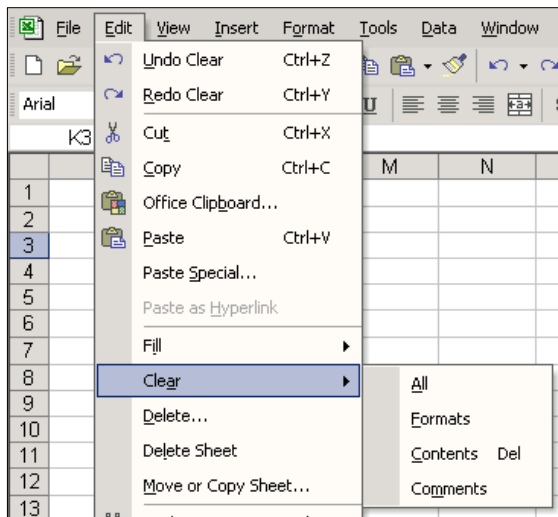
	A	B	C	D	E	F
1						
2		Measure 1	1	13	13.3	11.8
3		Measure 2	2	21.9	24.5	24.7
4		Measure 3	3	29.8	28	24.1
5		Measure 4	7	32.4	30.4	34.5
6		Measure 5	28	41.8	42.6	40.3
7						

	A	B	C	D	E
1					
2		Measure 1	13	13.3	11.8
3		Measure 2	21.9	24.5	24.7
4		Measure 3	29.8	28	24.1
5		Measure 4	32.4	30.4	34.5
6		Measure 5	41.8	42.6	40.3
7					

By contrast, if you choose the range C2:C6, right-click, and choose *Clear Contents* from the context menu the result looks like the illustration below. The selected data is deleted but no data is shifted. The same result occurs if you select the range and hit the Delete key on the keyboard.

	A	B	C	D	E	F
1						
2		Measure 1		13	13.3	11.8
3		Measure 2		21.9	24.5	24.7
4		Measure 3		29.8	28	24.1
5		Measure 4		32.4	30.4	34.5
6		Measure 5		41.8	42.6	40.3
7						

Note the additional options available if you choose *Clear* from the *Edit* menu instead of from the context (right-click) menu:



Clear All – clears contents and format.

Clear Formats – clears formatting only but leaves the cell contents.

Clear Contents Del – clears contents without shifting any cells.

Clear Comments – removes any comments that might be associated with the cells in the selected range.

Understanding the Formula Bar

Excel’s Formula bar is located directly above the worksheet document window. The formula bar:

1. Displays the contents of the current cell. For a cell holding a formula, it shows the formula, not the evaluated value the worksheet itself displays.
2. In its left-hand “Name Box”, displays the cell reference or name of the current cell or range.
3. Displays an *Insert Function* button that opens Excel’s “Insert Function” dialog list of built-in functions.
3. At the time you’re entering a formula displays a red X mark and a green check mark to help you conveniently confirm or cancel your entry.

Name Box		Function	Content of current cell	
D3		\sum	=SUM(B3:C3)	
	A	B	C	D
1				
2		January	February	Total
3	Sales	\$4,030	\$6,892	\$10,922
4				

Even if you have several worksheets visible in the Excel workspace at one time, only one Formula bar displays. It applies to whichever worksheet has the focus.¹

¹ Open a new worksheet window with the commands *Window, New Window*. Then choose *Window, Arrange, Tiled*. Determine which worksheet has the focus by its title bar. The current worksheet’s title bar displays in color, the other(s) are gray.. Move the focus from one sheet to another by clicking anywhere within the sheet you want to move focus to.

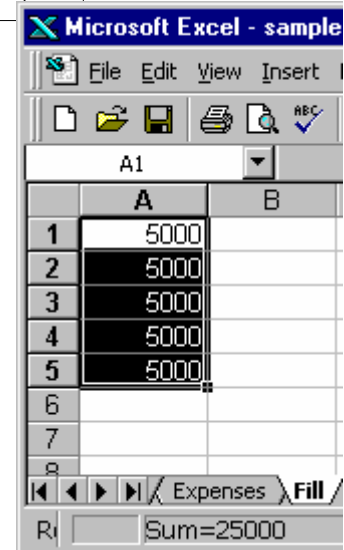
Book2		Practice: Naming Ranges			
	A	B	C	D	
1					
2		January	February	Total	
3	Sales	\$4,030	\$6,892	\$10,922	
4					
5					
6					
7					

Using Edit Fill

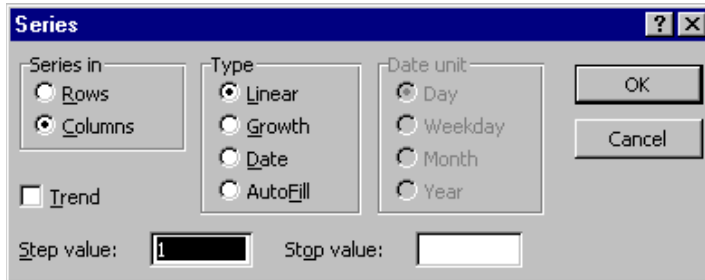
Excel makes it easy to copy data quickly. In the example at right, enter the value 5000 in Cell A1, then drag the “fill box” (the small black box that appears when the cursor is positioned in the lower-right-hand corner of the current cell) down through Cell A5 to fill these cells with the same value.

Highlighting the value to copy and the range to copy to and selecting *Edit, Fill, Down* accomplishes the same result.

Enter a sequence of numbers, highlight the range that contains the sequence, and drag the fill box down to have Excel automatically continue the sequence. *See Exercise 11 in the BasicsPractice workbook.*



An alternative to this graphical method of continuing a sequence are the *Edit, Fill, Series* commands that open the “Series” dialog.



Two *Edit, Fill, Series* examples:

	A	B
1	10/6/97	
2	10/6/98	
3	10/6/99	
4	10/6/00	
5	10/6/01	
6		

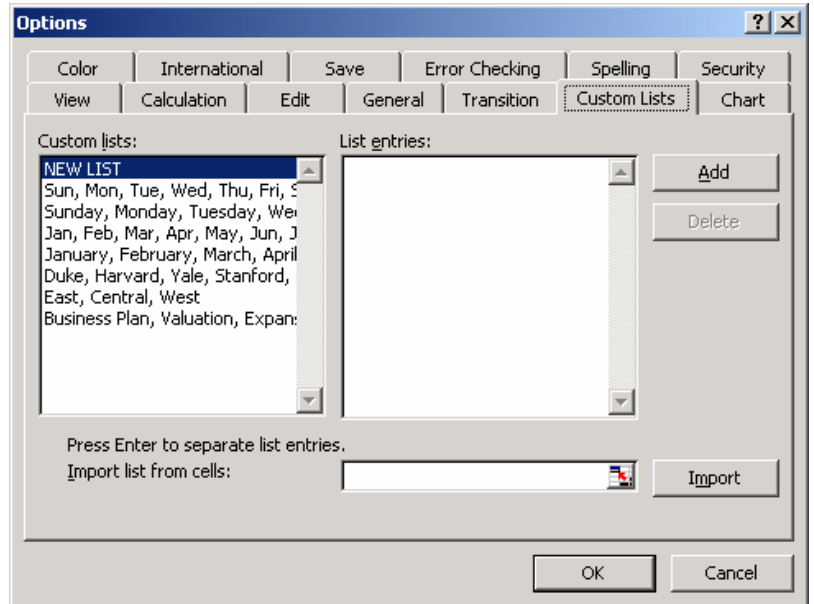
Date, incremented by year.

	A	B
1	3.41	
2	18.755	
3	103.1525	
4	567.3388	
5	3120.363	
6		

Growth with a step value of 5.5.

Excel maintains a set of “custom lists” that are accessible by opening the “Options” dialog (*Tools, Options*) and choosing the “Custom Lists” tab. Built-in lists are available for the days of the week and months of the year. Add your own lists for entries you frequently enter in your worksheets.

*See Exercise 12 in the **BasicsPractice** workbook.*



Copy/Paste and Move Formulas

The standard Windows commands *Edit, Copy* (or CTRL+C) and *Edit, Paste* (or CTRL+V) are available in Excel for copying single cells or multi-cell ranges.

When copying and pasting formulas, it’s important to understand how Excel treats cell references (see the topic *Relative and Absolute Addressing*). Unlike copying, moving a formula from one cell to another doesn’t change the formula.

A special option for copying a formula may occasionally come in handy if you want to copy (not move) a formula without changing its cell references in any way. Here’s how:

1. Make the cell that holds the formula to copy the current cell.
2. Drag over the formula that appears in the Formula Bar.
3. *Edit, Copy* (or CTRL+C) to put a copy of the Formula Bar formula on the Windows Clipboard.
4. Hit the Escape key.
5. Make the cell current in which you want to locate the copied formula.
6. *Edit, Paste* (or CTRL+V).

	A	B	C	D
1				
2		January	February	Total
3	Sales	\$4,030	\$6,892	JM(B3:C3)
4				

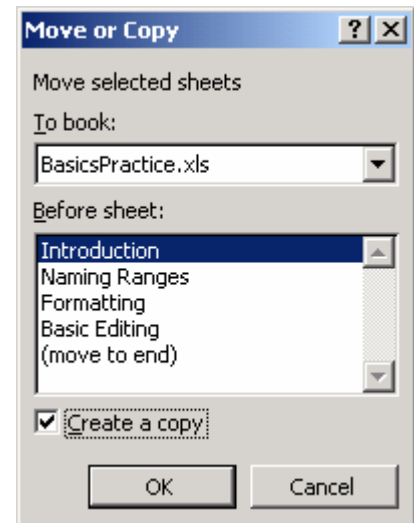
Excel locates a copy of the formula in the new cell without changing any cell references in the formula.

*See Exercise 13 in the **BasicsPractice** workbook.*

Move or Copy an Entire Worksheet

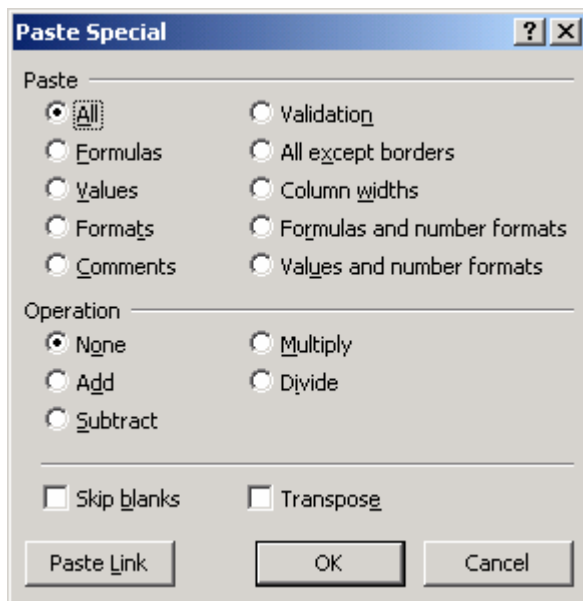
Use the Excel commands *Edit, Move or Copy Sheet* to open the convenient “Move or Copy” dialog.

With the worksheet you want to copy or move the current worksheet, open this dialog and toggle on the “Create a copy” option at lower left. Then use “To book” to select the open workbook to copy to. Or, leave the copy option off and move the worksheet to another workbook.



Edit, Copy and Edit, Paste Special

For many copy operations, the matching paste operation can be a simple “paste” or a more flexible “paste special”.



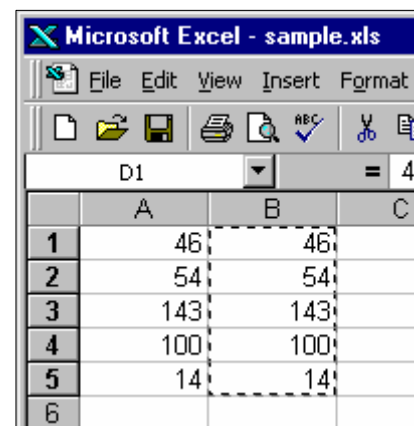
Excel’s *Paste Special* dialog is well worth exploring. It can be used to perform arithmetic calculations with two ranges of numbers, to change formulas to values, as an alternative to the format painter, to transpose a data range, and more.

Here are two examples:

Example 1: Edit, Copy and Edit Paste Special to Convert Formulas to Values

An often-used option under the Paste Special dialog is paste *Values*. For example, the values that display in Column A at right are all formulas. In Column B, the values are actual numbers not formulas, because they’ve been copied with *Paste Special* and the *Values* option.

See Exercise 14 in the BasicsPractice workbook.



Example 2: Edit, Copy and Edit Paste Special to Transpose Data

Another particularly useful option in the Paste Special dialog is *Transpose*. Use transpose to convert rows to columns in a data range. For example, copy the range in B2:F6 at left and use the transpose option to convert rows to columns, as in B8:F12.

	A	B	C	D	E	F	
1							
2		Measure 1	1	13	13.3	11.8	
3		Measure 2	2	21.9	24.5	24.7	
4		Measure 3	3	29.8	28	24.1	
5		Measure 4	7	32.4	30.4	34.5	
6		Measure 5	28	41.8	42.6	40.3	
7							
8		Measure 1	Measure 2	Measure 3	Measure 4	Measure 5	
9		1	2	3	7	28	
10		13	21.9	29.8	32.4	41.8	
11		13.3	24.5	28	30.4	42.6	
12		11.8	24.7	24.1	34.5	40.3	
13							

See Exercise 15 in the *BasicsPractice* workbook.

IV. Basic Formulas

Entering a Simple Formula

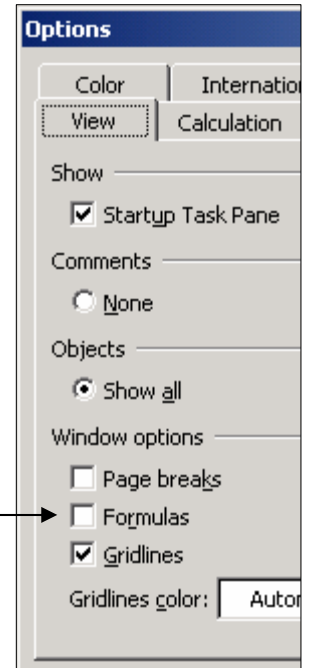
Enter a formula into a cell by making that cell current and typing.

All Excel formulas begin with an equals sign. The standard symbols are used to indicate addition (+), subtraction (-), multiplication (*), and division (/). Use actual values or cell references or cell names in formulas.

Examples:

=5+100
=5+Population
=Population - 5
= 5 * SalesRate
= Sales/SalesRate

Click a cell holding a formula and look at Excel's formula bar to see the formula. The evaluated result of the formula displays in the cell itself. To see formulas displayed in their cells instead of the formula results, choose *Tools, Options* and on the "View" tab choose "Display formulas".



Copying a Formula

If you've written a formula that references one or more worksheet cells and you want to copy the formula to another location, you must be aware of Excel's two modes of handling cell references (addresses) in formulas: **Relative** and **Absolute**.

Excel's *default* way of handling cell references in copied formulas is relative. For example, in the illustration below, Cell C11 holds the formula =SUM(C8:C10).

	B	C	D	E
7		Quarter 1	Quarter 2	Quarter 3
8	March	\$500	\$250	\$35
9	April	\$300	\$120	\$45
10	May	\$100	\$95	\$55
11		\$ 900.00		

If we want similar sum formulas to add the values for Quarters 2 and 3, there's no need to type in those formulas. Instead, copy the formula in C11. When Excel creates the copies, it makes the references to the cells in Column C relative. That is, the formula in Cell D11 references the cells D8:D10 and the formula in Cell E11 references the cells E8:E11. See Exercise 16 in the *BasicsPractice* workbook.

Of course there may be times when you want to copy a formula, but you want one or more (or all) of the formula's cell references to remain exactly the same in the copies. In this case, you must override the Excel relative referencing default. For example, in the illustration below, the formula in Cell C35 is =SUM(C32:C34)*C29. This formula gives the correct result.

	B	C	D	E
29	Tax rate:	4%		
30				
31		Quarter 1	Quarter 2	Quarter 3
32	March	\$500	\$250	\$35
33	April	\$300	\$120	\$45
34	May	\$100	\$95	\$55
35	Tax:	\$36		

But copying the formula to Cells D35 and E35 would result in errors because of Excel's default relative referencing in copied formulas. The reference to the tax rate (Cell C29) in the formula must be fixed in the copied formula so it stays C29 in the copies. Fix the reference by inserting dollar signs before the column and row references to that cell in the formula. The modified formula in Cell C35 is =SUM(C32:C34)*\$C\$29. Some of the references in the formula are relative (C32:C34) but the reference to tax rate (\$C\$29) is fixed. *See Exercise 17 in the BasicsPractice workbook.*

Tip-How to Quickly Change a Formula Cell Reference to Absolute

An absolute reference is indicated by the dollar signs before the row and column indicators; e.g., \$C\$29. An alternative to typing in the dollar signs is to

1. In the formula bar, position the mouse pointer on the cell reference you want to make absolute.
2. Tap the F4 key until the type of reference you want is displayed.

The F4 key toggles through four options:

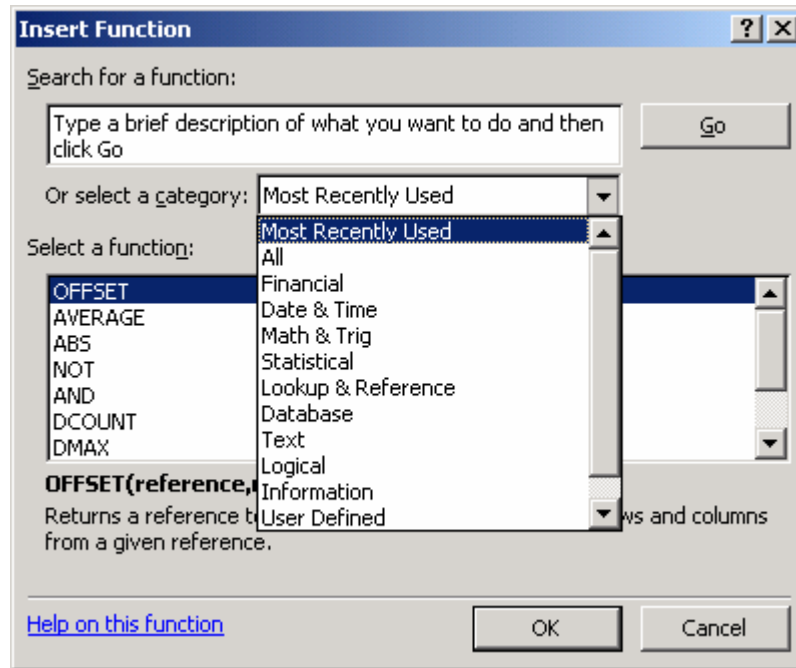
C29	relative
\$C\$29	absolute row and column
\$C29	absolute column, relative row (mixed addressing)
C\$29	absolute row, relative column (mixed addressing)

For an additional explanation of relative, absolute, and mixed addressing in Excel formulas see Excel's online help.

Excel Functions

Excel has a library of built-in formulas named functions that can make it easier and faster to build models and analyze data. From Excel's menus choose *Insert, Function* or click the Function button on the formula toolbar to open the "Insert Function" dialog. Find a function using the search box, or select a function category from the drop-down to see a list of functions in a category. Any function you select is briefly described at the bottom of the dialog. Click the *Help*

link to open Excel's more extensive online help for the function, particularly if you need help in understanding the parameters that a function requires.



Function Syntax

All Excel functions begin with an equals sign followed by the function name and a set of parentheses that hold the function parameters, if any. For example, Excel's function to calculate the payment for a loan based on constant payments and a constant interest rate is named PMT and looks like this:

=PMT(rate, nper, pv) where

rate is the interest rate for the loan

nper is the total number of payments for the loan

pv is the principal

Many Excel functions take a single argument that can be a range or a list of cells. For example:

=AVERAGE(number 1, number 2, ...)

=SUM(number 1, number 2, ...)

=MIN(number 1, number 2,...)

And a few functions take no arguments at all. They still require the parentheses after the function name, however. For example:

=TODAY() returns today's date.

*See Exercise 18 in the **BasicsPractice** workbook.*

Excel's Logical Functions

Excel's logical functions (IF, AND, OR, NOT, TRUE, FALSE) are often very useful when constructing formulas in spreadsheet models. If you also know how to nest IF functions and combine logical functions you have even more flexibility in model building. The key logical functions are described in the table below.

Syntax	Description	Example	Returns
=IF (logical condition, If-True, If-False)	Tests the condition and if true returns the If-True value, else returns the If-False value.	Assume: A1=100 A2=50 =IF(A1>A2, "Larger", "Smaller") =IF(A2>A1, "Larger", "Smaller")	Larger Smaller
=AND (logical condition 1, ...logical condition 30)	Returns TRUE if all conditions evaluate to true. Returns FALSE if one or more conditions evaluate to false.	Assume: A1 = 100 A2 = 50 =IF(AND(A1=100,A2=30), A1*2,A1) =IF(AND(A1=100,A2=50), A1*2,A1)	100 200
=OR (logical condition 1, ...logical condition 30)	Returns TRUE if any condition is true. Returns FALSE if all conditions evaluate to false.	Assume: A1 = 1st Year A2 = 2nd Year =IF(OR(A1="PhD", A2="2nd Year") "Current", "Alum") =IF(OR(A1="Class 06", "Class 07") "Current", "Alum")	Current Alum
=NOT (logical condition)	Reverses the value of its argument.	Assume: A1 = 1st Year A2 = 2nd Year =IF(NOT(A1="1st Year"), "Class of 05", "Class of 06") =IF(NOT(A1="PhD"), "Class of 05", "Class of 06")	Class of 06 Class of 05

See Exercise 19 in the *BasicsPractice* workbook.

Referencing a Value in Another Worksheet in a Formula

The Excel formulas you write can reference values in other Excel worksheets and in other Excel workbooks. If you reference an unnamed cell or range reference in another worksheet in the same workbook, precede the "external" cell or range with the name of the worksheet in single quotes and an exclamation mark. For example:

=C6*'Another Worksheet'!C7

In a workbook if you name the cells or ranges that you plan to use in formulas, you need not specify worksheet names in formulas, even if they reference values on a different worksheet. For example, if Cell C7 (above) in the same workbook were assigned the name TaxRate, the above formula would instead be:

=C6*TaxRate

If you reference an unnamed cell or range in a worksheet in another workbook, precede the “external” cell or range reference with a single quote mark, the name of the workbook in square brackets, the name of the worksheet, a single quote mark, and an exclamation mark. For example:

=C6*[Another Workbook.xls]Data Sheet!\$C\$7

Excel recognizes range names *within* a workbook, but not across workbooks. So, for example, if the workbook named “Another Workbook.xls” contained a cell named TaxRate, a formula in our original workbook referencing that cell would look like this:

=C6*'Another Workbook.xls!TaxRate

Formula Building Tip when References are External

While constructing a formula, you can click a cell in the same worksheet, in another worksheet in the same workbook, or in another workbook to have Excel include that cell reference in your formula. Excel will automatically include any necessary worksheet and workbook names in the reference if the reference is an external one.

Troubleshooting Formulas

Excel includes a set of auditing tools on a “Formula Auditing” toolbar that can help troubleshoot formulas or just make it easier to see value relationships in a worksheet. The most often used auditing tools are “Trace Precedents” and “Trace Dependents”. Turn on the Formula Auditing toolbar by choosing *View, Toolbars, Formula Auditing* from Excel’s menus.

	A	B
1	Tax rate:	6%
2		
3	Sale:	100
4	Tax:	6
5	Total:	106

	A	B
1	Tax rate:	6%
2		
3	Sale:	100
4	Tax:	6
5	Total:	106

Clicking Cell B5 in the illustration above and then clicking the “Trace Precedents” auditing tool displays a blue border around the cells that the SUM function in Cell B5 uses along with an arrow connecting the summed cells and the formula.

	A	B
1	Tax rate:	6%
2		
3	Sale:	100
4	Tax:	6
5	Total:	106

Clicking Cell B1 at left and then clicking the “Trace Dependents” auditing tool displays an arrow that shows where the tax rate value is used in a formula.

*See Exercise 20 in the **BasicsPractice** workbook.*

V. A Forecasting Tool: The Excel Data Table

Data Tables are a tool used frequently in Excel models to track how small changes in inputs affect the results of formulas in your model that are dependent on those inputs. For example, you might be interested in knowing how changes in the price your firm charges for an item affect the firm's net income. An analysis of this sort is often termed "sensitivity analysis".

Excel has two varieties of Data Table:

The One-Input Data Table
The Two-Input Data Table

Both varieties work in a similar fashion. You identify one or two key input variables in your model and describe the range of values you want those inputs to take on. Then you identify one or more formulas in your model that are dependent on those inputs. When you execute the Data Table command, Excel then iterates through a process of executing each formula you've identified, substituting in each formula each one of the values you've identified for the key input variables, and recording how the value changes change the results of the formulas.

The One-Input Data Table allows identification of a single input variable but an unlimited number of formulas. The Two-Input Data Table allows identification of two input variables but only a single formula. The layout of your Data Tables is important and must follow Excel's rules for Data Tables.

Advantages to using a Data Table include:

- The ability to use an unlimited number of values as inputs to one or more key formulas in your model.
- Having the Data Table generate outputs in a condensed matrix, making it easy to see all the possibilities you want to focus on and compare them.
- The option to select the most viable or interesting result values as inputs into Excel's Scenario Manager, if you want to focus on a handful of particular scenarios for a presentation or an archive.

Adjuncts and/or alternatives to using a data table:

- Entering inputs by hand one at a time and keeping manual track of the results or saving the results on a separate worksheet (tedious work perhaps resulting in hundreds of worksheets).
- Using Excel's Solver and its Sensitivity Report.

The One-Input Data Table

The One-Input Data Table allows you to identify a single decision variable in your model and see how changing the values for that variable affect the values calculated by one or more formulas in your model.

The illustration below shows a model that uses the Excel PMT function to calculate monthly payment on a loan, using interest rate, term, and principal inputs. The current model shows the payment for a single combination of inputs. This analysis can be greatly extended by a Data Table.

	C	D	E	F	G	H	I	J	K
3									
4		Calculate monthly payments using the PMT function. Determine payments for a range of interest rate , term , and principal values.							
5									
6									
7									
8									
9									
10		Interest rate:	5%	} Input values to vary.					
11		Term (years):	30						
12		Principal:	\$250,000						
13									
14		Monthly Payment:	(\$1,342.05)						The Excel PMT function used for the calculation: =PMT(Interest_rate/12,Term* 12,Principal)

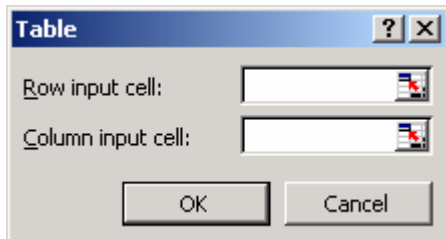
Data Table Structure

	Formula
Input 1	
Input 2	
Input 3	
Input 4	
Input 5	
Input 6	
Input 7	

A one-input data table can permit you to quickly see the effect of multiple interest rates on the monthly payment.

The illustration at left shows the structure of a one-input data table. That is, inputs down the left-hand column, and a copy of (or reference to) the model formula one column over and one row up.

Execute a data table by highlighting the entire range of inputs, the blank cell to the left of the formula, and the blank cells below it, and choosing *Data, Table* from Excel's menus. At the prompt Excel displays, click



“Column input cell” and indicate the model cell in the worksheet that holds the interest rate value. Click OK to have the Data Table calculate monthly payments for all the interest rate values included in the table. (In the illustration at right, the label “Interest” occupies the formerly blank cell above the inputs. This is an optional label.)

Vary Interest Input

Interest	(\$1,342.05)
3.5%	(\$1,122.61)
4.0%	(\$1,193.54)
4.5%	(\$1,266.71)
5.0%	(\$1,342.05)
5.5%	(\$1,419.47)
6.0%	(\$1,498.88)
6.5%	(\$1,580.17)

See Exercise 21 in the *BasicsPractice* workbook.

Additional formulas can be added to the one-input Data Table to the right of the first. All formulas used in the Data Table must reference the Data Table inputs.

The Two-Input Data Table

The two-input Data Table, as its name suggests, permits two inputs, one down the left-hand column and one across the top row. The two-input Data Table is limited to a single formula that must be located in the cell at the upper left hand corner of the table.

		Input 2: Term		
Input 1: Interest Rate		10	20	30
	(\$1,342.05)			
	3.50%			
	4%			
	4.50%			
	5%			
	5.50%			
	6%			

Execute the two-input Data Table in the same way as the one-input, this time providing both Column and Row references to the model at the prompt.

		Input 2: Term		
Input 1: Interest Rate		10	20	30
	(\$1,342.05)			
	3.50%	(\$2,472.15)	(\$1,449.90)	(\$1,122.61)
	4%	(\$2,531.13)	(\$1,514.95)	(\$1,193.54)
	4.50%	(\$2,590.96)	(\$1,581.62)	(\$1,266.71)
	5%	(\$2,651.64)	(\$1,649.89)	(\$1,342.05)
	5.50%	(\$2,713.16)	(\$1,719.72)	(\$1,419.47)
	6%	(\$2,775.51)	(\$1,791.08)	(\$1,498.88)

As with the one-input table, executing the two-input Data Table fills all the cells of the matrix with monthly payment values based on different combinations of interest rate and term.

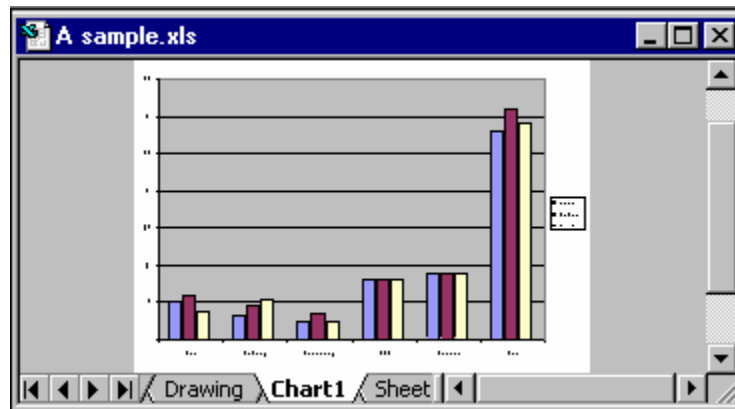
*See Exercise 22 in the **BasicsPractice** workbook.*

VI. Charting Basics

Providing a graphical look at the data in your spreadsheet can often tell a story that's not so obvious by just looking at numbers and text.

Quick, Default Charting

The fastest way to create a chart in Excel is to highlight the data to chart and hit the F11 key. Excel creates a default column chart and puts it on a new page in your workbook. *See Exercise 23 in the **BasicsPractice** workbook.*

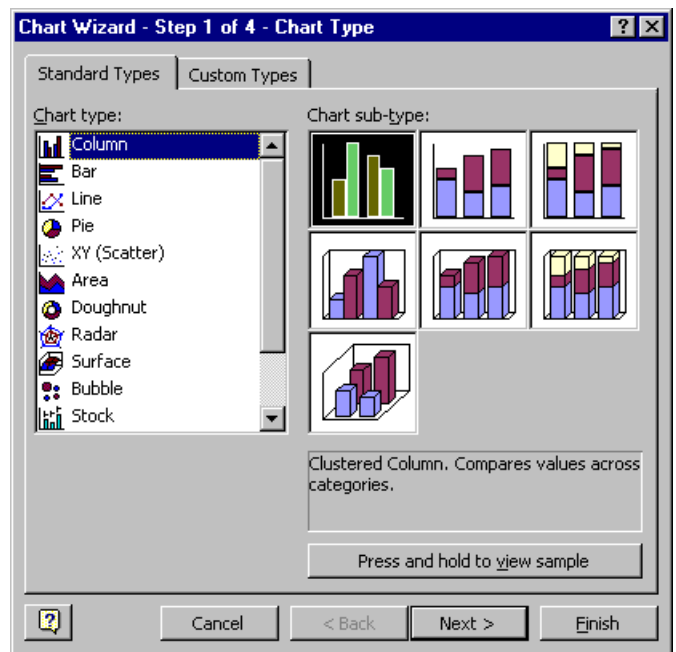


If the data you want to chart isn't contiguous, hold down the Control key as you select each data range to chart. Once your chart is created, you can then go on to edit the chart as you like.

Excel's Chart Wizard

To create a chart and have more control over the process during creation (instead of creating and then editing), use Excel's Chart Wizard. Invoke the Chart Wizard with the menu commands *Insert, Chart* or by clicking the Chart Wizard button on Excel's Standard Toolbar.

The Chart Wizard divides chart creation into four steps and walks you through each one. In **Step 1**, select the type of chart you want. There are lots of "sub-types" within each type.



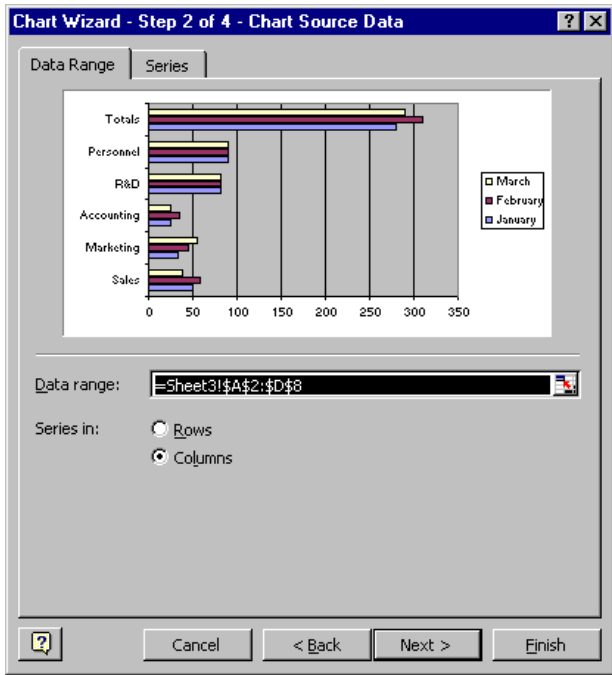
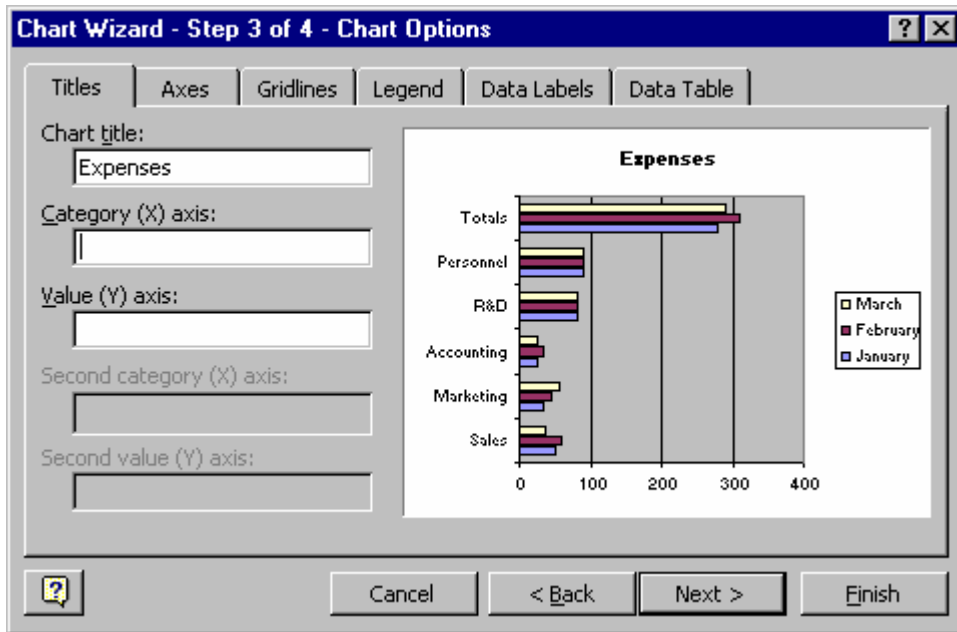
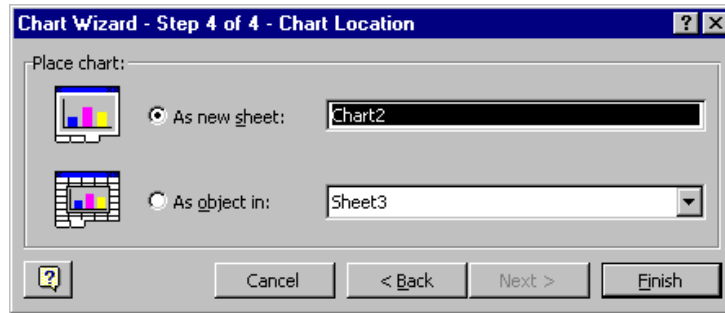


Chart Wizard **Step 2** lets you select (or confirm) the data to chart. If you've already highlighted the data to chart before invoking the Chart Wizard, that information will appear automatically in the *Data range* box.

Excel makes its best guess about how to arrange the data series: row-wise or column-wise. If you don't like the choice Excel has made, click the alternative option. The thumbnail sketch of the chart that appears in the dialog will change to reflect your choice.

Chart Wizard **Step 3** has six different tabs from which you control chart titles, axes and their labels, gridlines, the chart legend, data labels, and -- for some chart types -- an additional tabular view of the data that displays below the chart called a data table.

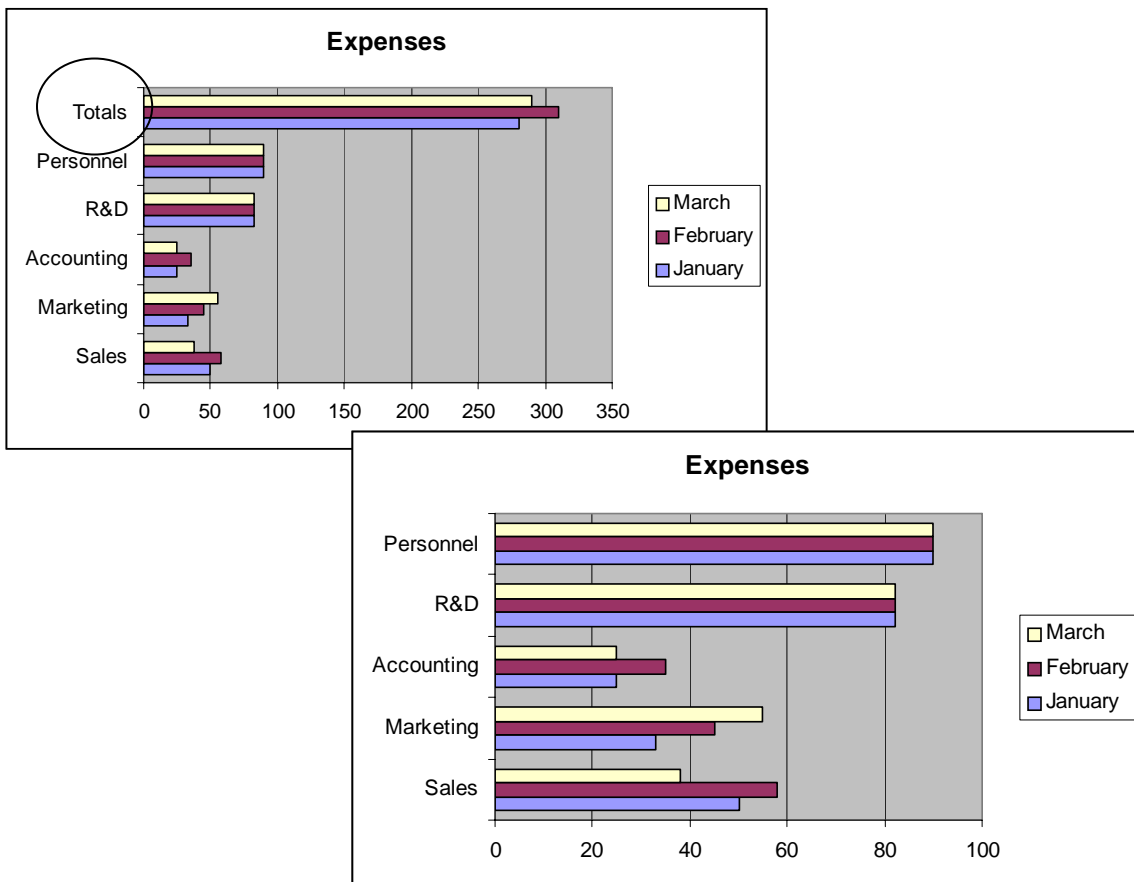




Step 4, the final Chart Wizard step, lets you select where Excel should generate the chart: On a new worksheet or in whatever other worksheet you select.

Once your chart is created, return to the Chart Wizard at any time to make changes to your chart. Click the chart to select it and then click the Chart Wizard button on the standard toolbar.

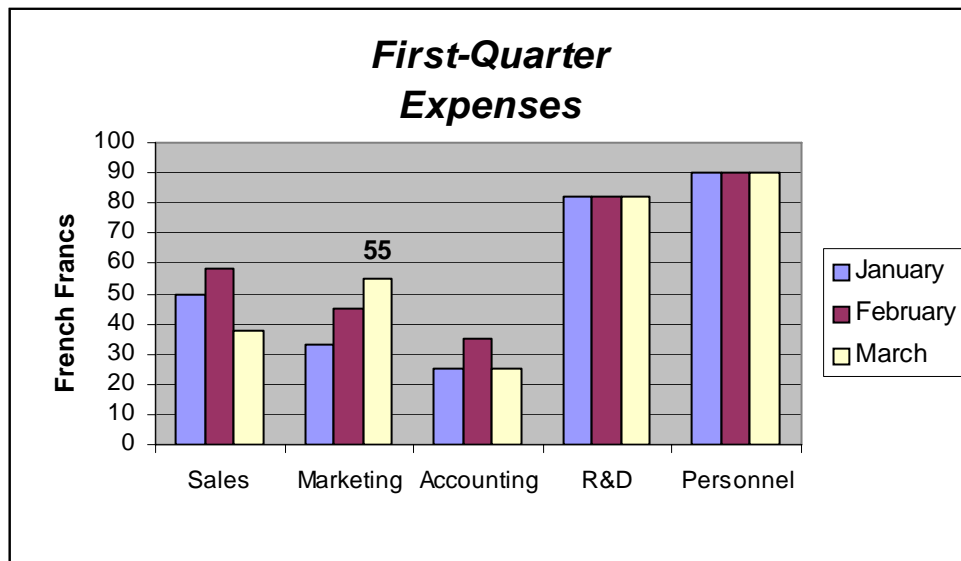
Most editing changes you can easily make without returning to the Chart Wizard. For example, the chart below mistakenly includes the **Totals** row of data. To remove the Totals data series from the chart, click the plot area to select it, right click, and select *Source Data* from the drop-down list. Then redefine the range of data to chart, this time excluding the Totals row of data.



Any time you have the chart selected, Excel's menu bar changes to show only chart-relevant menu items. Select options from the menus or select items within the chart, right-click, and select the option you want from the drop-down menu that displays.

Common changes you might make to a chart are to:

- Add a title, an x-axis label, or a y-axis label
- Change the formatting of the titles and labels
- Change the chart type to better display your data
- Add a data label to a critical data value
- Change the data series marker colors and patterns
- Change the gridlines in the plot area (behind the data series)



If your chart is on a worksheet with data (instead of being on its own chart sheet), move and size the chart by dragging with the mouse.

To delete a chart on a spreadsheet with data, select the chart and hit the delete key. To delete a chart on a sheet by itself, delete the sheet (make it current and select *Edit, Delete Sheet*).

*See Exercise 24 in the **BasicsPractice** workbook.*

A Special Chart Type: The XY Chart

An XY or scatter plot either shows the relationships among the numeric values in several data series *or* plots two groups of numbers a single series of xy coordinates. It

can show uneven intervals or clusters of data and is commonly used for scientific data.

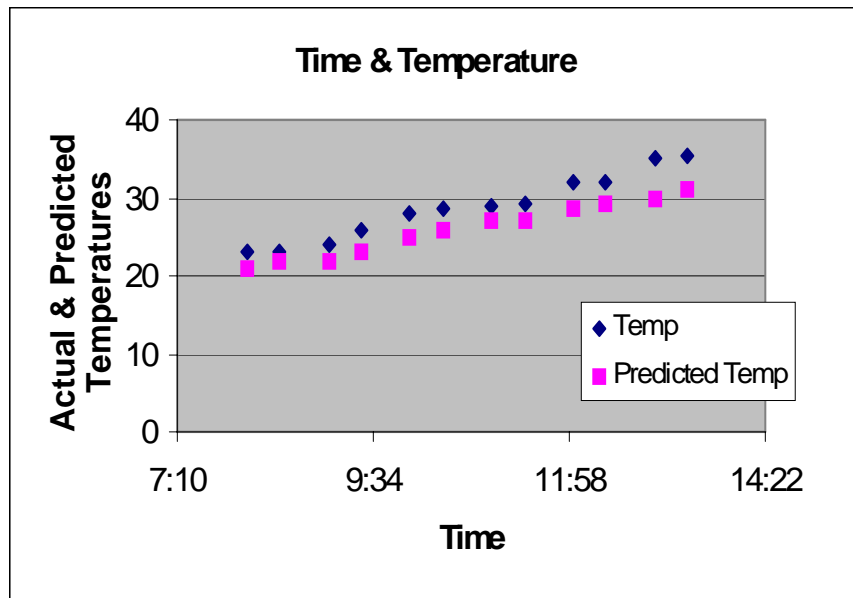
Example of an XY Scatter Plot

The data and plot below are an example of using a scatter plot to show relationships among several data series. This example shows the relationship between time and two temperature values. Time is the X value on the horizontal axis. There are two data series for the Y values: Actual temperatures and predicted temperatures.

Time	Temperature	Predicted Temperature
8:01	23	21
8:25	23	22
9:01	24	22
9:25	26	23
10:01	28	25
10:25	28.5	26
11:01	29	27
11:25	29.3	27
12:01	32	28.5
12:25	32	29.2
13:01	35	30
13:25	35.5	31

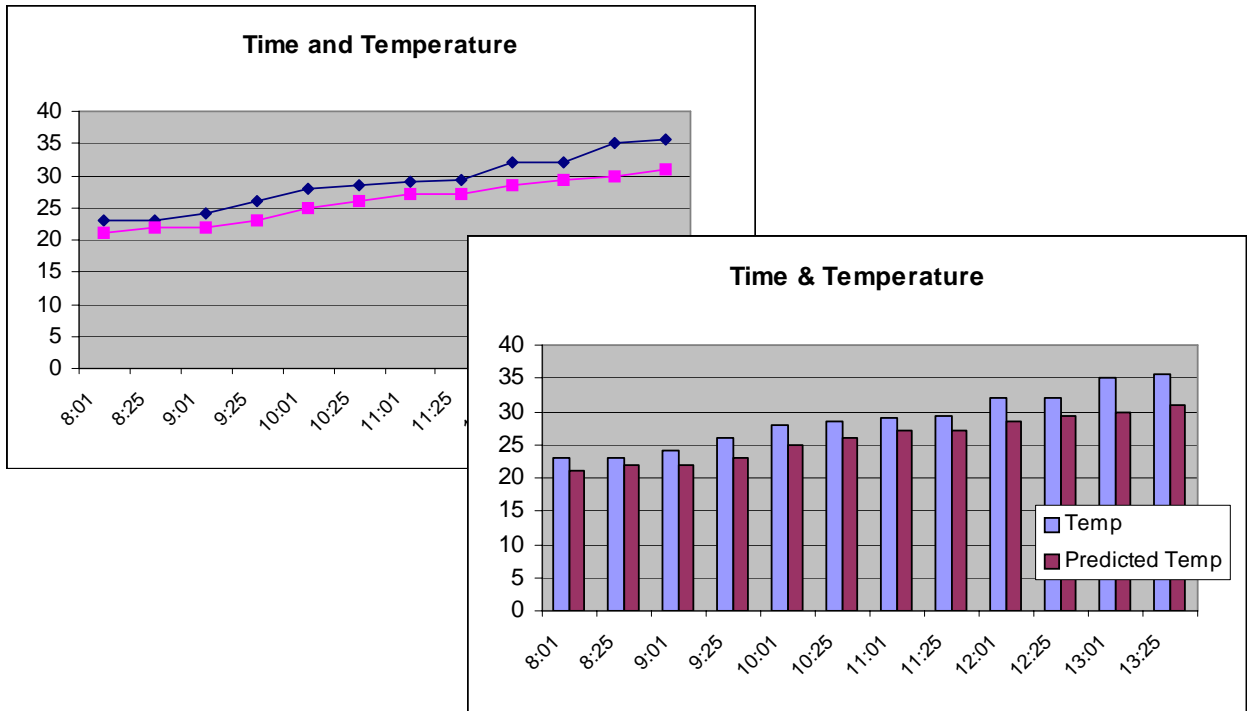
When you arrange the data for a scatter plot, place x values in one row or column and then enter corresponding y values in the adjacent rows or columns.

In the data shown at left, for example, values with the label "Time" are the x-axis values. The "Temp" and "Predicted Temp" values are Y values.



If You Select the Wrong Chart Type for Your Data

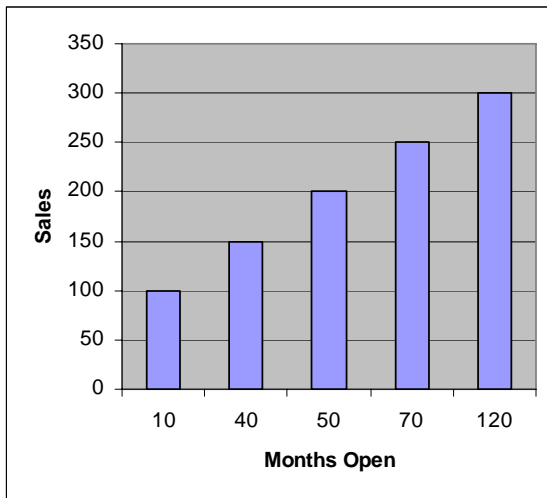
Excel offers many different chart types. The scatter plot is a unique type of plot because of the way it treats data. You might select chart type other than the scatter plot for the time and temperature data above. For example, the plots below show this data plotted as line and column chart types. Both produce a chart that looks meaningful for the time and temperature data because this data happens to include time intervals as the X axis.



However, there are many data sets where choosing any chart type will *not* produce a meaningful chart. For example, the next data set we'll consider is one of this type. We view the data set and see how *not* to plot the data with a line or column chart type. Then we see how to make a meaningful plot of the data with an XY Plot.

Months Open	Sales (\$ thousands)
10	100
40	150
50	200
70	250
120	300

At left is data from five retail stores. For each store, we have information about how long the store has been open and its average monthly sales. The task is to create a chart that shows the relationship between length of time open and sales.



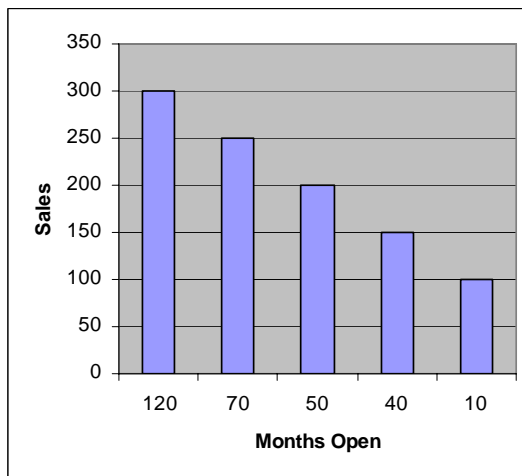
At left is a column chart of the data.

The scale on the X axis doesn't make sense; the intervals are not equal and shouldn't be.

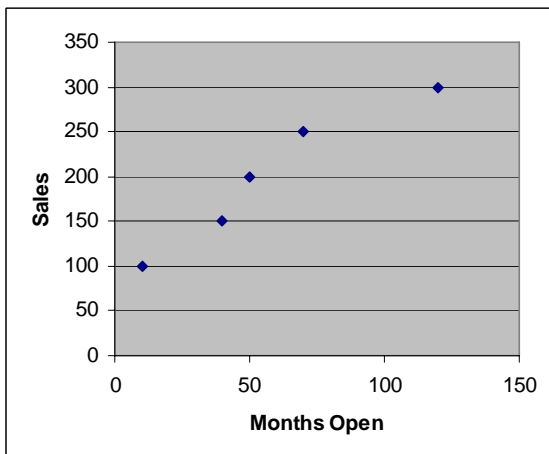
Examining the column chart above, one might, at least, get the idea that the relationship is positive, which makes sense. But reversing the order of the data (so that the longest-open store is listed first and so on), the result is a graph that at first glance makes the relationship look negative, as shown below.

Months Open	Sales (\$ thousands)
120	300
70	250
50	200
40	150
10	100

Data in reverse order.



Reverse data order column chart.



To get a meaningful chart of this data, the XY or Scatter Plot chart type works best, as shown at left.

In summary, data suitable for chart types *other than* the XY scatter plot:

- Data that changes over time and that compares items. For example, sales by year or by quarter. For data like this you might use a column or a line chart.
- Comparisons among items, with less emphasis on time. For example, sales by region. Try a bar chart for this kind of data.
- A comparison of each item to the whole. For example, which bicycle brands contribute to total sales. Use a pie chart for this kind of data.

Consider using an XY scatter plot when you have:

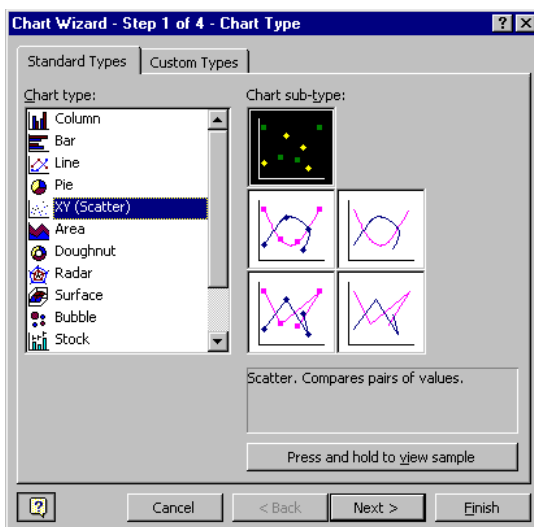
- Data that you want to plot as one series of XY coordinates.
- Data for which you want to see the relationships among numeric values in several data series.
- Data that's in uneven intervals, or clusters.

How to Create a Scatter Plot

In this example we plot two series values in a scatter plot as a single group of **xy** coordinates. To create this scatter plot, first arrange the data to plot in rows or columns. In this example, the data is arranged in rows.

X	5000	10000	15000	20000	25000	30000
Y	200000	400000	600000	800000	1000000	1200000

Highlight the data values by dragging over them with the mouse (no need to select the “x” and “y” headers here) and click the ChartWizard button from the standard toolbar. The Chart Wizard opens with Step 1.

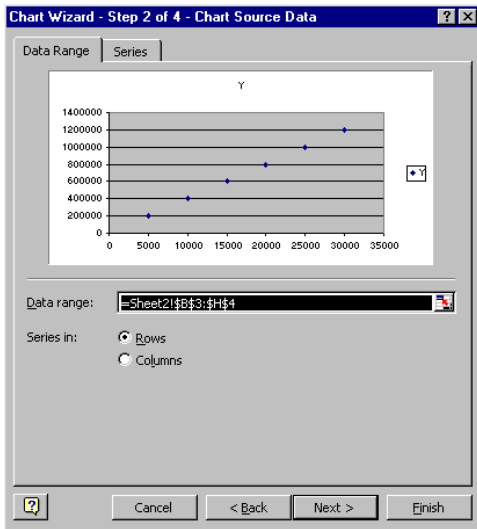


In Step 1, select a chart type and sub-type.

Select the **XY (Scatter)** option on the *Standard Types* tab.

Select from any of the chart sub-types. Note that when you select a chart type, Excel displays a short description of the chart.

Click *Next* to continue.

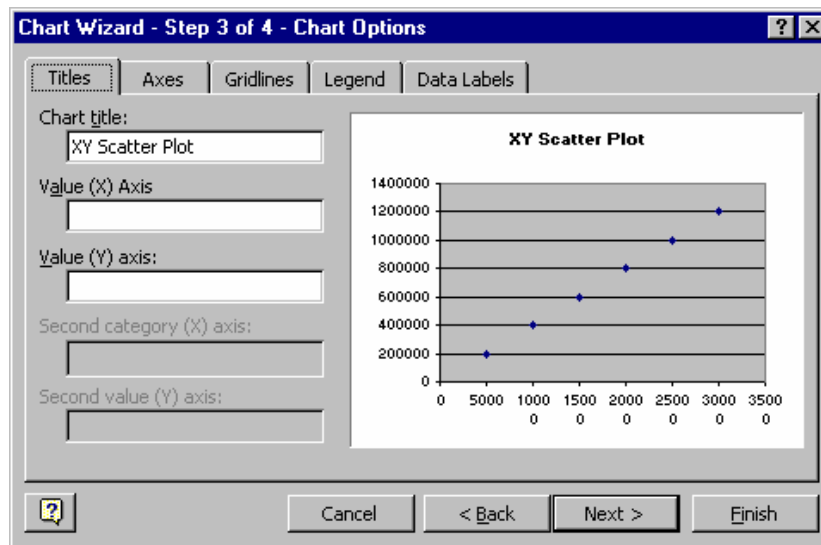


Step 2 asks you to identify the data you want to chart. If you selected the data range *before* starting the Chart Wizard, the correct range will already be filled into the “Data range” text box.

Indicate whether your data series are arranged in rows or columns. The thumbnail sketch of your xy plot will vary depending on what you select here and helping you to make the correct choice.

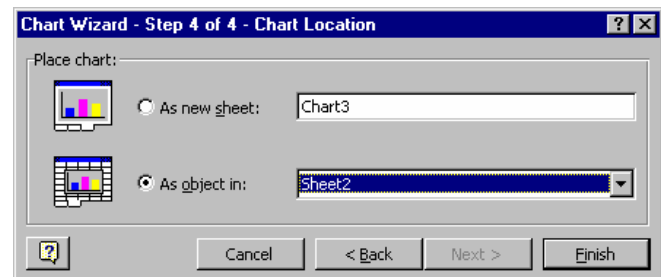
Click *Next*.

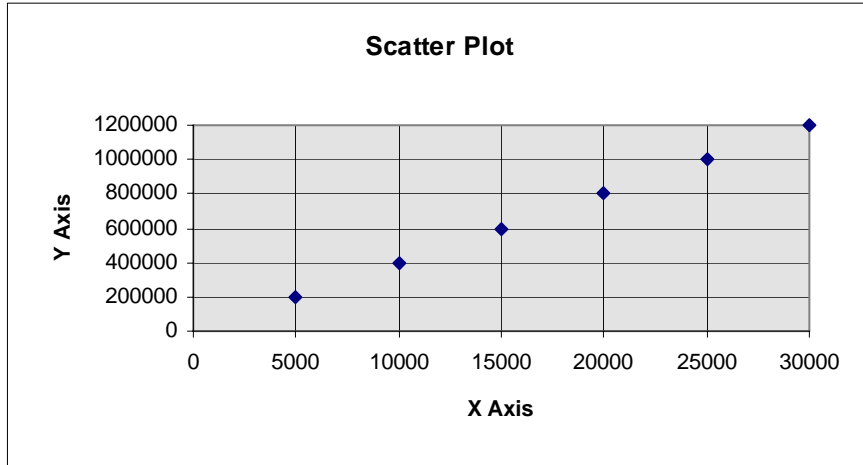
Step 3 displays a 5-tab dialog box that lets you customize your plot. The changes you make on any of the tabs are reflected in the thumbnail sketch.



When you’re finished customizing click *Next* to continue.

Step 4 gives you a choice of where the Chart Wizard will create your plot. Click *Finish* to complete the XY Plot and have it display on your spreadsheet.



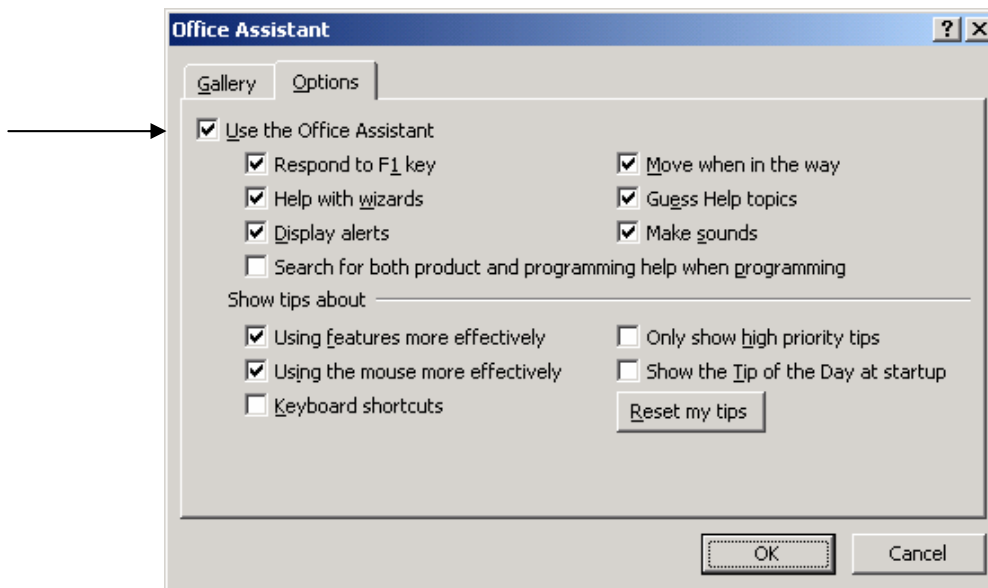


See Exercise 25 in the **BasicsPractice** workbook.

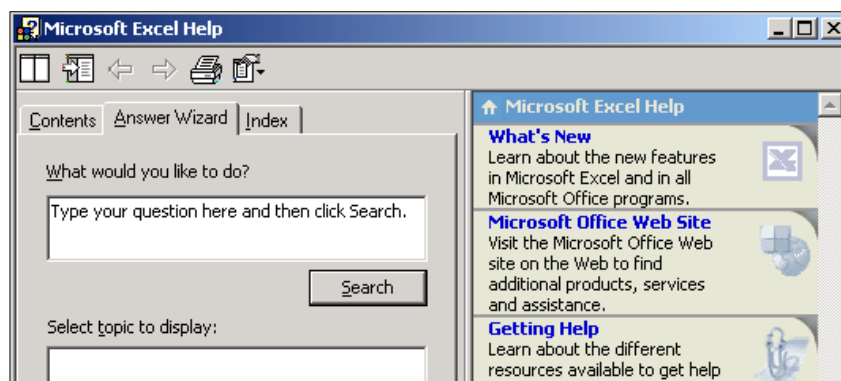
VII. Online Help

Excel's online help is like having a reference guide at hand, always ready when you need it. Open online help by choosing the *Help* option on Excel's menus.

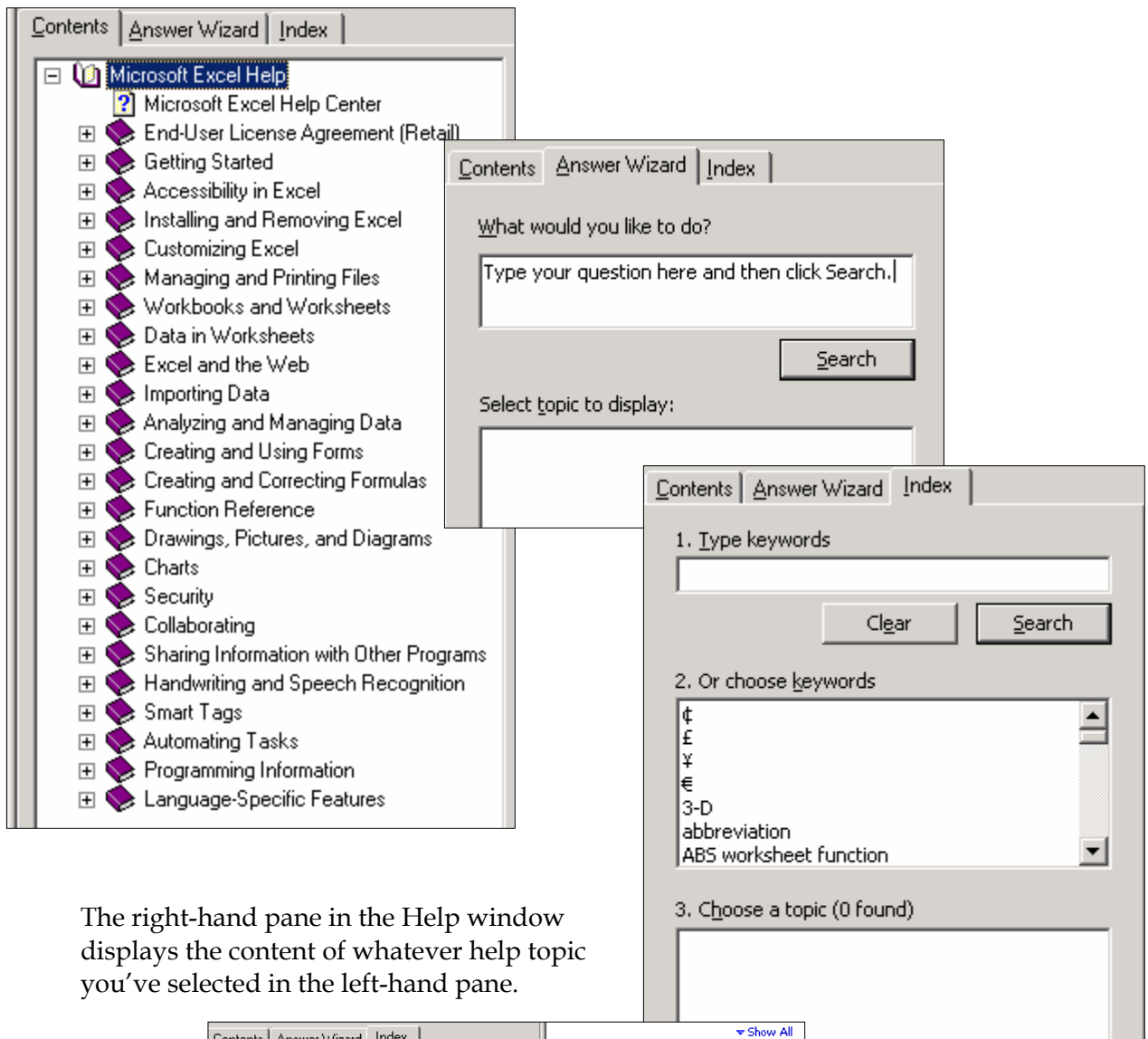
Although the Office Assistant can be entertaining, the best way to use Excel's online help is by going directly to the help interface. Turn off the Office Assistant by right-clicking the Office Assistant icon, choosing *Options* from the pop-up menu that displays, and unchecking the "Use the Office Assistant" option in the "Office Assistant" dialog.



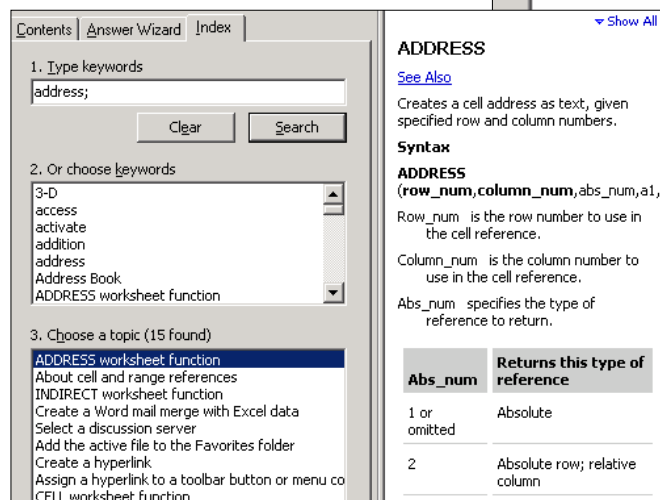
With the Office Assistant in retirement, clicking the *Help*, *Microsoft Excel Help* menu item opens the "Microsoft Excel Help" dialog.



Choose your view of help from the 3 tabs in the left-hand pane: "Contents", "Answer Wizard", or "Index". Each offers a different style of online help.



The right-hand pane in the Help window displays the content of whatever help topic you've selected in the left-hand pane.



Select a help topic.

View help on the selected topic.

VIII. For More Information

Many good Excel tutorials and reference guides are available in print, online, and on electronic media such as CD, video, and DVD. For a set of Excel tutorial materials written specifically for Fuqua MBA students see this website:

<http://faculty.fuqua.duke.edu/%7Epecklund/ExcelReview/ExcelReview.htm>

Recommended Excel texts include:

EXCEL 2002: THE COMPLETE REFERENCE

Ivens and Carlberg, Osborne, reference text.
ISBN 0-07213-2450, paperback, 759 pages

EXCEL 2002 FORMULAS

John Walkenbach, Wiley, formula reference.
ISBN 0-76454-800-X, paperback, 825 pages, CD ROM

MICROSOFT EXCEL VERSION 2002 INSIDE OUT

Dodge, Microsoft Press, reference text.
ISBN 0-7356-1281-1, paperback, 1104 pages, CD ROM

MICROSOFT EXCEL 2002 STEP BY STEP

Frye, Microsoft Press, beg/int tutorial guide.
ISBN 0-7356-1296-X, paperback, 352 pages, CD ROM

MICROSOFT EXCEL XP/2002: ILLUSTRATED COMPLETE

Cram, Course Technology, beg/int tutorial guide.
ISBN 0-61904-5051, paperback

MICROSOFT EXCEL XP/2002: COMPREHENSIVE

Ageloff, Course Technology, intensive tutorial guide

ISBN 0-61902-092-X, paperback, 808 pages

Offers a case-based, problem-solving approach especially recommended for a good MBA pre-program review. It's not necessary to go through the entire book. One can instead focus on the discussions and complete the primary exercises from the following list of sections. The data files used in the exercises may be downloaded from the publisher's website. See the textbook for complete instructions.

Tutorial 1: Using Excel to Manage Financial Data

Tutorial 2: Working with Formulas and Functions

Tutorial 3: Developing a Professional-Looking Worksheet

Tutorial 4: Working with Charts

Tutorial 6: Working with Multiple Worksheets and Workbooks

Tutorial 7: Developing an Excel Application

Tutorial 9: Data Tables and Scenario Management
Tutorial 10: Using Solver for Complex Problems

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Loren Abdulezer, Wiley

Covers Excel 2003, 2002, and 2000.

ISBN 0-7645-4120-X

Recommended Sources for Video/CD-ROM Materials on Excel

EXCEL TRAINING

KeyStone Learning Systems, Video or CD-ROM formats. Beginning and intermediate training. Order online or 1-800-581-9732.

<http://www.keystonelearning.com/keystone/>

EXCEL TRAINING

LearnKey Training, Video or CD-ROM formats. Order online or 1-800-865-0165.

<http://www.learnkey.com/>