

## Excel 2007 - Beginning

103-123

### Tutorial 3: Formulas & Functions

Notes	Activity
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This icon designates a video is available as an additional reference.  
Video DVD is available in the Stevens Point library.

#### Absolute vs. Relative References



Excel 3: Understanding Cell References

- In the first two tutorials, you learned to create formulas using cell references.
- You also learned that when you copy these formulas, Excel automatically updates the references, *relative* to the new location.

Notes	Activity
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- In Tutorial 1, you discovered that what you see in a cell is not necessarily what's stored there.
  - Cells with formulas display the formula result, but store the formula in the cell.
- Actually, Excel doesn't store the cell references in a formula either—it stores a *relative reference*.

Review the Total Hours formulas and discuss the applicability of relative references.

fx =D1+E1		
D	E	F
25	35	60

- In the example above, 60 appears in F1, but as the formula bar shows, F1 contains the formula =D1+E1
  - In actuality, F1 contains a relative reference that might read something like this:

=left 2 + left 1

meaning *add what's in the cell that is two cells to the left to what's in the cell that is one cell to the left*

fx =D1+E1	
D	E
25	35
60	

- In this example, because the total is calculated below the cells, the relative reference might read like this:

=up 1 + up 1 right 1

(*add the contents of the cell this is one cell up to the contents of the cell that one cell up and one cell to the right*).

- When these formulas are copied, the relative references are copied.
  - In the first example, the new formula will add what's two cells to the left to what's one cell to the left.
  - In the second example, the new formula will add what's one cell up to what's one cell up, one cell right.
- In most circumstances, relative referencing is what you want when you copy a formula.

## Notes

## Activity

- In some circumstances, you won't want to use relative referencing—you won't want Excel to automatically update a cell reference in a formula.

fx =D3*D1		
C	D	E
Item Price	\$3.75	
	Quantity	Total
Order 1	5	\$18.75
Order 2	10	

Create the Total Pay using only relative references.

Copy the formula to I18.

Note the errors.

- In this example, the order total for Order 1 is calculated as =D3\*D1 (actually: *left 1 \* left1 up 3*)
- When this formula is copied to E4 (the cell below) and error occurs

fx =D4*D2		
C	D	E
Item Price	\$3.75	
	Quantity	Total
Order 1	5	\$18.75
Order 2	10	#VALUE!

- The reference to D4 (contains 10) is correct, but the D2 contains the label *Quantity*, which cannot be multiplied by a value.
- Excel copied the relative references:  
*left 1 \* left1 up 3*
- To solve this problem, we'll have to implement an **absolute reference**
  - As the name implies, an *absolute* reference *absolutely* uses the cell reference provided. **It won't update the reference when the formula is copied.**
- In our example, we want Excel to treat the first cell reference (D3) as a relative reference (update it), but treat the second cell reference (D1) as an absolute reference (don't change it).
- Excel designates absolute references by including dollar signs (\$) in the cell reference.
- You can type the \$ in the reference, but it's generally easier to use the Excel absolute reference shortcut key: **F4**

## Notes

## Activity

- After entering a cell reference in a formula (either by typing it or using *point 'n shoot*) press F4. Excel automatically adds a \$ before the column letter and before the row number.
  - You'll learn why two \$ are needed later in these notes.
- To change an existing cell reference in a formula to an absolute reference, enter edit mode, place the insertion point in the middle (or beginning or end) of the cell reference and press F4.
- To change an existing absolute cell reference back to a relative reference, enter edit mode and simply remove the \$.
  - Alternatively, you can place the insertion point in the middle of the reference and press F4 repeatedly until the \$ disappear.
- The examples below show the effects of changing the D1 reference to an absolute reference.

Update the total pay formula making B5 absolute.

Copy the formula again.

Copy statistics to column J

fx =D3*\$D\$1		
C	D	E
Item Price	\$3.75	
	Quantity	Total
Order 1	5	\$18.75
Order 2	10	\$37.50

fx =D4*\$D\$1		
C	D	E
Item Price	\$3.75	
	Quantity	Total
Order 1	5	\$18.75
Order 2	10	\$37.50

Add the Projected Pay column (K). Enter the formula to calculate the projected pay.  
J8 \* (1 + F5)

- Except the for \$ in the D1 cell reference, the original formula and the displayed results are unchanged.
- After copying the formula again (replaces the old formula), the second formula now contains the absolute reference to D1 and the formula's result is correct.
- Because absolute references can be confusing, many people simply manually update all the copies of a formula instead of trying to figure out which references should be absolute.
  - You could easily have changed the reference to D2 in the incorrect copy of the formula back to D1.
- But imagine how tedious that process would be if you had 100 orders, 1000 orders, 10000 orders!

Copy through K18.

Notes	Activity
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- Some cell references need to be *mixed* references to copy properly.
  - The column reference is absolute, but the row reference is relative (\$A1)
  - The row reference is absolute, but the column reference is relative (A\$1)
  - The need for these kinds of references is much harder to recognize than complete, absolute references
  - They are most likely needed when you are copying a formula over multiple columns AND multiple rows.
  - Though they can make copying formulas easier, you can usually copy formulas effectively without mixed references, but you may have to copy more than once.
  - To enter a mixed cell reference, select the reference, press the F4 key repeatedly until the correct mix of absolute and relative references appears.
    - Or simply type the \$ where you need it.

Notes	Activity
<ul style="list-style-type: none"><li>• How do I know when to use an absolute reference?<ul style="list-style-type: none"><li>➤ The first key point: <b>the <u>only</u> purpose of absolute references is to allow you to copy formulas</b>. You don't use them for anything else.</li><li>➤ <i>If all copies of a formula reference the same cell, designate that cell as an absolute reference.</i></li><li>➤ Until you gain some experience recognizing absolute references, you can<ul style="list-style-type: none"><li>– use all relative references,</li><li>– copy the formula,</li><li>– look for errors in the copied versions of the formula. Remember the errors are not always obvious.</li><li>– Determine which cell reference in the original formula should have been absolute.</li><li>– Update the formula to include the absolute reference.</li><li>– Copy the formula again (important)</li><li>– Review the copies and repeat the process until you can copy the formula without errors.</li></ul></li><li>➤ Using absolute references where you shouldn't also causes formula errors (often very hard to detect). Check the values of some of the copied formulas (use a calculator if you have to) to ensure they are correct.</li></ul></li></ul>	

## Functions





### Excel 3: Understanding Function Syntax

- Excel has hundreds (thousands) of built-in functions.
- Functions are predefined formulas that calculate commonly needed values
- You've already seen a number of these functions in previous tutorials: SUM, AVERAGE, MIN, MAX



Notes	Activity
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- A function is made up of two parts
  - The function name (e.g. SUM, AVERAGE, PMT)
  - Parenthesis followed by *parameters aka arguments*
    - Parameters are cell references referring to the data the function should use to calculate its result)
    - Some parameters are optional. They are not always required but can be used when needed. Optional parameters are always the last parameters in the list.
- In previous tutorials, you learned to use the AutoSum functions (including MIN, MAX and AVERAGE)
- So that you will be comfortable using any of Excel's functions, in this tutorial, you'll learn to add functions to cells using the complete list of functions available in the Formulas tab
- When inserting a function into a cell, you do not need to start the formula with an equal sign (=)
- To make them easier to find and select, Excel groups functions into categories. You can see the categories in the Formulas tab of the Ribbon




Notes	Activity
<ul style="list-style-type: none"><li>There are four ways to locate the function you wish to use.</li><li>Technique #1 If you don't know the name of the function or what function category it is in, you can use the Insert Function button in the Formulas tab of the Ribbon.<ul style="list-style-type: none"><li>➤ There is a shortcut to this button just to the left of the formula bar so you can conveniently access this feature without having to open the Formulas tab.</li><li>➤ After you click the Insert Function button, the Insert Function dialog box appears. This dialog box helps you locate functions.</li><li>➤ In the <b>Search for a function:</b> box, type an English-like statement that describes what the function should calculate (try <i>calculate depreciation</i> as an example).</li><li>➤ Click the Go button.</li><li>➤ Under <b>Select a function:</b>, Excel will list all the functions that match your search criteria.</li><li>➤ You can scroll through this list and get a more detailed description of each function. Click any function to see its detailed description below the box.</li><li>➤ Once you've selected the appropriate function, click the OK button and the Function Arguments dialog box will appear.</li><li>➤ <b>Tip:</b> you can access the Insert Function dialog box from any of the function category buttons by clicking <i>Insert Function</i> at the bottom of each category's list.</li></ul></li></ul>	<p>Insert the Total Projected Pay using the Insert Function button.</p> <p>Search for <i>add range of numbers</i></p>
<ul style="list-style-type: none"><li>Technique #2 As you learned in Tutorial 1, you can use the AutoSum button to quickly insert the most commonly used functions.<ul style="list-style-type: none"><li>➤ This button and its list is available in both the Formula and the Home tab.</li><li>➤ No Function Arguments dialog appears when you use the AutoSum buttons.</li><li>➤ See Tutorial 1 for a detailed description on how to use the AutoSum functions.</li></ul></li></ul>	<p>Insert the Average Projected Pay using the AutoSum list.</p>




Notes	Activity
<ul style="list-style-type: none"> <li>• <b>Technique #3</b> Excel keeps a list of the most recently used functions on your computer. If you used a function in the past, it's most likely on this list. <ul style="list-style-type: none"> <li>➤ In the Function Library group of the Formulas tab, click the Recently Used  button to get a list of those functions.</li> <li>➤ Click the function you'd like to use. The Function Arguments dialog box will appear.</li> </ul> </li> </ul>	<p><b>Insert the Minimum Projected Pay using the Recently Used list.</b></p>
<ul style="list-style-type: none"> <li>• <b>Technique #4</b> Excel groups functions into categories. If you know which category contains your function, you can find it easily. <ul style="list-style-type: none"> <li>➤ Alternatively, you could simply hunt through each of the category lists for your function, but Technique #1 is generally more effective if you don't know which category the function is in.</li> <li>➤ Click the appropriate category button <div data-bbox="362 909 893 1005" data-label="Image">  </div> <ul style="list-style-type: none"> <li>– Note the More Functions category includes more categories. Surprisingly (to me), the Statistical functions category is hiding in here. It contains the MIN, MAX, AVERAGE functions and all their <i>cousins</i>.</li> </ul> </li> <li>➤ Click the appropriate function name (scroll if necessary). The Function Arguments dialog box will appear.</li> </ul> </li> </ul>	<p><b>Insert the Maximum Project Pay using the More Functions, Statistical category.</b></p>
<ul style="list-style-type: none"> <li>• <b>Function Parameters (Arguments)</b> <ul style="list-style-type: none"> <li>➤ Every function has a different list of parameters based on the data the function needs to complete its calculation</li> <li>➤ The Function Arguments dialog box helps you enter these parameters.</li> <li>➤ As you click in each parameter's box, Excel displays a description of that parameter in the lower portion of the dialog box.</li> <li>➤ Some parameters are optional. You do not have to enter values, but you can if it is appropriate. <ul style="list-style-type: none"> <li>– The Function Arguments dialog box designates <b>required</b> parameters by boldfacing their names. Optional parameters are not boldface.</li> </ul> </li> </ul> </li> </ul>	

Notes	Activity
<ul style="list-style-type: none"><li>➤ For each required parameter, you must designate either a cell, a range of cells, a formula, or a simple value. Most often, you will use a cell or range of cells.<ul style="list-style-type: none"><li>– Click the box next to the parameter name</li><li>– Select the appropriate cell or range of cells from the worksheet (or enter a value or a formula)<ul style="list-style-type: none"><li>▪ Move the dialog box if you can't see the cells to be selected.</li><li>▪ If necessary (rare) you can click the Collapse Dialog Box  button to shrink the dialog box to a single line box, making it easier to click on cells. After selecting the cell, click the button  to restore the dialog box.</li></ul></li><li>– Repeat for each required parameter and needed optional parameter.</li></ul></li><li>➤ After you have selected values (references) for each of the required parameters, Excel will calculate the function result and display it in the dialog box.<ul style="list-style-type: none"><li>– If the result is an error or not what you expect, check your parameters for accuracy.</li></ul></li><li>➤ As you enter the parameters, Excel <i>builds</i> the formula in the formula bar. With some experience you can speed up formula entry by typing functions manually.</li><li>➤ Click the OK button to insert the formula into the cell.</li><li>➤ Note: some functions don't require any parameters (TODAY). For these functions, a different Function Arguments dialog box appears with no parameter boxes. Click OK to close this dialog box.</li></ul>	

[illegible]

Notes	Activity
<p>➤ IF</p> <p> Excel 3: Working With Logical Functions Excel 7: Creating Nested If Functions</p> <ul style="list-style-type: none"> <li>– The IF function allows you to have Excel make decisions based on yes/no true/false <i>conditions</i>.</li> <li>– If the condition is true, Excel does one thing, if it is false, Excel does another.</li> <li>– Similar to conditional formatting except this function can't do formatting, it can only enter values.</li> <li>– Located in the Logical functions category.</li> <li>– The first parameter designates the condition <ul style="list-style-type: none"> <li>▪ Expressed using = &lt; &lt;= &gt; &gt;= &lt;&gt;</li> <li>▪ Normally a cell reference compared to a fixed value (E.g. A1 &gt; 100)</li> </ul> </li> <li>– Second parameter designates what value should appear in the cell if the condition is true <ul style="list-style-type: none"> <li>▪ Can be a fixed value, cell reference or formula</li> </ul> </li> <li>– Third parameter designates what value should appear in the cell if the condition is false (fixed value, cell reference or formula) <ul style="list-style-type: none"> <li>▪ Though this parameter is technically optional, Excel will insert the word FALSE into the cell when the condition is false if you don't designate something else.</li> <li>▪ <b>Tip:</b> Use two quotation marks with nothing in between (called the <i>empty string</i>), to leave a cell blank when the condition is false.</li> </ul> </li> <li>– =IF(A1&gt;100,"Good Job","")</li> </ul>	<p>Insert two columns before column J.</p> <p>Label them Regular Pay and Overtime Pay</p> <p>Clear the conditional formatting of the new cells.</p> <p>If a person works &lt;=40 hours calculate regular pay by multiplying their hours by the pay rate. Otherwise multiply the pay rate by 40.</p> <p>Copy the formula.</p> <p>If a person works &gt;40 hours calculate overtime pay (hours – 40) * pay rate * 1.5 otherwise enter 0</p> <p>Copy the formula.</p> <p>Update the Total Pay formula.</p>

Notes	Activity
<p>➤ PMT</p> <p> Excel 3: Working with Financial Functions Excel 9: Working with Loans &amp; Mortgages</p> <ul style="list-style-type: none"> <li>– The PMT function calculates the payment for a loan based on the amount borrowed, interest rate and duration of the loan.</li> <li>– Great for estimating the payments on a mortgage or car loan.</li> <li>– Located in the Financial functions category.</li> <li>– <b>Key concept:</b> The designated interest rate and the number of payments must both be in the same <i>units</i>. Most payments are made monthly, but most interest rates are annual (APR- Annual Percentage Rate). You'll have to convert the interest rate to monthly to match the payments.</li> <li>– The first parameter is the interest rate. This is normally provided as an annual rate. You'll probably want to convert it to a monthly rate (divide by 12)</li> <li>– The second parameter is the duration of the loan—the number of periods in the loan (NPER). If payments are made monthly, make sure this value is expressed in months (years * 12)</li> <li>– The third parameter is the amount borrowed—the present value (Pv) of the loan.</li> <li>– All other parameters are optional. We won't be using them.</li> <li>– The PMT function returns a negative value because accountants consider payments expenses. You'll probably want to convert it to a positive value. There are two ways to do this. <ul style="list-style-type: none"> <li>▪ The book recommends you edit the formula by placing a minus sign ( - ) in front of the PMT function name.</li> <li>▪ You can also make the result a positive value by making the Pv (loan amount) a negative number. Put a minus sign ( - ) in front of the loan amount.</li> </ul> </li> <li>– <code>=PMT (A1/12, A2*12, -A3)</code> <code>=-PMT (A1/12, A2*12, A3)</code> <ul style="list-style-type: none"> <li>▪ A1 contains an APR (annual interest rate)</li> <li>▪ A2 contains the number of <b>years</b> of the loan</li> <li>▪ A3 contains the amount borrowed.</li> </ul> </li> </ul>	<p>Switch to the investment sheet.</p> <p>Enter values in B3:B5 \$50,000 6.5% 15</p> <p>Calculate the monthly payment.</p> <p>Experiment with different numbers.</p>

## Notes

**AutoFill**

## Activity



## Excel 3: Working with AutoFill

- You learned in Tutorial 1 that you can use the Fill handle (AutoFill) to easily copy a formula to other.
  - It still works now that formulas may contain absolute references.
- AutoFill can also be used to quickly fill a range of cells with a series of values.
  - For example, you might need to fill column A with a series of sequential check numbers. You might want to include all the month names as column headers.
  - Instead of typing each value manually, AutoFill can simplify the process.
- Generally, to create a series,
  - type the first two values of the series into adjacent cells (down or across).
  - Select both cells
  - Drag the fill handle to extend the series. Excel will display a little tooltip window that displays what each value in the series will be as you drag.
  - Some series items only require the first item in the series be entered, not two (months, days of the week)
  - **Tip:** You can enter a series of numbers that goes up by one by entering only the first number. Then, hold the Ctrl key down while dragging the fill handle.
- For certain series (Quarters, Months, Days of Week) AutoFill will automatically start the series over again once it is complete. For example if the series starts with Monday, Excel will fill the series to Sunday and then continue with Monday again.

Use AutoFill to enter year columns headers from 5-30 by 5 (center)

Use AutoFill enter the Interest Rate row headers from 6 to 8 by .25% (format %,2)


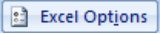
Calculate the payment in C16.

Interest rate column absolute.

Duration row absolute  
Pv absolute.

Copy across, then down.

In the AutoFill sheet experiment with other AutoFills

Notes	Activity
AutoFill Examples:	
<u>Cell 1 ( &amp; 2 )</u>	<u>Extended Values</u>
5 6	7 8 9 10 11 etc
5 10	15 20 25 30 etc
1.25 1.50	1.75 2.00 2.25 etc
Jan	Feb Mar Apr etc
January	February March April etc
1/15/2007 2/15/2007	3/15/2007 4/15/2007 etc
12/30/2007	12/31/2007 1/1/2008 1/2/2008 etc
Mon	Tue Wed Thu Fri Sat Sun Mon Tue etc
Monday	Tuesday Wednesday Thursday etc
9:15 9:30	9:45 10:00 10:15 etc
Qtr 1	Qtr 2 Qtr 3 Qtr 4 Qtr 1
Quarter 1	Quarter 2 Quarter 3 Quarter 4 Quarter 1
1 <sup>st</sup> Inning	2 <sup>nd</sup> Inning 3 <sup>rd</sup> Inning etc (1 <sup>st</sup> is the key)
Region 1	Region 2 Region 3 (number at end is the key)
<ul style="list-style-type: none"> <li> <b>Tip:</b> You can create your own custom series for data you use frequently           <ul style="list-style-type: none"> <li>➤ Example: (campuses) Adams Marshfield Stevens Point Wisconsin Rapids</li> <li>➤ After entering Adams, you can use AutoFill to fill in the rest</li> <li>➤  </li> <li>➤ Ensure Popular is selected.</li> <li>➤ Click the Edit Custom Lists button. The Custom Lists dialog box will appear.</li> <li>➤ Click under <b>List entries:</b> and add the series values, one per line.</li> <li>➤ Click the Add button</li> <li>➤ Click OK to close Custom Lists</li> <li>➤ Click OK to close Excel Options</li> <li>➤ Test the new series.</li> </ul> </li> </ul>	