

# Excel 2007 Formulas

Excel can be a great tool for just keeping track of your data, laid out in rows and columns. The real power of Excel, though, is the large number of tools it provides for “doing stuff” with the data that you enter. At the top of the list of these powerful tools is Excel’s ability to perform calculations on your data through the use of formulas and functions. Anything from simple addition to a hugely complex series of equations can be completed instantly by Excel, once the formulas have been entered in the spreadsheet.

## Cell References

Cell references are the basic building blocks of the formulas you will use in Excel. Notice that each column of a spreadsheet is assigned a letter and each row of a spreadsheet is assigned a number. Each cell in a spreadsheet can be uniquely identified by referring to the column letter and row number that the cell is in.

	A	B	C
1	4	16	
2	8	23	
3	15	42	
4			

Figure 1

In this example, the number 42 is entered in **column B** and in **row 3**. The cell reference for this cell is **B3**.

The value stored in cell **A1** is 4. The value stored in cell **A2** is 8. An Excel cell reference always names the column letter first, followed by the row number.

Cell references can get a little more involved than this, but this is the basic idea: You can refer to a cell by its column letter and row number.

## Basic Formulas Using Cell References

An Excel formula always begins with an equal sign. You can use cell references to set the value displaying in one cell equal to the value displaying in another cell. Typing **=A1** in any other cell on the sheet says, “I want this cell to display the same value that is displayed in cell A1.”

	A	B	C
1	815	=A1	
2			

Figure 2

	A	B	C
1	815	815	
2			

Figure 3

In the above example, the value 815 has been entered in cell **A1**. Rather than typing 815 a second time in cell **B1**, I have typed the formula **=A1** in cell **B1**. Figure 2 shows the formula, and Figure 3 shows the results of the formula.

If I change the value that is typed into cell **A1**, the formula in cell **B1** recalculates, and the value that displays in cell **B1** automatically changes to match the new value in cell **A1** (See Figures 4 and 5).

	A	B	C
1	316	316	
2			

Figure 4

	A	B	C
1	text	text	
2			

Figure 5

Notice that this formula can be used for duplicating text, as well as numbers. In Figure 5, I typed the word “text” in cell **A1**, and the formula in cell **B1** caused the word “text” to display in cell **B1** as well.

## The Formula Bar

Excel's **Formula Bar** gives you more work space for entering formula's into the cell that you have selected. When you have selected a cell, you can either begin typing a formula directly into the cell, or you can click up on the formula bar, and type your formula there.

The formula bar always shows you exactly what has been typed into the selected cell.

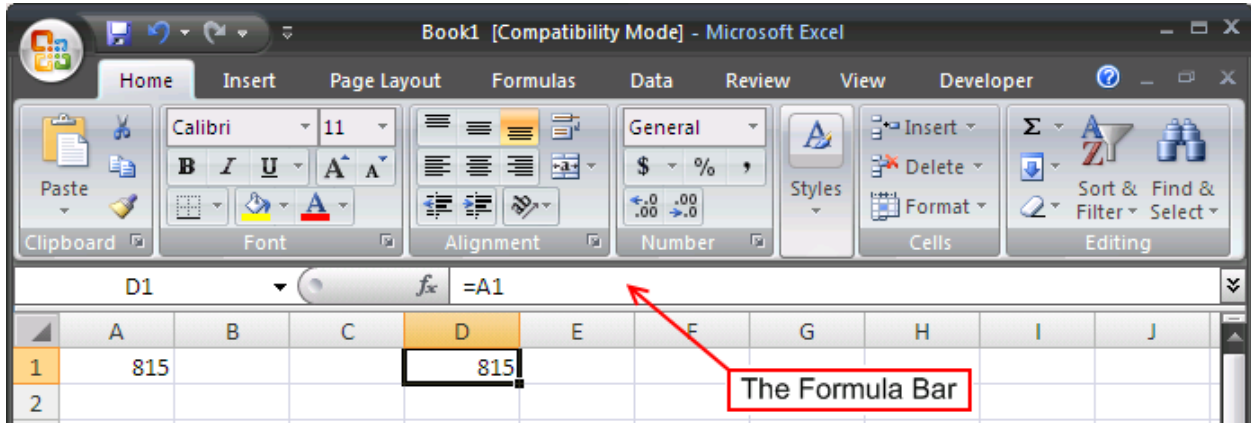


Figure 6 – The Formula Bar

Notice in Figure 6, that the selected cell, **D1**, is displaying the value 815. The formula bar shows us that this value is displaying because the formula **=A1** has been entered in the cell.

If you selected cell **A1**, the formula bar would display the number 815, because there is no formula in cell **A1**. The formula bar always shows you exactly what has been entered in the selected cell. What displays in the cells themselves can be exactly what was entered, or it can be what was entered modified by formatting that was applied to the cell, or, if a formula has been entered, the cell would display the results of the formula.

When you are initially entering a formula, often it won't make a difference to you if you type it directly in the cell, or if you type it in the formula bar. When you need to edit a formula, it is usually easiest if you click up in the formula bar after selecting the cell, and edit the formula there.

- You can expand the formula bar, if you are writing a lengthy formula. Click the downward pointing expand arrow at the right side of the formula bar to expand it. Click the same button again when you are ready to collapse the formula bar back to one line.

## Creating More Advanced Formulas

Cell references can be used as variables in more complex formulas. Just like you could write equations in algebra class, like  $Y = X + 10$ , and then you can solve for Y based on different values for X, you can do the same thing using cell references as your variables.

You always begin your Excel formulas by typing the equal sign. Excel will attempt to solve the formula that you set up to the right of the equal sign, and it will display the results in the cell.

Arithmetic Operator	Used For	Example
plus sign	+	Addition 2+2
minus sign	-	Subtraction 2-1
		Negation -1
asterisk	*	Multiplication 3*4
forward slash	/	Division 6/3
percent sign	%	Percent 90%
caret	^	Exponentiation 3^2

Figure 7 – Arithmetic Operators

You can set up formulas using cell references as variables and the arithmetic operators listed in Figure 7. Figure 8 shows some examples of formulas, and Figure 9 shows the results of those formulas.

	A	B	C	D
1	14	2	=A1+B1	
2	15	7	=A2-B2	=C1/C2
3	10	2	5	=A3*B3*C3
4	55	5	=A4/B4	
5	3	2	=A5^B5	
6	=7*7+1			

Figure 8

	A	B	C	D
1	14	2	16	
2	15	7	8	2
3	10	2	5	100
4	55	5	11	
5	3	2	9	
6	50			

Figure 9

So, in the earlier examples, we were just using cell references to duplicate the contents of another cell. Now we are doing some math. Let's take a closer look at a few of the formulas in Figure 8.

- The formula in cell **C1** says, "Add the contents of cell **A1** to the contents of cell **B1**, and display the result." The 14 in cell **A1** is added to the 2 in cell **B1**, and 16 displays in cell **C1**.
- Notice that the formula in cell **D2** refers to cells **C1** and **C2**, which also contain formulas. The results of the formulas in cells **C1** and **C2** are 16 and 8. The formula in cell **D2** divides the result of cell **C1** by the result of cell **C2**, and displays the result, 2.
- Notice that the formula in cell **A6** does not contain any cell references, only constants. 7 times 7 plus 1 equals 50. You can also use constants in your formulas along with cell references. For example, =A2\*9.

## Order of Operations

There is a concept from math class that you will need to keep in mind if you are going to do much with formulas: **Order of Operations**. Excel doesn't just read and calculate your formula from left to right; **some mathematical operations are always completed before other mathematical operations**. Figure 10 lists the mathematical operators in the order they would be calculated by Excel.

Order of Operations	
-	Negation (for example: -10)
%	Percent
^	Exponentiation
* and /	Multiplication and Division
+ and -	Addition and Subtraction

Figure 10

Formula	Result	Reason
=4+6/2	7	Division is performed before addition.
=1+2*2	5	Multiplication is performed before addition
=3-8/4+1	2	Division is performed before subtraction and addition

Figure 11 – Examples of the Order of Operations

You can control the order that operations are performed in your formulas through the use of parentheses (). The part of your formula that is within parentheses is calculated first. If you have parentheses within parentheses in your formula, the part of your formula within the inner most parentheses are calculated first.

Formula	Result	Reason
=(4+6)/2	5	The formula within the ( ) are calculated first, then the division.
=(1+2)*2	6	The formula within the ( ) is performed first, then the multiplication
=(8-3)/(4+1)	1	The formulas within the ( ) are calculated first, then the division

Figure 12 – Using Parentheses to Control the Order of Operations

	A	B	C	D
1	10	25	5	=A1+B1/C1
2	10	25	5	=(A2+B2)/C2
3	5	6	5	=(A3*B3)+(C3*10)
4	5	6	5	=A4*B4+C4*10
5	2	4	2	=A5*B5^C5*10-8
6	2	4	2	=(A6*B6)^C6*(10-8)

Figure 13

	A	B	C	D
1	10	25	5	15
2	10	25	5	7
3	5	6	5	80
4	5	6	5	80
5	2	4	2	312
6	2	4	2	128

Figure 14

Figure 13 shows some examples of formulas that demonstrate order of operations and the use of parentheses. Figure 14 shows the results of the formulas.

## Entering Cell Reference by Selecting Cells

Rather than typing all of the cell references in your formula, Excel allows you to select the cells and it enters the cell reference in your formula for you. To do this, begin your formula by typing the equal sign (=) within the cell. Now click on the first cell you want to reference. The cell reference for the cell you select will be entered in the formula.

If you wanted to enter the formula =A1-B1 into cell C1, for example, you could click on cell C1, and type the equal sign to begin entering the formula. Next click on cell A1. The cell reference A1 will be entered into your formula in cell C1. Type the minus sign. Then click on cell B1. The cell reference B1 will be added to your equation. Press enter.

While you are doing this, if you were to click on cell A1 and then click on cell B1 without typing a mathematical operator in between, the cell reference A1 would be entered on the first click, and then that cell reference would change to cell B1 on the second click.

## Formula Error Messages

There are a few common error messages you will run into when you use formulas:

**#####** - If you see number signs displaying in the cell instead of the formula results, the column is not wide enough for the results of the formula to display. Adjust the column width so that it is a little wider than the content of the cell, and this error will go away.

**#DIV/0!** – This error message tells you that your formula is trying to make Excel divide by zero. You'll see this error when your formula is something like =A1/A2, and cell A2 is blank. Once you fill in a value in cell A2, the error message will go away. While the cell A2 is blank, or if the cell contained zero, you would be trying to divide cell A1 by nothing.

**Circular Reference** – You will see an error message dialogue box pop up if your formula contains this error. Basically, a cell can't refer to itself. If you are typing a formula in cell A1, you can't reference cell A1. For example, the formula =A1\*5 says, "Take the value in cell A1 and multiply it by 5." If this formula is entered in cell A1, it would need to be solved before Excel would know what it needs to multiply by 5. Excel needs to solve the formula before it knows a value for A1, and it can't know the value of A1 until the formula is solved. You also get the circular reference error if your formula refers to a cell whose formula is dependent on the value in the cell you are in. You can't refer to a cell, that refers to a cell, that refers back to the original cell.