What is a Formula?

A formula is basically a set of values that have some type of mathematical operations performed on them. Examples of mathematical operations include addition, subtraction, multiplication or division. In Excel, formulas always begin with the = sign. In short, if there is no = sign then there is no formula.

Formula Examples:

<table>
<thead>
<tr>
<th>Formula</th>
<th>=2+2</th>
<th>=4-2</th>
<th>=2+4*3</th>
<th>=2+4*3/2</th>
<th>=((2+4)*3)/2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formula Result</td>
<td>4</td>
<td>2</td>
<td>14</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>

In Excel calculations are performed from left to right using the PEMDAS order of operations: Parenthesis, Exponents, Multiplication, Division, Addition and Subtraction. This means that Excel does what is in Parenthesis first. After doing calculations on the items in parenthesis exponents are calculated. Then Multiplication and Division are done starting from the left and moving to the right. Finally, any addition and subtraction is performed, again from left to right through the cell.

To change the order of operations you simply need to put the calculations you want done first in parenthesis. The last two formula examples in the table above show the difference parenthesis can make in how Excel performs its calculations.

Referencing Cells instead of Numbers

Excel refers to cells on the grid based on the column and row number. You can use this reference in your formulas. The first picture depicts two formulas, both of which end up with the same answer. The first formula, in row 2 simply uses the numbers in the formula and no cell references. The second formula, in row 3 uses cell references instead of the numbers to be added.

The second picture shows that when the value in column A is changed to 5, the formula using the cell references automatically updated to use the revised value.
Types of Cell References

There are several types of cell references in Excel, all of which serve a very important purpose. The listing below provides a brief intro to the four basic types (excluding named ranges). These are especially important when copying formulas down a column or across a row.

<table>
<thead>
<tr>
<th>Reference</th>
<th>When to Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>This reference is completely relative, meaning if you copy it down a row or column it will change to A2 or B1 respectively.</td>
</tr>
<tr>
<td>$A1</td>
<td>This reference has an absolute reference for column A, but a relative reference for the row. Copying it down the row will change the reference to $A2. Copying it to the right across the column will keep the reference as $A1.</td>
</tr>
<tr>
<td>A$1</td>
<td>This reference has a relative for column A, but an absolute for row 1. Copying it down the row will keep the reference as A$1. Copying it to the right across the column will change the reference to B$1.</td>
</tr>
<tr>
<td>$A$1</td>
<td>This reference is completely absolute, meaning if you copy it down a row or column it will stay the same.</td>
</tr>
</tbody>
</table>

**TIP:** Quickly change the type of cell reference by pressing the F4 key when making your formula!

Add Functions to your Formulas

While you can accomplish a lot using basic formulas you may find a need to perform more advanced types of calculations. Excel 2010 has roughly 400 functions that you can use to manipulate data to achieve the results you desire. A few of the most common functions are located under the AutoSum dropdown on the Home ribbon.

**TIP:** You can quickly insert the Sum function by using the keyboard shortcut ALT + = in any cell!
Using the Formulas Ribbon

The Formulas Ribbon provides access to not only the functions of Excel, but also tools that are useful in creating, modifying, understanding and troubleshooting formulas.

The insert function button (fx) is the first button on the Formulas ribbon. Not only is it on the Formulas ribbon, but also available directly below the ribbon making it always readily available.

Clicking the fx button will bring up the Insert Function dialog box. This allows you to do many things:

- Search for a function to fill your particular need
- Search for a function by category
- Select a function based on one of the search methods listed above
- Get more detail and help on how to use the function.

Selecting a function and clicking OK will bring up a Functions Arguments dialog box. This box walks you through creating a formula using the function you chose. It will put the comas, parenthesis and quotes in as necessary to make the function work properly.
3 Useful Functions

Most Excel users only use a fraction of the functions and abilities of Excel. With so many functions you can easily spend a lot of time searching for a function that will do what you need. The good news is about 10% of the Excel functions available will do 90% of the calculations you need! Let’s take a look at 3 of the functions that are in that 10%.

The IF Function

The IF function is the go to function anytime you need to make a decision based on values in your data. Let’s say for instance you need to determine the commission rate for a group of sales associates. If they have sales less than $550 they get a 5% commission and if they have sales over $550 they get a 10% commission.

Syntax: =if(logical_test,value_if_true,value_if_false)

TIP: You can nest (string together) up to 7 if functions if needed. In the above example if we had more than 2 possible commission rates we would have needed to add an additional if function.
The Concatenate Function

While the name Concatenate is likely not part of your everyday vocabulary it could be a function you use daily in Excel. Anytime you need to combine the values in multiple cells together (not add them but append them to each other) the concatenate function can help. In the example below we will use the concatenate function to tie the last name and first name together in a single cell separated by a comma and a space.

Syntax: =Concatenate(text1,text2,text3,...)

**TIP:** The & sign can be used to join cells together instead of using the Concatenate function! i.e. =A1&B1

**TIP:** To add spaces to items you join together put them in quotes. i.e. =concatenate(A1,” “,B2) OR =A1&” “&B1
The VLookup Function

The VLookup function provides the ability to look for a specific value in a separate table and then return information from that same row. In the example below we can use it to look up the grade a student should receive in the class by comparing their class score to the grade scheme and returning the corresponding letter grade.

Syntax: =VLOOKUP(lookup_value,table_array,col_index_num,range_lookup)

**TIP:** The lookup value must ALWAYS be searched for in the first column of your table array when using the VLookup function!

**TIP:** The last variable in the Vlookup function allows you to either return an exact match (when using False) or an approximate match (when using True). In the example above if I had another table that contained the Employee Last name and wanted to use a Vlookup to bring that information onto this sheet I would use false as the last variable to ensure a correct match!