Excel can be used to find totals for column or row numbers, calculate a mortgage payment, solve engineering or math problems and much more. There are several ways to enter formulas and calculate numbers in Excel.

**Five ways to enter formulas**

1. Manually enter Excel formulas
2. Click the Insert function Button
3. Select a function from a group in the Formula’s tab
4. The Recently Used button
5. Auto functions under the AutoSum Button

**The basics of Excel formulas**

**ALL** formulas begin with **Equals symbol (=)**

**Defining key terms of formulas will be helpful when working with formulas.**

**Formula** is an expression that calculates the value of a cell. (IF, SUM, COUNT, AVERAGE, etc)

**Function** is a predefined formula already available in Excel. Functions perform specific calculations in a particular order based on the specified values, called **arguments**, or parameters

**Arguments** A function's arguments refer to all the data or information required by a function. These arguments must be entered in the correct order.

**Syntax** refers to the layout and order of the functions and its arguments.

**Parenthesis and Commas** In addition to the order of arguments, the term "syntax" also refers to the placement of round brackets or parenthesis surrounding the arguments and to the use of the comma as a separator between the individual arguments.

**READING THE IF FUNCTION'S SYNTAX**

If a function in Excel normally has three arguments arranged in the following order:

1. Logical_test argument
2. Value_if_true argument
3. Value_if_false argument

*If the arguments are placed in a different order, the function returns an error message or gives you an answer you were not expecting.*
Basic Formulas

**SUM** basic arithmetic operation of addition:

\[ \text{SUM}(\text{number1}, [\text{Number 2}], ...) \]

In the syntax of all Excel functions, an argument enclosed in [square brackets] is optional, other arguments are required. Meaning, your Sum formula should include at least 1 number, reference to a cell or a range of cells.

For example:

\[ =\text{SUM}(A2:A6) \]

adds up values in cells A2 through A6

\[ =\text{SUM}(A2, A6) \]

adds up values in cell A2 and A6

\[ =\text{SUM}(A2:A6)/5 \]

adds up values in cells A2 through A6 and then divides the sum by 5.

**AVERAGE** finds the average of numbers

\[ \text{AVERAGE} (\text{number 1}, [\text{number2}], ...) \]

\[ =\text{AVERAGE} (A2:A6) \]

**MAX & MIN**

The MAX and MIN formulas get the largest and smallest values in a set of numbers.

\[ =\text{MAX} (A2:A6) \]

\[ =\text{MIN} (A2:A6) \]

**COUNT & COUNTA**

To calculate how many cells are in a given range contain numeric values (numbers or dates), you would use the COUNT function.

\[ \text{COUNT} (\text{value1}, [\text{value2}], ...) \]

While the COUNT function deals only with those cells that contain numbers, the Excel COUNTA function counts all cells that are not blank, whether they contain numbers, dates, times, text, logical values of TRUE and FALSE, errors or empty text strings (""):

\[ \text{COUNTA} (\text{value1}, [\text{value2}], ...) \]
**IF**

An IF formula ask Excel to test a certain condition and return one value or perform one calculation if the condition is met, and another value or calculation if the condition is not met:

\[
\text{IF (logical\_test, [value\_if\_true], [value\_if\_false])}
\]

\[
=\text{IF (A2}>=3, "OK", "Not OK")
\]

**TRIM**

If you have checked your formula and are certain it is correct and it returns errors, check for extra spaces in each cell reference. The TRIM function is an easy way to detect extra space.

\[
=\text{TRIM(A2)}
\]

**V-Lookup & H-Lookup Functions**

The VLOOKUP function performs a *vertical lookup* by searching for a value in the first column of a *table* and returning the value in the same row in the *index\_number* position.

The HLOOKUP function performs a *horizontal lookup* by searching for a value in the top row of the *table* and returning the value in the same column based on the *index\_number*.

The LOOKUP returns a value from a range (one row or one column) or from an array.

\[
\text{LOOKUP(value, lookup\_range, [result\_range])}
\]

*value* the value to search for in the *lookup\_range*

*lookup\_range* A single row or single column of data that is sorted in ascending order.

*result\_range* Optional. It is a single row or single column of data that is the same size as the *lookup\_range*. The LOOKUP function searches for the value in the *lookup\_range* and returns the value from the same position in the *result\_range*. If this parameter is omitted, it will return the first column of data.

**Returns**

The LOOKUP function returns any datatype such as a string, numeric, date, etc.

If the LOOKUP function can not find an exact match, it chooses the largest value in the *lookup\_range* that is less than or equal to the *value*.

If the *value* is smaller than all of the values in the *lookup\_range*, then the LOOKUP function will return #N/A.

If the values in the *LOOKUP\_range* are not sorted in ascending order, the LOOKUP function will return the incorrect value.
V-Lookup & H-Lookup Examples

In either lookup function, you can look for an **exact match** or an **approximate match**.

Example: VLook-up for approximate match

You use the data provided to find the tax rate based on the salaries given.

1. Click in cell D2 type 
   \=VLOOKUP to begin the formula
2. Select C2 and type a “,” (**this is the first salary you will figure.**)
3. Select column “G and H” and type a “,” (**this is the table the Vlookup will use to generate the tax rate. By selecting the entire column, these two columns become absolute references. SGS1:$HS13 meaning it will ONLY look at these two columns every time to find the value.**)
4. Type “2” and close parentheses. (**Typing 2 makes excel look at the second column of the table to find the answer**)
5. Use the “Fill Hand to copy the formula to the rest of the rows.

<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>H</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>25,000</td>
<td>2%</td>
</tr>
<tr>
<td>35,000</td>
<td>3%</td>
</tr>
<tr>
<td>45,000</td>
<td>4%</td>
</tr>
<tr>
<td>55,000</td>
<td>5%</td>
</tr>
<tr>
<td>65,000</td>
<td>6%</td>
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<tr>
<td>75,000</td>
<td>7%</td>
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<td>85,000</td>
<td>8%</td>
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<td>95,000</td>
<td>9%</td>
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<td>105,000</td>
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<td>115,000</td>
<td>11%</td>
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<tr>
<td>125,000</td>
<td>12%</td>
</tr>
<tr>
<td>135,000</td>
<td>13%</td>
</tr>
</tbody>
</table>

**Function**

\=VLOOKUP(C2,$G$1:$H$13,2)

**Function**: the formula used

**Lookup_value**: the number the answer is based on

**Table Array**: location of the data used to generate answer

**Col_index_number**: the column in the table array the answer is pulled from

### COUNTIF

The COUNTIF function is used for counting cells within a specified range that meet a certain criterion, or condition.

The Syntax:

\=COUNTIF(range, criteria)

- **range**– defines one or several cells to count. (e.g. B1:B20)
- **criteria**—defines the condition that tells the function which cells to count. It can be a number, text sting, cell reference or expression.

COUNTIF examples on next page...
COUNTIF Example

This example will show you how to determine how many employees listed are Full Time, Half-Time, Contract or Hourly workers.

1. **Choose the cell** you want the answer to appear
2. **Type** =COUNTIF(F:F, L2)

This function looks in Column F and counts how many cells have “Full Time”. Use the fill handle to copy the formula to the following rows to determine the “Half-time”, “Contract” and “Hourly” workers.

SUMIF Example

The **SUMIF function** is a function that adds all numbers in a range of cells based on one criteria.

In the worksheet of 2016 Sales Report you want to know what the Total Prior Year’s Sales were based on region.

1. **Click** in Cell H:6 and **type** =SUMIF (the function should pop-up from a list, you can select)
2. You can click on the “insert function button” to open the Function Argument box. (see image below)
3. In the Range box **Click cell B5**, use shift+Ctrl+ the down arrow to select the entire column.
4. In the Criteria box **Click cell B5**(this tells the function to look for cells containing the word “East”)
5. In the Sum-range box **Click cell C5**, use shift+Ctrl+ the down arrow to select the entire column. (**this tells function to add all the values in Column C that are associated with the word “East”**)
AverageIF Example

**AVERAGEIF function** returns the average (arithmetic mean) of all numbers in a range of cells, based on a given criteria.

Syntax: =AVERAGEIF(range, criteria, [average_range])

Parameters or Arguments

Range— the range of cells that you want to apply the criteria against.
Criteria— the criteria to determine which cells to average.
Average-range— Optional. It is the cells to average. If average_range is omitted, it uses range as the value for this parameter.

Example: from the data below we will find the average salary for employees working in the West Building and the Main Building.

1. Choose the cell where you want the answer to appear.
   **Type** the formula

2. Click enter.

<table>
<thead>
<tr>
<th>Function</th>
<th>Range of Buildings</th>
<th>Building</th>
<th>Salaries</th>
</tr>
</thead>
<tbody>
<tr>
<td>=AVERAGEIF(B:B, B2, H:H)</td>
<td>West</td>
<td>$</td>
<td>60,070.77</td>
</tr>
<tr>
<td>=AVERAGEIF(B:B12, H:H)</td>
<td>Main</td>
<td>$</td>
<td>67,078.16</td>
</tr>
</tbody>
</table>

Relative and Absolute Reference

Every cell has a cell address and is an identifier (**cell reference**) that distinguishes the particular cell from any other cell. The cell address also denotes the column and row in which it sits. The name of the cell can be found in the **name box**, which is located above Column A.

By default a cell reference is **relative**. For example if you refer to cell A2 from cell C2 you are referring to a cell that is two columns to the left and in the same row. A formula that contains a **relative cell reference changes** as you copy it from one cell to another.

**Example:** if you copy the formula =A2+B2 from cell C2 to D2, the formula adjusts to the right by one column and becomes =B2 + C2.

If you want to maintain the original cell reference in this example when you copy it, you make the cell you make the cell reference **absolute** (**which means is consistently refers to a particular cell**). To make a cell absolute you must precede the columns (A and B) and row (2) with a dollar sign ($). When you copy the formula =$A$2 + $B$2 from C2 to D2, the formula stays exactly the same.
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