



Excel Formulas and Functions

Overview of formulas in Excel

Create a formula that refers to values in other cells

1. Select a cell.
2. Type the equal sign =.

Note: Formulas in Excel always begin with the equal sign.

3. Select a cell or type its address in the selected cell.

	Jan
Sale	120
Overhead	100
Profit	=B2

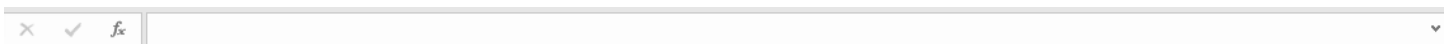
4. Enter an operator. For example, – for subtraction.
5. Select the next cell, or type its address in the selected cell.

120
100
=B2-B3

6. Press Enter. The result of the calculation appears in the cell with the formula.

See a formula

1. When a formula is entered into a cell, it also appears in the **Formula bar**.



2. To see a formula, select a cell, and it will appear in the formula bar.



Enter a formula that contains a built-in function

1. Select an empty cell.
2. Type an equal sign = and then type a function. For example, =SUM for getting the total sales.
3. Type an opening parenthesis (.
4. Select the range of cells, and then type a closing parenthesis).

	Jan	Feb	Mar	Apr	May	Jun	Total
Sales	100	200	250	150	300	500	=SUM(B2:G2)

5. Press Enter to get the result.



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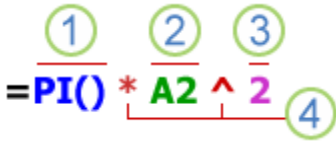
Formulas in-depth

You can browse through the individual sections below to learn more about specific formula elements.

The parts of an Excel formula

A formula can also contain any or all of the following: **functions**, **references**, **operators**, and **constants**.

Parts of a formula



1. **Functions:** The [PI\(\) function](#) returns the value of pi: 3.142...
2. **References:** A2 returns the value in cell A2.
3. **Constants:** Numbers or text values entered directly into a formula, such as 2.
4. **Operators:** The ^ (caret) operator raises a number to a power, and the * (asterisk) operator multiplies numbers.

Using constants in Excel formulas

A constant is a value that is not calculated; it always stays the same. For example, the date 10/9/2008, the number 210, and the text "Quarterly Earnings" are all constants. An expression or a value resulting from an expression is not a constant. If you use constants in a formula instead of references to cells (for example, =30+70+110), the result changes only if you modify the formula. In general, it's best to place constants in individual cells where they can be easily changed if needed, then reference those cells in formulas.

Using references in Excel formulas

A reference identifies a cell or a range of cells on a worksheet, and tells Excel where to look for the values or data you want to use in a formula. You can use references to use data contained in different parts of a worksheet in one formula or use the value from one cell in several formulas. You can also refer to cells on other sheets in the same workbook, and to other workbooks. References to cells in other workbooks are called links or external references.

- **The A1 reference style**

By default, Excel uses the A1 reference style, which refers to columns with letters (A through XFD, for a total of 16,384 columns) and refers to rows with numbers (1 through 1,048,576). These letters and numbers are called row and column headings. To refer to a cell, enter the column letter followed by the row number. For example, B2 refers to the cell at the intersection of column B and row 2.

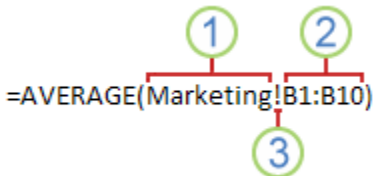


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To refer to	Use
The cell in column A and row 10	A10
The range of cells in column A and rows 10 through 20	A10:A20
The range of cells in row 15 and columns B through E	B15:E15
All cells in row 5	5:5
All cells in rows 5 through 10	5:10
All cells in column H	H:H
All cells in columns H through J	H:J
The range of cells in columns A through E and rows 10 through 20	A10:E20

- **Making a reference to a cell or a range of cells on another worksheet in the same workbook**

In the following example, the [AVERAGE function](#) calculates the average value for the range B1:B10 on the worksheet named Marketing in the same workbook.



 =AVERAGE(Marketing!B1:B10)

1. Refers to the worksheet named Marketing
2. Refers to the range of cells from B1 to B10
3. The exclamation point (!) Separates the worksheet reference from the cell range reference

Note: If the referenced worksheet has spaces or numbers in it, then you need to add apostrophes (') before and after the worksheet name, like ='123!A1 or ='January Revenue!A1.



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Create a simple formula in Excel

You can create a simple formula to add, subtract, multiply or divide values in your worksheet. Simple formulas always start with an equal sign (=), followed by constants that are numeric values and calculation operators such as plus (+), minus (-), asterisk(*), or forward slash (/) signs.

Let's take an example of a simple formula.

1. On the worksheet, click the cell in which you want to enter the formula.
2. Type the = (equal sign) followed by the constants and operators (up to 8192 characters) that you want to use in the calculation.

For our example, type **=1+1**.

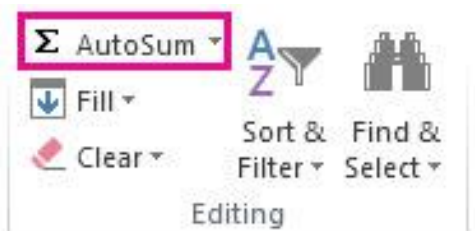
Notes:

- Instead of typing the constants into your formula, you can select the cells that contain the values that you want to use and enter the operators in between selecting cells.
 - Following the standard order of mathematical operations, multiplication and division is performed before addition and subtraction.
3. Press **Enter** (Windows) or **Return** (Mac).


Let's take another variation of a simple formula. Type **=5+2*3** in another cell and press **Enter** or **Return**. Excel multiplies the last two numbers and adds the first number to the result.

Use AutoSum

You can use AutoSum to quickly sum a column or row of numbers. Select a cell next to the numbers you want to sum, click **AutoSum** on the **Home** tab, press **Enter** (Windows) or **Return** (Mac), and that's it!



When you click **AutoSum**, Excel automatically enters a formula (that uses the [SUM function](#)) to sum the numbers.

Note: You can also type ALT+= (Windows) or ALT+  += (Mac) into a cell, and Excel automatically inserts the SUM function.



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Here's an example. To add the January numbers in this Entertainment budget, select cell B7, the cell immediately below the column of numbers. Then click **AutoSum**. A formula appears in cell B7, and Excel highlights the cells you're totaling.

		SUM			
		X	✓	fx	=SUM(B3:B6)
	A	B	C	D	
1		Jan	Feb		
2	Entertainment				
3	Cable TV	52.98	52.98		
4	Video rentals	7.98	11.97		
5	Movies	16.00	32.00		
6	CDs	18.98	29.99		
7	Totals	=SUM(B3:B6)			

Press Enter to display the result (95.94) in cell B7. You can also see the formula in the formula bar at the top of the Excel window.

		B7			
		X	✓	fx	=SUM(B3:B6)
	A	B	C	D	
1		Jan	Feb		
2	Entertainment				
3	Cable TV	52.98	52.98		
4	Video rentals	7.98	11.97		
5	Movies	16.00	32.00		
6	CDs	18.98	29.99		
7	Totals	95.94			

Notes:

- To sum a column of numbers, select the cell immediately below the last number in the column. To sum a row of numbers, select the cell immediately to the right.
- Once you create a formula, you can copy it to other cells instead of typing it over and over. For example, if you copy the formula in cell B7 to cell C7, the formula in C7 automatically adjusts to the new location, and calculates the numbers in C3:C6.
- You can also use AutoSum on more than one cell at a time. For example, you could highlight both cell B7 and C7, click **AutoSum**, and total both columns at the same time.



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Move or copy a formula

It's important to be aware of the possibilities for how a relative cell reference might change when you move or copy a formula.

- **Moving a formula:** When you move a formula, the cell references within the formula do not change no matter what type of cell reference that you use.
- **Copying a formula:** When you copy a formula, relative cell references will change.

Move a formula

1. Select the cell that contains the formula that you want to move.
2. In the **Clipboard** group of the **Home** tab, click **Cut**.


You can also move formulas by dragging the border of the selected cell to the upper-left cell of the paste area. This will replace any existing data.

3. Do one of the following:
 - **To paste the formula and any formatting:** In the **Clipboard** group of the **Home** tab, click **Paste**.
 - **To paste the formula only:** In the **Clipboard** group of the **Home** tab, click **Paste**, click **Paste Special**, and then click **Formulas**.

Copy a formula

1. Select the cell containing the formula that you want to copy.
2. In the **Clipboard** group of the **Home** tab, click **Copy**.
3. Do one of the following:
 - To paste the formula and any formatting, in the **Clipboard** group of the **Home** tab, click **Paste**.
 - To paste the formula only, in the **Clipboard** group of the **Home** tab, click **Paste**, click **Paste Special**, and then click **Formulas**.

Note: You can paste only the formula results. In the **Clipboard** group of the **Home** tab, click **Paste**, click **Paste Special**, and then click **Values**.

4. Verify that the cell references in the formula produce the result that you want. If necessary, switch the type of reference by doing the following:
 - a. Select the cell that contains the formula.
 - b. In the formula bar  , select the reference that you want to change.
 - c. Press F4 to switch between the combinations.



Excel Formulas and Functions

Functions

SUM function

The SUM function adds values. You can add individual values, cell references or ranges or a mix of all three.

For example:

- =SUM(A2:A10) Adds the values in cells A2:10.
- =SUM(A2:A10, C2:C10) Adds the values in cells A2:10, as well as cells C2:C10.

[Click to watch the "SUM function" video.](#)

AVERAGE function

Returns the average (arithmetic mean) of the arguments. For example, if the range A1:A20 contains numbers, the formula =AVERAGE(A1:A20) returns the average of those numbers.

MAX function

Returns the largest value in a set of values.

The formula =MAX(A2:A6) returns the largest value in the range A2:A6.

MIN function

Returns the smallest number in a set of values.

The formula =MIN(A2:A6) returns the smallest of the numbers in the range A2:A6.

[Click here to see a list of all available functions](#)



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Logical functions

IF function

The IF function is one of the most popular functions in Excel, and it allows you to make logical comparisons between a value and what you expect.

So an IF statement can have two results. The first result is if your comparison is True, the second if your comparison is False.

For example, =IF(C2="Yes",1,2) says IF(C2 = Yes, then return a 1, otherwise return a 2).

[Click to watch the "IF function" video.](#)

AND function

Use the **AND** function, one of the [logical functions](#), to determine if all conditions in a test are TRUE.

Here are some general examples of using **AND** by itself, and in conjunction with the **IF** function.

	A	B	C	D	E
1	Values				
2	50				
3	100				
4					
5	Formula	Result			Result
6	=AND(A2>1,A2<100)				TRUE
7	=IF(AND(A2<A3,A2<100),A2,"The value is out of range")				50
8	=IF(AND(A3>1,A3<100),A3,"The value is out of range")				The value is out of range

Formula	Description
=AND(A2>1,A2<100)	Displays TRUE if A2 is greater than 1 AND less than 100, otherwise it displays FALSE.
=IF(AND(A2<A3,A2<100),A2,"The value is out of range")	Displays the value in cell A2 if it's less than A3 AND less than 100, otherwise it displays the message "The value is out of range".
=IF(AND(A3>1,A3<100),A3,"The value is out of range")	Displays the value in cell A3 if it is greater than 1 AND less than 100, otherwise it displays a message. You can substitute any message of your choice.



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OR function

Use the **OR** function, one of the [logical functions](#), to determine if any conditions in a test are TRUE. Here are some general examples of using **OR** by itself, and in conjunction with **IF**.

	A	B	C	D	E
1	Values				
2	50				
3	100				
4					
5	Formula	Result			Result
6	=OR(A2>1,A2<100)				TRUE
7	=IF(OR(A2>1,A2<100),A3,"The value is out of range")				100
8	=IF(OR(A2<0,A2>50),A2,"The value is out of range")				The value is out of range

Formula	Description
=OR(A2>1,A2<100)	Displays TRUE if A2 is greater than 1 OR less than 100, otherwise it displays FALSE.
=IF(OR(A2>1,A2<100),A3,"The value is out of range")	Displays the value in cell A3 if it is greater than 1 OR less than 100, otherwise it displays the message "The value is out of range".
=IF(OR(A2<0,A2>50),A2,"The value is out of range")	Displays the value in cell A2 if it's less than 0 OR greater than 50, otherwise it displays a message.

NOT function

Use the **NOT** function, one of the [logical functions](#), when you want to make sure one value is not equal to another. Here are some general examples of using **NOT** by itself, and in conjunction with **IF**, **AND** and **OR**.

	A	B	C	D	E
1	Values				
2	50				
3	100				
4					
5	Formula	Result			Result
6	=NOT(A2>100)				TRUE
7	=IF(AND(NOT(A2>1),NOT(A2<100)),A2,"The value is out of range")				The value is out of range
8	=IF(OR(NOT(A3<0),NOT(A3>50)),A3,"The value is out of range")				100

Formula	Description
=NOT(A2>100)	A2 is NOT greater than 100
=IF(AND(NOT(A2>1),NOT(A2<100)),A2,"The value is out of range")	50 is greater than 1 (TRUE), AND 50 is less than 100 (TRUE), so NOT reverses both arguments to FALSE. AND requires both arguments to be TRUE, so it returns the result if FALSE.
=IF(OR(NOT(A3<0),NOT(A3>50)),A3,"The value is out of range")	100 is not less than 0 (FALSE), and 100 is greater than 50 (TRUE), so NOT reverses the arguments to TRUE/FALSE. OR only requires one argument to be TRUE, so it returns the result if TRUE.

[Click here to see the full list of logical functions.](#)



Excel Formulas and Functions

Reference formulas

Lookup a value with VLOOKUP

Use VLOOKUP when you need to find things in a table or a range by row. For example, look up a price of an automotive part by the part number, or find an employee name based on their employee ID.

In its simplest form, the VLOOKUP function says:

=VLOOKUP(What you want to look up, where you want to look for it, the column number in the range containing the value to return, return an Approximate or Exact match – indicated as 1/TRUE, or 0/FALSE).

There are four pieces of information that you will need in order to build the VLOOKUP syntax:

1. The value you want to look up, also called the lookup value.
2. The range where the lookup value is located. Remember that the lookup value should always be in the first column in the range for VLOOKUP to work correctly. For example, if your lookup value is in cell C2 then your range should start with C.
3. The column number in the range that contains the return value. For example, if you specify B2:D11 as the range, you should count B as the first column, C as the second, and so on.
4. Optionally, you can specify TRUE if you want an approximate match or FALSE if you want an exact match of the return value. If you don't specify anything, the default value will always be TRUE or approximate match.

Now put all of the above together as follows:

=VLOOKUP(lookup value, range containing the lookup value, the column number in the range containing the return value, Approximate match (TRUE) or Exact match (FALSE)).

Example 1 & 2

	A	B	C	D	E
1	ID	Last name	First name	Title	Birth date
2	101	Davis	Sara	Sales Rep	12/08/68
3	102	Fontana	Olivier	VP (Sales)	02/19/52
4	103	Leal	Karina	Sales Rep	08/30/63
5	104	Patten	Michael	Sales Rep	09/19/58
6	105	Burke	Brian	Sales Manager	03/04/55
7	106	Sousa	Luis	Sales Rep	07/02/63
8					
9					
10	Formula	=VLOOKUP(B3,B2:E7,2,FALSE)			
11	Result	Olivier			
12					

VLOOKUP looks for *Fontana* in the first column (column B) in table_array B2:E7, and returns *Olivier* from the second column (column C) of the table_array. FALSE returns an exact match.

	A	B	C	D	E
1	ID	Last name	First name	Title	Birth date
2	101	Davis	Sara	Sales Rep	12/08/68
3	102	Fontana	Olivier	VP (Sales)	02/19/52
4	103	Leal	Karina	Sales Rep	08/30/63
5	104	Patten	Michael	Sales Rep	09/19/58
6	105	Burke	Brian	Sales Manager	03/04/55
7	106	Sousa	Luis	Sales Rep	07/02/63
8					
9					
10	Formula	=VLOOKUP(102,A2:C7,2,FALSE)			
11	Result	Fontana			
12					

VLOOKUP looks for an exact match (FALSE) of the last name for 102 (lookup_value) in the second column (column B) in the A2:C7 range, and returns *Fontana*.



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Lookup a value with HLOOKUP

Searches for a value in the top row of a table or an array of values, and then returns a value in the same column from a row you specify in the table or array. Use HLOOKUP when your comparison values are located in a row across the top of a table of data, and you want to look down a specified number of rows. Use VLOOKUP when your comparison values are located in a column to the left of the data you want to find.

The H in HLOOKUP stands for "Horizontal."

HLOOKUP(lookup_value, table_array, row_index_num, [range_lookup])

The HLOOKUP function syntax has the following arguments:

- **Lookup_value** Required. The value to be found in the first row of the table. Lookup_value can be a value, a reference, or a text string.
- **Table_array** Required. A table of information in which data is looked up. Use a reference to a range or a range name.
 - The values in the first row of table_array can be text, numbers, or logical values.
 - If range_lookup is TRUE, the values in the first row of table_array must be placed in ascending order: ... -2, -1, 0, 1, 2,... , A-Z, FALSE, TRUE; otherwise, HLOOKUP may not give the correct value. If range_lookup is FALSE, table_array does not need to be sorted.
 - Uppercase and lowercase text are equivalent.
 - Sort the values in ascending order, left to right. For more information, see [Sort data in a range or table](#).
- **Row_index_num** Required. The row number in table_array from which the matching value will be returned. A row_index_num of 1 returns the first row value in table_array, a row_index_num of 2 returns the second row value in table_array, and so on. If row_index_num is less than 1, HLOOKUP returns the #VALUE! error value; if row_index_num is greater than the number of rows on table_array, HLOOKUP returns the #REF! error value.
- **Range_lookup** Optional. A logical value that specifies whether you want HLOOKUP to find an exact match or an approximate match. If TRUE or omitted, an approximate match is returned. In other words, if an exact match is not found, the next largest value that is less than lookup_value is returned. If FALSE, HLOOKUP will find an exact match. If one is not found, the error value #N/A is returned.

Axles	Bearings	Bolts
4	4	9
5	7	10
6	8	11
Formula	Description	Result
=HLOOKUP("Axles", A1:C4, 2, TRUE)	Looks up "Axles" in row 1, and returns the value from row 2 that's in the same column (column A).	4
=HLOOKUP("Bearings", A1:C4, 3, FALSE)	Looks up "Bearings" in row 1, and returns the value from row 3 that's in the same column (column B).	7
=HLOOKUP("B", A1:C4, 3, TRUE)	Looks up "B" in row 1, and returns the value from row 3 that's in the same column. Because an exact match for "B" is not found, the largest value in row 1 that is less than "B" is used: "Axles," in column A.	5

[Click here to see the All Lookup and Reference Functions.](#)

For more information, please refer to the Microsoft training resource page [HERE](#)