

# Creating Basic Excel Formulas

Formulas are equations that perform calculations on values in your worksheet. Depending on how you build a formula in Excel will determine if the answer to your formula automatically updates, as changes are made. A formula starts with an equal sign (=) and can contain any or all of the following:

**Function:** A function is a prewritten formula that takes a value or values, performs an operation, and returns a value or values. Use functions to simplify and shorten formulas on a worksheet, especially those that perform lengthy or complex calculations.

A Function is generally comprised of two components:

- 1) A function name
  - a) The name of a function indicates the type of math Excel will perform.
- 2) An argument
  - a) An “argument” is the values that a function uses to perform operations or calculations. The type of argument a function uses is specific to the function. Common arguments that are used within functions include numbers, text, cell references, and names

**References:** two types:

- 1) *Relative reference:* In a formula, the address of a cell based on the relative position of the cell that contains the formula and the cell referred to. If you copy the formula, the reference automatically adjusts. A relative reference takes the form A1.
- 2) *Absolute cell reference:* In a formula, the exact address of a cell, regardless of the position of the cell that contains the formula. An absolute cell reference takes the form \$A\$1.

**Operator:** A sign or symbol that specifies the type of calculation to perform within an expression. There are mathematical, comparison, logical, and reference operators.

**Constant:** A value that is not calculated and, therefore, does not change. For example, the number 210, and the text "Quarterly Earnings" are constants.

## Calculation operators and precedence

Operators specify the type of calculation that you want to perform on the elements of a formula. There is a default order in which calculations occur, but you can change this order by using parentheses.

## Types of operators

There are four different types of calculation operators: arithmetic, comparison, text concatenation, and reference.

### Arithmetic operators

To perform basic mathematical operations such as addition, subtraction, or multiplication; combine numbers; and produce numeric results, use the following arithmetic operators.

Arithmetic operator	Meaning	Example
+ (plus sign)	Addition	3+3
- (minus sign)	Subtraction Negation	3-1 -1
* (asterisk)	Multiplication	3*3
/ (forward slash)	Division	3/3
% (percent sign)	Percent	20%
^ (caret)	Exponentiation	3^2

### Comparison operators

You can compare two values with the following operators. When two values are compared by using these operators, the result is a logical value either TRUE or FALSE.

Comparison operator	Meaning	Example
= (equal sign)	Equal to	A1=B1
> (greater than sign)	Greater than	A1>B1
< (less than sign)	Less than	A1<B1
>= (greater than or equal to sign)	Greater than or equal to	A1>=B1
<= (less than or equal to sign)	Less than or equal to	A1<=B1
<> (not equal to sign)	Not equal to	A1<>B1

## Text concatenation operator

Use the ampersand (&) to join, or concatenate, one or more text strings to produce a single piece of text.

Text operator	Meaning	Example
& (ampersand)	Connects, or concatenates, two values to produce one continuous text value	("North"&"wind")

## Reference operators

Combine ranges of cells for calculations with the following operators.

Reference operator	Meaning	Example
: (colon)	Range operator, which produces one reference to all the cells between two references, including the two references	B5:B15
, (comma)	Union operator, which combines multiple references into one reference	SUM(B5:B15,D5:D15)

## The order in which Excel performs operations in formulas

In some cases, the order in which a calculation is performed can affect the return value of the formula, so it's important to understand how the order is determined and how you can change the order to obtain desired results.

### Calculation order

Formulas calculate values in a specific order. A formula in Excel always begins with an equal sign (=). The equal sign tells Excel that the succeeding characters constitute a formula. Following the equal sign are the elements to be calculated (the operands), which are separated by calculation operators. Excel calculates the formula from left to right, according to a specific order for each operator in the formula.

## Operator precedence

If you combine several operators in a single formula, Excel performs the operations in a specific order. If a formula contains operators with the same precedence — for example, if a formula contains both a multiplication and division operator — Excel evaluates the operators from left to right.

To keep things simple, the “Order of Operations” in a basic Excel formula is as follows:

- 1) **Parenthesis**
- 2) **Exponents**
- 3) **Multiplication or Division** – if both operators appear in the same formula, Excel evaluates the operators from left to right.
- 4) **Addition or Subtraction** – if both operators appear in the same formula, Excel evaluates the operators from left to right.

Tip: To recall the order of operations, try remembering:

**Please Excuse My Dear Aunt Sally.**

To change the order of evaluation, enclose in parentheses the part of the formula to be calculated first.

For example, the following formula produces 11 because Excel calculates multiplication before addition. The formula multiplies 2 by 3 and then adds 5 to the result.	<b>=5+2*3</b>
In contrast, if you use parentheses to change the syntax, Excel adds 5 and 2 together and then multiplies the result by 3 to produce 21.	<b>=(5+2)*3</b>

## Create a simple formula with constants and calculation operators

- 1) Click the cell in which you want to enter the formula.
- 2) Type = (an equal sign).
- 3) Enter the formula.

(Example1)	<b>=128+345</b> (adds those two numbers together)
(Example2)	<b>=(10+20+30)/3</b> (first add the contents of the parentheses, then divide the result of the parentheses by the number 3)

- 4) Press ENTER.

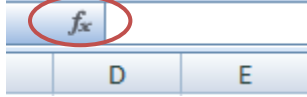
## Create a function manually:

- 1) Click the cell in which you want to enter the formula.
- 2) Type = (an equal sign).
- 3) Type the function name (function names are not case sensitive, they are spelling sensitive:  
ex. - SUM, AVERAGE, MAX).
- 4) Type ( (an open parenthesis).
- 5) Type the argument.
  - a) Remember to use a colon to included cells that are adjacent to each other; use a comma to include nonadjacent cells.
- 6) Type ) (a closing parenthesis).
- 7) Press ENTER.

Example1:	=SUM(100,200,300)	Adds the numbers: 100+200+300
Example2:	= SUM(A12:C12)	Adds the cells A12 through C12, including A12 and C12
Example3:	=SUM(A12,A13,C12)	Adds only the cells A12+A13+C12
Example4	=SUM(A12:C12,A13)	Adds the cells A12 through C12, and A13

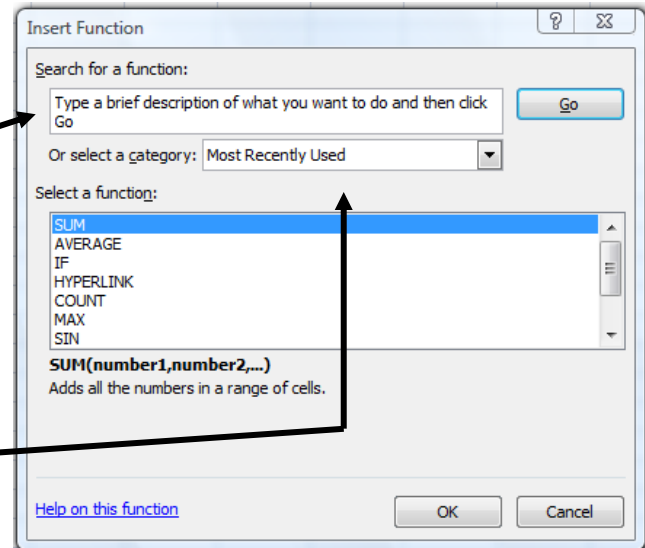
## Use the Insert Function dialog box to create a function:

- 1) Click the cell in which you want to enter the formula.
- 2) To start the formula, click the **Insert Function** command on the formula bar:





- 3) The Insert Function dialog box opens. Select the function you want to use and click **OK**.

- a) You can enter a question that describes what you want to do in the “Search for a function” box (for example, "add numbers" returns the SUM function).
- b) Or browse from the categories in the “Or select a category” box.

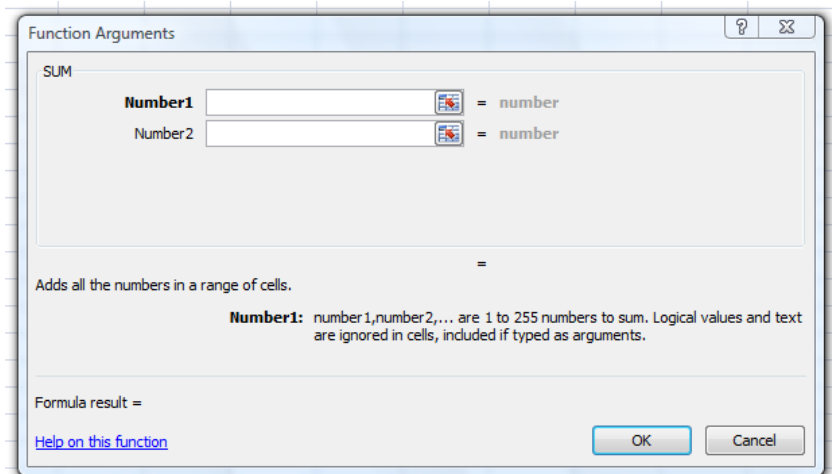


- 4) The Function Arguments dialog box opens.

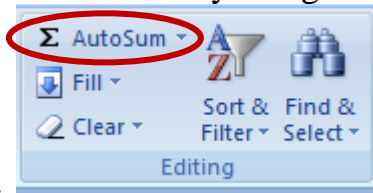
- 5) Enter the arguments.

- a) To enter cell references as an argument, at the end of the argument field, click Collapse Dialog  (which temporarily hides the dialog box), select the cells on the worksheet, and then press Expand Dialog .
- b) You can also manually enter the cell references.

- 6) When you complete the formula, press ENTER, or **OK**.



You can also sum numbers by using the **AutoSum** button, found on the **Home** tab, in the



**Editing** group.

### **One way to use the AutoSum button:**

- 1) Select the cell to contain the formula.
- 2) Click the AutoSum button.
  - a) If Excel finds numbers above the selected cell, it will assume a sum above.
  - b) If Excel does not find numbers above the selected cell, it will assume a sum left.

### **If the cells to be summed up are missing values:**

- 1) Select all the cells to be summed.
- 2) Click the AutoSum button.
  - a) As numbers are filled into the empty cells, the formula will update to include those figures.

### **Copy a formula**

If you are doing the exact same math in adjacent cells, using the same number of adjacent columns and rows, use the fill handle to copy the formula. The fill handle is the small black square in the lower-right corner of the selection. When you point to the fill handle, the pointer changes to a black cross.

You can also copy and paste a formula from one cell to another. If you were using relative references, the formula automatically adjusts.

## Fill formulas into adjacent cells

- 1) Select the cell that contains the formula that you want to fill into adjacent cells.
- 2) Drag the fill handle across the cells that you want to fill.

a) The formula has been displayed in the answer cell for this example. Normally you will only see the answer to the formula.


The goal is to copy the formula “=SUM(B2:B7)” to the next cell.

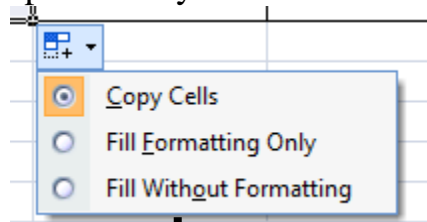
b) The next cell contains the exact same number of cells you are trying to add up.

c) By dragging the fill handle, you can easily copy a formula from one cell to another. When you point to the fill handle, the pointer changes to a black cross.

B	C
<b># of Students Semester 1</b>	<b># of Students Semester 2</b>
17	18
22	20
15	21
25	25
15	18
=SUM(B2:B7)	

- 3) After dragging, the reference automatically adjusts.

a) If necessary, choose how you want to fill the selection, click Auto Fill Options , and then click the option that you want.



B	C	
<b># of Students Semester 1</b>	<b># of Students Semester 2</b>	
17	18	20
22	20	21
15	21	22
25	25	15
15	18	20
=SUM(B2:B7)	=SUM(C2:C7)	

## Delete a formula

- 1) Click the cell that contains the formula.
- 2) Press DELETE.



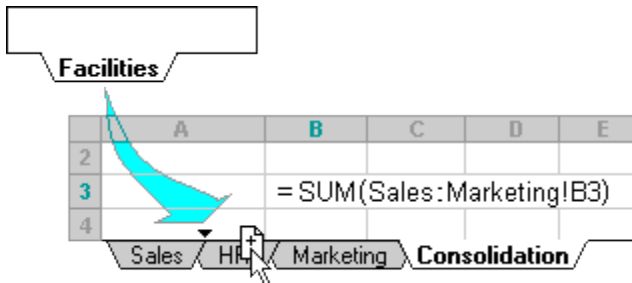
## Create a 3-D reference to the same cell range on multiple worksheets

A reference that refers to the same cell or range of cells on multiple sheets is called a 3-D reference. A 3-D reference is a useful and convenient way to reference several worksheets that follow the same pattern and cells on each worksheet containing the same type of data, such as when you consolidate budget data from different departments in your organization.

For example: you can use a 3-D reference to add up budget allocations between three departments, Sales, HR, and Marketing, each on a different worksheet, by using the following 3-D reference:

`=SUM(Sales:Marketing!B3)`

You can even add another worksheet, and then move it into the range that your formula refers to. For example, to add a reference to cell B3 in the Facilities worksheet, move the Facilities worksheet between the Sales and HR worksheets as shown in the following example.



Because your formula contains a 3-D reference to a range of worksheet names, `Sales:Marketing!B3`, all worksheets in the range are included in the new calculation.

Using the formula: `=SUM(Sheet2:Sheet6!A2:A5)`, the following examples explain what happens when you insert, copy, delete, or move worksheets that are included in a 3-D reference.

First, let's break down the formula: `=SUM(Sheet2:Sheet6!A2:A5)`

- 1) `=SUM`
  - a) Type of math you are doing
- 2) `(Sheet2:Sheet6!B3)`
  - a) This is the argument (enclosed in parentheses).
    - i) "Sheet2" is the name of the first worksheet in the range to be summed.
    - ii) The colon `:` indicates that the sheets are adjacent.
    - iii) "Sheet6" is the name of the last worksheet in the range to be summed.
    - iv) The `!` symbol indicates that this is the end of your worksheet range. The next thing you see in the formula is the cell reference to be summed.
    - v) "A2:A5" is the cell range on each spreadsheet you want to be summed.
- 3) Sum the cells "A2" through "A5" on the worksheets named "Sheet2" through "Sheet6".

## Create a 3-D reference

- 1) Click the cell where you want to enter the function.
- 2) Type = (equal sign), enter the name of the function, and then type an opening parenthesis.
- 3) Click the tab for the first worksheet that you want to reference.
- 4) Hold down SHIFT and click the tab for the last worksheet that you want to reference.
- 5) Select the cell or range of cells that you want to reference.
- 6) Complete the formula, and then press ENTER.

**Insert or copy:** If you insert or copy worksheets between Sheet2 and Sheet6 (the endpoints in this example), then Excel includes all values in cells A2 through A5 from the added worksheets in the calculations.

**Delete:** If you delete worksheets between Sheet2 and Sheet6, then Excel removes their values from the calculation.

**Move:** If you move worksheets from between Sheet2 and Sheet6 to a location outside of the referenced worksheet range, then Excel removes their values from the calculation.

**Move an endpoint:** If you move Sheet2 or Sheet6 to another location in the same workbook, then Excel adjusts the calculation to include the new worksheets between them unless you reverse the order of the endpoints in the workbook. If you reverse the end points, the 3-D reference changes the endpoint worksheet. For example, say that you have a reference to Sheet2:Sheet6: If you move Sheet2 after Sheet6 in the workbook, then the formula will point to Sheet3:Sheet6. If you move Sheet6 in front of Sheet2, the formula will adjust to point to Sheet2:Sheet5.

**Delete an endpoint:** If you delete Sheet2 or Sheet6, then Excel removes the values on that worksheet from the calculation.