# Excel 1

## Module 4 – Formulas and Functions

# Module Overview

In this module we will be looking at Formulas and Functions and the various ways to perform calculations using Excel.

Module Objectives:

- Learn how to create simple formulas with both numbers and cell references
- Learn the various ways to add values in Excel
- Learn how to use the Function button to search for functions
- Learn how to use the Status bar to check formulas

# Table of Contents

# 1. Simple Formula

| | Formula |
|---|---|
| **Vocabulary** | *Noun*<br><br>A formula performs calculations or other actions on the data in your worksheet. A formula always starts with an equal sign (=), which can be followed by numbers or cell references, math operators (like a + or - sign for addition or subtraction), and built-in Excel functions, which can really expand the power of a formula. |

## 1.1. Calculations

Excel can be used to perform calculations like a calculator by using a formula. To begin the formula, use an "=".  Use the following symbols on the keyboard to perform basic mathematic operations.

| Operators | |
|---|---|
| Plus + | Addition |
| Minus - | Subtraction |
| Asterisk * | Multiplication |
| Slash / | Division |
| Caret ^ | Exponentiation |
| Parentheses ( ) | Precedence |

| **Follow Me** | **Perform a calculation** |
|---|---|
| | 1. Open a new blank spreadsheet.<br>2. Type **=** then **1+8-3** into cell A1.<br>3. Press enter<br>4. See that Excel performs the calculation and displays "6" as the result. |
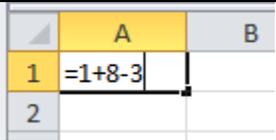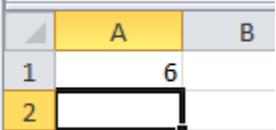
## 1.2. Cell Reference

Excel allows the user to use the values entered in other cells by making a cell reference.  To reference another cell value, you simply use its location.  For example, to reference the values in the cell in column B and row 4, the cell reference is **B4**.  When you type a cell reference, Excel identifies it by coloring it blue. To use this reference, you must precede it with an "=".

| | Reference a cell | |
|---|---|---|
| **Follow Me** | 1. Open a new blank spreadsheet.<br>2. Type a value into cell B4.<br>3. Reference this cell in cell C1 by typing **=B4** into Cell C1.<br>4. Press enter. | |
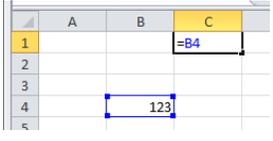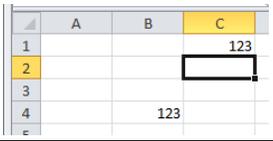
If the value in the cell that is referenced changes, the value in the cell with the reference changes as well.

| | Value change in a referenced cell | |
|---|---|---|
| **Follow Me** | 1. In the open spreadsheet, change the value in cell B4 to a different number.<br>2. Press enter.<br>3. Note that the value in C1 changes accordingly because it references cell B4. | |
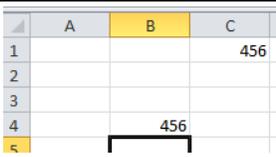
Cell reference is useful in a spreadsheet where you use the same value many times throughout. Enter the value in one cell, and if it is changed, it will change throughout the spreadsheet (wherever it is referenced).

## 1.3. Operations on a referenced cell

Values entered into a cell can be added, subtracted, multiplied and divided by numbers contained in another cell. To accomplish this you must create a formula which references the cells to operate on.

A formula always starts with an equal sign. For example, a formula to add 10 to the value of cell A1 looks like "=**A1**+10**"**.

**A1** in the above example is a cell reference. To add up the contents of cell A1 and A2 and A3 you would enter an equal sign followed by the cell references separated by math operators, or "=**A1+A2+A3**". In this case, **A1**, **A2**, and **A3** are all cell references.
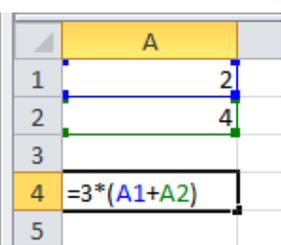
| | Calculations using referenced cells | |
|---|---|---|
| **Follow Me** | 1. In the open spreadsheet, copy this simple grocery list<br>2. In B4, type **=B1+B2+B3**<br>3. Press enter. Excel adds the values in cells B1, B2, and B3 and gives the total price, of 9. | |
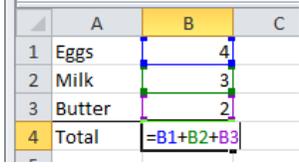
Sometimes, it is necessary to tell Excel to perform certain operations in your formula before others. To do this, use parentheses. For example:

To multiply the sum of cells A1 and A2 by 3,

Enter "= 3*(**A1+A2**)". This tells Excel to add the values in cells A1 and A2 prior to multiplying that sum by 3.

Entering "=3***A1+A2**" tells Excel to multiply the value in A1 by 3 and then add the value in A2. See below how the results differ. This shows the importance of using parentheses to tell Excel specifically how to perform the desired calculation.

| = 3*(**A1+A2**) | =3***A1+A2** |
|---|---|
|  |  |

You can see in this example that using parentheses to give Excel the order of operations to use changes the result.

## 1.4.    Formula Bar
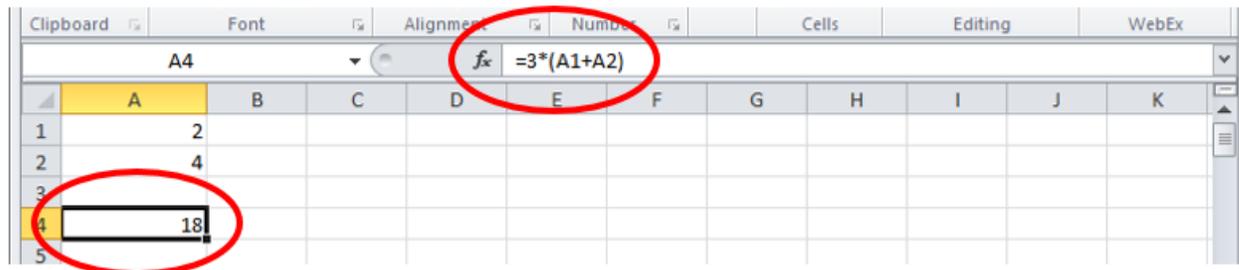
Once the user presses "Enter," Excel will show the result of a formula in a cell, rather than the formula itself. However, the formula bar will always show the formula contained within a cell if there is one present. Here, from the above example, if the user selects the cell with the "18" result, the formula bar shows that 18 is the result of the calculation 3*(A1+A2).



The formula bar is useful for the user to see what formula was used to get the given result. Similarly, it can be used to check that the correct formula was used, or to troubleshoot if the result is not what is expected.

Additionally, the user can make a correction to a formula in the formula bar. Here, if the user realizes the cells A1 and A2 should have been multiplied by 4 instead, they need only to change "3" to "4" in the formula bar and press Enter.

Pressing enter (or clicking on the checkmark next to the formula bar) is important because it tells Excel the user is finished and to make the calculation. If changes are being made in the formula bar, the

**Pro Tip:** An easier method to reference a cell in a formula is to click on the cell itself. As long as the formula is led by an "=", Excel knows to reference the cell that is clicked. It will also put a colored border around the referenced cell.

user may always press the Esc key (or the red "X" next to the formula bar) to leave the formula bar and cancel the changes made.

It does not matter whether you use upper or lower case – Excel will convert function names and cell references to upper case for you. Although it is rare to want to do so, the **Formula** bar can be turned off with a toggle switch selection under the **View** tab, **Show/Hide** group. It can also be turned on here in case you cannot seem to find it.

# 2. Sum
## 2.1.    Adding values together (Sum)

The most basic way to add two values together is to use Excel like a calculator, by typing in "=", and the numbers to add, using a "+" sign. For example, if you type "=123+456" into a cell and press Enter, the result, "579" will be calculated.  This method could become cumbersome when there are more values to add or they have to be copied from elsewhere in the spreadsheet.

Alternatively, to add values in the spreadsheet, you might reference the cells. To add the values in cells A1, A2, and A3, simply type "=A1+A2+A3" and press Enter.  You will see Excel colors the references as they are typed and puts similarly colored boxes around each of the referenced cells.  Alternatively you can click as well, for example:

1. Type "="
2. Click on cell A1
3. Type "+"
4. Click on cell A2
5. Type "+"
6. Click on cell A3 (now the formula will look just as if it has been typed manually.
7. Press Enter.

Excel also has a function called "SUM" which can be used for adding.  This function looks like "=SUM()". Excel is going to look for a list of the values to add inside the parentheses following SUM.  Separate each item in the list with commas.

For example: =SUM(**B2**,**C7**)

In this case, Excel will add the values in B2 and C7 together.

| Follow Me | SUM Function |
|---|---|
| | 1. In the open spreadsheet, use or create this simple grocery list<br>2. In Cell B4, type "=SUM("<br>3. Click on cell B1.<br>4. Type ","<br>5. Click on Cell B2.<br>6. Type ","<br>7. Click on Cell B3.<br>8. Press enter. Excel adds the values in cells B1, B2, and B3 and gives the total price, of 9. |

| Follow Me | Editing SUM Function |
|---|---|
| | 1. Now, let's say you know you need to also spend $4 in gas getting to the grocery store.<br>2. Select cell B4.<br>3. In the formula bar, you see your formula, "=SUM(**B1**,**B2**,**B3**)"<br>4. Click in the formula bar after B3. Type "," and "4". The formula should now look like "=SUM(B1,B2,B3,4).<br>5. Press Enter to perform the calculation. The result, 13, is the total price for Eggs, Milk, Butter and Gas. |

## 2.2.  Adding a range of values (Sum)

Sometimes, as in the case of a list or budget, you need to add the values in several cells that are all next to each other in a row, column, or range. In this case, rather than list out every cell reference, type the first cell reference, then a colon (":"), then the last cell reference.  For example, **=SUM(B1:B7)** would add cells B1 through B7.

Alternatively, you can simply type the function "=SUM(" and then click to select the first cell in the list. Hold the mouse button down and drag to the last value in the list.  This tells Excel to add all of the values between the first and last cells that are selected.

| Follow Me | Summing a range |
|---|---|
| | 1. Add a few more items to the simple grocery list with prices, as pictured here.<br>2. In Cell B8, type "=SUM("<br>3. Select the first price in the list, the price of eggs<br>4. Drag down to the last price, the price of meat<br>5. The function should now say "=SUM(B1:B7"<br>6. Press Enter. The total price is 34. |

To review, remember, when writing a formula for a range of cells:

1. Start with the equal sign
2. Type the function name...
3. Followed by a left parenthesis
4. Type your beginning cell
5. Type a colon
6. Type the ending cell
7. Type a closing parenthesis

8. Press the Enter key

The SUM function is so commonly used there is a shortcut button on the Home tab (Editing group). It is the one with the Greek letter Sigma as pictured below.

To use the SUM button, click below the column of numbers you want to total and click the SUM button. Or, click to right of the row of numbers you want to total and click the SUM button.
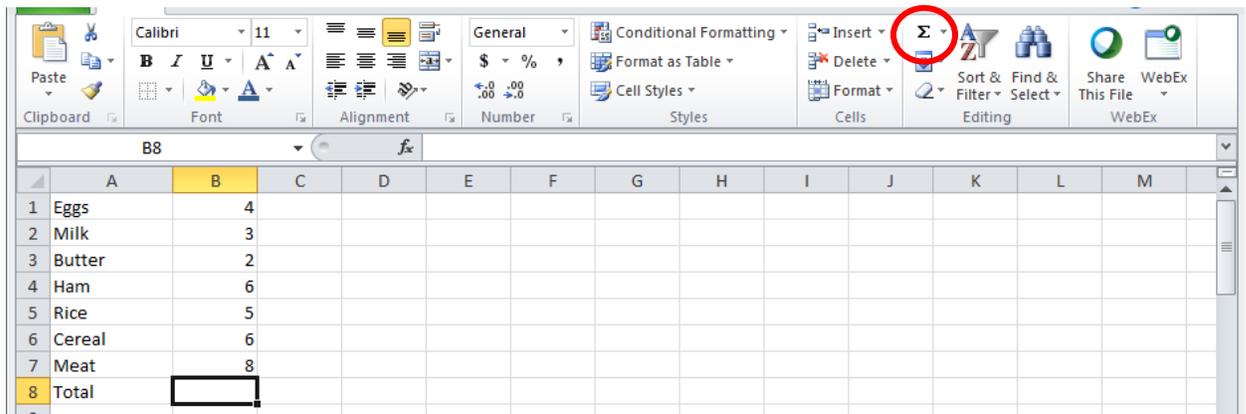


# 3. Function Button/Search
## 3.1.    Function Button

There are many other functions contained in Excel. To access a full list and be able to search for the function needed, there is a function button, denoted $f_x$ next to the formula bar.  Press this button to open the Insert Function dialog box.
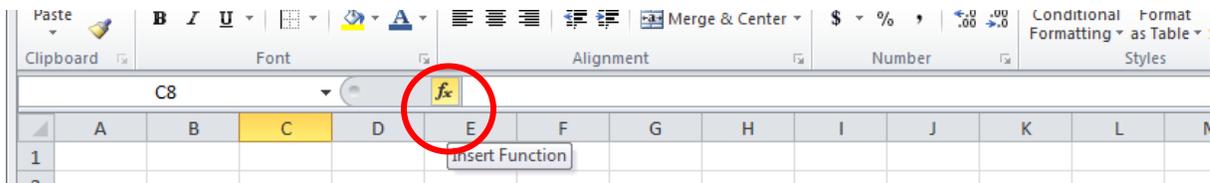
If a description of the needed function is provided, Excel will search and give the most helpful related functions. Alternatively, a category of functions may be selected using the dropdown and a list in that category can be searched manually.
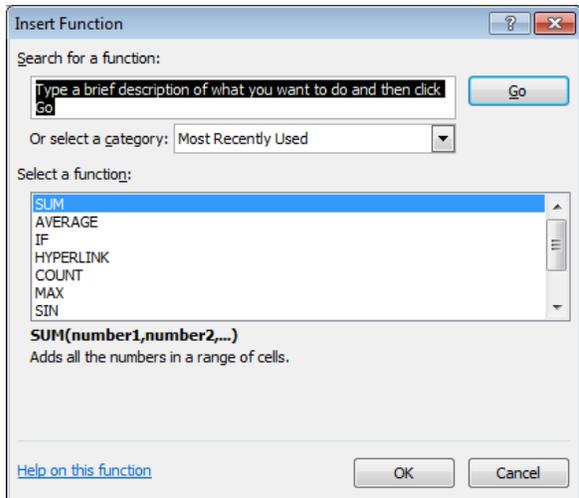
Clicking on a listed function under "Select a function" shows that function with its arguments and a brief description below the results box.

| Vocabulary | Arguments |
| --- | --- |
| | *Noun* |
| | A range of data, a specified input, or other parameters, needed by a particular function. |
| | Functions in Excel take arguments. Most functions will require at least one argument in order to work. Arguments are presented in parentheses following the function. |
| | If a function requires more than one argument, the arguments are separated by commas. |

Selecting a function using the function search will enter that function into the currently selected cell for the user.

## 3.2.    Average

A frequently used function in Excel is AVERAGE. One would use this function to calculate the average of a group of values in a spreadsheet. Traditionally to find the average, you would add all the numbers then divide the total by how many numbers there are. The arguments required by the AVERAGE function are the values or value range to be averaged.

| Follow Me | Average a range |
|---|---|
| | 1. With the grocery list, change "Total" to "Average" in column A.<br>2. In Cell B8, type "=AVERAGE("<br>3. Select the first price in the list, the price of eggs<br>4. Drag down to the last price, the price of meat<br>5. The function should now say "=AVERAGE(B1:B7"<br>6. Press Enter. The total price is about 4.85. |

## 3.3. Min/Max

Two additional useful functions in Excel are MIN and MAX.

MIN determines the lowest (minimum) value in a range of values. Some practical examples of the use of this function might be finding the youngest person in a list of ages. Or the shortest distance in a list of mileages.

MAX determines the highest (maximum) value in a range of values. One might use the MAX function to determine the highest revenue among salespeople or the tallest person on a sports team roster.

| Follow Me | MAX function |
|---|---|
| | 1. With the grocery list, change "Average" to **Max** in column A.<br>2. In Cell B8, type **=MAX(**<br>3. Select the first price in the list, the price of eggs<br>4. Drag down to the last price, the price of meat<br>5. The function should now say **=MAX(B1:B7**<br>6. Press Enter. The highest price on the list is 8. |

# 4. Formula Checking (Formula Bar)

Often it is prudent to check the function in a cell if the result is consequential to an important decision to make, for example, or if the result does not seem appropriate. Clicking on the cell containing the formula shows the entire formula in the formula bar. The formula bar shows the function as well as all of the selected arguments, and allows the user to check them for accuracy.

Clicking in the formula bar will also prompt Excel to show the locations of the arguments visually in the spreadsheet by boxing them with matching colors. If any portion of the formula is incorrect, it may be corrected inside the formula bar before pressing Enter to re-perform the calculation.

Here, we can see that the arguments are blue, as is the box around the arguments.

| | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Eggs | 4 | | | | | | | | |
| 2 | Milk | 3 | | | | | | | | |
| 3 | Butter | 2 | | | | | | | | |
| 4 | Ham | 6 | | | | | | | | |
| 5 | Rice | 5 | | | | | | | | |
| 6 | Cereal | 6 | | | | | | | | |
| 7 | Meat | 8 | | | | | | | | |
| 8 | Max | (B1:B7) | | | | | | | | |

SUM ▾ ✕ ✓ *fx* =MAX(B1:B7)

# 5. Exercises – Now You!

- In the Family Budget spreadsheet:

Sum the expenses for each month in the Expense Total Row

Sum the incomes for each month in the Income Total Row

Sum the expense totals (in column N) to calculate the Grand Total for the year

Sum the income totals (in column N) to calculate the Grand Total for the year