Excel 2
Module 2 – Formulas & Functions
Module Overview
This module is part of the Excel 2 course which is for advancing your knowledge of Excel. During this lesson we will expand on your existing knowledge of formulas and functions.

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1. Formulas and Functions Review

All functions and formulas begin with an “=” sign. Formulas typically use mathematical operators, listed in the table to the right. By default, functions and formulas will show the answers in the worksheet. To see the function or formula you must select the cell and use the formula bar to evaluate the formula or function.

Excel Operators

<table>
<thead>
<tr>
<th>Operators</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plus +</td>
<td>Addition</td>
</tr>
<tr>
<td>Minus -</td>
<td>Subtraction</td>
</tr>
<tr>
<td>Asterisk *</td>
<td>Multiplication</td>
</tr>
<tr>
<td>Slash /</td>
<td>Division</td>
</tr>
<tr>
<td>Caret ^</td>
<td>Exponentiation</td>
</tr>
<tr>
<td>Parentheses ( )</td>
<td>Precedence</td>
</tr>
</tbody>
</table>

Follow Me

Open Weekly Totals

1. Open Weekly Totals.xlsx – This is the workbook created during Excel 2 – Module 1.
2. Select the Total Chart and using the delete key, remove the chart.

In the Weekly Totals workbook, the formulas under Total (column G) add each of the week’s days (Week 1 Monday, Tuesday, Wednesday, Thursday, and Friday) by adding each day’s cell reference. Remember, cell references allow us to change the value of a particular day without needing to update all the formulas and functions using that day (so you only need to update one cell).

Cell Reference

Noun

Cell Reference is the intersection of a row and column, used to describe the location of a cell within a spreadsheet.

Functions in Excel can be used to make working in Excel simpler. Let’s begin with a simple example of a function.
# Change formulas into functions

1. In G2, replace \( =B2+C2+D2+E2+F2 \) with the SUM function.
2. Type \( =\text{SUM}(B2,C2,D2,E2,F2) \) – remember to hit enter after entering data into a cell.

## 1.1. Cell Ranges

When using functions Excel allows cell ranges to be used. These allow the user to enter in many cells for a calculation rather than selecting individual cells.

### Cell Range

**Noun**

Cell Range or just Range refers to a selection of cells. It is noted as the first cell reference and last cell reference of a selection with a “:” between.

For example A2:A10 or B4:D9

Ranges are always ordered from the left or top most to the bottom or right most. Ranges can also be used for full columns or rows.

### Example Ranges

<table>
<thead>
<tr>
<th>Range Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 cells, square</td>
<td>B2:C3</td>
</tr>
<tr>
<td>20 cells, rectangle</td>
<td>C3:G6</td>
</tr>
<tr>
<td>3 cells, in row</td>
<td>B4:D4</td>
</tr>
<tr>
<td>3 cells, in column</td>
<td>B2:B4</td>
</tr>
<tr>
<td>Single row</td>
<td>3:3</td>
</tr>
<tr>
<td>Single column</td>
<td>C:C</td>
</tr>
<tr>
<td>Multiple(3) rows</td>
<td>1:3</td>
</tr>
<tr>
<td>Multiple(4) columns</td>
<td>B:E</td>
</tr>
</tbody>
</table>
Follow Me

Replace cell references for range

1. In G2, replace \(=\text{SUM}(B2+C2+D2+E2+F2)\) with the same function using a range.
2. Type \(=\text{SUM}(B2:F2)\) – you can use your mouse to click and select the range or type it.
3. Using the auto fill, change all of the formulas under Total to the new function.

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>SUM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Week 1</td>
<td>2</td>
<td>2</td>
<td>7</td>
<td>9</td>
<td>1</td>
<td>=SUM(B2:F2)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Week 2</td>
<td>1</td>
<td>4</td>
<td>6</td>
<td>3</td>
<td>10</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Week 3</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Week 4</td>
<td>0</td>
<td>3</td>
<td>9</td>
<td>5</td>
<td>3</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.2. Absolute Reference

In some cases there may be parts of the formula that you will not want to change when copying or auto filling formulas. To do this you need to tell Excel which part of the cell reference should not change (the row or the column) when the formula is copied to a different location in the worksheet. To do this, put a $ in front of the part you do not want to change.

In our example, Weekly Totals, let’s calculate the average of the week Totals and compare each week to that average.

<table>
<thead>
<tr>
<th>Allow changes</th>
<th>Do not change the Row</th>
<th>Do not change the Column</th>
<th>Do not change either (always the same cell)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>A$1</td>
<td>$A1</td>
<td>$A$1</td>
</tr>
</tbody>
</table>

Using the Function Arguments dialog box is one of the easiest ways to ensure your function works correctly. The box will guide you through the function parameters and the bottom of the box shows the Formula result.
Compare Totals to Average Cont.

We would like to average the weekly totals.

5. Select the range of weekly Totals for Number1, G2:G5
6. Click OK once you have selected or typed in the range.

Now that the average has been calculated we can compare each weekly Total to the Average, being careful to use absolute cell reference to ensure the cell reference representing the average does not change as the function is copied.

7. In H1 type Difference
8. In cell H2 enter the following formula, =G2-$B$7
9. Using the auto fill, add the formula to the other weeks (through H5)
2. Complex Functions - Vlookup

Entering in more complex functions can be easy using the Function Arguments dialog box. Let’s work through another example.

Vlookups can be used to pull information into a table from another table. One variable in the table should be unique, such as name, social security number, or ID number. That variable must be included in both tables you are working with.

In our example, we will use Vlookup to add birthdates to our list of students. The first table will be a teacher’s class roster. The second table will be a master list of school birthdays.

Follow Me
Open Ms Roberts Birthdays
1. Open Ms Roberts Birthdays.xlsx
2. Add Birthdays to D2.

Ms Roberts has 19 students. There are 218 student birthdays in the Birthdays tab, they are currently sorted by day.
Adding each birthday to the list will take time, a fast way is to use a vlookup.

Let’s take a look at the vlookup function.

VLOOKUP(lookup_value, table_array, col_index_num, range_lookup)

Looks for a value in the leftmost column of a table, and then returns a value in the same row from a column you specify. By default, the table must be sorted in an ascending order.

Lookup Value – what you are looking for in the other table (In our example, we will look for the matching student ID number).

Table Array – the table or range from which the data will be retrieved, the lookup value needs to match the leftmost column of the table array and the data to be retrieved.
should also be in the table. (In our example, we will use the entire table in the Birthdays sheet).

**Column Index Number (Col_index num)** – this is how many columns over in the table the data you want is located (In our example, the birthday is the second column of the table).

**Range lookup** – this value (either TRUE or FALSE) is used to tell Excel if you want an exact match or approximate. In many cases, including our example, you will want an exact match. Use FALSE to find an exact match.

Note: the table must be sorted in ascending order. This means the further down the table, the larger the number.

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**Follow Me**

**Sort Birthdays**

1. Select Birthday tab
2. Highlight the entire table, can use a shortcut to select all (ctrl + A)
3. Select **Filter** from the Sort & Filter drop down on the ribbon Home tab (Editing group)

4. Using the drop down arrow on Student ID, sort smallest to largest (ascending).

Now that the birthdays have been sorted, we can begin adding the vlookup to add in birthdays to Ms Roberts Class.
Add Vlookup

1. Return to the Ms Roberts Class tab.
2. Select D3
3. Click the function button
4. Search for Vlookup
5. Select VLOOKUP from the list and click OK

Add Function Arguments

6. In the Lookup_value we will begin by adding the student ID of the student we are looking for, type or click A3. You should now see the student ID appear next to your selection, 20160109.
7. In Table_array we will add the birthday table, to ensure the entire table is always selected we will choose this by column. You can type or click but choose the Birthdays tab columns A and B or Birthdays!A:B

We recognize the cell range A:B but have not covered referencing cells or ranges in other sheets. This is done by typing the name exactly as it appears (capitals included) with an ! after. In our examples the two sheet references are Ms Roberts Class! and Birthdays!
8. In **Col_index_num** add the column number of the table that holds the data you wish to add. In this case birthdays are held in the second column so type **2**

9. In **Range_lookup** we will add **FALSE** this will ensure that only an exact match will be returned.

*The second section of the Function Arguments dialog box contains more information on the function being entered as well as what information is required for each argument (parameter).*

10. Click OK once finished.

The functions button and dialogs fill in the function for you. Notice how D3 now holds the full function with all arguments completed

=VLOOKUP(A3,Birthdays!A:B,2,FALSE)
Continue adding all Birthdays

1. Using the auto fill function, continue adding each birthday.

   The sheet may look funny as the vlookup does not copy formatting. Because dates are also numbers we need to format our sheet to show dates in a way we can read.

2. Select D3:D21 us the drop down in the Number group of the Home tab to format the numbers into the Short Date format.