Microsoft Excel: Formulas

When you need to perform a calculation in Excel you use a formula. A **formula** is the arithmetic used to calculate values appearing in the worksheet. Once you have created a formula, if you change one number, Excel will automatically recalculates any formula affected by the change. **An Excel formula always begins with an equals sign** (=). Formulas are created by combining numbers, cell references, arithmetic operators, and/or functions. **Functions** are predefined or built-in formulas (shortcuts) for the most commonly used calculations.

Arithmetic Operators used in Formulas

Addition	+	=B4+B5+B6	Adds the values of cells B4,B5, and B6
Subtraction	-	=C9-D10	Subtracts the value in cell D10 from the value in cell C9
Multiplication	*	=B1*10	Multiplies the value in cell B1 by the constant 10
Division	/	=C9/B9	Divides the value in cell C9 by the value in cell B9
colon	:	=SUM(F10:F20)	Adds the cell range F10 through F20

Formulas

Using the Duke Real Estate spreadsheet, we will practice some various formulas

1. Calculate the **Price per Sq. Ft.**
    i. Divide the selling price by the size (=D7/B7)
    ii. Copy the formula to the other rows, using the **fill handle** to copy the formula.
2. Calculate the **Percent of List Price**
    i. Divide the selling price by the list price (=D7/C7)
    ii. Copy the formula to the other rows by positioning your cursor over the fill handle and **double clicking - ** ** notice how Excel automatically fills in the formula based on the rows containing values
3. Calculate the **Commission**
    i. Multiply the selling price by the commission rate
    ii. Copy the formula to the other rows

We have an error in our formula – we should not have $0 let's examine the formula.

We will use the **edit mode** to view the formula in cell F*. **Double click** in cell F8 and you will notice that each cell reference in the formula appears in a different color and the corresponding cells referred to in the formula are outlined in the same color. This feature is called the **Range Finder** and is designed to make it

easier to check the accuracy of your formula. Look at what has happened to the commission – we are now multiplying by zero.

Copying formulas

You can copy formulas in Excel using ribbon commands - copy & paste, toolbar buttons, or the fill handle. Using the fill handle reduces errors and it's the fastest way to copy formulas. When you copy a formula that contains a cell reference, Excel automatically updates the cell reference for the new location. Cell references that change when they are copied are called **relative cell references.**

Sometimes you may not want the cell reference to change to reflect its new position in the worksheet. You may want the cell reference to point to the same location in the worksheet as you copy it. This is called an **absolute reference.** An absolute reference is a cell reference in a formula that does not change when copied to another cell. To do this you insert a **dollar sign ($)** between the column and row of the cell reference. **Ex: $G$4 – absolute vs. G4 relative**.

4. Correct the formula with an absolute cell reference
     i. Double click in cell **F7**. Make sure the **insertion point** is to the **right** of the **multiplication operator**, anywhere in the cell reference**B17.**
     ii. Press the **F4** key to change the reference to **$ B$17.** *You may need to press F4 more than once until you see **$ BF$17.***
     iii. Press **Enter** to update the formula
     iv. Copy the formula to the other rows. Notice the difference. Click **Save**
5. Calculate the **Net to Seller**
     i. Subtract the commission from the selling price (=D7-F7)
     ii. Copy the formula to the other rows
6. Calculate **Totals** for the columns
     i. Click in cell **C16** then click the Auto Sum button
     ii. Select the Range of cells **C7 through C14** and click enter
     iii. Click back in cell **C16** – click on the fill handle and drag to the right to fill in the formula for the columns
     iv. Click in an empty cell to exit the copy mode
7. Calculate the needed values in the **summary section**
     i. Click in cell **G19**, click on the **arrow** next to the Auto Sum button and click on **Average**
     ii. Excel will select nearby values
     iii. Click in cell D7 and drag down to select the values through D14
     iv. Click enter to complete
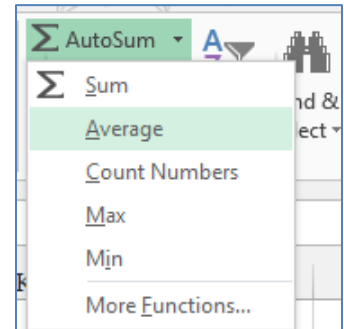
v. Click in cell **G20** and repeat the above steps using the **Max function**

vi. Click in cell **G21** and repeat the above steps using the **Min function**

Formula Practice

Find the Profit per Item

1. Click on the Salsa Sales Data worksheet
2. Click in cell D5 and type "=" click in cell B5, type the minus sign "-"and click in cell C5
3. Press the enter key - you should have 1.99
4. Click in cell D5 to make it the active cell, use the fill handle and copy the formula to cells D6 through D9

Find the Total Sales for each product and the Profit from the sales

1. Click in cell F5 and enter the formula: =B5*E5
2. Copy – Double-click on the fill handle to copy this formula
3. Click in cell G5 and enter the formula: =D5*E5
4. Click in cell E10 then click on the AutoSum button, click enter to find the total units sold
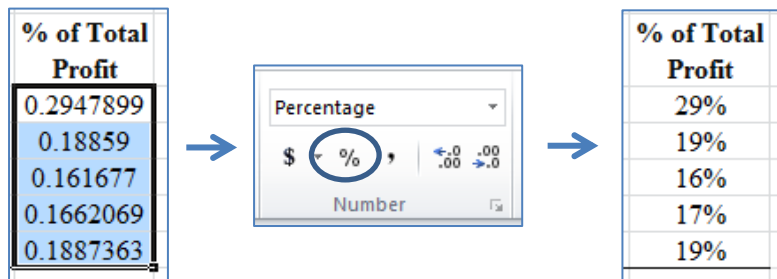5. Copy the formula to F10 and G10

Now we want to find the profit per item as a percentage of sales.

1. Click in cell H4 and type the title for this new information % of Total Profit
2. Click in cell H5 and enter the formula to divide the profit from the Verde Mild Salsa by the total profit from all the items sold (=G5/G10)
3. Copy the formula for the rest of the products
4. We seem to have a problem!! #DIV/0!

Let's fix this problem

1. If you look at the error message, you can see that we have a divide by zero error and this means that we need to use an absolute cell reference.
2. We will use the **edit mode** to correct this. Click in cell **H5** the cell we want to edit.
3. **Double click** the mouse button to edit the formula in the cell. Notice that each cell reference in the formula in cell H5 appears in a different color and the corresponding cells referred to in the formula are outlined in the same color. This feature is called the **Range Finder** and is designed to make it easier to check the accuracy of your formula.

4. Make sure the **insertion point** is to the **right** of the **division operator**, anywhere in the cell reference **G10.**

5. Press the **F4** key to change the reference to **$G$10.** *You may need to press F4 more than once until you see* **$G$10.**

6. Press **Enter** to update the formula

7. Now use the **fill handle** to copy the formula. Notice the difference. Click **Save**

8. Highlight the numbers in the **% of Total Profit column** and click on the **%** symbol to format the numbers with the % symbol.

% of Total Profit
0.2947899
0.18859
0.161677
0.1662069
0.1887363

Percentage

$ % ,   .0 .00 / .00 .0

Number

% of Total Profit
29%
19%
16%
17%
19%

More Formulas

1. Using the **Fundraiser** spreadsheet, we will create the formula to complete the total column

2. Click in cell **E5** and type and equals sign =

3. Click on the cost of the pizza **B4,** type * click in cell **B5** type +

=B4*B5+C4*C5+D4*D5

4. Click in cell **C4** type * click in cell **C5** type + click in cell **D4** type * Type **D5**

5. Click enter

6. Copy the formula to the rest of the rows.

7. Double click in cell **E18** to review the formula you just created. Our formula is incorrect because the number we are multiplying by has moved, therefore we need to make the cells in row 4 absolute cell references.

8. Click back in cell E5. In the formula bar, click right between the **B** and the **4**

=B4*B5+C4*C5+D4*D5

9. Now press your **F4 key** on your key board until it looks like **$B$4.**

10. Do the same thing for C4 and E4

=$B$4*B5+$C$4*C5+$D$4*D5

11. This will create the Absolute cell references that we need to calculate our totals correctly.

Copy your formula again to replace the incorrect ones.

	2	1
	8	7
	15	7
	27	16
	17	11

=SUM(B4:B20)

SUM(**number1**, [number2], ...)

Now let's complete the worksheet by summing the columns

12. Click in cell B21, click on the AutoSum button

13. Excel will select the nearby cells that contain values but may not always select the cells you want.

14. Click in B5 and drag down to select only the cells containing the number of items sold – we do not want to include the selling price.

15. Click the enter key to complete the formula

16. Copy the formula to the three columns to the right.

Using Formulas to Summarize Data

For the next set of examples we will use the sales figures from company XYZ and create a summary of each salespersons sales for the past three years.

Using the 2010 Sales worksheet, we will prepare our sales data for our summary sheet

Sort the data by salesperson then by order date

1. Make sure that your active cell is somewhere within your data
2. Click on **Sort & Filter** and select **Custom Sort**
3. From the **Sort by** drop down select **Salesperson** – sort A to Z
4. Click the **Add Level** button to add the second sort field
5. In the Then by field select **Order Date** and sort by Oldest to Newest
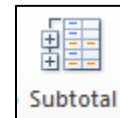
Subtotal the Order Amount for each Salesperson.

1. With the data sorted, Click on the **Data** tab and then click **Subtotal**.
2. In the **At each change in:** select Salesperson.
3. In the **Use function:** box, select the **SUM** function.
4. In the **Add subtotal to:** box, click only the Order Amount check box.
5. Leave "Page break between groups" unchecked
6. You can leave the "Replace current subtotals" checked
7. Leave "Summary below data" checked
8. Click **OK**.
9. Notice how you can use the minus signs on the left side of the Excel window to collapse the data or expand it.
10. Repeat for the 2011 data sheet

	A	B	C	D
1	Salesperson	Orderdate	OrderNum	Order Amount
2	Buchanan	7/16/2003	10248	$440.00
3	Buchanan	7/23/2003	10254	$556.62
4	Buchanan	8/9/2003	10269	$642.20
5	Buchanan	9/10/2003	10297	$1,420.00
6	Buchanan	10/18/2003	10320	$516.00
7	Buchanan	10/25/2003	10333	$877.20
8	Buchanan	11/26/2003	10359	$3,471.68
9	Buchanan	11/27/2003	10358	$429.40
10	Buchanan	12/9/2003	10372	$9,210.90
11	Buchanan	12/19/2003	10378	$103.20
12	**Buchanan Total**			$17,667.20
30	**Callahan Total**			$19,160.70
31	Davolio	7/23/2003	10258	$1,614.88
32	Davolio	8/2/2003	10270	$1,376.00
33	Davolio	8/9/2003	10275	$291.84
34	Davolio	8/26/2003	10285	$1,743.36
35	Davolio	9/2/2003	10292	$1,296.00
36	Davolio	9/11/2003	10293	$848.70
37	Davolio	9/17/2003	10304	$954.40

3-D Formulas

3-D formulas include cell references from other worksheets in the same or different workbooks. In 3-D formulas the worksheet names are separated from the cell address by an exclamation point (!).

Example #1

In worksheets 2010, 2011 and 2012 Buchanan's sales totals are in the <u>same cell location</u> **D12** and we can use a 3-D **function** to Sum D12 across 3 different worksheets.

1. Click the **3-Year Totals** worksheet tab
2. Click **B2**, the cell which will hold the 3 year total sales for Buchanan.
3. Click the AutoSUM Button. The formula bar should read : **=SUM()**
4. Click the **2010** worksheet tab.
5. Click cell **D12,** which holds the total sales by Buchanan for the year 2010.
6. Hold the **Shift key down** and click the **2011** worksheet tab. Notice how both 2010 and 2011 tabs are selected.
7. Continue to hold down the Shift key and click the **2012** worksheet tab.
8. Notice the formula bar should read: **=SUM('2010:2012'!D12).**
9. Press Enter.

Example #2

Because all of the subtotals for the sales people are not in the same cells, we will use a 3-D **formula** to calculate the rest of the sales totals for each salesperson for 2010 – 2012.

1. Click the **3-Year Totals** worksheet tab
2. Click **B3**, the cell which will hold the 3 year total sales for Callahan.
3. Type =
4. Click the **2010** worksheet tab.
5. Click cell **D30,** which holds the total sales by Callahan for the year 2010.
6. Type +
7. Click the **2011** worksheet tab.
8. Click cell **D68**, which holds the total sales by Callahan for the year 2011.
9. Type +
10. Click the **2012** worksheet tab.
11. Click the cell which holds the total sales by Callahan for the year 2012
12. Press **Enter**
13. Practice this type of formula by repeating these steps for the other sales people