MATHS AND STATISTICAL FUNCTIONS

Functions are predefined formulas that perform calculations by using specific values, called <u>arguments</u>, in a particular <u>order</u>, or structure.
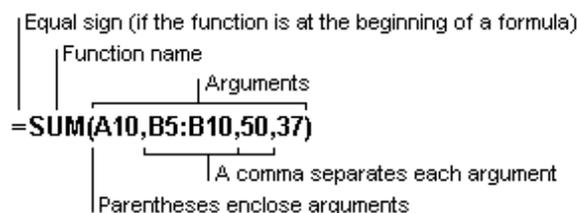
For example, the SUM function adds values or ranges of cells.

ARGUMENTS

Arguments can be numbers, text, logical values such as TRUE or FALSE, arrays (tables), error values such as #N/A, or cell references. The argument you designate must produce a valid value for that argument. Arguments can also be constants, formulas, or other functions.

STRUCTURE

The structure of a function begins with the function name, followed by an opening parenthesis, the arguments for the function separated by commas, and a closing parenthesis. If the function starts a formula, type an equal sign (=) before the function name.

```
Equal sign (if the function is at the beginning of a formula)
  Function name
              Arguments
=SUM(A10,B5:B10,50,37)
                A comma separates each argument
  Parentheses enclose arguments
```

Excel has a wide range of functions that can be used quickly and efficiently in a worksheet.

The most commonly used functions can be accessed by selecting the **Sum** button on the Home Ribbon
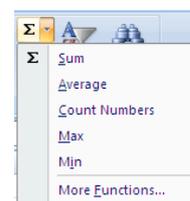
To apply other Function select **More Functions** from the Sum drop-down menu

Functions can be accessed from the **Function Ribbon**. This can be activated by selecting on the Formulas Tab
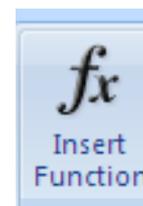

Cell Reference

When we want to tell Excel to apply a function to a value you indicate the cell address of that cell. The Address will be indicated by the row and column reference. Normally this is a row number and a column letter. For example if I want to indicate that the cell I want to reference is the one with 1000 entered as below you would type D2, i.e. column D row 2 as the address of that cell.

AUTOSUM

The SUM function can be activated using the **AUTOSUM** function button. Be very careful using this button as it automatically selects a range for you. It can select an incorrect range or even a numeric value such as a year, which shouldn't be involved in the calculation. When using this button, always double-check the range to make sure it's correct.

Syntax: =SUM(range) Adds all the numbers in a range of cells.

**Exercise 1: Using AUTOSUM**

Exercise 2: Using COUNT

The count function counts the number of cells that contains **numbers** within a list of arguments

Syntax: COUNT(value1,value2, ...) Value1, value2, ...are 1 to 30 arguments that can contain or refer to a variety of different types of data, but only numbers are counted.

Empty cells, logical values, text, or error values in the array or reference are ignored.

In the example below COUNTIF has been selected from the Statistical Function Group in the Formulas Tab

Select Formulas>Statistical>COUNT
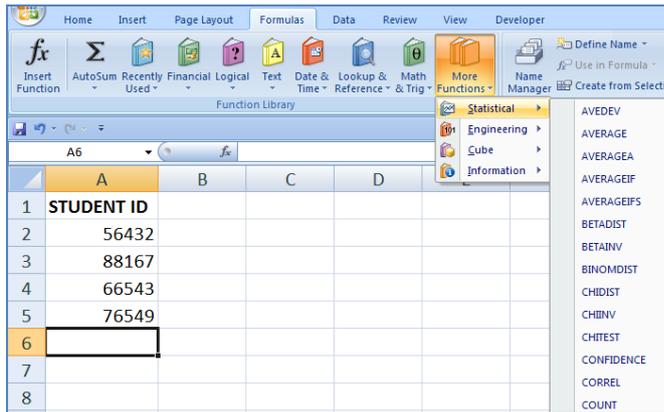
The no of entries under STUDENT ID will be displayed.
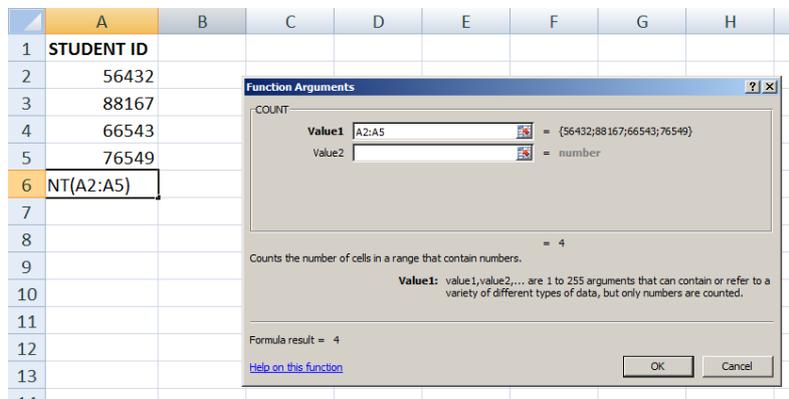
When you click OK the answer is 4.

To review or change your formula click the cell with the formula in this case **A6** and select the function button.

THE COUNTA FUNCTION

To count logical values, text, or error values, the COUNTA function is used.

Syntax: COUNT(**value1**,value2, ...)

Exercise 3: Using COUNTA

	A	B
1	SCORE	OTHER SCORE
2	5	5
3		4
4	4	3
5	N/A	2
6	2	1

Example	Result
=COUNT(A2:A6)	3
=COUNT(B2:B6)	5
=COUNTA(A2:A6)	4

Exercise 4: Using COUNTA

	A
1	**Position**
2	Supervisor
3	Manager
4	Operator
5	Supervisor
6	Operator
7	

Example	Result
=COUNT(A2:A6)	0
=COUNTA(A2:A6)	5

COUNTBLANK

=COUNTBLANK() counts the blank cells

Exercise 5: Using COUNTBLANK

	A
1	DATA
2	2
3	
4	7
5	=COUNTBLANK(A2:A4)

RESULT	1

COUNTIF

Count how often a single value occurs. The example below counts the number of entries for *Tom*.

Exercise 6: Using COUNTIF

| | RESULT | 4 |

MAX

Returns the largest value in a set of values

Syntax: MAX(number1,number2,...)

Exercise 7: Using MAX

| RESULT | 650 |

MIN

Returns the smallest number in a set of values

Syntax:MIN(number1,number2,...**)**

Number1, number2, ...   are 1 to 30 numbers for which you want to find the minimum value.

Exercise 8: Using MIN

RESULT	325

MEDIAN

The three most common measures of central tendency are: Median, Average, Mode. The MEDIAN function measures central tendency, which is the location of the center of a group of numbers in a statistical distribution. Returns the middle number of a group of numbers; that is, half the numbers have values that are greater than the median, and half the numbers have values that are less than the median. For example the median of 10, 7, 9, 27, 0, 4 is 8.

Exercise 9: Using MEDIAN

MODE

Returns the most frequently occurring number in a group of numbers. For example the median of 2, 3, 4, 5, 4, 4 is 4.

Exercise 10: Using MODE

AVERAGE

Returns the arithmetic mean, and is calculated by adding a group of numbers and then dividing by the count of those numbers. For example, the average of 2, 3, 3, 5, 7, and 10 is 30 divided by 6, which is 5.

Syntax: =AVERAGE(number1,number2, ...)

Number1, number2, are 1 to 30 numeric arguments for which you want the average. The arguments must be either numbers or cell names, arrays, or references that contain numbers.

If an array or reference argument contains text, logical values, or empty cells, those values are ignored; however, **cells with the value zero are included.**

Exercise 11: Using AVERAGE

Examples	Result
=AVERAGE(A2:A6)	4
=AVERAGE(A2:A6, 5)	5
=AVERAGE(A2:A6) equals =SUM(A2:A6,)/COUNT(A2:A6)	4

AVERAGEIF

Returns the average (arithmetic mean) of all the cells in a range that meet a given criteria. **Syntax:** AVERAGEIF(range,criteria,average_range)

Range is one or more cells to average, including numbers or names, arrays, or references that contain numbers.

Criteria is the criteria in the form of a number, expression, cell reference, or text that defines which cells are averaged. For example, criteria can be expressed as 32, "32", ">32", "apples", or B4. The exercise below shows the average quantity sold for Products beginning with *A*. Note in the example below enter the asterisk * after the letter A to tell Excel that you want it to find all Products beginning with A e.g. **A***
Normally Excel will enter the double quotes Shift+2 " " around the criteria string. If it does not do this then you should enter the quotes yourself. The criteria can be entered in upper or lower case.

Exercise 12:

AVERAGEIF

AVERAGEIFS

Average Products beginning with *A* sold by *Mary*

Exercise 13: Using AVERAGEIFS

SUMIF

You use the SUMIF function to sum the values in a range (range: Two or more cells on a sheet. The cells in a range can be adjacent or nonadjacent.) that meet criteria that you specify. For example, suppose that in a column that contains numbers, you want to sum only the values that are larger than 500. You can use the following formula:

=SUMIF(B2:B25,">500")

Exercise 14: Using SUMIF

In this example, the criteria is applied the same values that are being summed. If you want, you can apply the criteria to one range and sum the corresponding values in a different range.

For example, the formula =SUMIF(A3:A6, "Toys", B3:B6) sums only the values in the range B3:B6, where the corresponding cells in the range A3:A6 equal "Toys."
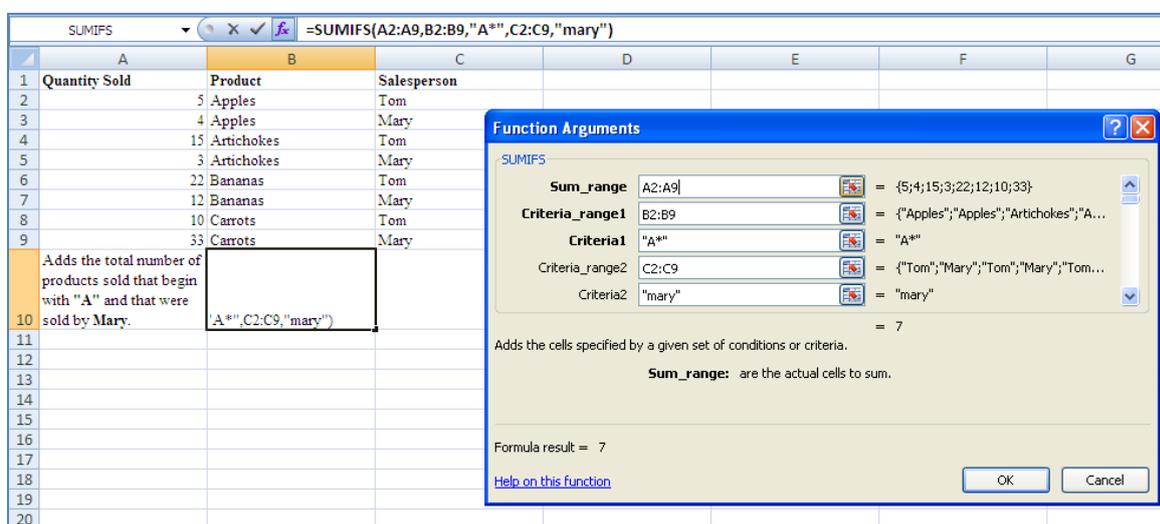
Exercise 15:

SUMIFS

Adds the cells in a range (range: Two or more cells on a sheet. The cells in a range can be adjacent or nonadjacent.) that meet multiple criteria. For example, if you want to sum the numbers in the range A1:A20 only if the corresponding numbers in B1:B20 are greater than zero (0) and the corresponding numbers in C1:C20 are less than 10, you can use the following formula:

=SUMIFS(A1:A20, B1:B20, ">0", C1:C20, "<10")

The order of arguments differ between the SUMIFS and SUMIF functions. In particular, the sum_range argument is the **first** argument in SUMIFS, but it is the **third** argument in SUMIF. If you are copying and editing these similar functions, make sure you put the arguments in the correct order.

Exercise 16: Using SUMIFS

LARGE Returns the k-th largest value in a data set.

SMALL Returns the k-th smallest value in a data set

Exercise 17: Using SUMIFS

Examples	Result
=LARGE(A2:A6,2)	5
=LARGE(A2:A6, 3)	4
=SMALL(A2:A6, 2)	3
=SMALL(A2:A6, 3)	4

	A
1	SCORE
2	5
3	6
4	4
5	3
6	2

Date and Time

Entry required	Function
The current date updated each day (floating format)	=TODAY()
The current date and time updated from the system calendar and clock (time is updated each time the worksheet is calculated)	=NOW()

Exercise 18: DATE AND TIME
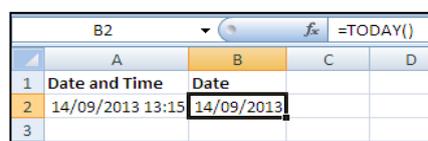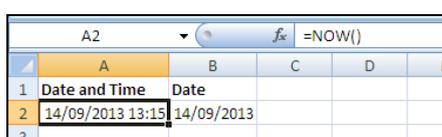
ROUND

The **ROUND** function rounds a number to a specified number of digits. For example, if cell A1 contains 23.7825, and you want to round that value to two decimal places, you can use the following formula:

=ROUND(A1, 2) The result of this function is 23.78. Note the number of decimal places shown indicates the maximum number of digits to display after the decimal. If there is only 1 or 0 digits then there will only be 1 or 0 digits shown as in the example below.

Exercise 19: Using ROUND
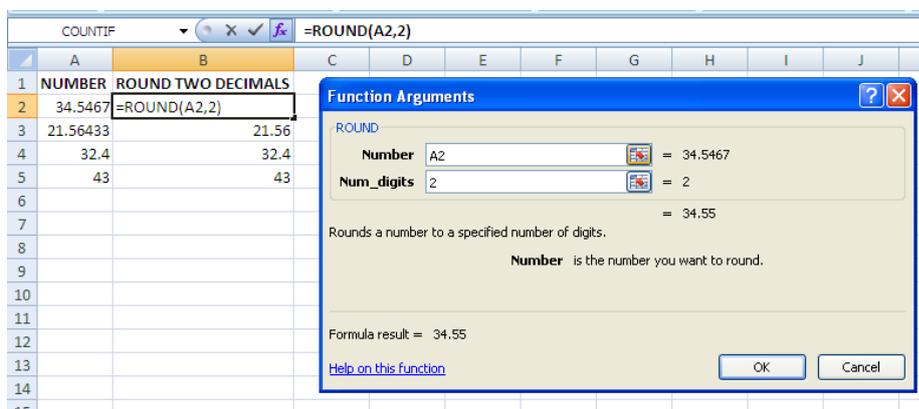
RANDOM

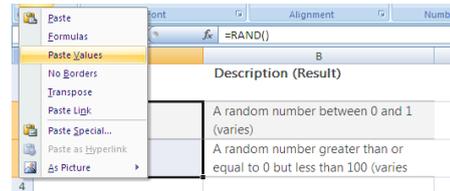Returns an evenly distributed random real number greater than or equal to 0 and less than 1. A new random real number is returned every time the worksheet is calculated. If you don't want this to happen then **copy**(CTRL+C) and **Paste Values** to retain the same random numbers once they are generated

Exercise 20: Using RANDOM

PRODUCT

The **PRODUCT** function multiplies all the numbers given as arguments and returns the product. For example, if cells A1 and A2 contain numbers, you can use the formula **=PRODUCT(A1, A2)** to multiply those two numbers together. You can also perform the same operation by using the multiply (*****) mathematical operator: for example, **=A1 * A2**.

Exercise 21: Using PRODUCT

ABSOLUTE vs RELATIVE CELL REFERENCING

There are two types of cell references: **relative** and **absolute**. Relative and absolute references behave differently when copied and filled to other cells. Relative references **change** when a formula is copied to another cell. Absolute references, on the other hand, remain **constant**, no matter where they are copied.

Example 1- relative cell referencing

VAT(sales tax) is applied at 21%. When the formula is filled down to the cells below the cell reference will change relative to the row the formula is filled into.

	A	B	C	D
1	ITEM	PRICE	VAT 21%	TOTAL
2	SOAP	€ 1.20	=B2*21%	
3	SHAMPOO	€ 2.50		
4	SPONGE	€ 3.00		
5	SHOWER GEL	€ 4.50		

	A	B	C	D
1	ITEM	PRICE	VAT 21%	TOTAL
2	SOAP	1.2	=B2*21%	
3	SHAMPOO	2.5	=B3*21%	
4	SPONGE	3	=B4*21%	
5	SHOWER GEL	4.5	=B5*21%	

Cell reference in row 3 is relative to row 3

Example 2 – absolute referencing

	A	B	C	D
1			21%	
2	ITEM	PRICE	VAT	TOTAL
3	SOAP	€1.20		
4	SHAMPOO	€2.50		
5	SPONGE	€3.00		
6	SHOWER GEL	€4.50		

	A	B	C	D
1			21%	
2	ITEM	PRICE	VAT 21%	TOTAL
3	SOAP	€1.20	=B3*C1	
4	SHAMPOO	€2.50		
5	SPONGE	€3.00		
6	SHOWER GEL	€4.50		
7				
8				

1. In the example above an extra row is entered above row 1 and VAT at 21% is entered in Cell C1.
2. In cell C3 enter the formula as shown. =B3*C2
3. The $ symbols makes the cell reference absolute or fixed. When the formula is filled into the cells below the row reference remains fixed in row 1.
4. Complete the total =C3*D3
5. Change the VAT to 22% You will see that the formula will update the cells below. This saves having to change the formula.
6. **If the VAT changes then you do not have to enter the formula again. You can just change the VAT %**

	A	B	C	D
1			0.21	
2	ITEM	PRICE	VAT 21%	TOTAL
3	SOAP	1.2	=B3*C1	
4	SHAMPOO	2.5	=B4*C1	
5	SPONGE	3	=B5*C1	
6	SHOWER GEL	4.5	=B6*C1	
7				