Level 6 Spreadsheet 6N4089

Section 4 – Formulas and Functions

Contents

RMN

All Functions

1. INPUT FORMULA USING:

RELATIVE CELL REFERENCES

Relative cell reference refers to the location of a cell or group of cells. When formula, function and charts are created relative cell references are frequently used. By default, a spreadsheet cell reference is *relative*, which means as a formula or function is auto filled i.e. copied and pasted to other cells, the cell reference changes to reflect the new location of the formula or function.

A relative cell reference consists of the column letter and row number which cross at the cells location for example **B2**, **G34** or a range **A2:B6**.

ABSOLUTE CELL REFERENCING

Absolute cell reference is also used in formula, functions and charts and identifies the fixed location of a cell or group of cells. Absolute cell referencing works in contrast to relative cell referencing, by making a cell absolute it is *prevented from changing* when the formula is auto filled i.e. copied and pasted to other cells, so it stays fixed on a specific cell or range.

To make a cell absolute use the dollar sign before the column and row **A5**

An easy way to apply the $ symbol to a cell reference is to click on the cell reference and press the **F4** key on the keyboard. (See an example of the use Absolute Cell Referencing in the Simple IF formula on page 18).

MIXED REFERENCING

A mixed cell reference is a combination of both types of referencing in one reference, which contains both a relative and absolute part. Either the column or row can be absolutely cell referenced individually e.g. **$A5** or **A$5**. In the example **C$1** the C column can change while the 1 row is fixed, as the formula is auto filled.

RANGE

Cell references are often referred to individually, however they can also be referred to in a group or *range* of cells. Ranges are identified by the cell reference in the upper left and lower right corners of the range. These are separated by a colon : which shows Excel that all cells between these two points should be included. The following example shows a SUM function with a range of C2:E8. The following is an example of an adjacent range of cells:
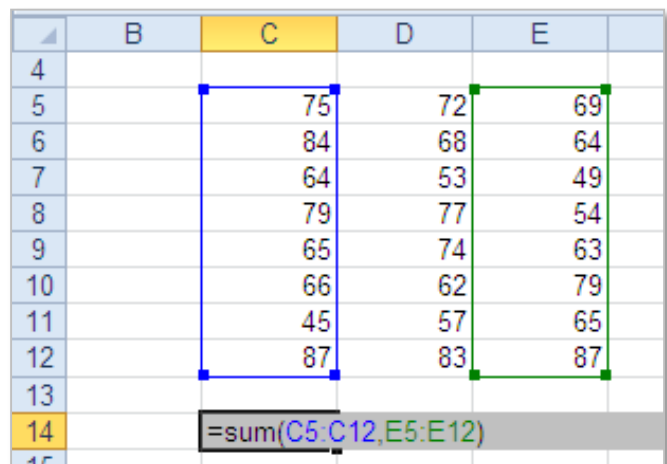
UNION

Ranges can be made up of adjacent or non-adjacent cells. Non adjacent cell ranges are identified by separating the range of each cell block with a comma , . This is also known as a Union Operator, which combines multiple references into one reference an example of this is as follows:

=SUM(C5:C12,E5:E12)

NOTE: The **Ctrl** can also be used to include a Union: highlight the first cell range, hold the Ctrl key and then highlight the second range.

INTERSECTION

An Intersection reference works by calculating on the cells common to the two reference ranges. To identify an intersection range the ranges of cells are separated by a space   .   The following is an example of an intersection reference using the SUM function: **=SUM(D22:E26 E22:F26)**

Using the intersection reference method only the overlapping cells are used. In this example the overlapping cells are E22, E23, E24, E25, E26.

3D

A 3D range refers to a range which has cells on ***different worksheets***. The selected cell or range of cells used in the formula must be identical on all the worksheets which are included. The following is an example of a 3D reference.

In short a 3D reference is a reference that refers to the same cell or range on multiple worksheets. As with the other reference methods, it is possible to use 3D references in formulas and functions.

The 3D cell reference **=SUM(Sheet1:Sheet3!C7:C8)** can be used to add up the numbers in cells "C7:C8" on 3 different worksheets.

FORMULA REFERENCE OPTIONS SUMMARY

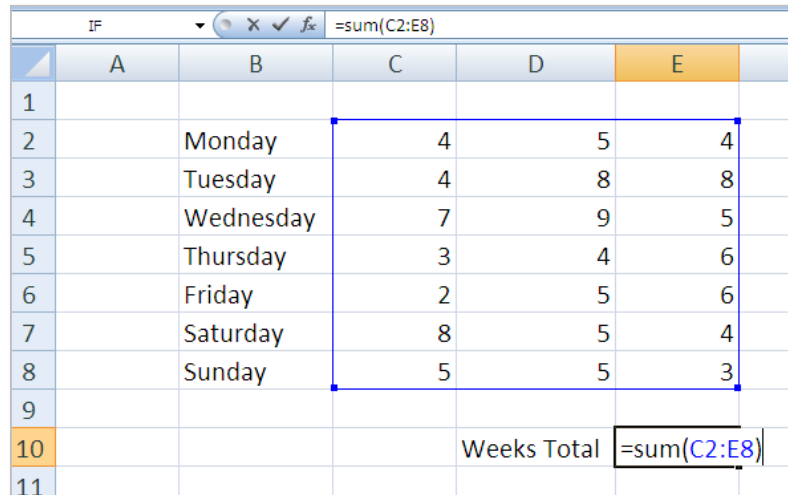| Meaning (Example)	Reference Operator
Relative Cell References, a relative cell reference consists of the column letter and row number.	A2
Absolute Cell Referencing identifies the fixed location of a cell or group of cells.	A5
Mixed Referencing, a mixed cell reference is a combination of both types of referencing in one reference, which contains both a relative and absolute part.	$C1 or C$1
Range, produces one reference to all the cells between two cells, including the two cell references (B5:B15)	: (colon)
Union, combines multiple references into one reference (SUM(B5:B15,D5:D15))	, (comma)
Intersection, produces one reference to cells common to the two references (B7:D7 C6:C8)	(space)
3D, creates a range which refers cells on different worksheets =SUM('Sheet1:Sheet3'!C7:C8)	

NOTES:

2. FUNCTIONS OR FORMULA

Formula or Functions what is the difference???

A function is a pre-built set of executable codes in Excel which perform a specific task. Like formula a function starts with the equal sign = followed by the function's name and its arguments (contained in brackets). The function name tells Excel what calculation to perform. For example the SUM function will add a group of numbers together within a range. **=SUM(C2:C8)**

However if it was required to multiply the total of two SUM functions together, there is no prebuilt function to do this, for this a formula is written.

A formula is a mathematical equation or set of commands used to generate a specific result or value. Formula may include functions, cell references, numbers and mathematical operators. The formula for the above problem is **=SUM(C2:C8)*SUM(B2:B8)**

In Excel Formula can be created using both the *Insert Function* button which opens the *Function Builder* or formula can be typed directly. In these notes all formula are created by typing the formula.

STORED AND DISPLAYED

The difference between a *stored* value and a *displayed* value can be explained as follows: a percentage is displayed in a cell as 47.5% however this is stored in the spreadsheet as 0.475. When we use a function or formula in a cell what is stored is the formula but what is displayed is the result of the formula.

ON STORED VALUES

Spreadsheets are used to store information in cells and worksheets. Performing calculations on stored values simply means performing calculations on a cell which has data in it and no formula under the data.

ON DISPLAYED VALUES

Displayed values mean values which are being shown as the result of formatting, formula or functions. Displayed values can be used in calculations in the same way stored values are used.

Note: The formula bar will always display the actual content of the cell, whether is it a formula or a stored value.

3. DATE AND TIME:

There are a number of date functions available in Excel only some of these are explained in the pages that follow, take time to become familiar with all of these, and the other date and time formula available in Excel. All date and time functions take their date from the **computer clock**, which means that if the computer clock is showing the wrong date or time the formula will too.

To access common Date and Time functions go to the **Formula** tab and click on the **Date & Time** button. To see a brief explanation of any formula hover over the formula without clicking and it will be display as shown.

DATES AS SERIAL NUMBERS

Computers store dates as a number representing the number of full days since midnight January 1, 1900, plus the number of hours, minutes and seconds for the current day. This is called the serial number.

To view the serial number as a date, format the number to the required date category.

DISPLAY DATES IN CORRECT FORMAT

As mentioned dates are stored as a number, to display them as a date it is important to change the format to the required style. Formatting can be applied to a cell or group of cells at any one time.

In this example the **=TODAY()** formula has been used and is visible in the formula bar, it
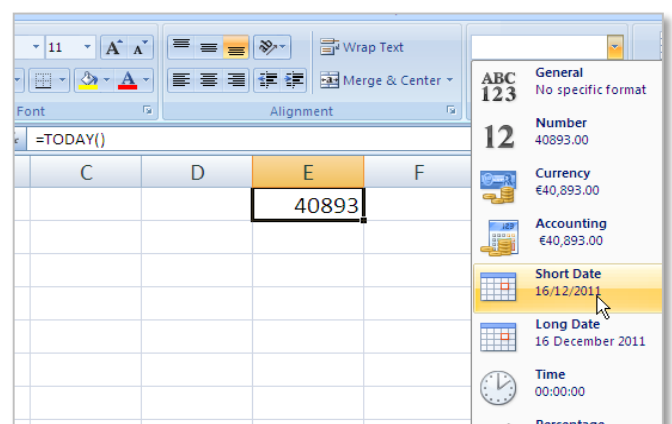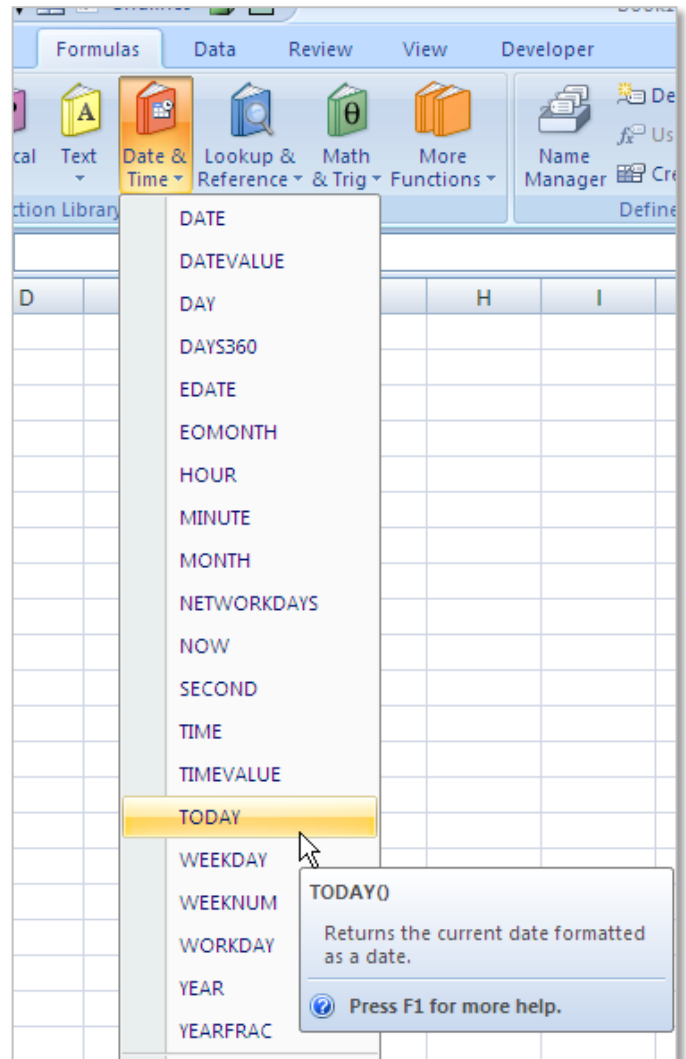
is currently set as the *General* format and is displaying as the serial number. To view this number as a date, choose the *Short Date* or *Long Date* format in the *Number* group on the *Home* menu.

Format Cells Dialogue Box - Date

Alternatively, right click on the cell and choose **Format Cells** (or select *More Number Formats)*. This will open the Format Cells dialogue box as shown.

This dialogue box offers a variety of different preset **Date** options.   These dates are grouped by location. So to choose American date format for example 9/21/1995 meaning September 21st 1995 the locality should be set to English (US).
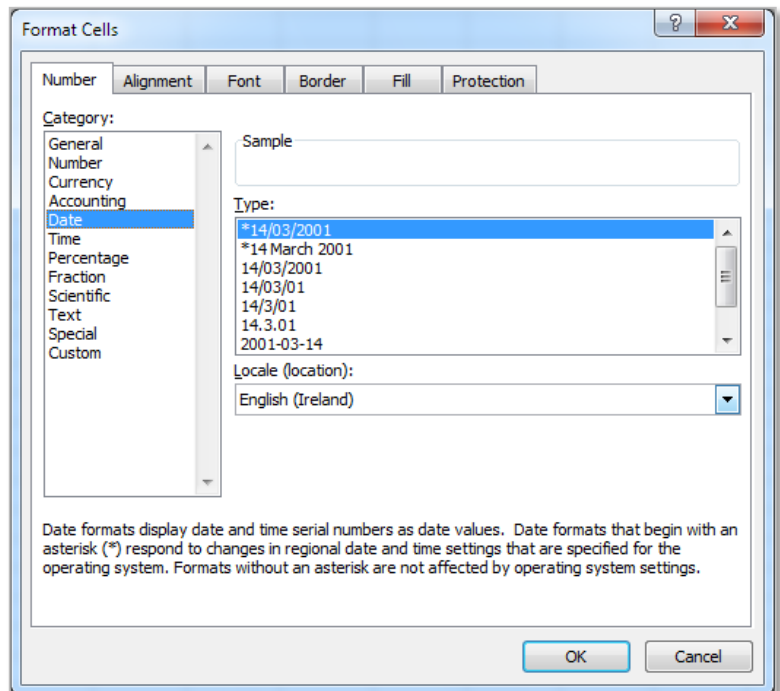
Format Cells Dialogue Box - Custom

In addition custom number formats can be set by selecting **Custom**.

From the **Type***:* text box, formats can be formatted to suit any formatting required. Edit the format as required and press enter to save.
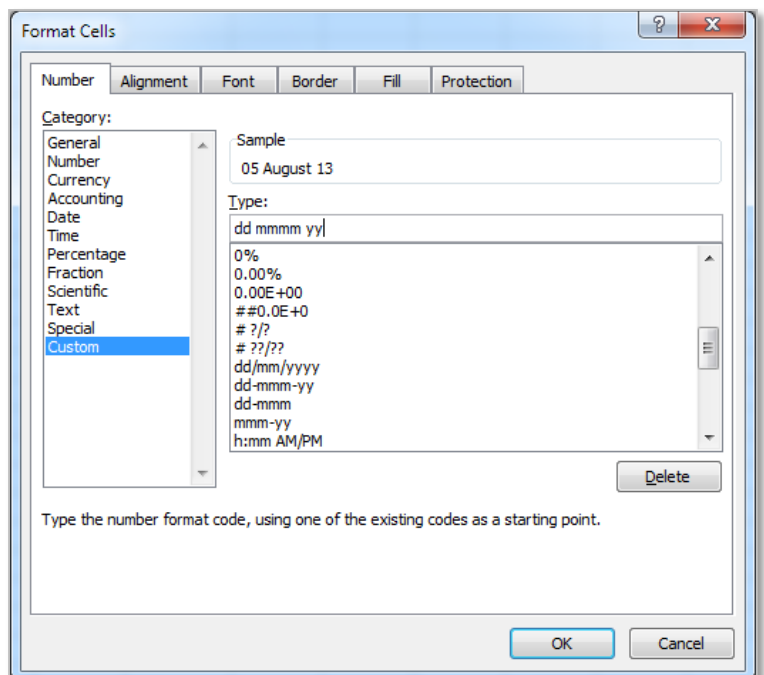
Dates can be set using:

   d   Date   **m**   Month   **y**   Year

Times can be set using:

   h   Hour   **m**   Minute   **s**   Second

Symbols such as **/** **:** and - or a space can also be added as required.

DAY

=DAY(serial_number)   Returns the day of the month, as a number from 1 to 31.

=DAY(D6)	
C	**D**
	20 November 2013 Today
	20 Day

Example This function can be used in a formula to find out the number of days between two dates. Since the function excludes the month and year portions of a date, it will not correctly calculate the number of days between two dates that are in different months or years.

D9		fx	=DAY(B9)-DAY(A9)	
A	**B**	**C**		**D**
07/11/2013	28/11/2013	Subtract two days from each other		21

MONTH

=MONTH(serial_number)   Returns the month, a number from 1 (January) to 12 (December).

	fx	=MONTH(B10)	
B	**C**		**D**
28/07/2013			7 Month

Example In the example below the formula finds the number of months between two dates. Since the function excludes the year portion of a date, it will not correctly calculate the number of months between two dates that are in different years (ensure the two months are in the same year).

D11		fx	=MONTH(B11)-MONTH(A11)	
A	**B**	**C**		**D**
01/05/2013	28/09/2013	Subtract two months from each other		4 Month - Month

YEAR

=YEAR(serial_number)   Returns the year of a date, an integer in the range 1900 – 9999

▼ ⊙	f_x	=YEAR(D6)	
B	**C**	**D**	
20/11/2013		2013	Year

Example subtracting two years will give the number of years between the two dates. Ensure the small date is taken from the large date.

D13	▼ ⊙	f_x	=YEAR(B13)-YEAR(A13)	
A	**B**	**C**	**D**	
15/04/2004	28/05/2013	Subtract two years from each other.	9	Year - Year

NOW

=NOW()   Returns the current date and time formatted as a date and time. This function has no argument, when entered into the required cells this formula calls the current date and time from the computer clock. This functions updates automatically when the worksheet is calculated i.e. when the worksheet is reopened.

Example in this example the cell formatting is set to hh:mm.

f_x	=NOW()	
C	**D**	
Shows todays Date and Time	14:56	Now

TODAY

=TODAY()   Returns the current date formatted as a date. Again this function has no argument and uses the computer clock. This function also updates automatically when the worksheet is calculated.

f_x	=TODAY()	
C	**D**	
Shows todays Date	20 November 2013	Today

PERFORM CALCULATIONS ON DATES AND TIMES

Calculations can be completed on dates and times because they are stored as a serial number as discussed on page 6.

TO CALCULATE THE NUMBER OF DAYS BETWEEN TWO DATES IN *DAYS*

TAKE TWO DATES FROM EACH OTHER

1. Type in two dates and set them both to date format.
2. Use a formula **=B4-C4** to take the largest date from the smallest date.
3. Ensure the formula cell **E4** is set to *General* format to allow the answer to be displayed as a number.

	B	C	D	E
4	21 January 2012	16 December 2011	**Number of Days**	36
5				

DIFFERENCE IN MONTHS BETWEEN DATES

=(YEAR(Cell Ref)-YEAR(Cell Ref))*12+MONTH(Cell Ref)-MONTH(Cell Ref)

1. Type in two dates and set them both to date format.
2. Use the formula **=(YEAR(C4)-YEAR(B4))*12+MONTH(C4)-MONTH(B4)**
3. Ensure the formula cell is set to *General* format to allow the answer to be displayed as a number.

This formula works by finding the number of years, multiplying this by 12 and adding the number of months.

	A	B	C	D	E	F
4	21 January 2012	16 October 2011	**Number of Months**	3		
5						
6						
7						

WEEKDAY

=WEEKDAY(Cell Ref)   Returns the day of the week in a number. The WEEKDAY function returns the day of the week based on one date in a cell reference. Each day is represented as a number with the week starting on Sunday as 1, Monday as 2, etc.

	D18		fx	=WEEKDAY(A18)	
	A	**B**		**C**	**D**
17					
18	13/01/2012	**Weekday as a Number**			6
19	12/01/2012	**Weekday as a Number**			5
20					

Note: If you wanted to display the day as the actual day 1 = Sunday, 2 = Monday, etc. you could add the use of a Nested IF formula or a Lookup.

DATEDIF

=DATEDIF(StartDate,EndDate,Unit)   Returns the number of days, months or years.

The DATEDIF function can be used to calculate the number of days between dates.

1. The first cell reference is the final date.
2. The second cell reference is the most recent date.
3. The unit can used to find the number of days ("d"), number of months ("m") and number of years ("y").

	D14		fx	=DATEDIF(B14,A14,"d")	
	A	**B**	**C**		**D**
14	16 Dec 2011	08 Jan 1982	**Days d**		10934
15			**Months m**		359
16			**Years y**		29

An interesting about thing about the DATEDIF function is that it is an undocumented function which means that while it works, it is not listed under the formula tab in Excel. Therefore it must be typed manually into a cell and not with the dialog box available for other functions.

NETWORKDAYS

=NETWORKDAYS(StartDate,EndDate,Holidays)   Counts the number of working days between two dates.

The NETWORKDAYS function can be used to count the number of working days between two dates. The function automatically removes the weekend days from the total. To remove additional days such as a range of holidays the *holiday* argument can be used.

1. Enter the start date as the first cell reference.
2. Enter the end date as the second cell reference.
3. The holidays are entered as a range between two different dates in two cell references.

C22		f_x	=NETWORKDAYS(B22,B23,B24:B25)	
	A	**B**		**C**
21	**Net Working Days excluding some holidays**			
22	Start Date:	09/01/2012		58
23	End Date:	30/03/2012		
24	Holiday Start:	13/02/2012		
25	Holiday End:	17/02/2012		

WEEKNUM

=WEEKNUM(serial_numer,return_type)   Returns the week number in the year.

D22			f_x	=WEEKNUM(D21)		
	A	**B**	**C**		**D**	
21			Pay Date:		20/11/2013	TODAY
22			Week Number:		47	WEEKNUM

NOTES

4. HORIZONTAL AND VERTICAL LOOKUPS:

HLOOKUP

=HLOOKUP(lookup_value,table_array,row_index_num,range_lookup)

A HLOOKUP looks for a value in the top row of a table or array of values and returns the value in the same column from a row specified.

Example The following is a travel location distance lookup list used to calculate expenses for a business. In the lookup area which is cells A23:F25 the information is organised **horizontally** and the range is named as *Distance* this is the **table_array**, the location in cell B30 is the **lookup_value** this is searched in the row 23 of the array Distance. When it is found the contents of row 2 (**row_index_num**) which is the Contact is displayed. Finally the **range_lookup** is set to FALSE which means that only an exact match should be displayed (this can also be set to TRUE for an approximate match – useful when working with percentages).

C30		f_x	=HLOOKUP(B30,Distance,2,FALSE)				
	A	B	C	D	E	F	G
20							
21			HLOOKUP				
22							
23	Location	Gort	Headford	Loughrea	Oughterard	Tuam	
24	Contact	Mark O Shea	Peter Flynn	Sue Barrett	Tina Moore	John Lynch	
25	Distance	19	16	28	15	22	
26							
27		Rate per Mile	€0.75				
28							
29	Date	Location	Contact	Distance	Expenses		
30	04/08/2003	Tuam	John Lynch	22	€16.50	HLOOKUP	
31	04/08/2003	Headford				Absolute Cell Referencing	
32	05/08/2003	Loughrea					
33	05/08/2003	Gort					
34	05/08/2003	Oughterard					
35							

Use HLOOKUP functions in cells C30 and D30 (remember to change the row). In cell E30 use multiplication and absolute cell referencing with cell C27.

NOTES:

VLOOKUP

=VLOOKUP(lookup_value,table_array,col_index_num,range_lookup)

A VLOOKUP looks for a value in the leftmost column of a table, and then returns a value in the same row from a column specified. By default, the table must be sorted in an ascending order.

Example The following is a stock list of mobile phones. The range from cells A7:D17 has been organised **vertically** and named as *Phones* this is the **table_array**, the phone ID in cell G7 is the **lookup_value** this is searched in the left column, when it is found the contents of column 2 which is the name of the phone is displayed **col_index_num**. Finally the **range_lookup** is set to FALSE which means that only an exact match should be displayed (this can also be set to TRUE for an approximate match – useful when working with percentages).

	G16		f_x	=VLOOKUP(G9,Phones,2,FALSE)				
	A	B	C	D	E	F	G	H
7			**VLOOKUP**					
8								
9	Phone ID	Product	Unit Price	Quantity in Stock		Type in Phone ID	10857	
10	10234	Samsung Noire	99	45				
11	10235	Sony Ericsson F305	99	51				
12	10245	Samsung Adidas MiCoach	99	23				
13	10556	Motorola W230	29	53				
14	10857	Samsung J700	59	35				
15	10987	Sony Ericsson C905	389	15				
16	11983	Samsung L700 Purple	89	23		Mobile	Samsung J700	VLOOKUP
17	12576	Samsung Tocco Pink	269	20		Unit Price	59	VLOOKUP
18	12985	Sony Ericsson T303	59	64		Qty in Stock	35	VLOOKUP
19	19883	Nokia 5220	119	31				
20								

LOOKUP

=LOOKUP(lookup_value,lookup_vector,result_vector)

A LOOKUP looks up a value either from a one-row or one-column range or from an array. Provided for backward compatibility as the VLOOKUP and HLOOKUP are the more up to date versions of this function.

NOTES:

14

Example In this example we have mobile phones listed by their *Order ID*, *Product Name*, *Unit Price* and *Quantity in Stock*. Using the **Lookup** function and the *Order ID* from the A column to find the *Product* name using only an ID number.

Cell H5 is used to store the *Order ID* which you are looking up, this is known as the **lookup value**. The *Product ID* will be shown in H7 so the formula will go in here. The **lookup value** is found in the look up vector. In this example the **lookup vector** is the list of *Order ID* numbers (so everything from A2 to A11). Finally the **result vector** shows the list where the answer will come from (product names from B2 to B11).

Note: If the lookup value is not on the list the lookup function will return the nearest lowest value. So if we searched for 21 in this example, lookup would give us the Sony Ericsson C905.

In the example shown here the **lookup** will go the cell **H5** find the number 15. Then it will look at cells **A2:A11** and find 15 at row 6. Then will look in the results vector from **B2:B11** and find the name of the product in row 6.

The answer which is returned will be 'Samsung J700'.

NOTE A lookup will not work if the information is not sorted according to the result vector. In our example above the *Order ID* numbers have been sorted in ascending order before this lookup was completed.

5. MATHEMATICAL:

Mathematical functions are used to perform common mathematical operations such as adding, rounding and multiplying. They are all found on the **Formula** tab in the **Function Library** under the **Math & Trig** drop down list.

INT

=INT(number)   Rounds a number down to the nearest integer.

f_x	=INT(B6)		
B	C	D	
45.9856321	Rounds a number down to the nearest integer.	45	INT

Example The INT function can be used to round numbers down before they are multiplied to keep figures low. In this example the INT function has been used on cell D2 to convert the number to 25. Cells F1 and F2 show the products of D1 multiplied by E1 and D2 multiplied by E2, using the INT function on D2 gives a difference in the result of 2.55.

=INT(D1)		
D	E	F
25.255	10	252.55
25	10	250

POWER

=POWER(number,power)   Returns the result of a number raised to a power.

f_x	=POWER(B7,2)	
	C	D
4	Returns a number raised to a power.	16 POWER

Example The POWER function can be used in the calculation of the area of a circle.

B53		f_x =POWER(A53,2)	
	A	B	C
51	Calculate the area of each of the following circiles using POWER:		
52	Circle Radius (cm)	Area	
53	25	625.00	

17

ROUND

=ROUND(number,num_digits)   Rounds a number to a specified number of digits.

	f_x	=ROUND(B8,4)	
B		**C**	**D**
45.9856321145		Rounds anumber to a specified number of digits.	45.9856 ROUND

The ROUND function can be used to reduce a value by a specific number of decimal places. Unlike formatting options that allow you change the number of decimal places displayed, the round function actual alters the data in your worksheet. **num_digits** represents the number of decimal places the number should be reduced to.

Note: If the value of the number to the right of the rounding digit is less than five, the rounding digit is left unchanged, and if the value of the number to the right of the rounding digit is five or higher, the rounding digit is raised by one. In the following example the number is rounded down to 45.9856.

ROUNDUP

=ROUNDUP(number,num_digits)   Rounds a number up, away from zero.

Similar to the ROUND function the ROUNDUP rounds to a specified number of digits however ROUNDUP will always round a number upward to the nearest whole number.

	f_x	=ROUNDUP(B9,3)	
B		**C**	**D**
89.2232123		Rounds a number up away from zero.	89.224 ROUNDUP

ROUNDDOWN

=ROUNDDOWN(number,num_digits)   Rounds a number down, toward zero.

Similar to the ROUND function the ROUNDDOWN rounds to a specified number of digits however ROUNDDOWN will always round a number down to the nearest whole number.

	f_x	=ROUNDDOWN(B10,0)		
B		**C**	**D**	**E**
45.897456		Rounds a number down, toward zero.	45 ROUNDDOWN	

SQRT

=**SQRT(number)**   Returns the positive square root of a number.

The square of a number is a number multiplied by itself for example the square of 4 (written as 4^2) is 16. The square root works in the opposite direction to a square, so the square root of 25 is 5 (for more information on how a square root is calculated visit MathsIsFun - Square Root).

Example the square root of the figure in 22500 in cell B11 is calculated as 150.

fx	=SQRT(B11)	
B	**C**	**D**
22500	Returns the positive Square Root of a number.	150 SQRT
50625		225 SQRT
90000		300 SQRT

The SQRT function will not work on a negative number and will return the #NUM! error.

SUM

=**SUM(number1,number2,…)** Adds all the numbers in a range of cells.

The SUM formula works by adding the values from any given range of cells.

Example the total of the figures in the range B14:B17 (21, 51, 58, 45) is calculated as 175.

X ✓ fx	=sum(B14:B17)	
B	**C**	**D**
21	Add the numbers in a range of cells.	=sum(B14:B17) SUM
51		SUM(**number1**, [number2], …)
58		
45		

There is no subtract function in Excel the sum function can be used to subtract if the values are entered into the cell or the function as negative numbers, for example =SUM(58,-56).

NOTES:

SUMIF

=SUMIF(range,criteria,sum_range)   Adds the cells specified by a given condition or criteria.

The SUMIF function is used to sum the values in a range that meet a given criteria.

Example to sum all the sales of Apples sold on Monday use the following formula =SUMIF(B62:B70,"Apples",C62:C70). Any row in the range B62:B70 that contains the word *Apples* has the corresponding number from the range C62:C70 added to the sum total. When using the SUMIF total in this way it is important to ensure all spelling is correct and that no spaces are added after words in cells.

	C72	▼	*fx*	=SUMIF(B62:B70,"Apples",C62:C70)	
	A	B		C	
58					
59	**Monday Sales**				
60					
61	**Customer**	**Product**		**Amount**	
62	Tony Leahy	Apples			250
63	Sinead Donovan	Bananas			100
64	Peter Smith	Apples			300
65	Stephen Connors	Pears			75
66	Seamus O'Neill	Bananas			80
67	Gary Jennings	Bananas			150
68	Mike Healy	Apples			200
69	Eileen Carr	Pears			300
70	Christine Flynn	Apples			50
71					
72	Total Sales of Apples				800
73	Total Sales of Bananas				330
74	Total Sales of Pears				375
75					

An alternative way of using the SUMIF formula is to give a comparison criteria within the formula, for example to add up all the figures greater than or equal to 200 use this formula =SUMIF(C62:C70,">=200",D62:D70).

NOTES:

20

RAND

=RAND() Returns a random number greater than or equal to 0 and less than 1, evenly
distributed (changes on recalculation of the worksheet).

The RAND function generates a random number between 0 and 1 every time the worksheet is
recalculated. Like the TODAY function no arguments are used with the RAND function.

	D18		fx	=RAND()	
	A	B	C	D	
18	RAND		Generates a Random number between 0 and 1.	0.740488661	RAND
19			Multiply by 100 to get a whole number.	45.19063655	RAND

It can be useful to multiply the number generated by the RAND function by 100 to get a whole
number =RAND()*100.

RANDBETWEEN

=RANDBETWEEN(bottom,top) Returns a random number between the numbers specified.

The RANDBETWEEN function returns a random number between the two numbers specified in
bottom and **top**. If the number in **top** is set to a number lower than the **bottom** number this
formula will return a #NUM! error.

	D20		fx	=RANDBETWEEN(1,6)		
	A	B	C	D	E
20	RANDBETWEEN		Returns a random number between those specified.	5	RANDBETWEEN

The RANDBETWEEN function is very useful for simulating, see the *Tossing a Coin* and *Dancefloor*
example in Moodle.

EVEN

=EVEN(Number) Rounds a positive number up and a negative number down to the nearest
even integer (whole number).

		fx	=EVEN(B21)	
B	C		D	
1.5	Rounds a number up to the nearest even integer.		2	EVEN
3			4	EVEN
2.15			4	EVEN
-1.5	When the number is negative it rounds away from zero.		-2	EVEN
-6.9			-8	EVEN

If nonnumeric is entered into an EVEN function it will return #VALUE! error value.

=ODD(Number)   Rounds a positive number up and a negative number down to the nearest odd integer (whole number).

The ODD function is very similar to the EVEN function except it rounds up to the nearest ODD number see the following examples.

	f_x =ODD(B26)		
B	**C**	**D**	
1.5	Rounds a number up to the nearest odd integer.	3	ODD
3		3	ODD
2.15		3	ODD
-1.5	When the number is negative it rounds away from zero.	-3	ODD
-6.9		-7	ODD

If nonnumeric is entered into an ODD function it will return #VALUE! error value.

An extensive list of Excel mathematical functions can be found on Office.Microsoft.Com. Research and explain one additional **Mathematical** function here…

6. STATISTICAL:

Statistical functions can be used to analysis the data in a spreadsheet. For example, they can be used to tell the number of data entries there are or the average value of the data.

AVERAGE

=AVERAGE(number1,number2,…) Returns the average (arithmetic mean) of its arguments, which can be numbers or names, arrays or references that contain numbers.

	B11	▾	f_x	=AVERAGE(B6:B10)	
	A	B		C	
6	AVERAGE	21	Average number of a list of numbers.		
7		51			
8		24			
9		3			
10		18			
11		23.4			
12					

The AVERAGE function is used to calculate the average of a list of numbers, it adds up all the figures in the range and divides the total by the number of numbers. This formula can be accessed from the AutoSum drop down menu. =AVERAGE(B6:B10). The average function ignores blank cells.

AVERAGEIF

=AVERAGEIF(range,criteria,average_range) Finds average(arithmetic mean) for the cells specified by a given condition or criteria.

	C20	▾	f_x	=AVERAGEIF(B14:B18,"Product A",C14:C18)	
	A	B	C	D	E
14	AVERAGEIF	Product A	54		
15		Product A	26		
16		Product C	84		
17		Product B	16		
18		Product A	4		
19			69	Average if number is greater than 50.	
20			28	Average if product is Product A.	
21					

The AVERAGEIF function calculates an average if a given condition is met. The two examples shown above are as follows:

A. =AVERAGEIF(C14:C18,">50") - if the number is above the value of 50 use it in the calculation of the average. This would add the numbers 54 and 84 and divide by 2 to get the average of 69.

B. =AVERAGEIF(B1:B18,"Product A",C14:C18) - if the product sold is *Product A* use the value in column C to calculate the average. This would add the numbers 54, 26 and 4 and divide their total by 3 to get the figure 28.

MAX

=MAX(number1,number2,…)   Returns the largest value in a set of values. Ignores logical values and text.

B29		fx	=MAX(B24:B28)
	A	B	C
24	MAX	48	
25		51	
26		5.12354	
27		45678	
28		-123546	
29		45678	

The MAX function will return the maximum or highest number from the list of numbers in the cell range C1 to C10. This formula can be accessed from the AutoSum drop down menu. =MAX(B24:B28)

MIN

=MIN(number1,number2,…)   Returns the smallest number in a set of values. Ignores logical values and text.

E29		fx	=MIN(E24:E28)
	D		E
24	MIN		48
25			51
26			5.12354
27			45678
28			-123546
29			-123546

The MIN function will return the minimum/smallest number from the list of numbers in the cell range C1 to C10. This formula can be accessed from the AutoSum drop down menu. =MIN(E24:E28)

COUNT

=COUNT(value1,value2,…)   Counts the number of cells in a range that contain numbers.

B37		fx	=COUNT(B33:D36)
	A	**B**	**C**	**D**
33	COUNT		4	5
34				3
35		1		1
36			24	
37		6		
38				

The COUNT function counts the number of cells that contain numbers within a range of cells, ignoring any black cells. This example counts all the numbers in the range of cells from B33:D36.
=COUNT(B33:B36)

COUNTA

=COUNTA(value1,value2,…)   Counts the number of cells in a range that are not empty.

B46		fx	=COUNTA(B41:D45)
	A	**B**	**C**	**D**
41	COUNTA	Seventeen		
42		4	6	
43				8
44		0	Twenty four	
45			Mary	
46		7		
47				

The COUNTA function can be used to count the number of cells in a range that re not empty. That is any cells containing data including text, dates, numbers, formula, etc. The function also ignores any black cells in the range. =COUNTA(B41:D45)

COUNTIF

=COUNTIF(range,criteria)   Counts the number of cells within a range that meet the given condition.

The function COUNTIF counts the number of cells within a range that meet the given condition. In this example in the cell range C38:E40 find the number of 7's (7 is the criteria). The answer is 4 as there are 4 number 7's in the cell range.

f_x	=COUNTIF(C38:E40,7)			
	C	D	E	F
			7	
	7	8	7	
	7			
	4	COUNTIF		

This formula also works on text, in this example the criteria is the word "Cat". There are four words cat in the cell range C38:E40.

f_x	=COUNTIF(C38:E40,"Cat")			
	C	D	E	F
			Cat	
	Cat	8	Cat	
	Cat		Dog	
	4	COUNTIF		

The COUNTIF formula can also be used with the wildcard characters, q**uestion mark ?** and **asterisk** * in the criteria. The question mark can represent any single character and the asterisk represents any string of characters.

Examples the following formula are all examples of how the criteria can be varied using wildcard characters and calculation, based on the given set of data.

◢	A	B	C	D
57	COUNTIF	Apples	32	
58		Apples	54	
59		Oranges	62	
60		Peaches	12	
61		Apples	54	
62		Peaches	35	
63		Oranges	54	

Formula	Explanation
=COUNTIF(B57:B63,"Apples")	Count the number of cells with "Apples" in column B. (3)
=COUNTIF(B57:B63,B59)	Count the number of cells with Oranges using cell B59 as the criteria for Oranges, in column B. (2)
=COUNTIF(B57:B63,B58)+COUNTIF(B57:B63,B59)	Count the number of times Apples and Oranges appear in column B. (5)
=COUNTIF(C57:C63,">40")	Count the number of cells in column C that have a value greater than 40. (4)

=COUNTIF(C57:C63,"<>"&C61)	Count the number of cells in column C that have a value which is not equal to 54. (4)
=COUNTIF(C57:C63,">=30")-COUNTIF(C57:C63,">50")	Count the number of cells in column C that are greater than or equal to 30 and less than 50.

MEDIAN

=MEDIAN(number1,number2,…)   Returns the median, or the number in the middle of the set of given numbers.

B78	fx	=MEDIAN(B72:B77)

	A	B	C
73	MEDIAN	2	
74		7	
75		15	
76		13	
77		16	
78		13	
79			

Returns the median number, which is the number in the middle of a given set of numbers. Or the Median is the *"middle number"* (in a sorted list of numbers). For more information on the Median visit - **Math is Fun**.   =MEDIAN(B72:B77)

In this example the list would be sorted to 2, 7, 13, 15, 16, as there are 5 numbers on the list the middle number is the 3rd number 13.

If there is an even number of numbers in the range the MEDIAN calculates the average of the two numbers in the middle. So the MEDIAN OF 2, 5, 7, 13, 15, 16 would be 10.

MODE OR MODE.SNGL

=MODE.SNGL(number1,number2,…)   Returns the most frequently occurring, or repetitive, value in an array or range of data.

B89	fx	=MODE.SNGL(B82:B88)

	A	B	C
82	MODE	21	
83		45	
84		12	
85		21	
86		65	
87		35	
88		12	
89		21	
90			

The MODE function returns the most frequently occurring or repetitive value in a range of numbers. This function has recently been replaced by the MODE.SNGL although the MODE function will also still work.   =MODE.SNGL(B82:B88)

For more information on the Mode visit **Math is Fun** http://www.mathsisfun.com/mode.html

There are many more useful statistical formulae available on the **Formulas** tab in the **Functions Library** group under the **More Functions** and **Statistical** list. For example look at the **Small** function.

An extensive list of Excel statistical functions can be found on Office.Microsoft.Com. Research and explain one additional **Statistical** function here…

7. TEXT

Text functions are used to manage the text in a spreadsheet. They are all found on the **Formula** tab in the **Function Library** under the **Text** drop down list.

CONCATENATE

=CONCATENATE(text1,text2,)   Joins several text strings into one text string.

	B11			*fx*	=CONCATENATE(C7," ",D7)		
	A	B	C	D	E	F
6	CONCATENATE		First Name	Surname	Address	Balance
7			Tom	Treanor	Clontibret	€32.00
8			Mary	McKenna	Clones	€45.00
9			Jane	Kerr	Magheracloone	€65.00
10						
11		Tom Treanor				

The concatenate function can be used to join together text that is in separate columns. The concatenate function joins up to 255 text strings into one, this can include text, characters, numbers, cell references or a combination of these. The example above includes the first name in cell C7 *Tom* , then a space included inside inverted commas as it is a considered a character " " and then the surname in cell D7 *Treanor*. =CONCATENATE(C7," ",D7)

Example the following use of the function would produce a sentence write out the answer to the function in the space below. =CONCATENATE(C8," ",D8," from ",E8," owes €",F8,".")

LEFT

=LEFT(text,num_chars)   Returns the specified number of characters from the start of a text string.

When no argument is supplied for **num_chars** only the first character is returned.

=LEFT(B16)

	C16			*fx*	=LEFT(B16)
	A	B	C
16	LEFT	Mary	M
17		Mr McKenna	Mr
18		Sale Price	Sale
19			

When a number is supplied for num_chars that number of characters is taken from the cell referenced. =LEFT(B17,2)

C17			fx	=LEFT(B17,2)
	A	B		C
16	LEFT	Mary	M	
17		Mr McKenna	Mr	
18		Sale Price	Sale	

The left function returns the first character or a number of characters from another cell containing text, starting at the left side of the cell. The LEFT function is used to remove unwanted characters from a cell, if data is imported with unwanted text it can be easily removed, for example if numbers were taken in with *687 miles* the word *miles* could be removed with =LEFT(cellref,3).

LOWER

=LOWER(text)   Converts all letters in a text string to lowercase.

C24			fx	=LOWER(B24)
	A	B		C
22	LOWER	AlPHAbet Soup	alphabet soup	
23		Sara	sara	
24		THREE 3	three 3	
25				

The LOWER function converts all letters in the cells referenced to lowercase, if there are numbers in the cell they are left unchanged. =LOWER(B24)

MID

=MID(text,start_num,num_chars)   Returns the characters from the middle of a text string, given a starting position and length.

ARGUMENT	EXPLANATION
Text	The string containing the characters to be extracted.
start_num	The position of the first character to be extracted.
chars	The number of characters MID should extract.

	C28	▼	◉	f_x	=MID(B28,7,3)	

	A	B	C
28	**MID**	Drove 340 miles	340
29		Drove 273 miles	273
30		Drove 234 miles	234
31			

This function is useful for separating numbers from unwanted characters. Returns a specific number of characters from a text string, starting at the position specified based on the number of characters specified. Mid counts each character as 1. =MID(B28,7,3)

PROPER

=PROPER(text)   Converts a text string to proper case; the first letter in each word in uppercase, and all other letters to lowercase.

	D35	▼	◉	f_x	=PROPER(B35)	

	A	B	C	D	E
34	**PROPER**	this SENTENCE IS not propER		This Sentence Is Not Proper	
35		mARY jONES		Mary Jones	
36		15 green lane		15 Green Lane	
37		TRIAL BALANCE		Trial Balance	
38					

This function ensures that the first letter of each word in the cell is uppercase and all the others are lowercase. If there are several words in the cell each word is capitalized. This is very useful for converting text that has not been correctly typed. =PROPER(B35)

RIGHT

=RIGHT(text,num_chars)   Returns the specified number of characters from the end of a text string.

	C43	▼	◉	f_x	=RIGHT(B43,5)	

	A	B	C
41	**RIGHT**	Right Price	Price
42		Green	n
43		273 miles	miles
44			

The RIGHT function is very similar to the LEFT function except it works from the right of the cell referenced instead of the left. So the RIGHT function extracts a substring starting from the right most character of the cell referenced. If not num_chars is specified only the last letter is extracted. =RIGHT(B43,5) and =RIGHT(B42)

TRIM

=TRIM(text)   Removes all spaces from a text string except for single spaces between words.

	B48				f_x	=TRIM(B47)	
	A	B		C		D	E
47	TRIM	When	text has spaces	that are	not needed use		TRIM!
48		When text has spaces that are not needed use TRIM!					
49							

When text is copied from another source into Excel sometimes the text can be copied with too many spaces between the words. This can happen when text is copied from the internet or from a Word document. The TRIM function can be used to remove these spaces. The TRIM function removes spaces when there is more than one space leaving one space remaining between each word. =TRIM(B47)

UPPER

=UPPER(text)   Converts a text string to all uppercase letters.

	C52			f_x	=UPPER(B52)
	A		B		C
52	UPPER		income tax		INCOME TAX
53			Green Lane		GREEN LANE
54			mAry jones		MARY JONES
55					

The UPPER function sets all the text in the cell to upper case ignoring numbers. This can be used to correct text that has been entered incorrectly.

NOTE: After text has been formatted to the necessary state the formula can be removed from the text. To do this copy the column with the text and paste the text as values only. This will remove the formula and leave only the text in the pasted cells.
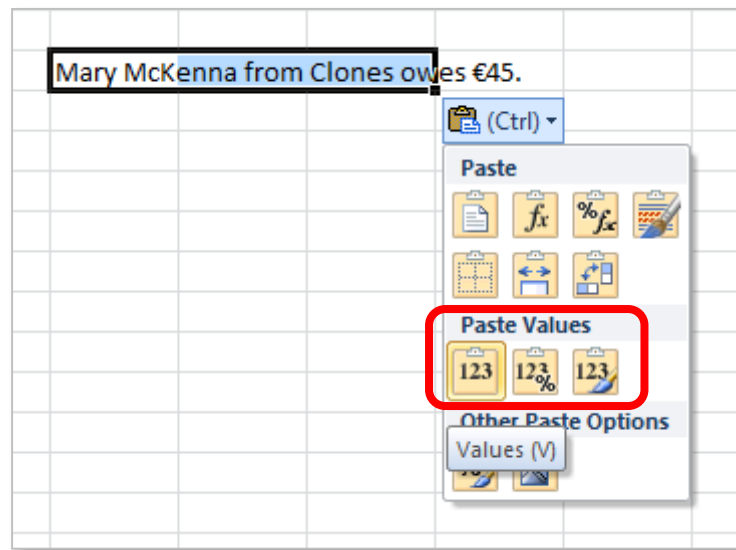
An extensive list of Excel text functions can be found on Office.Microsoft.Com. Research and explain one additional **Text** function here, for example look at the REPT function.

Financial functions can be used to help determine changes in value of investments and loans. They are all found on the **Formula** tab in the **Function Library,** under the **Financial** drop down list.

DB – DEPRECIATION or DECLINING BALANCE

=DB(cost,salvage,life,period,[month])   Depreciation of an asset over time.

The monetary value of an asset decreases over time due to use, wear and tear or obsolescence, this can be described as **depreciation**. There can be caused by a number of factors which affect depreciation such as market conditions and objects which could be affected by depreciation include premises, machinery, equipment and vehicles. Accounts estimate the decrease in value using the information regarding the useful life of the asset.

The DB function requires four values with the option of the month as a fifth value. These are:

ARGUMENT	EXPLANATION
cost	Purchase Price of the asset.
salvage	Disposal Value of the asset.
life	Number of years over which the asset is depreciated.
period	Year number.
month *(optional)*	Month number in that year. If the month is omitted it is assumed to be 12.

Example in this example the depreciation of a company van over 5 years is calculated for each year.

The sum of each of the **5 years depreciation** and the **disposal price** should be approximately the total value of the **purchase price**.

FV – FUTURE VALUE

=FV(rate,nper,pmt,pv,type)   Returns the future value of an investment based on periodic, constant payments and a constant interest rate.

Future value of pension/investment scheme, with a constant interest rate and constant payments.

The FV function requires the following values:

ARGUMENT	EXPLANATION
rate	The interest rate per period. *Required*.
nper	The total number of payment periods in an annuity. *Required*. **Note:** an annuity is a series of constant cash payments made over a continuous period e.g. car loan or mortage.
pmt	The payment made each period; it cannot change over the life of the annuity. *Required*.
pv	The present value, or the lump-sum amount that a series of future payments is worth right now. *Optional* - if omitted it is assumed to be 0.
type	The number 0 or 1 and indicates when payments are due. *Optional* - if omitted it is assumed to be 0. 0 - At the end of the period. 1- At the beginning of the period.

Example in this future value calculation the rate is 0.06 for the 12 months. There are 10 payments into the account at €200 per payment. Currently there is €500 in the account and the payment is due at the start of each payment period.

	A	B	C
	A58		f_x =FV(A51/12,A52,A53,A54,A55)
48	FV		**Future value of pension/investment scheme.**
49			
50	**Data**		**Description**
51	0.06		Annual Interest Rate
52	10		Number of Payments
53	-200		Amount of the payment
54	-500		Present value
55	1		Payment is due at the beginning of the period.
56			
57	**Result**		**Description**
58	€2,581.40		Future value of an investment using the terms from A2:A5.
59			

NPV – NET PRESENT VALUE

=NPV(rate,value1,value2,)   Returns the net present value of an investment based on a discount rate and a series of future payments (negative values) and income (positive values).

The Net Present Value function requires the following values:

ARGUMENT	EXPLANATION
rate	The rate of discount over the length of one period. *Required*.
value1	The value*n* are the future payments and income for the investment (cash flows). There can be up to 254 arguments. Value1 is *required*, subsequent values are *optional*.
value2	Each value must be equally spaced in time and occur at the end of each period.
	NPV uses the order of value1, value2, ... to interpret the order of cash flows. Be sure to enter your payment and income values in the correct sequence.

The NPV investment begins one period before the date of the value1 cash flow and ends with the last cash flow in the list. The NPV calculation is based on future cash flows. If your first cash flow occurs at the beginning of the first period, the first value must be added to the NPV result, not included in the values arguments. NPV is similar to the PV function (present value). The primary difference between PV and NPV is that PV allows cash flows to begin either at the end or at the beginning of the period.

Example in this NPV example the discount rate is 0.1%, an initial investment of €10,000 was made. In the subsequent years 1, 2 and 3, returns of €3,000, €4,200 and €6,800 were made. This means the NPV of the investment is €1,188.44.

	A77			f_x	=NPV(A70,A71,A72,A73,A74)	
	A		B	C		
67	NPV			Net Present Value		
68						
69	Data			Description		
70	0.1			Annual Discount Rate		
71	-10000			Initial cost of investment one year from today.		
72	3000			Return from the first year.		
73	4200			Return from the second year.		
74	6800			Return from the third year.		
75						
76	**Result**			**Description**		
77	€1,188.44			Future value of an investment using the terms from A2:A5.		

PMT – PRINCIPLE PER MONTH

=PMT(rate,nper,pv,fv,type)   Calculates the payment for a loan based on constant payments and a constant interest rate.

Principle per month of a loan repayment, calculates the payments for a loan. The payment returned by PMT includes principal and interest but no taxes, reserve payments or fees sometimes associated with loans.

The Principle Per Month function requires the following values:

ARGUMENT	EXPLANATION
rate	The interest rate for the loan. *Required*.
nper	The total number of payments for the loan. *Required*.
pv	The present value, or the total amount that a series of future payments is worth now; also known as the principle. *Required*.
fv	The future value, or a cash balance you want to attain after the last payment is made. If omitted 0 is assumed (the future value of the loan is 0). *Optional*.
type	The number 0 or 1 which indicates when payments are due. *Optional*. 0 - At the end of the period. 1 - At the beginning of the period.

Example in this PPM example the loan is €180,000 at the interest rate of 6% for 180 months (or 18 years). The future value of the loan is assumed to be 0 with the payments due at the beginning of the month.

	A96		fx	=PMT(A91/12,A92,A93)	
	A	**B**	**C**		**D**
88	PMT		**Principle per month of a loan repayment.**		
89	Example 1				
90	**Data**		**Description**		
91	6%		Annual Interest Rate		rate
92	180		Number of months of payment		nper
93	€180,000		Amount of loan		pv
94					
95	**Result**		**Description**		
96	-€1,518.94		Monthly payment for a loan with terms specified as arguments in A91:A93,		
97			payments are due at the beginning of the month.		
98					

PV - PRESENT VALUE

=PV(rate,nper,pmt,fv,type)   Returns the present value of an investment: the total amount that a series of future payments is worth now.

Returns the present value of an investment, the total amount that a series of future payments is worth now. For example, when money is borrowed, the loan amount is the present value to the lender.

The Present Value function requires the following values:

ARGUMENT	EXPLANATION
rate	The interest rate per investment period. *Required*.
nper	The total number of payment periods in an annuity. For example if you get a four year car loan and make monthly payments, this is 4*12 or 48 periods. *Required*.
pmt	The payment made each period and cannot change over the life of the annuity. *Required*.
fv	The future value or a cash balance you want to attain after the last payment is made. If fv is omitted, it is assumed to be 0 (the future value of a loan, for example, is 0). *Optional*.
type	The number 0 or 1 and indicates when payments are due. *Optional*.

Example this PV example shows an insurance scheme of €500 per month with an 8% interest rate. The money will be paid out for 20 years. The present value of the insurance scheme is €59,777.15.

A120			f_x	=PV(A116/12,12*A117,A115,,0)	
	A	B		C	D
112	PV		Present Value		
113					
114	Data		Description		
115	€500.00		Money paid out of an insurance annuity at the end of every month.	pmt	
116	8%		Interest rate earned on the money paid out.	rate	
117	20		Years the money will be paid out.	nper*12	
118					
119	Result		Description		
120	-€59,777.15		Present value of an annuity with the terms A115:A117.		
121					

SLN – STRAIGHT LINE DEPRECIATION

=SLN(cost,salvage,life) Returns the straight-line depreciation of an asset for one period.

Straight Line Depreciation of an asset for one period. With the SLN (Straight Line) function, each year the depreciation value is the same.

The Straight Line Depreciation function requires the following values:

ARGUMENT	EXPLANATION
cost	The initial cost of the asset. *Required*.
salvage	The value at the end of the depreciation, also known as the salvage value of the asset. *Required*.
life	The number of periods over which the asset is depreciated, also known as the life of the asset.

Example this SLN example the cost of the vehicle is €10,000 it will be salvaged in 10 years for €1,000 after one year the SLN calculates the vehicle has lost €900 in value. If this is subtracted from the **Cost** price of the vehicle the value of the vehicle is shown for each year.

DEPRECIATION

In Excel there are five different types of depreciation functions. They are SLN, SYD, DB, DDB and VDB. In this section we have looked at SLN and DB to view information on the other types of depreciation visit Excel-Easy.com.

An extensive list of Excel financial functions can be found on Office.Microsoft.Com. Research one additional **Financial** function and name it here.

9. DATABASE

Excel has a number of **Database** functions that can be used to easily summarise information from large tables of data. These functions are available in the **Insert Function** dialogue box under the **Database** category.

SET UP DATA

The Database functions require that the data in the worksheet is set up like a database, with field names at the top, records in rows, no blanks anywhere and no data in cells next to the data base. In addition a criteria row needs to be set up with the same headings as the database see cell range A8:E9 below (just like advanced Filtering). To use the database functions first *name* the data table in the name box, this data table has been named *SalesDB* in the name box.

SalesDB		ƒx	Date		
	A	B	C	D	E	F
8	Date	Order ID	SalesRep	Customer	Sale	
9			Beth			
10						
11	Date	Order ID	SalesRep	Customer	Sale	
12	15 June 2014	21543	John	DB Foods	€12,563.00	
13	16 June 2014	21544	Beth	Value Buy	€4,500.00	
14	19 June 2014	21545	Simon	DB Foods	€6,423.00	
15	19 June 2014	21546	John	MC Ltd.	€1,245.00	
16	19 June 2014	21547	Simon	Treanors	€3,489.00	
17	21 June 2014	21548	John	Value Buy	€1,568.00	
18	23 June 2014	21549	Beth	MC Ltd.	€11,489.00	
19	23 June 2014	21550	Beth	Treanors	€1,564.00	
20	25 June 2014	21551	John	DB Foods	€25,250.00	
21	27 June 2014	21552	Simon	Wholesale	€3,549.00	
22	30 June 2014	21553	Simon	MC Ltd.	€1,258.00	
23	01 July 2014	21554	John	DB Foods	€4,985.00	
24	01 July 2014	21555	John	Treanors	€2,587.00	
25	02 July 2014	21556	Simon	DB Foods	€3,451.00	
26	02 July 2014	21557	Beth	Value Buy	€892.00	
27	02 July 2014	21558	Simon	Value Buy	€10,456.00	
28	05 July 2014	21559	Beth	MC Ltd.	€12,563.00	
29						
30						

It is important to note that all of the **criteria** used in Database functions are ranges, taken from the

criteria rows (rows 8 and 9 above). All of the following examples are based on the above data table which has been named as *SalesDB*.

DAVERAGE

=DAVERAGE(database,field,criteria) Averages the values in a column in a list or database that match conditions you specify.

The DAVERAGE function averages all the numbers in the database column that match set criteria, in this example the criteria is set to *Beth* under the *SalesRep* heading. The average of all Beth's sales is calculated as €6,201.60.

	A	B	C	D	E
8	Date	Order ID	SalesRep	Customer	Sale
9			Beth		

f_x	=DAVERAGE(SalesDB,E8,C8:C9)	
G	**H**	
DAVERAGE	€6,201.60	The average sale for Beth.

DCOUNT

=DCOUNT(database,field,criteria) Counts the cells containing numbers in the field (column) of records in the database that match the conditions you specify.

The DCOUNT function returns the number of cells in a column or database that contains numeric values and meets a given criteria. Here the result is 5 because *DB Foods* bought from the company 5 times.

	A	B	C	D	E
8	Date	Order ID	SalesRep	Customer	Sale
9				DB Foods	

f_x	=DCOUNT(SalesDB,E8,D8:D9)	
G	**H**	**I**
DCOUNT	5	The number of times DB Foods bought products from us.

DCOUNTA

=DCOUNTA(database,field,criteria)   Counts nonblank cells in the field (column) of records in the database that match the conditions you specify.

The DCOUNTA function returns the number of cells in a column or database that contains nonblank values and meets a given criteria. In this example the DCOUNTA function is used to count the total number of *Sales* in the data table.

	A	B	C	D	E	
8	Date	Order ID	SalesRep	Customer	Sale	
9						
10						

fx	=DCOUNTA(SalesDB,E8,E8:E9)	
G	**H**	**I**
DCOUNTA	17	Counts the total number of sales.

DGET

=DGET(database,field,criteria)   Extracts from a database a single record that matches the conditions you specify.

The DGET function retrieves from a database a single record that matches a given criteria. In this example the *Sales Total* is retrieved for *Order ID* 21553. Note that the criteria is set to 21553.

	A	B	C	D	E	
8	Date	Order ID	SalesRep	Customer	Sale	
9		21553				
10						

fx	=DGET(SalesDB,E8,B8:B9)	
G	**H**	**I**
DGET	€1,258.00	Gets the sale total for Order ID 21553.

DMAX

=DMAX(database,field,criteria)   Returns the largest number in the field (column) of records in the database that match the conditions you specify.

The DMAX function returns the largest number in a column in a list or database, based on a given criteria. In this example the maximum number in the *Sale* column is selected for the *Sales Rep* Beth.

	A	B	C	D	E
8	Date	Order ID	SalesRep	Customer	Sale
9			Beth		

fx =DMAX(SalesDB,E8,C8:C9)

G	H	
DMAX	€12,563.00	The maximum sale for Beth.

DMIN

=DMIN(database,field,criteria)   Returns the smallest number in the field (column) of records in the database that match the conditions you specify.

The DMIN function returns the smallest number in a column in a list or database, based on a given criteria. In this example the minimum *Sale* for *SalesRep* Beth is calculated as €892.

	A	B	C	D	E
8	Date	Order ID	SalesRep	Customer	Sale
9			Beth		

fx =DMIN(SalesDB,E8,C8:C9)

G	H	
DMIN	892	The minimum sale for Beth.

An extensive list of Excel database functions can be found on Office.Microsoft.Com. Research and explain one additional **Database** function and write its name here.

10.NESTED AND COMPOUND LOGICAL FUNCTIONS WITH A LOGICAL OPERATOR

LOGICAL FUNCTIONS

In Excel Logical Functions are used to allow decisions or outcomes to be reached.

The Logical Functions we will cover are IF, AND, OR, NOT, TRUE and FALSE. To access the Logical Functions go to the *Formulas > Logical* or type them into the cell.

The Logical Functions AND, OR and NOT will work on their own but the will have limited usefulness. If used on their own the will return the value TRUE or FALSE.
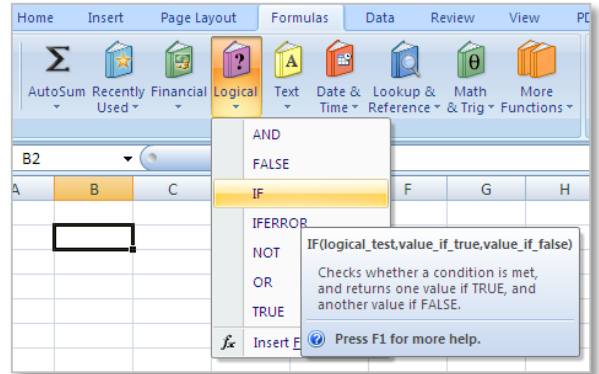
COMPARISON OPERATORS

Logical Functions are used in *Logical Tests* with *Comparison Operators*.

Logical Function and Comparison Operators

When logical functions are used in Logical Tests they need to be used alongside Comparison Operators.

The comparison operators that can be used in the logical test are:

Equal (=)   Less than (<)   Less than or equal to (< =)

Greater than (>)   Not equal to (< >)   Greater than or equal to (> =)

AND

=AND(logical1,logical2,)   Checks whether all arguments are TRUE, and returns TRUE if all arguments are TRUE.

=AND(B9>50,C9>50,D9>50) The function works by checking that each of the logical tests are true. If all of the logical tests are true then TRUE value is returned, however if one of the logical tests is false then False value is returned.

These notes have been compiled by Rynagh McNally for students of Monaghan Institute.

Note: The AND function can have up to 255 logical tests in 2007 or newer Excel software with only up to 30 logical tests in 2003 or older.

OR

=OR(logical1,logical2,)   Checks whether any of the arguments are TRUE, and returns TRUE or FALSE. Returns FALSE only if all arguments are FALSE.

=OR(B21>50,C21>50,D21>50)   The function works by checking any one of the logical tests are true, in this example *Value 2* is over 50. Then the TRUE value is returned. If all logical tests are false then the FALSE value is returned.

Note: The OR function can have up to 255 logical tests in 2007 or newer Excel software with only up to 30 logical tests in 2003 or older.

The OR function is very much the same as the AND function. The one and only difference is, only **one** of all supplied **logical** arguments needs to be true for the OR Function to return TRUE.

NOT

=NOT(logical)   Changes FALSE to TRUE, or TRUE to FALSE.

=NOT(B32>50)   The function works by checking the logical test is true or false. If the function is false, the TRUE value is returned.

These functions are used in conjunction with other functions to create formula. Each of the above logical operators can be used with the IF function.

SIMPLE IF STATEMENT

The **IF** function introduces the option of decision making into spreadsheets, to do this the formula tests a specified condition to see if it is True or False.

=IF(logical_test,value_if_true,value_if_false)   Checks whether a condition is met, and returns one value if TRUE, and another value if FALSE.

=IF(C2>=G1,"Pass","Fail")   This simple IF function works by checking the logical test is true or false, if the student has got greater than or equal to 60% in their Marks out of 100 they will receive the true value a Pass which is the ValueIfTrue if they get less than 60% the receive the ValueIfFalse which is a Fail.

These notes have been compiled by Rynagh McNally for students of Monaghan Institute.

Note: Words used in formula are included in *Inverted Commas* e.g. "Pass".

Both the ValueIfTrue and the ValueIfFalse actions can be a formula, a text statement, a numeric value or a blank cell (to show a blank cell for a ValueIfTrue or a ValueIfFalse include "" *empty inverted commas*).

With an IF statement we can also add an AND feature. For example if a number is greater than 10 and less than 20.

IF WITH AND   =IF(AND(A1>=10,A1<=20),"Inside 10 and 20","Outside 10 and 20")

In this example we have nested the AND function inside the logical test of the IF. Note that this will only give the true value if *all* of the *logical* arguments evaluate to True. If only one from many, evaluate to False and the rest are True, the AND Function will return the False value.

IF WITH OR   =IF(OR(A2>100,A3>100),A1*10,A1/10)

Let's now suppose we want to check the contents of 2 cells and if either one is greater than 100 multiply A1 by 10, if not divide by 10.

IF WITH NOT   =IF(NOT(A2<=15), "OK", "Not OK")

If the value in cell A2 is not less than or equal to 15, then return "OK". (Not OK) In this example the number in B4 is more than 15 so the answer is returned OK. If the number had been less than 15 the answer would have returned as Not OK.

11. USE NESTED FUNCTIONS

If a question has more than two outcomes we can create a nested IF statement. Within a nested IF statement, the IF function can be used up to 64 times. Each of the logical tests are applied one at a time, the final logical tests value is added as the **false** value.

Example: When grading the FETAC assignments the grades are as follows:

Distinction	80-100%
Merit	65-79%
Pass	50-64%
Fail	0-49%

To check a list of grades for students in a spreadsheet we can use a nested IF function.

	A	B	C
1	Relation Database Results Level 6 2010		
2			
3	Student Names	Module Results	FETAC Grade
4	Kathleen Lee	78%	
5	Mark O'Grady	65%	
6	Deirdre Monaghan	34%	
7	Thomas Gallagher	99%	
8	Kevin McKenna	74%	
9			

In the cell C4 we will create a simple IF function which will check the grade of Kathleen Lee's results. This function can then be auto filled to cell C8 to calculate each student's results. To create the function start with **=if(** this will show an **IF** function guide below the cell. In this question we will start at the highest result and work to the lowest result.

Module Results	FETAC Grade		
78%	=if(		
65%	IF(logical_test, [value_if_true], [value_if_false])		
34%			

The first part of the function is a **logical test,** next the value if true for that logical test, to nest a second **IF** replace the value if false with another **IF** statement. The first logical test is the cell reference value compared against **B4>=0.80**. The **value if true** is set to the word "Distinction" which will appear as the result (the word is included in inverted commas because it is text).

The second logical test will compare the value in **B4** against 0.65 to check if it is greater than or equal to the value 0.65 (the decimal point is used as the value is in percentages). Continue to nest the IF statements inside the original IF statement, remember to close all brackets to ensure the function is correct.

The final result "Fail" is included as the **value if false** there is only one value if false and this is the final result. The value if false holds true for any other answers/options.

To check the results for the other students use the auto fill to drag the function down to cell C8.

NOTES:

12.REFERENCES:

WEBSITES:

The following websites all offer support on a variety of function and formula:

www.spreadsheets.about.com

www.bettersolutions.com/excel

www.techonthenet.com/excel/formulas/index.php

www.homeandlearn.co.uk/excel2007/excel2007s5p5.html

An extensive list of **Excel Functions** can be found on Office.Microsoft.com as follows:

- **Mathematical** functions Office.Microsoft.Com.

- **Statistical** functions can be found on Office.Microsoft.Com.

- **Text** functions can be found on Office.Microsoft.Com.

- **Financial** functions can be found on Office.Microsoft.Com.

- **Database** functions can be found on Office.Microsoft.Com.

List of all Function with Explanations - for more information visit TechOnTheNet.Com.

Depreciation 5 Types - for more information visit Excel-easy.com and Office.Microsoft.com.

Math Concepts and Questions visit MathsIsFun.com.