Welcome to your Excel Advanced Formulas & Functions training course

1. Building complex referencing formulas
2. Using advanced functions
3. Date & text functions
4. Auditing formulas

Microsoft Office Training Series
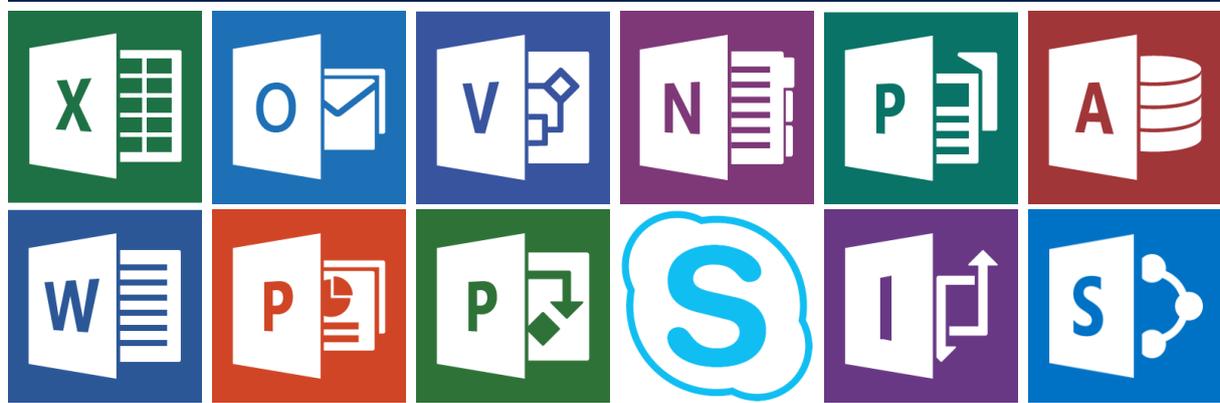
Professional Development Series

Microsoft Technical Series

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Unit 1: Building Complex Referencing Formulas

In this unit you will learn how to:

- Use Nested IF functions

- Creating compound logical tests using AND, OR, NOT with IF statements

- Nesting Lookup functions

- Use the CHOOSE function

- Use the MATCH function to locate date

- Use INDEX to retrieve data values

- Use a nested formula containing INDEX and MATCH functions.

Using Nested IF statements

A single IF statement is used for displaying two possible values depending on a condition or logical test.

=IF(logical_test,True,False)

For example, suppose you want to display either Pass or Fail for scores above (or equal) to 70 and Fail for scores below 70.

	C2			f_x	=IF(B2>=70,"Pass","FaIL")	
	A	B	C	D	E	F
1	**First Name**	**Score**	**Pass/Fail**			
2	Yolanda	98	Pass			
3	Nancy	63	FaIL			
4	Ken	75	Pass			
5	Larry	78	Pass			
6	Moe	55	FaIL			
7	Rita	84	Pass			
8	James	69	FaIL			
9	Pamela	57	FaIL			
10	Ed	81	Pass			

The formula to use would be a single IF statement:

=IF(B2>=70,"Pass","Fail")

But if instead you want to award grades Excellent, Very Good, Fair or Poor then you will need to use more than one nested IF statement. In this case you would use 3 IFs.

	A	B	C
1	First Name	Score	Grade
2	Yolanda	98	
3	Nancy	63	
4	Ken	75	
5	Larry	78	
6	Moe	55	
7	Rita	84	
8	James	69	
9	Pamela	57	
10	Ed	81	
11			

Create a nested IF function in cell C2 that examines cell B2 and uses the following parameters:

>=90 result Excellent
>=70 result Very Good
>=50 result Fair
<50 result Poor

Copy the results down

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To Create this nested IF statement:

- Start by clicking in cell C2

- Select the Formulas tab, Logical, IF

- Starting with the higher scores, enter the logical tewst B2>=90

- Enter "Excellent" as the value if true

- Click in the value_If_false box

- Select IF from the function list to the left of the formula bar..

| IF | ▼ | ⊙ | ✕ | ✓ | fx | =IF(B2>=90,"Excellent") |

	A	B	C	D	E	F	G	H
1	First Name	Score	Grade					
2	Yolanda	98	cellent")					
3	Nancy	6?						
4	Ken	75						
5	Larry	78						
6	Moe	55						
7	Rita	84						
8	James	69						
9	Pamela	57						
10	Ed	81						

Create a nested IF function in cell
and uses the following parameter

>=90 result Excellent
>=70 result Very Good
>=50 result Fair
<50 result Poor

Function Arguments

IF

Logical_test   B2>=90   ⊞ = TRU

Value_if_true   "Excellent"   ⊞ = "Ex

Value_if_false | ⊞ = an

= "Ex

Checks whether a condition is met, and returns one value if TRUE, and anot

Value_if_false is the value that is returned if Lo
is returned.

Formula result = Excellent

- A blank function argument window now appears ready for you to enter the second logical test:
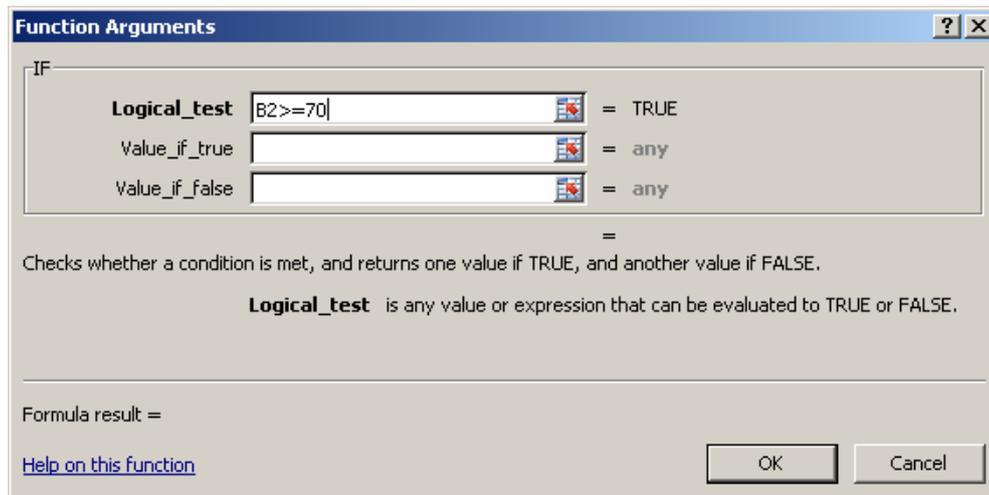
- Type Very Good as the value_if_true

- Select the value-if-false box and as before and select IF from the function list.

The final multiple IF statement reads

=IF(B2>=90,"Excellent",IF(B2>=70,"Very Good",IF(B2>=50,"Fair","Poor")))

Using the CHOOSE function

The Choose function displays an item from a list based on a number. It can be used as an alternative to a multiple IF statement.

> Syntax
>
> CHOOSE(Index_Value, item1, item2, item3)

For example it can be used to display a day of the week from a number.

=Choose(Weekday(A1), "Sun","Mon",Tue","Wed",Thu","Fri","Sat","Sun")

Where A1 contains a date.

Here is another example where the CHOOSE function is used to display the correct medal for a given position in a race.

E5	fx	=CHOOSE(C5,"Gold","Silver","Bronze","","","")

	A	B	C	D	E
	Mens 10,000m Final **London Olympics 2012**				
	Athlete	**Country**	**Rank**	**Time (m:s)**	**Medal**
	BEKELE Kenenisa	ETH	4	27:32.4	
	BEKELE Tariku	ETH	3	27:31.4	Bronze
	FARAH Mo	GBR	1	27:30.4	Gold
	MUCHIRI Bedan Karoki	KEN	5	27:32.9	
	RUPP Galen	USA	2	27:30.9	Silver
	TADESE Zersenay	ERI	6	27:33.5	

The Choose function displays a #Value error if the index value is larger than the number of items listed. To avoid the error message an IF statement can be used to check for the first 3 places:

=IF(C5<=3,CHOOSE(C5,"Gold","Silver","Bronze"),"")

Using the MATCH function to locate data position

The MATCH function searches for a specified item in a range of cells, and then returns the relative position of that item in the range. For example, if the range A1:A3 contains the values 5, 25, and 38, then the formula

=MATCH(25,A1:A3,0) returns the number 2, because 25 is the second item in the range.

Use MATCH instead of one of the LOOKUP functions when you need the position of an item in a range instead of the item itself. For example, you might use the MATCH function to provide a value for the row_num argument of the INDEX function.

> The Syntax is as follows: -
>
> MATCH(lookup_value, lookup_array, [match_type])

Match Types

Match_type 1 or omitted	**MATCH** finds the largest value that is less than or equal to *lookup_value*. The values in the *lookup_array* argument must be placed in ascending order, for example: ...-2, -1, 0, 1, 2, ..., A-Z, FALSE, TRUE.
Match_type 0	**MATCH** finds the first value that is exactly equal to *lookup_value*. The values in the *lookup_array* argument can be in any order.
Match_type -1	**MATCH** finds the smallest value that is greater than or equal to *lookup_value*. The values in the *lookup_array* argument must be placed in descending order, for example: TRUE, FALSE, Z-A, ...2, 1, 0, -1, -2, ..., and so on.

If **match_type** is 0 and **lookup_value** is a text string, you can use the wildcard characters — the question mark (**?**) and asterisk (*****) — in the **lookup_value** argument.

A question mark matches any single character; an asterisk matches any sequence of characters. If you want to find an actual question mark or asterisk, type a tilde (**~**) before the character.

The following example shows how the MATCH function finds the row number in which a particular item is located.

Use the INDEX function for retrieving information by location

The INDEX function returns a value or the reference to a value from within a table or range. There are two forms of the INDEX function: the arrayform and the reference form. Definition of Array: Used to build single formulas that produce multiple results or that operate on a group of arguments that are arranged in rows and columns. An array range shares a common formula; an array constant is a group of constants used as an argument.

The INDEX Array form

The INDEX array form returns the value of an element in a table or an array, selected by the row and column number indexes.

Use the array form if the first argument to INDEX is an array constant.

> The Syntax for the INDEX function is as follows: -
>
> INDEX(array, row_num, [column_num])

The INDEX function syntax has the following arguments: -

Array (Required) is a range of cells or an array constant.

If array contains only one row or column, the corresponding row_num or column_num argument is optional.

If array has more than one row and more than one column, and only row_num or column_num is used, INDEX returns an array of the entire row or column in array.

Row_num Required. Selects the row in array from which to return a value. If row_num is omitted, column_num is required.

Column_num Optional. Selects the column in array from which to return a value. If column_num is omitted, row_num is required.

The next example shows how a value is retrieved from a table array using the INDEX function incorporating the row number and column number options.

◢	A	B	C	D	E	F	G	H	I	J
1										
2										
3	**Acct**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**			
4	A302	99	41	31	114	90	1		**Acct:**	A397
5	A397	10	56	3	7	44	50		**Month:**	Apr
6	A806	49	71	83	37	110	14			
7	A936	2	101	18	63	54	95		**Result**	7
8	A740	98	20	80	59	96	16			
9	A945	36	19	106	52	35	70			
10	A695	62	43	58	34	51	69		=INDEX(B4:G22,2,4)	
11	A507	105	91	78	29	32	75			
12	A571	13	108	27	67	86	68			
13	A315	11	9	4	76	30	23			
14	A552	55	26	28	85	111	81			
15	A628	40	87	88	47	107	60		Row #	
16	A621	74	57	103	33	104	64			
17	A211	93	92	84	61	112	79		Column #	
18	A563	53	15	8	42	24	46			
19	A547	94	12	77	38	22	39			
20	A940	48	100	102	97	66	45			
21	A339	25	72	73	113	21	6			
22	A673	17	89	82	65	5	109			
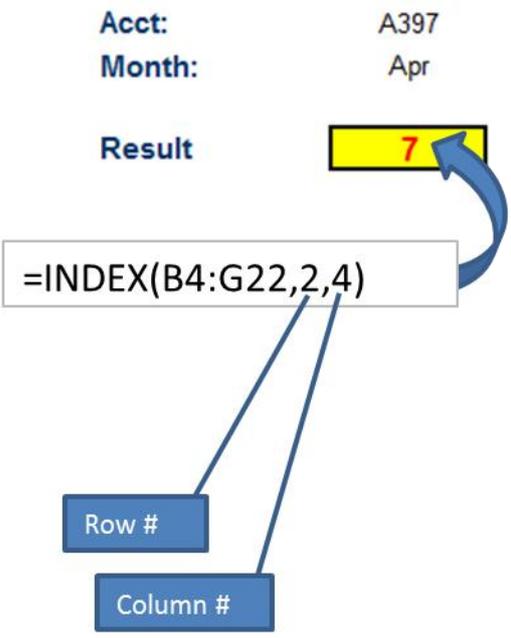
Unit 2: Using Advanced Functions

In this unit you will learn how to:

- Use COUNTIFS, SUMIFS and AVERAGEIFS to tabulate data based on single/multiple criteria

- Use Statistical functions: MEDIAN, RANK, LARGE, SMALL

- Use Maths functions: Round and related functions, the Mod function

- Use the AGGREGATE function to sum data in ranges with errors

- Use a variety of Financial _{functions} such as PMT, FV, IRR

Use COUNTIFS and SUMIFS

Excel has the useful functions COUNTIF and SUMIF which are able to count the number of records or sum values of a field based on a criteria. In the list below for example theses function calculate there are 10 'Full Time' employees with a total salary of £604,760. Here are the formulas:

=COUNTIF(B3:B25,"Full Time")
=SUMIF(B3:B25,"Full Time",D3:D25)

Similarly the AVERAGEIF function would calculate the average salary for the Full Time employees:

=AVERAGEIF(B3:B25,"Full Time",D3:D25)

Since Excel 2007 there has been a corresponding set of functions ending with the letter S. COUNTIFS, SUMIFS and AVERAGEIFS. These functions allow for **multiple criteria**. For example, the number of Full Time employees with a job rating of 5.

◢	A	B	C	D	E	F	G
1						Full Time AND Job Rating 5	3
2	Employee Name	Status	Job Rating	Salary		Salary Total	151,210
3	Ware, David	Contract	1	68,510			
4	Kennedy, Kimberly	Contract	5	76,930			604,760
5	Howell, Douglas	Full Time	5	37,020			
6	Vaughn, Harlon	Contract	3	64,590			10
7	Hunt, Norman	Hourly	4	23,692			
8	Rogers, Colleen	Full Time	2	49,260			
9	Briggs, Bryan	Part Time	5	48,415			
10	Thomas, Shannon	Full Time	5	65,910			
11	Schultz, Norman	Full Time	2	68,520			
12	Burnett, Kevin	Full Time	1	73,030			
13	Sullivan, Robert	Contract	3	80,690			
14	Wright, Brad	Full Time	5	48,280			
15	Booth, Raquel	Part Time	2	19,935			
16	Norton, Bruce	Part Time	1	17,205			
17	Myers, Marc	Part Time	4	11,230			
18	Snyder, Duane	Full Time	3	71,380			
19	Dyer, Carrie	Part Time	5	23,380			
20	Ramirez, Keith	Contract	5	43,320			
21	Swanson, Vicki	Full Time	2	74,710			
22	Kirk, Chris	Full Time	1	73,850			
23	Juarez, Neill	Contract	2	59,330			
24	Richardson, Deborah	Part Time	2	46,105			
25	Kemp, Holly	Full Time	2	42,800			

COUNTIFS

The COUNTIFS function counts the number of cells where the multiple criteria are true in multiple ranges.

> Syntax
>
> COUNTIFS(criteria_range1, criteria 1, criteria_range2, criteria2)

In the example the first criteria range and first criteria is Status range B3:B25 and "Full Time". The second criteria range and second criteria is Job rating range C3:C25 and Job Rating 5) Here is the function:

=COUNTIFS(B3:B25,"full time",C3:C25,5)

SUMIF

Syntax

SUMIFS(Sum range, criteria_range1, criteria 1, criteria_range2, criteria2)

The SUMIF function calculates the total salary for the same two criteria.

=SUMIFS(D3:D25,B3:B25,"full time",C3:C25,5)

In this example there are 3 Full Time employees with a total salary of £151,210.

Excel allows a maximum of 127 range/criteria pairs.

Creating Tabulated data using SUMIFS

Rather than just calculating one result from a SumIfs it is possible to create tabulated data that allows a comparison to be made between all the Job Ratings and Status types.

I	J	K	L	M	N
				Status	
		Contract	Full Time	Hourly	Part Time
		1			
		2			
Job Rating		3			
		4			
		5			

To create tabulated data using the SUMIFS function first type all the different values as Row and column labels. Then click at the intersection point K3.and create the SUMIFS function:
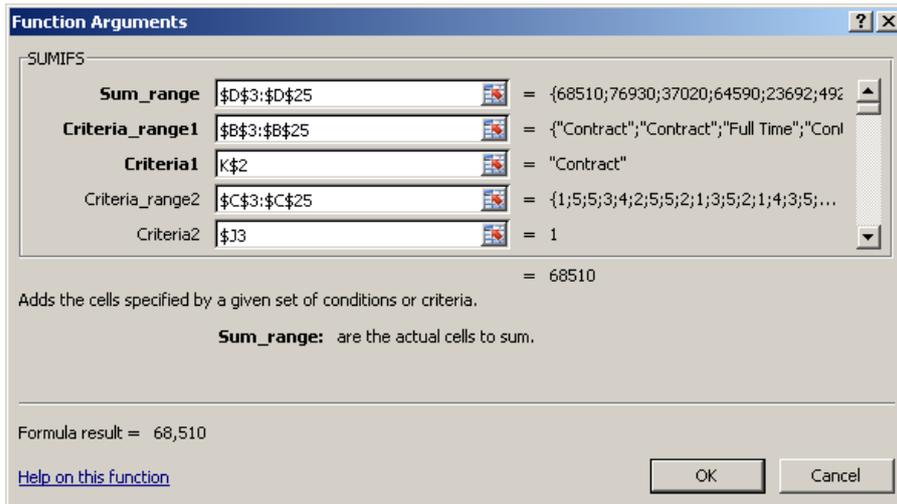
Note about Partial Absolute Referencing

All the criteria ranges have Absolute references.

The Status criteria is partially Absolute where the **row** is fixed (K$2).

The Job rating criteria is partially Absolute where the **column** is fixed ($J3).

The full formula is:

=SUMIFS($D$3:$D$25,$B$3:$B$25,K$2,$C$3:$C$25,$J3)

It can be Autofilled or copied down and across to fill the table as follows.

Creating Tabulated data with a Pivot Table

The same tabulated data created using Sumifs functions can be created with a Pivot Table.

Sum	Contract	Full Time	Hourly	Part Time	Grand Total
1	£68,510	£146,880		£17,205	£232,595
2	£59,330	£235,290		£66,040	£360,660
3	£145,280	£71,380			£216,660
4			£23,692	£11,230	£34,922
5	£120,250	£151,210		£71,795	£343,255
Grand	£393,370	£604,760	£23,692	£166,270	£1,188,092

Row Labels as the Job Rating

Column labels as Status

Value as Salary (with Currency Number format)

Whereas the Pivot Table needs to be refreshed if there is a change in the data, the Sumifs table will update automatically.

Creating Tabulated data with a Data Table

A third method to create the same tabulated data is via a Data Table. This method uses the same Sumifs formula but avoids the need for Absolute and Partial Absolute Referencing.

First type the Sumifs formula at the top left

To creating the Data Table

1. Create the border labels for the table.
2. Create a Row and Column input cells. Type the word Contract into the Row input cell and 1 into the Column input cell.
3. Type the SUMIFS formula at the top left blank cell that intersects the borders referring to the input cells for the two criteria.

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=SUMIFS(D3:D25,B3:B25,I21,C3:C25,I22)

	I	J	K	L	M	N
Contract						
1						
				Status		
	⟐	68510	Contract	Full Time	Hourly	Part Time
Job Rating		1				
		2				
		3				
		4				
		5				

4. Highlight the table including the formula and borders.
5. Select Data, What-IF Analysis, Data Table
6. For the Row Input click on the word Contract (I21) and for the Column Input click on the Job Rating 1 (I22)

=SUMIFS(D3:D25,B3:B25,I21,C3:C25,I22)

	I	J	K	L	M	N
Contract						
1						
				Status		
	⟐	68510	Contract	Full Time	Hourly	Part Time
Job Rating		1	68,510	146,880	0	17,205
		2	59,330	235,290	0	66,040
		3	145,280	71,380	0	0
		4	0	0	23,692	11,230
		5	120,250	151,210	0	71,795

Finally the input cell values can be cleared and the zeros supressed with the Custom format: #,##0;;""
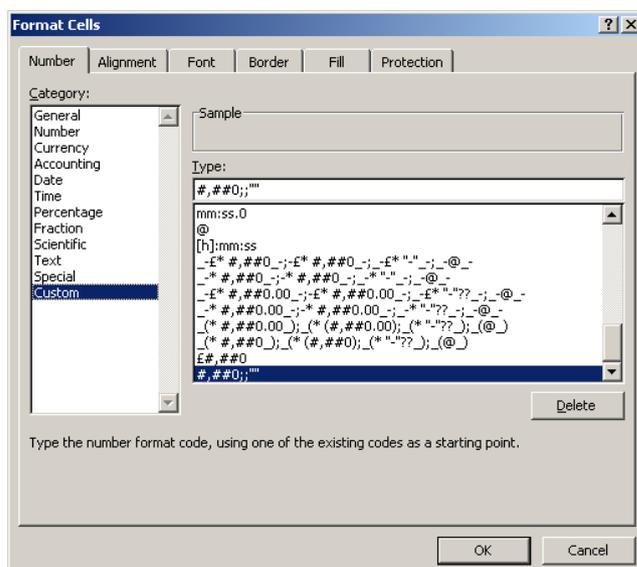
This custom format displays numbers with embedded commas, no decimal places and zero values as blank.

fx =SUMIFS(D3:D25,B3:B25,I21,C3:C25,I22)

		Status			
		Contract	Full Time	Hourly	Part Time
Job Rating	1	68,510	146,880		17,205
	2	59,330	235,290		66,040
	3	145,280	71,380		
	4			23,692	11,230
	5	120,250	151,210		71,795

RANK and RANK.AVG Function

Calculating the ranking order for values in a range can be helpful.   For example if you have a worksheet containing annual sales figures for salespeople you can rank them in order. If there are duplicate values there are two different ways of handling the ranking.

	C2		f_x	=RANK(B2,$B$2:$B$19)	
	A	B	C	D	E
1	**Sales Person**	**Total**	**RANK**	**RANK.AVG**	
2	Bobby Ball	580,000	12	12	
3	Dave Green	760,000	2	2	
4	David Beckham	450,000	18	18	
5	Debbie Harry	600,000	9	10	
6	Donny Osmond	620,000	8	8	
7	Emma Peel	600,000	9	10	
8	John Smith	850,000	1	1	
9	John Steed	680,000	6	6	
10	Mark Moore	700,000	5	5	
11	Megan Wilson	600,000	9	10	
12	Mike Oldfield	490,000	17	17	
13	Paul Bowler	510,000	16	16	
14	Peter Shilton	560,000	13	13	
15	Roger DeCourcey	710,000	4	4	
16	Roger Moore	650,000	7	7	
17	Sally White	550,000	14	14	
18	Sam Cooke	730,000	3	3	
19	Terry Buccanon	530,000	15	15	

In the above example the RANK function calculates there is a 3 way tie for 9th place. The next in rank will be in 12th place.

Using the RANK.AVG function the average rank is calculates the tie to have a rank of 10 (the average of 9, 10 and 11).

MEDIAN function

In the example below of 25 employees their Average year's service is compared with the Median service. The average (also referred to as arithmetic mean) is 8.68 after formatting to 2 decimal places whereas the Median is 8.

Emp No	Employee Name	Status	Service Years	Salary			
1	Ware, David	Contract	7	68,510			
2	Kennedy, Kimberly	Contract	9	76,930			
3	Howell, Douglas	Full Time	2	37,020			
4	Vaughn, Harlon	Contract	12	64,590			
5	Hunt, Norman	Hourly	2	23,692			
6	Rogers, Colleen	Full Time	18	49,260			
7	Briggs, Bryan	Half-Time	12	48,415		Service Years	
8	Thomas, Shannon	Full Time	9	65,910		Average	8.68
9	Schultz, Norman	Full Time	12	68,520		Median	8
10	Burnett, Kevin	Full Time	2	73,030		Mode	2
11	Sullivan, Robert	Contract	14	80,690			
12	Wright, Brad	Full Time	3	48,280			
13	Booth, Raquel	Half-Time	20	19,935			
14	Norton, Bruce	Half-Time	5	17,205			
15	Myers, Marc	Half-Time	2	11,230			
16	Snyder, Duane	Full Time	11	71,380			
17	Dyer, Carrie	Half-Time	2	23,380			
18	Ramirez, Keith	Contract	6	43,320			
19	Swanson, Vicki	Full Time	7	74,710			
20	Kirk, Chris	Full Time	7	73,850			
21	Juarez, Neill	Contract	19	59,330			
22	Richardson, Deborah	Half-Time	1	46,105			
23	Kemp, Holly	Full Time	8	42,800			
24	Morales, Linda	Full Time	9	72,830			
25	Espinoza, Derrell	Full Time	18	34,990			

To see how the Median is calculated it helps to sort the employees by the Service column.

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Emp No	Employee Name	Status	Service Years	Salary			
22	Richardson, Deborah	Half-Time	1	46,105			
3	Howell, Douglas	Full Time	2	37,020			
5	Hunt, Norman	Hourly	2	23,692			
10	Burnett, Kevin	Full Time	2	73,030			
15	Myers, Marc	Half-Time	2	11,230			
17	Dyer, Carrie	Half-Time	2	23,380			
12	Wright, Brad	Full Time	3	48,280		Service Years	
14	Norton, Bruce	Half-Time	5	17,205		Average	8.68
18	Ramirez, Keith	Contract	6	43,320		Median	8
1	Ware, David	Contract	7	68,510		Mode	2
19	Swanson, Vicki	Full Time	7	74,710			
20	Kirk, Chris	Full Time	7	73,850			
23	Kemp, Holly	Full Time	8	42,800			
2	Kennedy, Kimberly	Contract	9	76,930			
8	Thomas, Shannon	Full Time	9	65,910			
24	Morales, Linda	Full Time	9	72,830			
16	Snyder, Duane	Full Time	11	71,380			
4	Vaughn, Harlon	Contract	12	64,590			
7	Briggs, Bryan	Half-Time	12	48,415			
9	Schultz, Norman	Full Time	12	68,520			
11	Sullivan, Robert	Contract	14	80,690			
6	Rogers, Colleen	Full Time	18	49,260			
25	Espinoza, Derrell	Full Time	18	34,990			
21	Juarez, Neill	Contract	19	59,330			
13	Booth, Raquel	Half-Time	20	19,935			

After sorting by Service Years you can see that the Median is the number in the middle of a set of numbers. There are 12 people with a service lower than 8 and 12 people with a service greater than 8 years.

The MODE function

Another statistical function is MODE. In the same example the Mode of the Service Years is 2. This is the most common service for the 25 employees. If there were other years which are equally common then MODE returns the first one searching from top to bottom. There is also new function to deal with multiple mode values called MODE.MULT. This is an Array function which will be mentioned in a later module on Array functions.

The LARGE and SMALL functions.

In addition to the MAX or MIN functions that calculate the highest and lowest value in a range, the functions LARGE and SMALL find the second, third or any given rank within a range of values. In the example above:

=LARGE(E2:E26,2) finds 76930 as the second highest salary.

=SMALL(E2:E26,2) finds 17205, the second smallest salary.

These functions may be useful when you want to find out information without having to sort a list.

Use Maths functions: Round and related functions, the Mod function

ROUND and related functions

In some situations, formatting may cause Excel to display inaccurate results such as when totalling numbers with decimal places. Because Excel uses the full precision of figures rather than the displayed figures the sum total may appear to be incorrect.

	A	B
		Revenue
1	Customer	£Millions
2	Ainsworth	2.4
3	Exxon	2.9
4	Ford	2.7
5	Wal-Mart	4.0
6		
7	Total	11.9

In the example someone might notice the figures should add up to 12.0 rather than 11.9 and wonder where the missing amount went. You could explain that 11.9 is the more accurate answer and show the precise figures.

	A	B
1	**Customer**	**Revenue £Millions**
2	Ainsworth	2.369
3	Exxon	2.908
4	Ford	2.692
5	Wal-Mart	3.980
6		
7	**Total**	**11.9**

But if you want the figures to actually add up precisely as displayed on screen you can use a ROUND function. In cell C2 enter the function =ROUND(B2,1)

The result is now exactly 2.4. After copying the formula down for the other customers the total now adds up to 12.0.

C2			f_x	=ROUND(B2,1)	

	A	B	C	D
1	**Customer**	**Revenue £Millions**	**Rounded**	**% of Total**
2	Ainsworth	2.4	2.4	19.8%
3	Exxon	2.9	2.9	24.3%
4	Ford	2.7	2.7	22.5%
5	Wal-Mart	4.0	4.0	33.3%
6				
7	**Total**	**11.9**	**12.0**	**100.0%**

The ROUND function rounds up or down depending on the precise figure. For example when rounding to 1 decimal place 2.35 rounds up to 2.4, 2.34 rounds down to 2.3. To round all numbers up another function can be used called ROUNDUP. The function ROUNDDOWN is used to always round figures down.

Note in the above example the % values don't quite add up to 100.0%. This can be corrected by changing the formula from =B2/B$7 to =C2/B$7 so it then refers to the rounded values.

There is yet another similar function called MROUND which rounds number to a particular multiple. For example

	A	B	G	H
			=MROUND(B2,2)	
		Revenue	Round to nearest	Round to nearest
1	Customer	£Millions	multiple of 2	multiple of 0.5
2	Ainsworth	2.4	2	2.5
3	Exxon	2.9	2	3
4	Ford	2.7	2	2.5
5	Wal-Mart	4.0	4	4
6				

The revenues here are rounded to the nearest 2 million and in the next column to the nearest half million pounds.

Another related function is called CEILING. It can be used, for example, to round a price up to the nearest 5p amount.

	A	B	C	D	E
				=CEILING(C2,5)	
1	SKU	Cost	Calc	Price	
2	A254	17.98075	38.9615	40	
3	A357	10.98	24.96	25	
4	D267	15.99	34.98	35	
5	E359	7.91	18.82	20	
6	E347	19.96	42.92	45	
7	D398	7.5	18	20	
8	D259	15.35	33.7	35	

The function in the Price column is

=CEILING(C2,5)

Where the level of significance is 5

The difference between this and using MROUND is that CEILING always rounds up whereas MROUND rounds to the nearest multiple. For example, 15.26 rounds to 20 and 15 respectively with CEILING and MROUND.

	E3			f_x	=MROUND(C3,5)
	A	B	C	D	E
				Price	Price
1	SKU	Cost	Calc	CEILING	MROUND
2	C334	12.57	28.14	30	30
3	D230	6.13	15.26	20	15
4	E270	12.85	28.7	30	30
5	E365	7.66	18.32	20	20
6	B331	8.78	20.56	25	20
7	B360	16.83	36.66	40	35

MOD function

At first there doesn't seem to be a business need for the Mod function. What it does is return the remainder part of a number which is divided by another number. For example:

=Mod(8,3) returns 2

As 8 divided by 2 is 6 with a remainder of 2.

The function can be employed as a way of formatting worksheet tables in a banded style using Conditional Formatting.

	A	B	C	D	E	F	G	
1		Jan	Feb	Mar	Apr	May	Jun	
2	Line 1	379	351	379	335	345	329	
3	Line 2	390	309	374	356	339	377	
4	Line 3	345	333	338	399	364	330	
5	Line 4	336	346	363	343	395	399	
6	Line 5	347	331	394	382	320	323	
7	Line 6	340	311	311	394	322	359	
8	Line 7	318	362	332	386	362	328	
9	Line 8	382	376	329	350	371	369	
10	Line 9	372	312	319	308	323	311	
11	Line 10	372	358	372	376	327	336	
12	Line 11	317	345	377	346	394	341	
13	Line 12	338	351	394	314	328	308	

- Select the range of cells to format.

- From the Home tab select Conditional Formatting, New Rule.

- Select 'Use a formula to determine to which cells to format' then enter the formula:

- Type =MOD(ROW(A2),2)=1

- Select Format and change the fill colour to green, OK.

The result is only odd rows change colour because when their ROW number is divided by 2 gives a remainder of 1.

The same effect can be achieved more directly by converting the range to a Table and clicking Banded Rows. But this method allows control over how many rows are banded.

Try editing the formula to read

=MOD(ROW(A2),3)=1

	A	B	C	D	E	F	G
1		Jan	Feb	Mar	Apr	May	Jun
2	Line 1	379	351	379	335	345	329
3	Line 2	390	309	374	356	339	377
4	Line 3	345	333	338	399	364	330
5	Line 4	336	346	363	343	395	399
6	Line 5	347	331	394	382	320	323
7	Line 6	340	311	311	394	322	359
8	Line 7	318	362	332	386	362	328
9	Line 8	382	376	329	350	371	369
10	Line 9	372	312	319	308	323	311
11	Line 10	372	358	372	376	327	336
12	Line 11	317	345	377	346	394	341
13	Line 12	338	351	394	314	328	308

	A	B	C	D	E	F	G
1		Jan	Feb	Mar	Apr	May	Jun
2	Line 1	379	351	379	335	345	329
3	Line 2	390	309	374	356	339	377
4	Line 3	345	333	338	399	364	330
5	Line 4	336	346	363	343	395	399
6	Line 5	347	331	394	382	320	323
7	Line 6	340	311	311	394	322	359
8	Line 7	318	362	332	386	362	328
9	Line 8	382	376	329	350	371	369
10	Line 9	372	312	319	308	323	311
11	Line 10	372	358	372	376	327	336
12	Line 11	317	345	377	346	394	341
13	Line 12	338	351	394	314	328	308

Now every third row becomes banded.

A similar effect can be achieved for columns using the COLUMN function.

This time the formula is

=MOD(COLUMN(B2),2)=1

Other banding effects can be created

=MOD(ROW(A2),4)>1

Produces bands every 3rd and 4th row where the remainder of the row divided by 4 is greater than 1.

Use the AGGREGATE function to sum data in ranges with errors

This function is a cousin of the SUBTOTAL function and only available in Excel 2010. One of the benefits of using the AGGREGATE function is that it ignores errors. For example:

The formula in C11, SUM(C3:C9) returns an error because there are divide by zero errors in some of the cells in the sum range.

With the AGGREGATE function

=AGGREGATE(9,2,C3:C9)

The 9 refers to function number taken from the list shown below

Function_num	Function
1	AVERAGE
2	COUNT
3	COUNTA
4	MAX
5	MIN
6	PRODUCT
7	STDEV.S
8	STDEV.P
9	SUM
10	VAR.S

Function_num	Function
11	VAR.P
12	MEDIAN
13	MODE.SNGL
14	LARGE
15	SMALL
16	PERCENTILE.INC
17	QUARTILE.INC
18	PERCENTILE.EXC
19	QUARTILE.EXC

The 2 in the second argument is used here to ignore errors as well as subtotal functions. Other options from 0 – 7 allow hidden rows to be ignored and other variations. Selecting the hyperlink 'Help on this function' displays a full list of all options.

Use a variety of Financial functions such as PMT, FV, IRR

The most common use of Excel is to perform calculations involving money. Every day people make thousands of financial decisions based on figures in a spreadsheet. These decisions range from simple to complex. Can I afford to buy a new car in the next 18 months? Will a business result in a positive cash flow after 5 years?

PMT

The PMT (Payment Monthly Term) function returns the loan payment (principal plus interest) per period assuming constant payment amounts and a fixed interest rate.

> **Syntax**
>
> PMT(rate,nper,pv,[fv],[type])

	A	B	C	D	E
13			I have borrowed	£6,000	to buy a car
14			@	6.25%	per annum
15			to be paid back in	18	months
16			I need to pay		per month
17					

For example suppose you borrow £6,000 to buy a car and plan to pay it off on monthly installments at an interest rate of 6.25% over 18 months. The PMT function calculates that the repayment to be made is £350.07 at the end of every month.

Note that Rate is the monthly interest rate so is divided by 12.

Nper is the number of monthly payments to be made.

Pv is the monthly payment amount and is entered as a negative because it is a payment.

Fv is a cash balance you may wish to attain after the last payment is made (assumed to be 0 if omitted).

Type determines when the monthly payment is to be paid (0 or omitted for end of month, 1 for beginning of month).

Note that £350.07 x 18 = £6,301.24 so the amount of interest to be paid in this example is £301.24.

FV

The FV or Future Value function calculates the future value of an investment based on constant payments and a constant interest rate.

Syntax

FV(rate,nper,pmt,[pv],[type])

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For example if you pay £250 into the bank every month at an annual interest rate of 6.5% for 2 years what will be the future value of your investment?

	A	B	C	D	E	F	G	H
4		If I pay	£250	into a bank account at the beginning of every month
5		which earns	6.50%	per annum
6		in two years I will have		

In C6 create the following FV function by selecting Formulas, Financial, FV
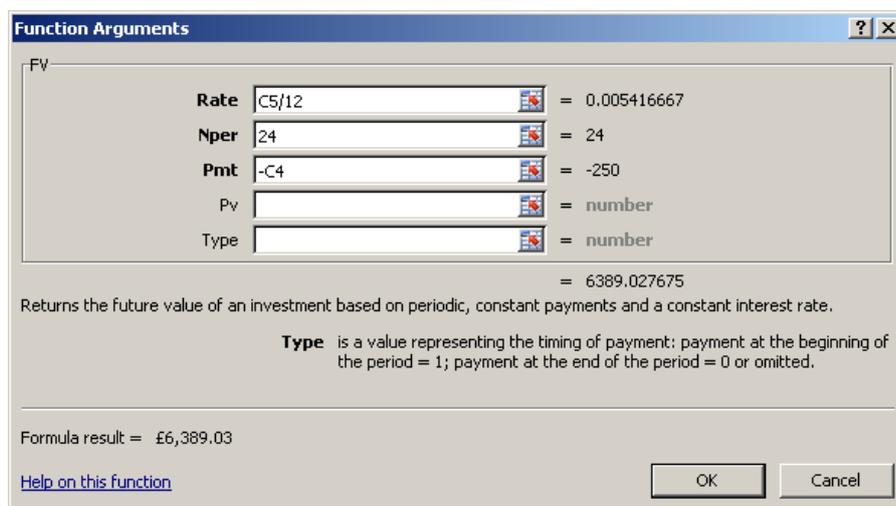
As before

Rate is the monthly interest rate

Nper is the number of months 24/12

Pmt is -£250 as it is a payment

PV is an optional lump-sum amount that is paid at the beginning of the investment. In this case it is 0.

Type is again for when the monthly payment is paid (End of the month if omitted).

This function =FV(C5/12,24,-C4) returns £6,389.03 as the future value of the investment.

Now suppose you invest £2,000 as a lump-sum as well as making regular payments at the end of each month for 2 years.

	C12	▼	●	f_x	=FV(C10/12,24,-C11,-C9)			
	A	B			C	D	E	F
9		If I pay			£2,000	into a bank account		
10		which earns			6.50%	per annum		
11		and then put in			£250	at the beginning of every month		
12		in two years I will have			£8,665.89			

Note again that the *Pv* and *Pmt* are entered as negative values because they are both payments.

This time the FV function returns £8,665.89 which now includes the initial lump-sum with interest as well as the monthly payments and their interest.

IRR

Another useful financial function for businesses is the Internal Rate of Return IRR. This function calculates the rate of return on a series of regular cash flow income (positive values) and payments (negative values).

> **Syntax**
>
> IRR(values, [guess])

In the example above the IRR is 9% for the income amounts shown and the initial cost payment of 70,000.
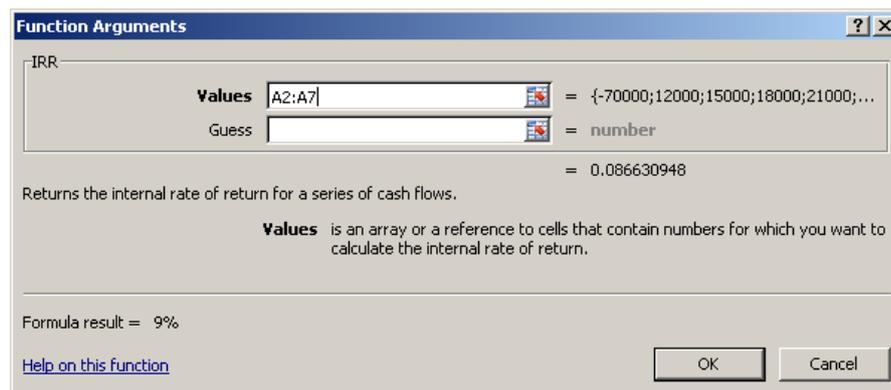
Values: the range of payment and income values.

Guess: is optional and set to 10% if omitted.

Note: A #NUM! error message appears if an answer could not be found after 20 cycle calculations. In that case enter a guess for the IRR %.

Unit 3: Date & Text Functions

In this unit you will learn how to:

- Find smarter ways to calculate dates and times using TODAY, NETWORKDAYS, WORKDAY and DATEDIF

- Use Text functions UPPER, PROPER, LEFT, RIGHT, LEN, MID, SEARCH and FIND

- Use TYPE to identify the data type of cell contents

- Use TRIM to remove excess spaces in cells

Calculating Dates and Times using TODAY, NETWORKDAYS, WORKDAY and DATEDIF

TODAY

The TODAY function displays the current date. Because it updates to show the new current date it is often used for date calculations that change with time such as a person's age.

> **Syntax**
>
> =TODAY()

NETWORKDAYS

This function calculates the number of working days (not weekend dates) between two dates.

> **Syntax**
>
> =NETWORKDAYS(StartDate,EndDate,Holidays)

Holidays is a list of dates which will be excluded from the calculation such as public holidays. They can be entered as range of cells or as a list "25/12/12","01/"01/13"etc.

This example calculates the net working days between two dates for employees taking annual leave.

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	C2	▾	f_x	=NETWORKDAYS(A2,B2,$A$7:$A$11)	
	A	B	C	D	
1	**Start Date**	**End Date**	**Work Days**		
2	Mon 04-Mar-13	Fri 15-Mar-13	10		
3	Wed 27-Mar-13	Wed 03-Apr-13	4		
4	Tue 20-Aug-13	Fri 30-Aug-13	8		
5					
6					
7	Fri 29-Mar-13	Good Friday			
8	Mon 01-Apr-13	Easter Monday			
9	Mon 06-May-13	Early May Bank Holiday			
10	Mon 27-May-13	Spring Bank Holiday			
11	Mon 26-Aug-13	Summer Bank Holiday			
12					

WORKDAY

This function calculates a future or past date based on a starting date and a specified number of working days. One of its uses could be to calculate invoice due dates or delivery dates from an order date.

> **Syntax**
>
> =WORKDAY(StartDate,Days,Holidays)

In this example the function calculates a delivery date based on an order date and an estimate of the number of days till delivery.

	C16	▾	f_x	=WORKDAY(A16,B16,A7:A11)
	A	B	C	
13				
14				
15	**Order Date**	**Delivery Days**	**Delivery Date**	
16	Thu 04-Apr-13	2	Mon 08-Apr-13	
17	Thu 16-May-13	28	Wed 26-Jun-13	
18				

DATEDIF

Another useful function for calculating intervals between dates is DATEDIF. It is one of Excel's mysteries why DATEDIF does not appear in the drop-down list of functions. You must always enter it manually. The function originates from Lotus 1-2-3 and is no longer documented in Excel Help.

DATEDIF is useful for calculating the number of days, months and years between two dates.

> **Syntax**
>
> =DATEDIF(FirstDate,SecondDate,"Interval")

FirstDate must be earlier than *SecondDate* or an error is returned.

Interval is as follows:

"d"	Days between the two dates.
"m"	Months between the two dates.
"y"	Years between the two dates.
"yd"	Days between the dates, as if the dates were in the same year.
"ym"	Months between the dates, as if the dates were in the same year.
"md"	Days between the two dates, as if the dates were in the same month and year.

For example suppose you want to know someone's age in years. The formula using DateDif would be:

=DATEDIF(C8,TODAY(),"y")

To include the number of months type:

=DATEDIF(C8,TODAY(),"ym")

And to include the number of days:

=DATEDIF(C8,TODAY(),"yd")

Putting these together the age in years, months and days would be:

=DATEDIF(C8,TODAY(),"y")&" Years, "&DATEDIF(C8,TODAY(),"ym")&" Months and "&DATEDIF(C8,TODAY(),"md")&" Days"

Time Calculations

Time values can be entered into Excel worksheets by typing them in the format:

hh:mm

For example 12:00 would mean mid day.

The time is based on a 24 hour clock so 1:00 would be 1 AM.

If you wish to type in 12 hour format then add the suffix AM or PM.

It is possible to include seconds by typing a second colon for example 12:00:10.

Time values can also be formatted afterwards in the usual way using

Format, Cells, Number, Time. Here are a list of some of the possible ways of formatting times:

Time format	How it displays
hh:mm	09:00
h:mm	9:00
hh:mm AM/PM	09:00 AM, 04:00 PM
hh:mm:ss	09:00:00
mm:ss.0	27:30.4 (27 mins, 30.4 seconds)
[hh]:mm	Allows for hour values greater than 24

When a time is entered into a cell with a valid time format Excel actually stores the value as a number between 0 and 1. Midnight would be stored as 0 and midday as 0.5. This can be seen by choosing General from the Format, Cells number format category,

Creating Timesheets

Times can be added up with a Sum function. This goes well until the total goes above 24 hours.

Start	End	Duration
09:00	18:30	09:30
09:00	17:00	08:00
08:00	18:00	10:00
Total		**03:30**

To display the absolute number of hours you need to apply a custom format:

[hh]:mm

The correct result of 27:30 is then displayed for the timesheet.

Use Text Functions

When data is copied from another source such as a Website you may need to manipulate or transform it in some way. The text functions mentioned in this unit can are designed to transform data. For example the UPPER function transforms text to upper case. The LEFT and RIGHT function truncates text to a specific number of characters to the left or right. Other functions such as FIND are used in combination with other text functions to locate the position of spaces or other characters within text. Other functions such as TRIM are used to clean out spaces from the beginning or end of text.

Often you will want to replace the original data with the transformed data. To do that you will need to create the transformed data containing the text function in a temporary column. The new data containing the function or functions can then be copied but then pasted back as **Values** onto the original data.

LEFT

The LEFT function displays a specific number of characters from the left hand side of a piece of text.

> **Syntax**
>
> =LEFT(Text,NumberOfCharacters)

Example:

Suppose you import a list of athletes from the 2012 Olympic Website and find the Last name is in capitals and before the first name. You would rather display the names as First name then Last name in Proper case but there are 107 runners, so you don't feel like retyping the names.

Use of the LEFT function wouldn't help because the Last names are all different lengths. You could display the Last name initials by typing in B3:

=LEFT(A3,1)

Copying the function down will display all athlete initials. But to display the Last names you need first to find the position of the space and use that to determine the length of Number of characters to display.

In Cell B3 you would type:

=LEFT(A3,FIND(" ",A3)-1)

This formula uses the text function FIND and will work for all the athletes with a single Last names.

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FIND

The FIND function looks for a specific character or characters in the text within a cell and returns its character position counting from the left.

For example for GELANA tiki FIND(" ",A3) returns 7

Subtracting 1 results in the number of characters for her Last name.

You can optionally start part way through the text by typing a start number. That might be useful if there is more than one space in a full name.

> **Syntax**
>
> =FIND(FindText,WithinText,[startnumber]))

So combining the LEFT and FIND functions results in a list of Last names only. There are two exceptions, PETROVA ARKHIPOVA Tatyana and DA SILVA Adriana Aparecida because there are effectively two Last names without a hyphens between them. They will have to be edited manually but 105 names are separated automatically with these text functions.

SEARCH

The SEARCH function is very similar to FIND. The main difference is that SEARCH is not case sensitive and it allows 'wildcards' to be used. A **?** stands for single character and a ***** stands for any number of characters.

For example

=SEARCH("* * ",A3)

returns the position 1if the text happens to contain 2 spaces, (3 names rather than 2) otherwise it returns #VALUE.

PROPER

This function capitalizes the first character of each work of the text within a cell.

To convert text to Proper case simply type =PROPER(A3) in a blank column and copy down.

UPPER and LOWER

These text functions convert all text in cell to upper or lower case.

> **Syntax**
>
> =UPPER(Text)
>
> =LOWER(Text)

They may be useful when there is a mixture of case. They can also be wrapped around other functions, for example,

=PROPER(LEFT(A3,FIND(" ",A3)-1))

LEN

This function counts the number of characters in a piece of text including spaces and numbers.

> **Syntax**
>
> =LEN(Text)

At first there may not seem to be a business need for counting the number of characters in piece of text. But it can be useful for transforming data when used in combination with other text functions.

In the example below, suppose you wish to separate the country from the athlete name and display it in column C. Unfortunately there is no space or other delimiter after the country name to help you. This is because the data came originally from a flag on the Website next to each athlete name. So you the SEARCH function or even Excel's powerful Text to Columns feature on the Data tab will not help you.

But if you have the athlete name already it should be possible to use a combination of the LEN and LEFT function to subtract extract the country name.

|	A	B	C
1			
2	**Athlete**	**CountryAthlete**	**Country**
3	GELANA Tiki	EthiopiaGELANA Tiki	
4	JEPTOO Priscah	KenyaJEPTOO Priscah	
5	PETROVA ARKHIPOVA Tatyana	Russian FederationPETROVA ARKHIPOVA Tatyana	
6	MARY Jepkosgei	KenyaKEITANY Mary Jepkosgei	
7	GAMERA-SHMYRKO Tetyana	UkraineGAMERA-SHMYRKO Tetyana	
8	ZHU Xiaolin	People's Republic of ChinaZHU Xiaolin	
9	AUGUSTO Jessica	PortugalAUGUSTO Jessica	
10	STRANEO Valeria	ItalySTRANEO Valeria	
11	MAYOROVA Albina	Russian FederationMAYOROVA Albina	
12	FLANAGAN Shalane	United States of AmericaFLANAGAN Shalane	
13	GOUCHER Kara	United States of AmericaGOUCHER Kara	
14	JOHANNES Helalia	NamibiaJOHANNES Helalia	
15	BARROS Marisa	PortugalBARROS Marisa	
16	MIKITENKO Irina	GermanyMIKITENKO Irina	
17	SMITH Kimberley	New ZealandSMITH Kimberley	
18	KIZAKI Ryoko	JapanKIZAKI Ryoko	
19	WEIGHTMAN Lisa Jane	AustraliaWEIGHTMAN Lisa Jane	
20	ANDERSSON Isabellah	SwedenANDERSSON Isabellah	
21	OZAKI Yoshimi	JapanOZAKI Yoshimi	
22	KIPLAGAT Edna Ngeringwony	KenyaKIPLAGAT Edna Ngeringwony	
23	FELIX Ana Dulce	PortugalFELIX Ana Dulce	

Unit 4: Auditing Formulas

In this unit, you will learn how to:

- Trace formula precedents, dependents and errors

- Correct errors in formulas

- Combine IF with VLOOKUP to suppress error messages

- Use the IS information function

- Use error checking functions; ISERR, ISERROR, IFERROR

Trace Formula Precedents, Dependents and Errors

On the Formulas, **Formula Auditing** group there are buttons that can help you trace errors and show the cells that are referenced in a formula.

The **Trace Precedents** button will display blue arrows to cells that supply data to the formula. Arrows may be red if a supplying cell has an error.

The **Trace Dependents** button will display arrows to the other cells that depend on a given cell's data.

The **Remove Arrows** button will remove both precedence and dependence arrows from your Excel screen.

The **Show Formulas** button will toggle between showing results and formulas in the worksheet. You can also use the **Ctrl + 'pipe' key** shortcut keys to do the same thing.

Correcting Errors in Formulas

The Error Checking option will check the entire worksheet for formula errors. If any are found, you will be alerted with an error checking dialogue (like the one below) that pertains to the specific error in question.
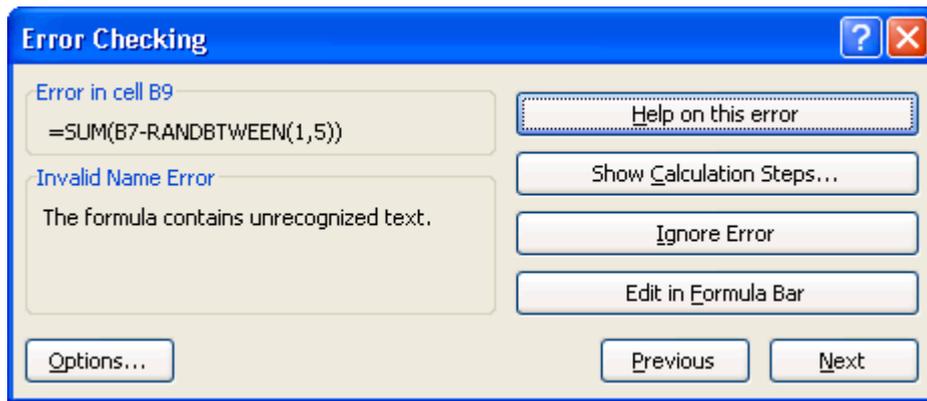
You can also click the down arrow next to the Error Checking button to see additional options.
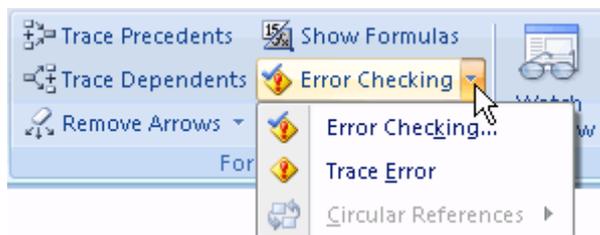
The first option, **Error Checking**, will perform the same action as if you clicked the Error Checking button directly. The **Trace Error** option will display arrows to the cells referenced in an incorrect formula. The **Circular References** menu will display cells that contain circular references, if there are any in the worksheet.

The **Evaluate Formula** dialog will help you analyse, interpret and correct formulas.
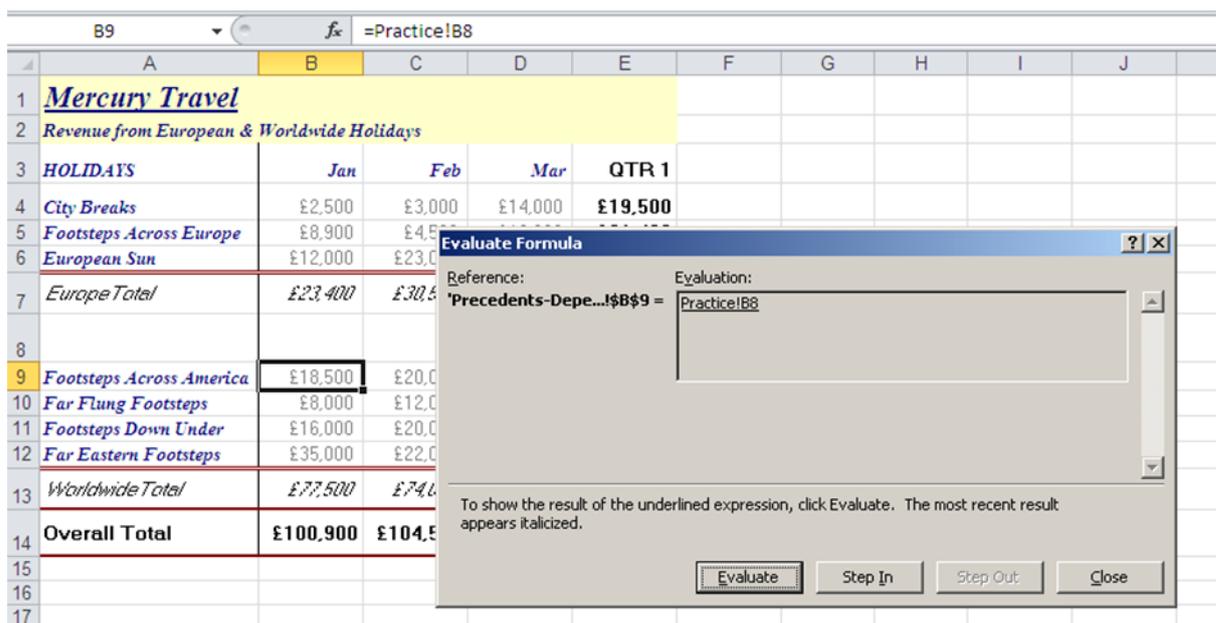
In this example cell B9 contains a formula linked to a cell in the worksheet called Practice.

Clicking **Step In** navigates to the Practice worksheet and **Step Out** returns back the worksheet containing the link.

Evaluate displays the value of the current cell rather than its formula.

Combine IF with VLOOKUP to suppress error messages

When working with VLOOKUP functions you may wish to suppress the #N/A error message that appears when an exact match is not found. For example, the invoice below uses a VLOOKUP functions to extract information from the Product List worksheet.

	B16		fx	=VLOOKUP(A16,'Product list'!$A$5:$C$44,3,FALSE)		
	A	B	C	D	E	F
4	Chiswick				Date	02/10/2012
5	London	W4 8YH			Customer no.	Customer No
6	sales@timeoutholidays.co.uk					
7						
8	To:	NAME				
9		ADDRESS 1				
10		ADDRESS 2				
11		TOWN / CITY				
12		POST CODE				
13						
14						
15	Code	No. of days	Description	Price per unit	Commission	Total
16	SAM30	30	See South America 30 days	£5,748.00	15.0%	£6,610.20
17						
18						
19						
20						
21	H78	14	Highland 14 day tour	£1,673.00	15.0%	£1,923.95
22						
23						
24						
25						
26	IT14	14	Idyllic Italy 14 day tour	£1,988.00	16.0%	£2,306.08
27						
28						
29						
30						
31					Total	£10,840.23
32						
33						

If the Product Code is blank then the Vlookup returns #N/A

14		
15	Code	No. of days
16	◇	#N/A
17		
18		

To suppress the error message an IF function can be used to test if the Code is blank as follows:

=IF(A16="","",VLOOKUP(A16,'Product list'!$A$5:$C$44,3,FALSE))

The IF statement specifically for a blank cell ("")

An alternative method is to use the ISNA function which displays a blank whenever a #N/A message appears.

=IF(ISNA(VLOOKUP(A16,'Product list'!$A$5:$C$44,3,FALSE)),"",VLOOKUP(A16,'Product list'!$A$5:$C$44,3,FALSE))

The IS Information Function

Type =IS into a cell and you will see there are many different functions beginning with IS. They are referred to collectively as **IS Functions**.

IS Functions return different types of information about a reference cell. They all return either TRUE or FALSE, for example ISBLANK returns TRUE if a cell is empty, ISNA returns TRUE if a cell contains a #N/A error message.
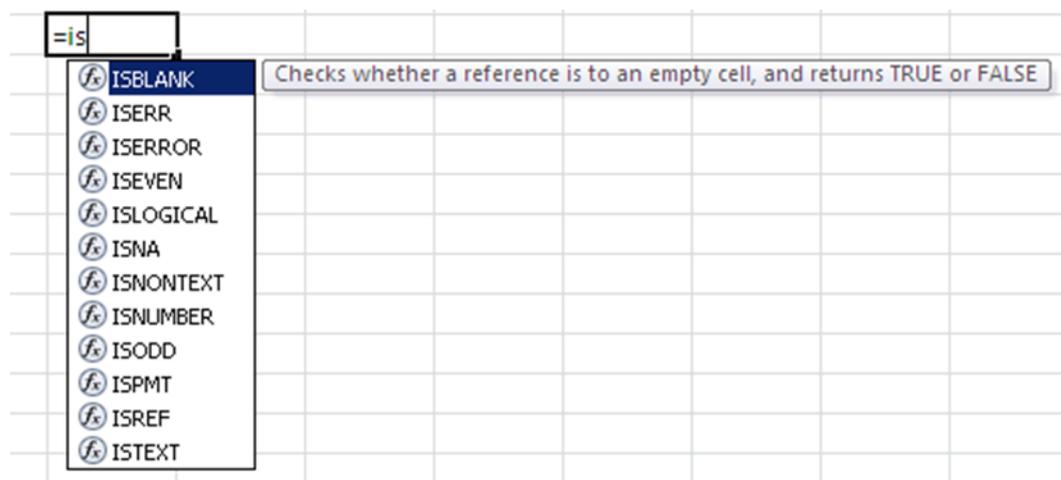
Here are the definitions of each IS Function.

ISBLANK	Value refers to an empty cell.
ISERR	Value refers to any error value except #N/A.
ISERROR	Value refers to any error value (#N/A, #VALUE!, #REF!, #DIV/0!, #NUM!, #NAME?, or #NULL!).
ISLOGICAL	Value refers to a logical value.
ISNA	Value refers to the #N/A (value not available) error value.
ISNONTEXT	Value refers to any item that is not text. (Note that this function returns TRUE if the value refers to a blank cell.)
ISNUMBER	Value refers to a number.
ISREF	Value refers to a reference.
ISTEXT	Value refers to text.

ISERR Function

This function tests a cell and returns TRUE if is an error in that cell.

ISERR returns FALSE if the contents of the cell calculates without an error or if the error is the #NA message.

Cell to test	Result	
3	FALSE	=ISERR(A2)
#DIV/0!	TRUE	=ISERR(A3)
#NAME?	TRUE	=ISERR(A4)
#REF!	TRUE	=ISERR(A5)
#VALUE!	TRUE	=ISERR(A6)
#N/A	FALSE	=ISERR(A7)
#N/A	FALSE	=ISERR(A8)

Syntax

=ISERR(test cell)

The test cell can be a cell reference or a calculation.
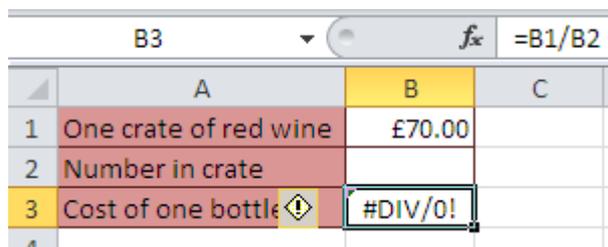
	B3		fx	=B1/B2	
	A		B	C	
1	One crate of red wine		£70.00		
2	Number in crate				
3	Cost of one bottle	①	#DIV/0!		

In this example an error message appears because a cell B2 has been left blank. This created the divide by zero error (#DIV/0!) for the formula =B1/B2 in B3. While the error message disappears as soon as a value is typed into B2 it makes the spreadsheet look untidy.

The ISERR function can be used within an IF statement to suppress the error messages such as #DIV/0! or #VALUE!

=IF(ISERR(B1/B2),"",B1/B2)

Now any error message caused by 0, blank or a space being typed into B2 are suppressed and display as a blank cell. If there is no error then the calculation is performed (cost per bottle).

ISERROR Function

This function is similar to ISERR except it returns TRUE if there is a #NA error.

Syntax

=ISERROR(test cell)

IFERROR

This function not only traps for errors but also returns a value you specify if an error occurs. The IFERROR function avoids the need for an IF function and can also be created as an array formula.

Syntax

=IFERROR(test cell,value if error)

For example

=IFERROR(B1/B2,"")

IFERROR as an Array Formula

The IFERROR function can be entered as an Array to perform a calculation on a range of cells rather than a single cell.

> **Syntax**
>
> {=IFERROR(test on each element in array, value if error in element)}

For example the Quota per Unit is entered as an array which calculates A2:A4/B2:B4 for each element and returns the word "error" if an error results for each calculation.

To create the formula

1. Select range C2:C4

2. Type =IFERROR(

3. Highlight A2:A4

4. Type /

5. Highlight B2:B4

6. Close)

7. Press Ctrl+Shift+Enter (CSE)

Pressing CSE at the end adds the array brackets to the formula:

={IFERROR(A2:A4/B2:B4,"error")}

Excel Advanced Part 2 Functions

Excel Function Syntax (Required arguments shown in bold)	What it does
Logical	
=IF(logical_test,True,False)	Tests if a logical test is met and returns one true and one false result.
=AND(condition1,condition2,...)	Returns TRUE or FALSE if both or all conditions are met.
=OR(condition1,condition2,...)	Returns TRUE or FALSE if either conditions met.
=NOT(condition)	Returns TRUE if a condition is not met.
=IFERROR(value, value_if_error)	Displays a message if an error occurs.
Lookup & Reference	
=VLOOKUP(ItemToFind,RangeToLook, Column, SortedOrUnsorted)	Looks for an item in the leftmost column of a table range and returns a value from a specified column number.
=CHOOSE(Index_Value, item1, item2, item3)	Chooses a value or action from a list of items based on an index number.
=MATCH(lookup_value, lookup_array, match_type**)**	Returns the relative position of an item in range.
=INDEX(range, row_num, column_num**)**	Returns a value in a range based on a row and column position within the range.
Statistical	
=COUNTIFS(criteria_range1, criteria 1, criteria_range2, criteria2)	Counts the number of items that meet both or all the criteria in the criteria ranges.
=SUMIFS(Sum range, criteria_range1, criteria 1, criteria_range2, criteria2)	Sums a range of values that meet all of the criteria in the criteria ranges.

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Excel Function Syntax (Required arguments shown in bold)	What it does
=RANK(NumberToRank, RangeOfNumbers, RankOrder**)**	Returns the rank position of a value in a list of numbers (highest rank for ties).
=RANK.AVG(number,ref,order**)**	Returns the rank position of a value in a list of numbers (average rank for ties).
=MEDIAN(Range1,Range2,Range3...)	Returns the middle rank value in a range.
=MODE(Range1,Range2,Range3...)	Returns the most common value in a range.
=ROUND(NumberToRound, DecimalPlaces)	Rounds a value to a specified number of decimal places.
=ROUNDUP(NumberToRound,Decimal Places)	Rounds up a value to specified number of decimal places.
=ROUNDDOWN(Cell,DecimalPlaces)	Rounds down a value to specified number of decimal places.
=CEILING(Cell,Decimal Places)	Rounds a number to a specified significance.
=MOD(Cell,Devisor)	Returns the remainder when a number is divided by a devisor.
=ROW()	Returns the row number of a reference.
=COLUMN()	Returns the column number of a reference.
Date and Time	
=TODAY()	Returns the current date
=NETWORKDAYS(StartDate, EndDate, Holidays)	Calculates the number of working days between two dates not including holidays.
=DATEDIF(FirstDate,SecondDate, Interval)	Subtracts the days between 2 dates in days, months or years.
=WORKDAY(StartDate,Days,Holidays)	Returns the date after a specified number of working days.
Date(year,month,day)	Returns the date a year, month and date value.

Excel Function Syntax (Required arguments shown in bold)	What it does
Day(date)	Returns the Day number of a a date.
Month(date)	Returns the Month number of a date.
Text	
=CONCATENATE(text1,text2,text3...)	Joins together text values.
=LEFT(text, num_chars)	Returns a number of characters to the right of a cell.
=RIGHT(text,num_chars)	Returns a number of characters to the right of a cell.
=SEARCH(find_text, within_text, start_num**)**	Searches for the character position of a text character within text.
=FIND(find_text, within_text, start_num**)**	Searches for the character position of a text character within text (case sensitive).
=LEN(text)	Returns the number of characters in a cell.
=MID(text, start_num, num_chars)	Returns text within cell starting from a given position and number.
Financial	
=PMT(rate, nper, pv, fv**,** type**)**	Calculates the payment on a loan based on constant payment and constant interest rates.
=FV(rate,nper,pmt,pv**,**type**)**	Calculates the future value of a regular number of payments.
=IRR(initial investment,cash flow1,cashflow2,guess**)**	Calculates the percentage rate of return on a series of payments of varying amount.
Information	
=ISNA(cell)	Checks whether a value is #NA and returns either TRUE or FALSE.
=ISBLANK(cell)	Returns TRUE if a cell is empty.
=ISTEXT(cell)	Returns TRUE if a cell is a text.

Excel Function Syntax (Required arguments shown in bold)	What it does
=ISNUMBER(cell)	Reyurns TRUE if a cell is a number.
=CELL("filename")	Returns the filename and path of the current file. Displays blank if a file is not yet saved. Press F9 to update after saving.
Array Functions **Press Ctrl+Shift+Enter after typing**	
{=TRANSPOSE(array)}	Converts a vertical range to horizontal or visa vice versa.
{=SUM(range1*range2)}	Returns the product of ranges or arrays.
=SUMPRODUCT(range1,range2)	Alternative way to return the product of ranges or arrays. No need to press CSE
{=FREQUENCY(data_range,bin_array)}	Calculates how often a value occurs in each element of the bin_array.

Quick reference: Excel shortcuts

CTRL combination shortcut keys

KEY	DESCRIPTION
CTRL+SHIFT+(	Unhides any hidden rows within the selection.
CTRL+SHIFT+)	Unhides any hidden columns within the selection.
CTRL+SHIFT+&	Applies the outline border to the selected cells.
CTRL+SHIFT_	Removes the outline border from the selected cells.
CTRL+SHIFT+~	Applies the General number format.
CTRL+SHIFT+$	Applies the Currency format with two decimal places (negative numbers in parentheses).
CTRL+SHIFT+%	Applies the Percentage format with no decimal places.
CTRL+SHIFT+^	Applies the Exponential number format with two decimal places.
CTRL+SHIFT+#	Applies the Date format with the day, month, and year.
CTRL+SHIFT+@	Applies the Time format with the hour and minute, and AM or PM.
CTRL+SHIFT+!	Applies the Number format with two decimal places, thousands separator, and minus sign (-) for negative values.
CTRL+SHIFT+*	Selects the current region around the active cell (the data area enclosed by blank rows and blank columns). In a PivotTable, it selects the entire PivotTable report.
CTRL+SHIFT+:	Enters the current time.
CTRL+SHIFT+"	Copies the value from the cell above the active cell into the cell or the Formula Bar.
CTRL+SHIFT+Plus (+)	Displays the **Insert** dialogue box to insert blank cells.
CTRL+Minus (-)	Displays the **Delete** dialogue box to delete the selected cells.
CTRL+;	Enters the current date.
CTRL+`	Alternates between displaying cell values and displaying formulas in the worksheet.
CTRL+'	Copies a formula from the cell above the active cell into the cell or the Formula Bar.
CTRL+1	Displays the **Format Cells** dialogue box.
CTRL+2	Applies or removes bold formatting.

CTRL+3	Applies or removes italic formatting.
CTRL+4	Applies or removes underlining.
CTRL+5	Applies or removes strikethrough.
CTRL+6	Alternates between hiding objects, displaying objects, and displaying placeholders for objects.
CTRL+8	Displays or hides the outline symbols.
CTRL+9	Hides the selected rows.
CTRL+0	Hides the selected columns.
CTRL+A	Selects the entire worksheet.
	If the worksheet contains data, CTRL+A selects the current region. Pressing CTRL+A a second time selects the current region and its summary rows. Pressing CTRL+A a third time selects the entire worksheet.
	When the insertion point is to the right of a function name in a formula, displays the **Function Arguments** dialogue box.
	CTRL+SHIFT+A inserts the argument names and parentheses when the insertion point is to the right of a function name in a formula.
CTRL+B	Applies or removes bold formatting.
CTRL+C	Copies the selected cells.
	CTRL+C followed by another CTRL+C displays the Clipboard.
CTRL+D	Uses the **Fill Down** command to copy the contents and format of the topmost cell of a selected range into the cells below.
CTRL+F	Displays the **Find and Replace** dialogue box, with the **Find** tab selected.
	SHIFT+F5 also displays this tab, while SHIFT+F4 repeats the last **Find** action.
	CTRL+SHIFT+F opens the **Format Cells** dialogue box with the **Font** tab selected.
CTRL+G	Displays the **Go To** dialogue box.
	F5 also displays this dialogue box.
CTRL+H	Displays the **Find and Replace** dialogue box, with the **Replace** tab selected.
CTRL+I	Applies or removes italic formatting.
CTRL+K	Displays the **Insert Hyperlink** dialogue box for new hyperlinks or the **Edit Hyperlink** dialogue box for selected existing hyperlinks.
CTRL+N	Creates a new, blank workbook.
CTRL+O	Displays the **Open** dialogue box to open or find a file.

	CTRL+SHIFT+O selects all cells that contain comments.
CTRL+P	Displays the **Print** dialogue box.
	CTRL+SHIFT+P opens the **Format Cells** dialogue box with the **Font** tab selected.
CTRL+R	Uses the **Fill Right** command to copy the contents and format of the leftmost cell of a selected range into the cells to the right.
CTRL+S	Saves the active file with its current file name, location, and file format.
CTRL+T	Displays the **Create Table** dialogue box.
CTRL+U	Applies or removes underlining.
	CTRL+SHIFT+U switches between expanding and collapsing of the formula bar.
CTRL+V	Inserts the contents of the Clipboard at the insertion point and replaces any selection. Available only after you have cut or copied an object, text, or cell contents.
	CTRL+ALT+V displays the **Paste Special** dialogue box. Available only after you have cut or copied an object, text, or cell contents on a worksheet or in another program.
CTRL+W	Closes the selected workbook window.
CTRL+X	Cuts the selected cells.
CTRL+Y	Repeats the last command or action, if possible.
CTRL+Z	Uses the **Undo** command to reverse the last command or to delete the last entry that you typed.
	CTRL+SHIFT+Z uses the **Undo** or **Redo** command to reverse or restore the last automatic correction when AutoCorrect Smart Tags are displayed.

Function keys

KEY	DESCRIPTION
F1	Displays the **Microsoft Office Excel Help** task pane.
	CTRL+F1 displays or hides the Ribbon, a component of the Microsoft Office Fluent user interface.
	ALT+F1 creates a chart of the data in the current range.
	ALT+SHIFT+F1 inserts a new worksheet.
F2	Edits the active cell and positions the insertion point at the end of the cell contents. It also moves the insertion point into the Formula Bar when editing in a cell is turned off.
	SHIFT+F2 adds or edits a cell comment.
	CTRL+F2 displays the Print Preview window.
F3	Displays the **Paste Name** dialogue box.
	SHIFT+F3 displays the **Insert Function** dialogue box.
F4	Repeats the last command or action, if possible.

CTRL+F4 closes the selected workbook window.

| F5 | Displays the **Go To** dialogue box. |
| | CTRL+F5 restores the window size of the selected workbook window. |

F6	Switches between the worksheet, Ribbon, task pane, and Zoom controls. In a worksheet that has been split (**View** menu, **Manage This Window**, **Freeze Panes**, **Split Window** command), F6 includes the split panes when switching between panes and the Ribbon area.
	SHIFT+F6 switches between the worksheet, Zoom controls, task pane, and Ribbon.
	CTRL+F6 switches to the next workbook window when more than one workbook window is open.

| F7 | Displays the **Spelling** dialogue box to check spelling in the active worksheet or selected range. |
| | CTRL+F7 performs the **Move** command on the workbook window when it is not maximized. Use the arrow keys to move the window, and when finished press ENTER, or ESC to cancel. |

F8	Turns extend mode on or off. In extend mode, **Extended Selection** appears in the status line, and the arrow keys extend the selection.
	SHIFT+F8 enables you to add a nonadjacent cell or range to a selection of cells by using the arrow keys.
	CTRL+F8 performs the **Size** command (on the **Control** menu for the workbook window) when a workbook is not maximized.
	ALT+F8 displays the **Macro** dialogue box to create, run, edit, or delete a macro.

F9	Calculates all worksheets in all open workbooks.
	SHIFT+F9 calculates the active worksheet.
	CTRL+ALT+F9 calculates all worksheets in all open workbooks, regardless of whether they have changed since the last calculation.
	CTRL+ALT+SHIFT+F9 rechecks dependent formulas, and then calculates all cells in all open workbooks, including cells not marked as needing to be calculated.
	CTRL+F9 minimizes a workbook window to an icon.

F10	Turns key tips on or off.
	SHIFT+F10 displays the shortcut menu for a selected item.
	ALT+SHIFT+F10 displays the menu or message for a smart tag. If more than one smart tag is present, it switches to the next smart tag and displays its menu or message.
	CTRL+F10 maximizes or restores the selected workbook window.

F11	Creates a chart of the data in the current range.
	SHIFT+F11 inserts a new worksheet.
	ALT+F11 opens the Microsoft Visual Basic Editor, in which you can create a macro by using Visual Basic for Applications (VBA).

| F12 | Displays the **Save As** dialogue box. |

Other useful shortcut keys

KEY	DESCRIPTION
ARROW KEYS	Move one cell up, down, left, or right in a worksheet.
	CTRL+ARROW KEY moves to the edge of the current data region in a worksheet.
	SHIFT+ARROW KEY extends the selection of cells by one cell.
	CTRL+SHIFT+ARROW KEY extends the selection of cells to the last nonblank cell in the same column or row as the active cell, or if the next cell is blank, extends the selection to the next nonblank cell.
	LEFT ARROW or RIGHT ARROW selects the tab to the left or right when the Ribbon is selected. When a submenu is open or selected, these arrow keys switch between the main menu and the submenu. When a Ribbon tab is selected, these keys navigate the tab buttons.
	DOWN ARROW or UP ARROW selects the next or previous command when a menu or submenu is open. When a Ribbon tab is selected, these keys navigate up or down the tab group.
	In a dialogue box, arrow keys move between options in an open drop-down list, or between options in a group of options.
	DOWN ARROW or ALT+DOWN ARROW opens a selected drop-down list.
BACKSPACE	Deletes one character to the left in the Formula Bar.
	Also clears the content of the active cell.
	In cell editing mode, it deletes the character to the left of the insertion point.
DELETE	Removes the cell contents (data and formulas) from selected cells without affecting cell formats or comments.
	In cell editing mode, it deletes the character to the right of the insertion point.
END	Moves to the cell in the lower-right corner of the window when SCROLL LOCK is turned on.
	Also selects the last command on the menu when a menu or submenu is visible.
	CTRL+END moves to the last cell on a worksheet, in the lowest used row of the rightmost used column. If the cursor is in the formula bar, CTRL+END moves the cursor to the end of the text.
	CTRL+SHIFT+END extends the selection of cells to the last used cell on the worksheet (lower-right corner). If the cursor is in the formula bar, CTRL+SHIFT+END selects all text in the formula bar from the cursor position to the end—this does not affect the height of the formula bar.
ENTER	Completes a cell entry from the cell or the Formula Bar, and selects the cell below (by default).
	In a data form, it moves to the first field in the next record.
	Opens a selected menu (press F10 to activate the menu bar) or performs the action for a selected command.
	In a dialogue box, it performs the action for the default command button in the dialogue box (the button with the bold outline, often the **OK** button).
	ALT+ENTER starts a new line in the same cell.
	CTRL+ENTER fills the selected cell range with the current entry.
	SHIFT+ENTER completes a cell entry and selects the cell above.
ESC	Cancels an entry in the cell or Formula Bar.
	Closes an open menu or submenu, dialogue box, or message window.
	It also closes full screen mode when this mode has been applied, and returns to normal screen mode to display the Ribbon and status bar again.

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HOME	Moves to the beginning of a row in a worksheet.
	Moves to the cell in the upper-left corner of the window when SCROLL LOCK is turned on.
	Selects the first command on the menu when a menu or submenu is visible.
	CTRL+HOME moves to the beginning of a worksheet.
	CTRL+SHIFT+HOME extends the selection of cells to the beginning of the worksheet.
PAGE DOWN	Moves one screen down in a worksheet.
	ALT+PAGE DOWN moves one screen to the right in a worksheet.
	CTRL+PAGE DOWN moves to the next sheet in a workbook.
	CTRL+SHIFT+PAGE DOWN selects the current and next sheet in a workbook.
PAGE UP	Moves one screen up in a worksheet.
	ALT+PAGE UP moves one screen to the left in a worksheet.
	CTRL+PAGE UP moves to the previous sheet in a workbook.
	CTRL+SHIFT+PAGE UP selects the current and previous sheet in a workbook.
SPACEBAR	In a dialogue box, performs the action for the selected button, or selects or clears a check box.
	CTRL+SPACEBAR selects an entire column in a worksheet.
	SHIFT+SPACEBAR selects an entire row in a worksheet.
	CTRL+SHIFT+SPACEBAR selects the entire worksheet.
	If the worksheet contains data, CTRL+SHIFT+SPACEBAR selects the current region. Pressing CTRL+SHIFT+SPACEBAR a second time selects the current region and its summary rows. Pressing CTRL+SHIFT+SPACEBAR a third time selects the entire worksheet.
	When an object is selected, CTRL+SHIFT+SPACEBAR selects all objects on a worksheet.
	ALT+SPACEBAR displays the **Control** menu for the Microsoft Office Excel window.
TAB	Moves one cell to the right in a worksheet.
	Moves between unlocked cells in a protected worksheet.
	Moves to the next option or option group in a dialogue box.
	SHIFT+TAB moves to the previous cell in a worksheet or the previous option in a dialogue box.
	CTRL+TAB switches to the next tab in dialogue box.
	CTRL+SHIFT+TAB switches to the previous tab in a dialogue box.