

**=C5\*C16**

Part of the cell reference points to cell **C16** (which if you check is empty). The problem is that because of the relative nature of the formula, the component that should always refer to the contents of the cell in **C15** (i.e. the delivery charge percentage), in fact moves down as you drag down the screen to extend your calculations.

- Select the range **D4:D12** and press the **Del** key to delete the cell contents.
- Click on cell **D4** and we will try again. This time type in the following formula.

**=C4\*\$C\$15**

The dollar signs make the reference to cell **C15** absolute.

- Try extending the formula to fill the range down to **D12**. This time you should find that the delivery charges are calculated correctly.

	A	B	C	D
1				
2				
3		<b>Part Number</b>	<b>Price (excluding delivery)</b>	<b>Cost of delivery</b>
4		100837	22.99	1.15
5		100263	10.95	0.55
6		100937	20.50	1.03
7		100234	10.50	0.53
8		100375	12.95	0.65
9		100746	29.84	1.49
10		100387	23.43	1.17
11		100883	9.48	0.47
12		100338	20.50	1.03

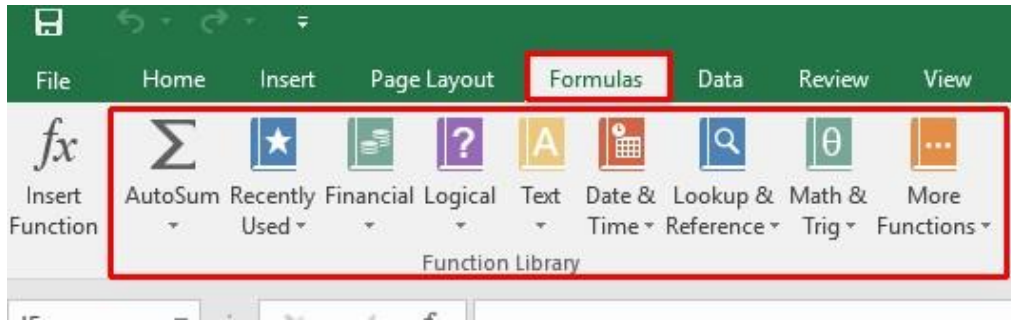
**TIP:** You have seen relative and absolute referencing. You can also have mixed references, which contain an absolute and a relative reference.

- Save your changes and close the workbook.

## Excel 2016 Functions

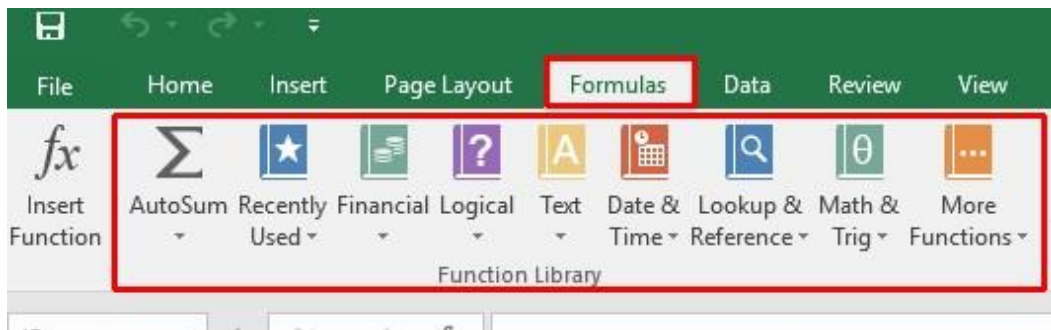
### What are functions?

- A function allows you to calculate a result such as adding numbers together, or finding the average of a range of numbers. Functions are located under the **Formulas** tab.



## Common functions

□ Some commonly used functions include:



**AVERAGE:** Used to determine the average value of the selected cells contents.

**COLUMNS:** Used to return the number of columns within a reference.

**COUNT:** Used to count how many numbers are in the list.

**COUNTA:** Used to count the number of cells that are not empty and the values within the list of arguments.

**COUNTBLANK:** Used to count empty cells within a cell range.

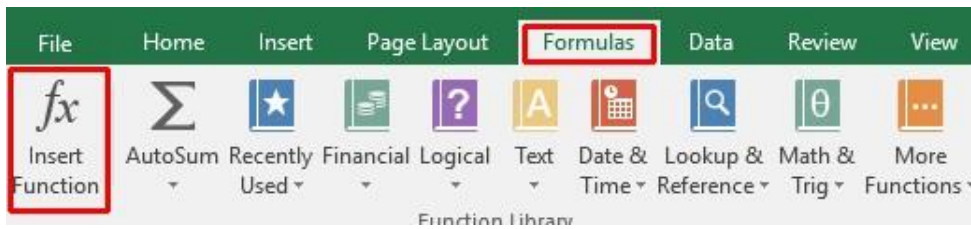
**MAX:** Used to return the maximum number from a list.

**MIN:** Used to return the minimum number from a list.

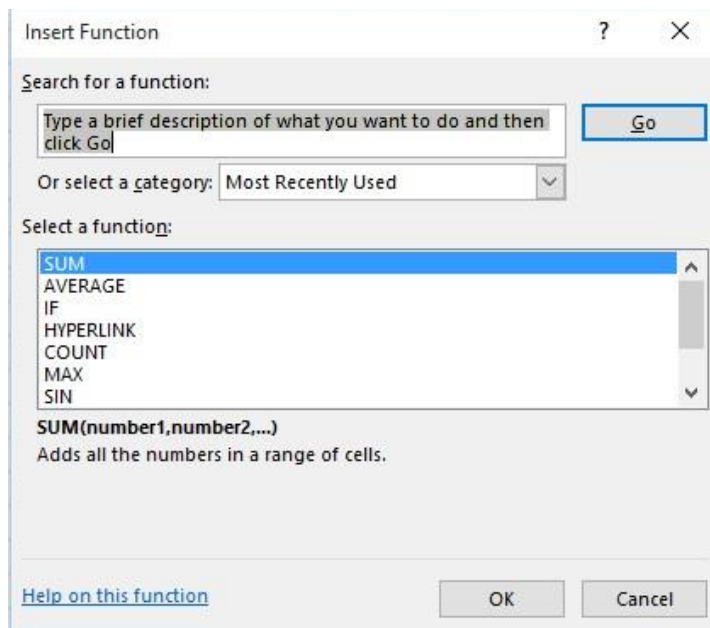
**ROUND:** Used to round off numbers to a specified number of decimal points.

**SUM:** Used to add the contents of selected cells.

To display the available functions, press **Ctrl+N** to display a blank workbook and then click on the **Formulas** tab and within the **Function Library** group click on the **Insert Function** icon.



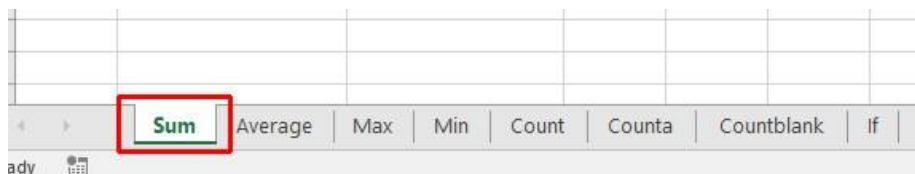
This will display the **Insert Function** dialog box.



□ Scroll down the list which as you will see is extensive.

## Sum function

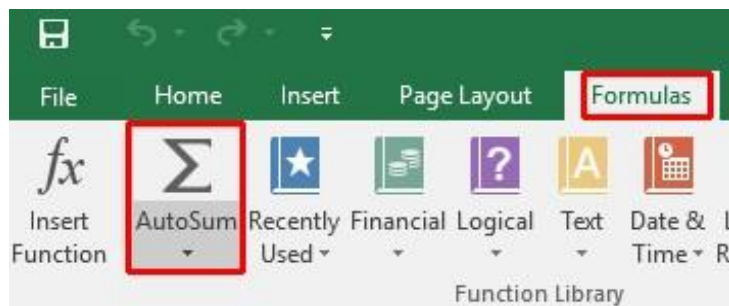
- Open a workbook called **Functions**.
- If necessary, click on the **Sum** worksheet tab.



- Click on cell **C8**.

	A	B	C
1			
2			
3		<b>Sales Region</b>	<b>No of sales</b>
4		North	34
5		South	11
6		East	84
7		West	38
8		TOTAL	
9			

- In this cell we need to sum the values in the column above.
- Click on the **Formulas** tab and within the **Function Library** group click on the **AutoSum** icon.

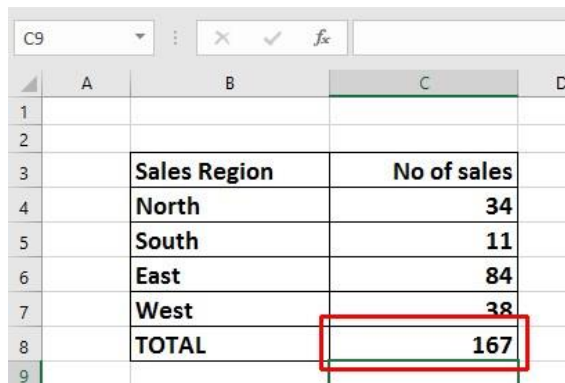


**TIP:** Click on the **AutoSum** icon, not the **down arrow** under or beside the icon.

- You will see the following displayed on your screen.

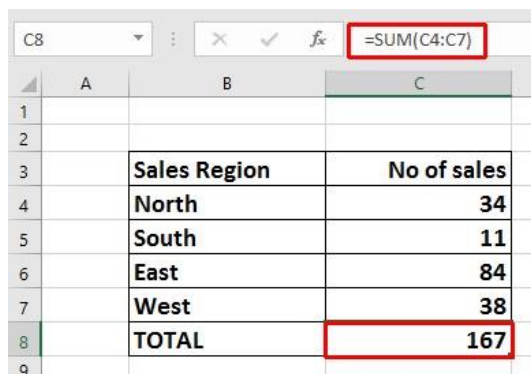
	A	B	C	D
1				
2				
3		<b>Sales Region</b>	<b>No of sales</b>	
4		North	34	
5		South	11	
6		East	84	
7		West	38	
8		TOTAL	=SUM(C4:C7)	
9			SUM(number1, [number2], ...)	

- Press the **Enter** key and you will see the AutoSum result in cell **C8**.



	A	B	C	D
1				
2				
3		<b>Sales Region</b>	<b>No of sales</b>	
4		North	34	
5		South	11	
6		East	84	
7		West	38	
8		<b>TOTAL</b>	<b>167</b>	
9				

- Click on cell **C8**, and you will see the function displayed in the bar just above your worksheet.



	A	B	C	D
1				
2				
3		<b>Sales Region</b>	<b>No of sales</b>	
4		North	34	
5		South	11	
6		East	84	
7		West	38	
8		<b>TOTAL</b>	<b>167</b>	
9				

As you can see the function is:

**=SUM(C4:C7)**

- This function tells Excel to sum the values in the range **C4:C7**.

## Average function

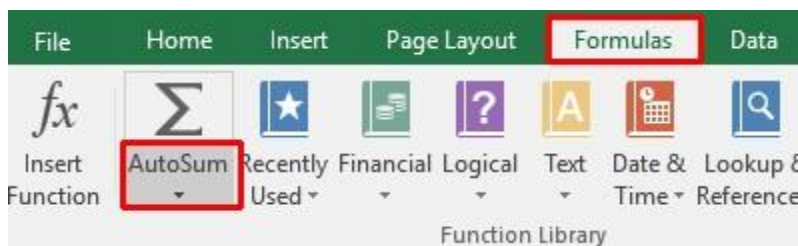
- Click on the **Average** worksheet tab.



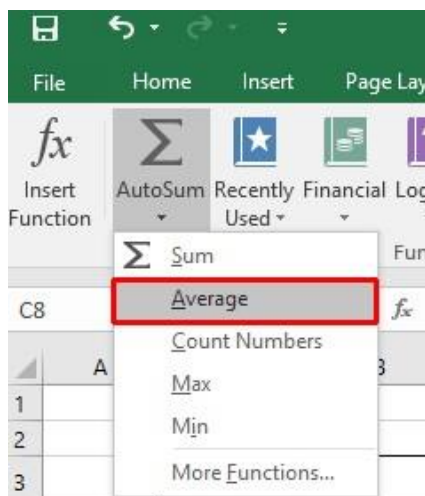
- Click on cell **C8**.

	A	B	C
1			
2			
3		<b>Sales Region</b>	<b>No of sales</b>
4		North	34
5		South	11
6		East	84
7		West	38
8		<b>Average no. of sales per region</b>	
9			
10			

- In this cell we want to display the average number of sales within the regions.
- Click on the **Formulas** tab and within the **Function Library** group click on the **arrow** under (or next to) the **AutoSum** icon.



- You will see a drop down list displayed. Click on the **Average** command.



- You will see the following displayed on your screen.

	A	B	C	D
1				
2				
3		<b>Sales Region</b>	<b>No of sales</b>	
4		<b>North</b>	<b>34</b>	
5		<b>South</b>	<b>11</b>	
6		<b>East</b>	<b>84</b>	
7		<b>West</b>	<b>38</b>	
8		<b>Average no. of sales per region</b>	<b>=AVERAGE(C4:C7)</b>	

- Press the **Enter** key and you will see the average value displayed in cell **C8**.

	A	B	C
1			
2			
3		<b>Sales Region</b>	<b>No of sales</b>
4		<b>North</b>	<b>34</b>
5		<b>South</b>	<b>11</b>
6		<b>East</b>	<b>84</b>
7		<b>West</b>	<b>38</b>
8		<b>Average no. of sales per region</b>	<b>41.75</b>

- Click on cell **C8**, and you will see the function displayed in the bar just above your worksheet.

The screenshot shows the Excel interface with the **Formulas** tab selected. The **Function Library** is visible, and the **Formula Bar** above the worksheet displays the function **=AVERAGE(C4:C7)** for cell **C8**. The worksheet below shows the same data as the previous table, with the result **41.75** displayed in cell **C8**.

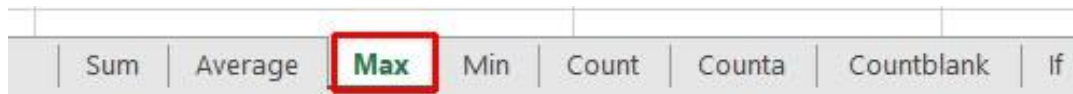
As you can see the function is:

**=AVERAGE(C4:C7)**

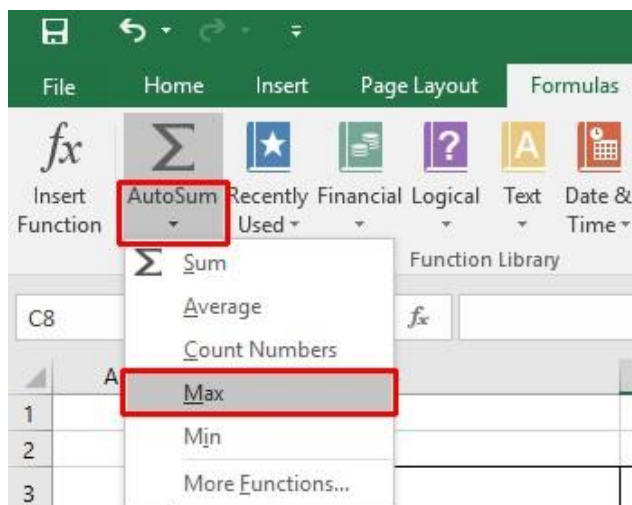
- This function tells Excel to sum the average in the range **C4:C7**.

## Max function

- Click on the **Max** worksheet tab.



- Click on cell **C8**. In this cell we want to display the highest number of sales within a region.
- Click on the **Formulas** tab and within the **Function Library** group click on the **down arrow** under (or next to) the **AutoSum** icon. You will see a drop down list displayed. Click on the **Max** command.



- You will see the following displayed on your screen.

SUM		=MAX(C4:C7)	
A	B	C	D
1			
2			
3	<b>Sales Region</b>	<b>No of sales</b>	
4	North	34	
5	South	11	
6	East	84	
7	West	38	
8	<b>Highest no of sales in a region</b>	<b>=MAX(C4:C7)</b>	
9		MAX(number1, [number2], ...)	
10			

- Press the **Enter** key and you will see the maximum value displayed in cell **C8**.



	A	B	C
1			
2			
3		<b>Sales Region</b>	<b>No of sales</b>
4		<b>North</b>	<b>34</b>
5		<b>South</b>	<b>11</b>
6		<b>East</b>	<b>84</b>
7		<b>West</b>	<b>38</b>
8		<b>Highest no of sales in a region</b>	<b>84</b>
9			

- Click on cell **C8**, and you will see the function displayed in the bar just above your worksheet.

The screenshot shows the Excel 2016 interface with the **Formulas** ribbon selected. The **Function Library** group is visible, and the **Formulas** task pane is open. The function bar above the worksheet displays the formula **=MAX(C4:C7)** for cell C8. The worksheet below shows the same data as the previous image, with cell C8 containing the value 84.

As you can see the function is:

**=MAX(C4:C7)**

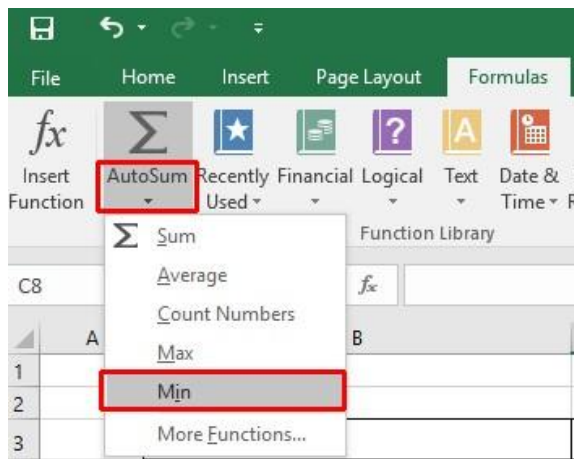
- This function tells Excel to display the maximum value within the range **C4:C7**.

### Min function

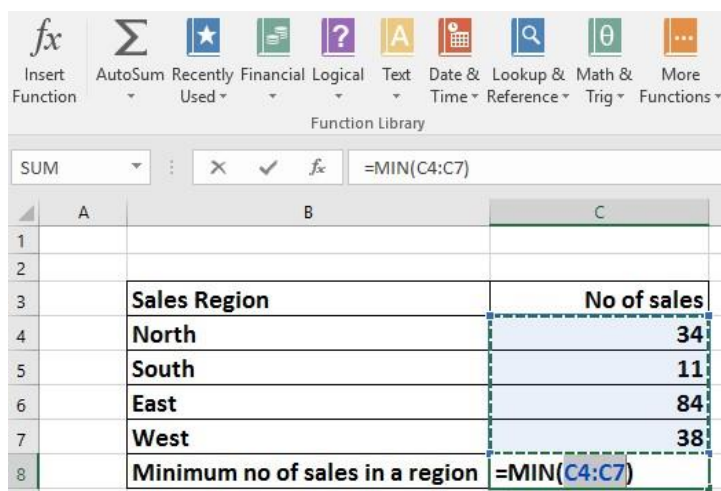
- The **MIN** function will display the minimum number within a range.
- Click on the **Min** worksheet tab.



- Click on cell **C8**. In this cell we want to display the lowest number of sales within a region.
- Click on the **Formulas** tab and within the **Function Library** group click on the **down arrow** under (or next to) the **AutoSum** icon. You will see a drop down list displayed. Click on the **Min** command.



- You will see the following displayed on your screen.



- Press the **Enter** key and you will see the minimum value displayed in cell **C8**.

	A	B	C
1			
2			
3		<b>Sales Region</b>	<b>No of sales</b>
4		North	34
5		South	11
6		East	84
7		West	38
8		<b>Minimum no of sales in a region</b>	<b>11</b>
9			

- Click on cell **C8**, and you will see the function displayed in the bar just above your worksheet.

The screenshot shows the Excel 2016 interface with the **Formulas** tab selected. The **Function Library** group is visible, and the formula bar shows `=MIN(C4:C7)` for cell C8. The worksheet below contains the following data:

	A	B	C
1			
2			
3		<b>Sales Region</b>	<b>No of sales</b>
4		<b>North</b>	<b>34</b>
5		<b>South</b>	<b>11</b>
6		<b>East</b>	<b>84</b>
7		<b>West</b>	<b>38</b>
8		<b>Minimum no of sales in a region</b>	<b>11</b>

As you can see the function is:

**=MIN(C4:C7)**

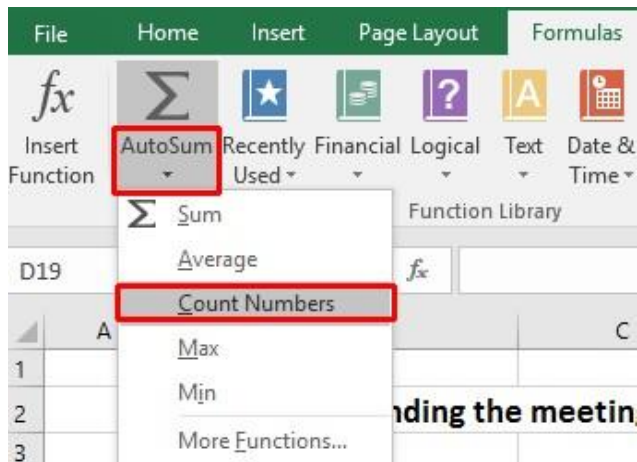
- This function tells Excel to display the minimum value within the range **C4:C7**.

## Count function

- The **Count** function will count up the number of cells which contain numbers.
- Click on the **Count** worksheet tab.



- Click on cell **C19**. In this cell we want to display the number of cells in the column above that contain a number.
- Click on the **Formulas** tab and within the **Function Library** group click on the **down arrow** under (or next to) the **AutoSum** icon. You will see a drop down list displayed. Click on the **Count Numbers** command.



- You will see the following displayed on your screen.

Delegates attending the meeting			
	Delegate country	Present	Not present
4	Australia	1	
5	Brazil	1	
6	Canada	1	
7	China		1
8	Cyprus	1	
9	Greece	1	
10	India	1	1
11	Ireland	1	
12	New Zealand	1	
13	Pakistan	1	
14	South Africa	1	
15	Turkey		1
16	UK	1	
17	USA	1	
18		=COUNT(C17:C18)	

- WARNING:** In all the previous examples, there was a column containing values immediately above the cell into which we inserted the function. In this case some of the cells within the column are empty and Excel, as you can see, has only applied the Count function to the range C17:C18. The reason for this is that the next cell up, i.e. cell C16 is empty.

We need to tell Excel that the range we are interested in actually extends from C5:C18.

To do this, click on cell C18 and while holding down the mouse button drag up to cell C5. Then release the mouse button. Your screen should now look like this.

Delegates attending the meeting			
Delegate country	Present	Not present	
Australia	1		
Brazil	1		
Canada	1		
China		1	
Cyprus	1		
Greece	1		
India	1	1	
Ireland	1		
New Zealand	1		
Pakistan	1		
South Africa	1		
Turkey		1	
UK	1		
USA	1		
<b>Totals</b>		<b>12</b>	

- Press the **Enter** key and you will see the count value displayed in cell **C19**.

Delegate country	Present	Not present	
Australia	1		
Brazil	1		
Canada	1		
China		1	
Cyprus	1		
Greece	1		
India	1	1	
Ireland	1		
New Zealand	1		
Pakistan	1		
South Africa	1		
Turkey		1	
UK	1		
USA	1		
<b>Totals</b>	<b>12</b>		

- Click on cell **C19**, and you will see the function displayed in the bar just above your worksheet.

	A	B	C	D
3				
4		<b>Delegate country</b>	<b>Present</b>	<b>Not present</b>
5		Australia	1	
6		Brazil	1	
7		Canada	1	
8		China		1
9		Cyprus	1	
10		Greece	1	
11		India	1	1
12		Ireland	1	
13		New Zealand	1	
14		Pakistan	1	
15		South Africa	1	
16		Turkey		1
17		UK	1	
18		USA	1	
19		<b>Totals</b>	<b>12</b>	

As you can see the function is:

**=COUNT(C5:C18)**

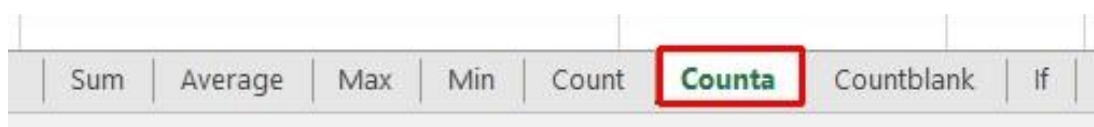
- This function tells Excel to display the number of cells containing a value within the range **C5:C18**.

**NOTE:** If you made a mistake, click on cell **C19** and press the **Del** key. Then try again.

- Use the same technique to count up the number of people who could not attend, and display the value in cell **D19**.

## The COUNTA function

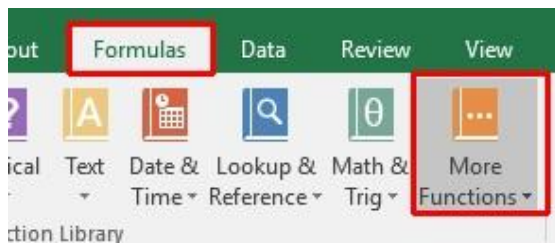
- Used to count the number of cells within a range that are not empty.
- Click on the **Counta** worksheet tab.



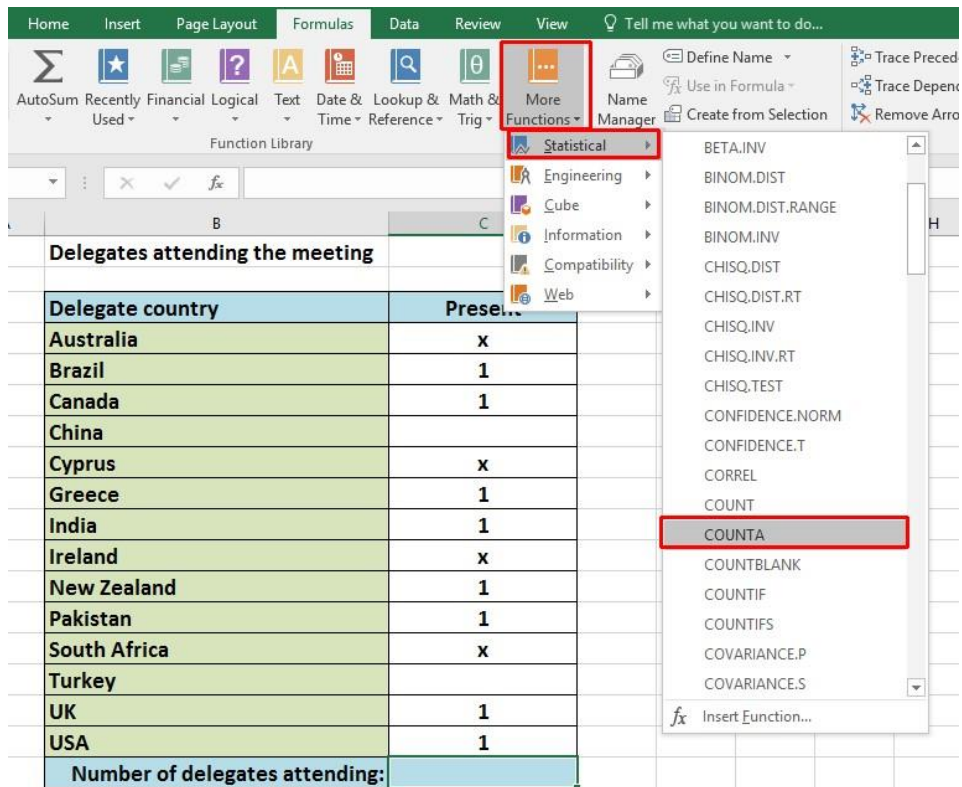
- You will see data that contains a mixture of numbers (1) and letters (x).

	A	B	C
2		Delegates attending the meeting	
3			
4		Delegate country	Present
5		Australia	x
6		Brazil	1
7		Canada	1
8		China	
9		Cyprus	x
10		Greece	1
11		India	1
12		Ireland	x
13		New Zealand	1
14		Pakistan	1
15		South Africa	x
16		Turkey	
17		UK	1
18		USA	1
19		Number of delegates attending:	
20			

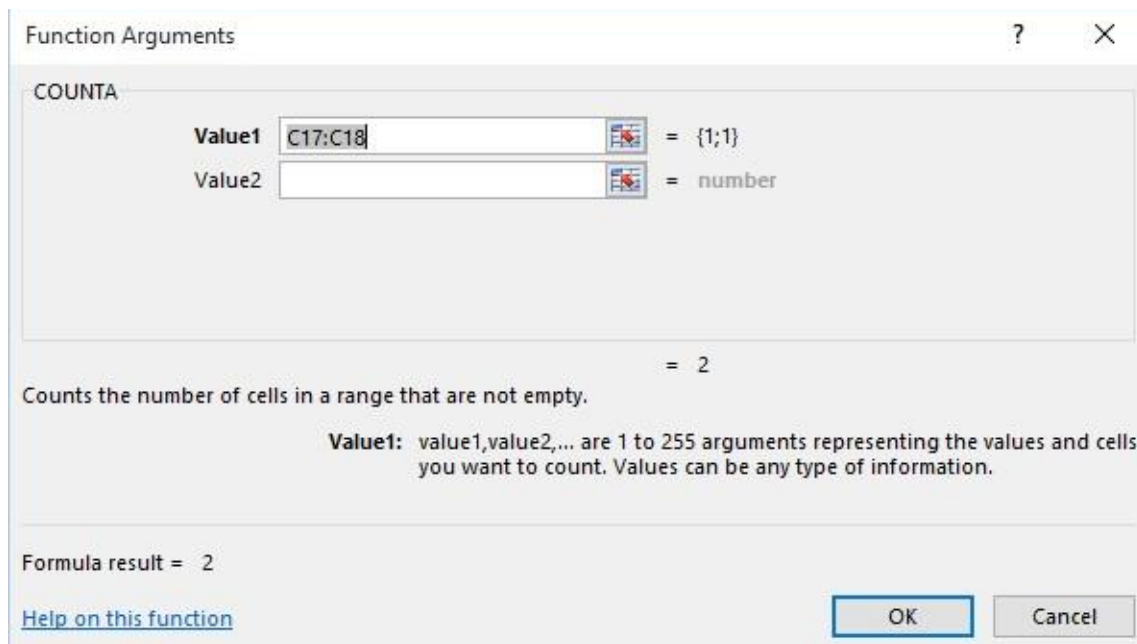
- The Count function would only count up the number of cells containing numbers, whereas Counta will count the number of cells containing numbers and letters.
- Click on cell **C19**.
- Click on the **More Functions** icon (contained within the **Function Library** section of the **Formulas** tab).



- From the drop down displayed, select **Statistical**. From the submenu select **Counta**.

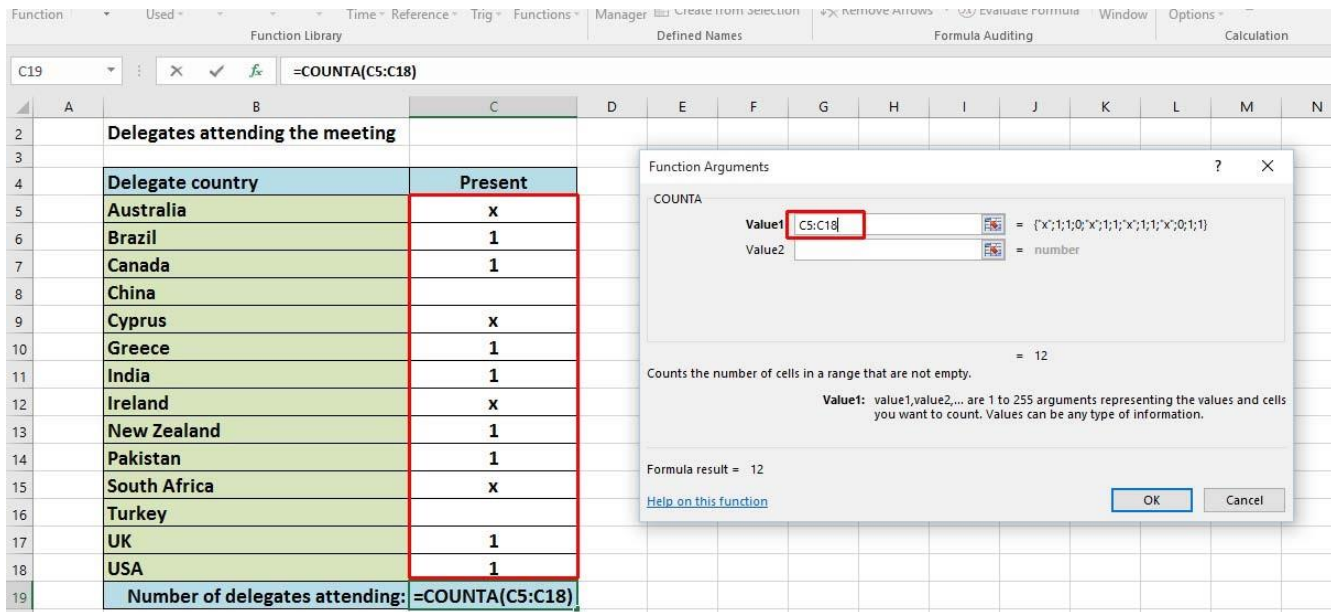


- This will display the **Function Arguments** dialog box, as illustrated.

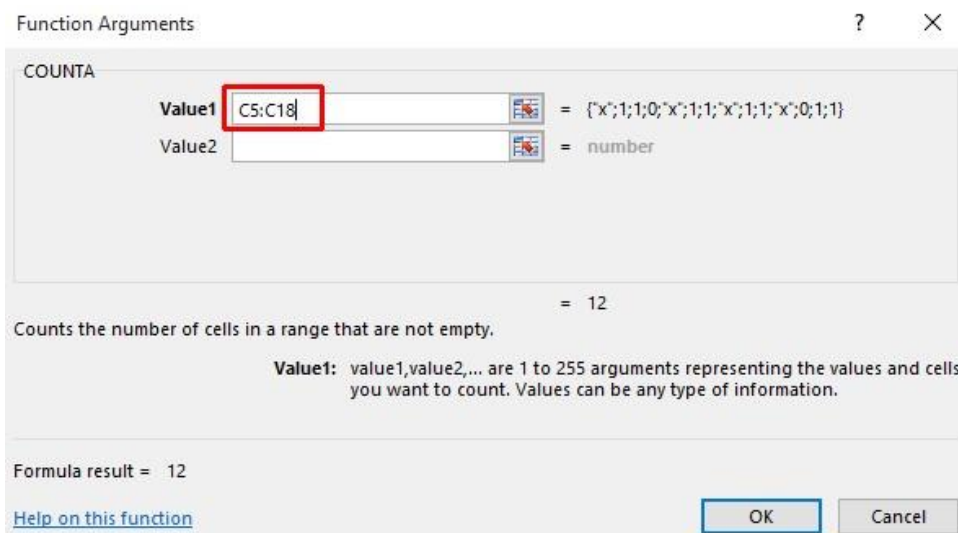


- If necessary move the dialog box to one side and then select the cell range **C5:C18**, as illustrated.





- The **Function Argument** dialog box will look like this.



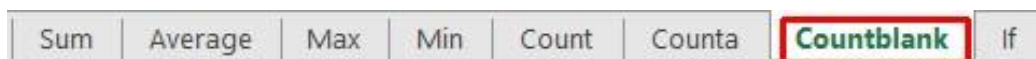
- Click on the **OK** button and you will see the following.

	A	B	C
2		Delegates attending the meeting	
3			
4		Delegate country	Present
5		Australia	x
6		Brazil	1
7		Canada	1
8		China	
9		Cyprus	x
10		Greece	1
11		India	1
12		Ireland	x
13		New Zealand	1
14		Pakistan	1
15		South Africa	x
16		Turkey	
17		UK	1
18		USA	1
19		Number of delegates attending:	12

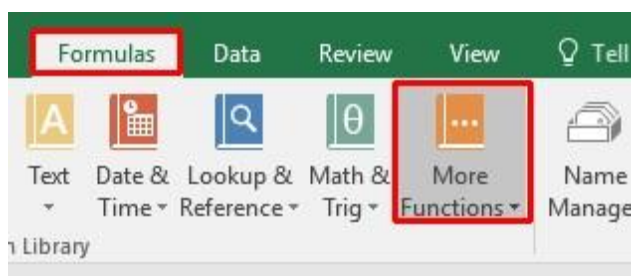
- As you can see the function has counted every instance of a number or letter within the specified cell range.

### The COUNTBLANK function

- Used to count empty cells within a cell range.
- Click on the **Countblank** worksheet tab.



- Click on cell **C19**.
- Click on the **More Functions** icon (contained within the **Function Library** section of the **Formulas** tab).



- From the drop down displayed, select **Statistical**. From the submenu select **Countblank**. You may have to scroll down the list to see this function.

Delegate country	Present
Australia	1
Brazil	1
Canada	1
China	
Cyprus	1
Greece	1
India	1
Ireland	1
New Zealand	1
Pakistan	1
South Africa	1
Turkey	
UK	1
USA	1
Number of delegates absent	2

- As you can see the function has counted every instance of an empty cell within the specified cell range.

## What are 'IF functions'?

- Excel has a number of functions which allow us to evaluate values and make decisions based on the result of the evaluation. The **IF( ) FUNCTION** is one of these.

### IF( ) SYNTAX

The format (Syntax) of the IF( ) function is as follows:

**IF(LOGICAL\_TEST, ACTION\_IF\_TRUE, ACTION\_IF\_FALSE)**

### LOGICAL\_TEST

The logical\_test evaluates an expression to see if it passes the test, i.e. is TRUE or does not pass the test, i.e. is FALSE

Logical operators		Values for Evaluation		Result
		A=10 C=15	B=5 D=10	
= (Equal to)		A=B		FALSE
		A=D		TRUE
> (Greater than)		A>B		TRUE
		A>C		FALSE
< (Less than)		A<B		FALSE
		A<C		TRUE
>= (Greater than or Equal to)		A>=B		TRUE
		A>=D		TRUE
		A>=C		FALSE
<= (Less than or Equal to)		A<=B		FALSE
		A<=C		TRUE
		A<=D		TRUE

- **ACTION\_IF\_TRUE**

Action\_if\_true can be a value or an operation. Whichever, the result is placed in the cell which contains the IF( ) Function if the logical\_test is true.

- **ACTION\_IF\_FALSE**

Action\_if\_false can be a value or an operation. Whichever, the result is placed in the cell which contains the IF( ) Function if the logical\_test is false.

## Using the IF function

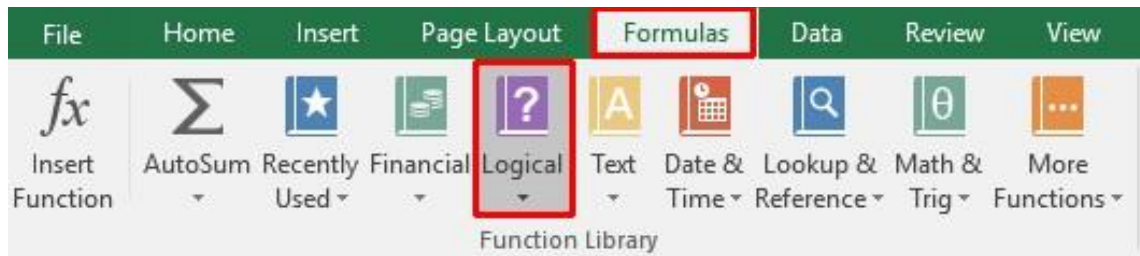
- Click on the **If** worksheet tab.



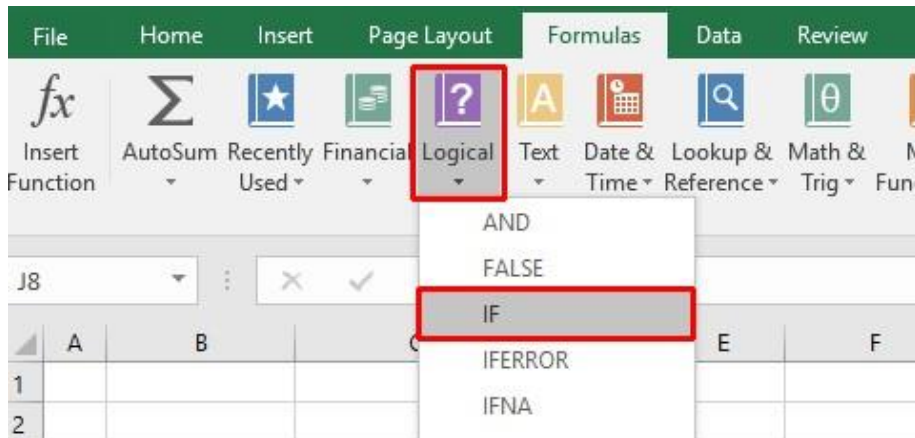
- In cells **J8:J13** we need to display the word **PASS** or **FAIL**, depending on whether the average is over **70%**.

	A	B	C	D	E	F	G	H	I	J	
1											
2											
3											
4											
5											
6			<b>SUBJECTS</b>								
7		<b>STUDENTS</b>	<b>Mathematics</b>	<b>English</b>	<b>History</b>	<b>Geography</b>			<b>Average grades</b>	<b>Passed?</b>	
8		Hadiya	68	78	59	59			66		
9		Dai	69	69	69	67			69		
10		Aaron	76	78	79	87			80		
11		Rowan	67	86	58	65			69		
12		Aaliyah	85	77	87	78			82		
13		Gabriela	59	68	78	89			74		
14											
15											
16			To pass a student needs an average grade of over 70%								

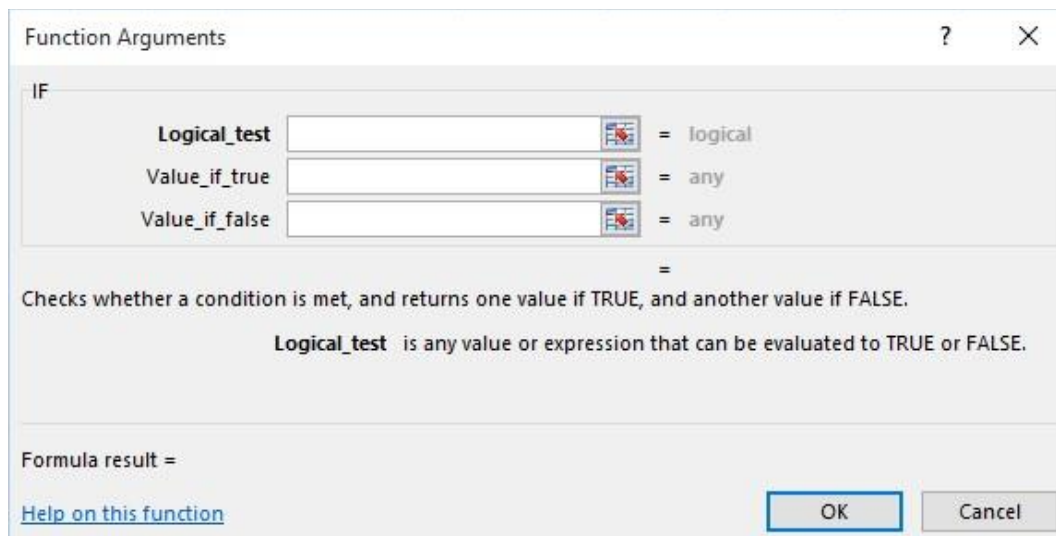
- Click on the cell **J8**.
- Click on the **Logical** icon within the **Function Library** group of the **Formulas** tab.



- This will display a drop down list. Select the **IF** command.



- This will display the **Function Arguments** dialog box.

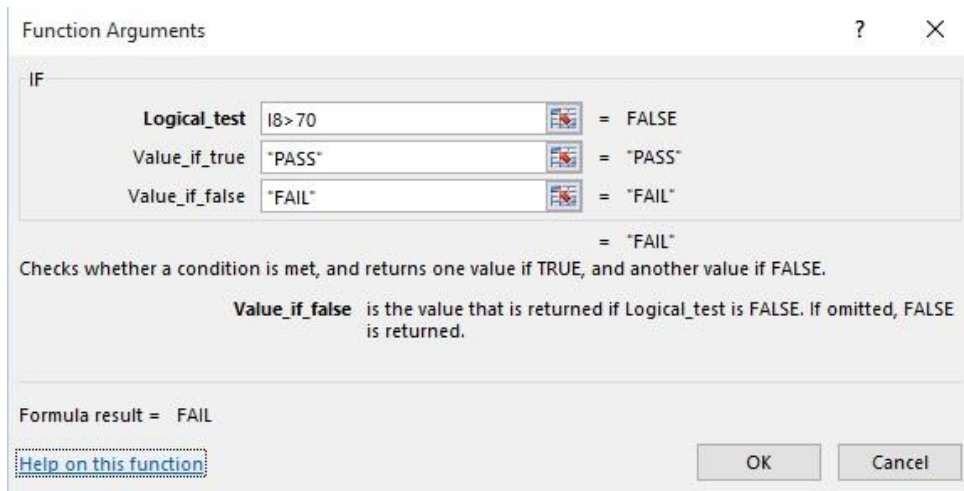


- In the **LOGICAL\_TEST** section of the dialog box, we enter the logical test, i.e. **I8>70**

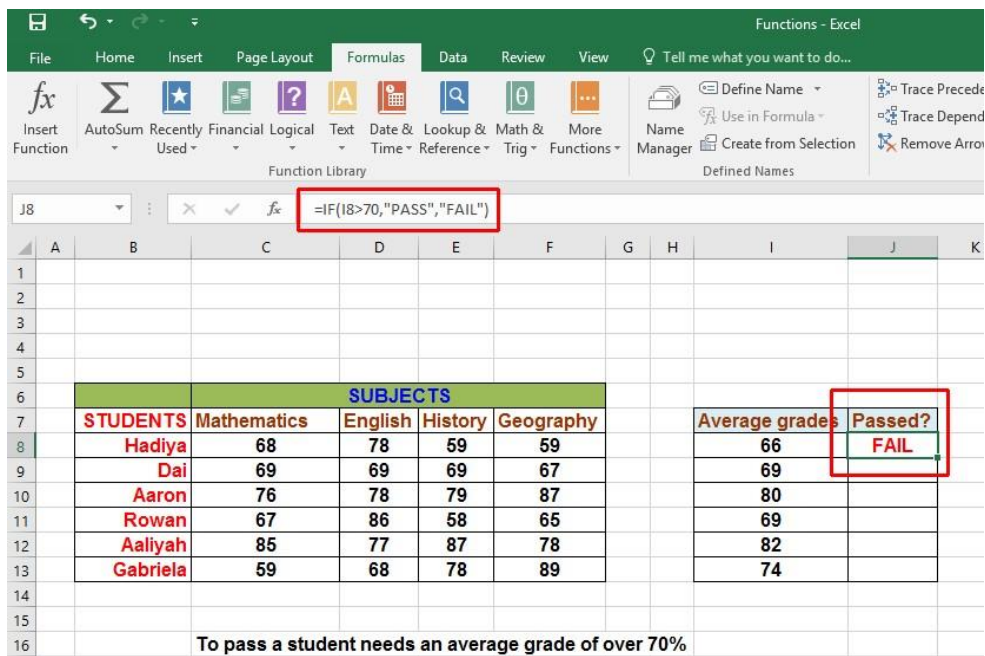
In the **VALUE\_IF\_TRUE** section of the dialog box, we enter the word **PASS**.

In the **VALUE\_IF\_FALSE** section of the dialog box, we enter the word **FAIL**.

- Your dialog box will now look like this.



- Click on the **OK** button to continue. Your screen will now look like this.



- Use the normal Excel drag techniques to extend this function to the cells **I9:J13**. Your screen will now look like this.

STUDENTS	Mathematics	English	History	Geography	Average grades	Passed?
Hadiya	68	78	59	59	66	FAIL
Dai	69	69	69	67	69	FAIL
Aaron	76	78	79	87	80	PASS
Rowan	67	86	58	65	69	FAIL
Aaliyah	85	77	87	78	82	PASS
Gabriela	59	68	78	89	74	PASS

To pass a student needs an average grade of over 70%

- Save your changes and close the workbook.