NASSCOM® FOUNDATION

Directorate General of Training

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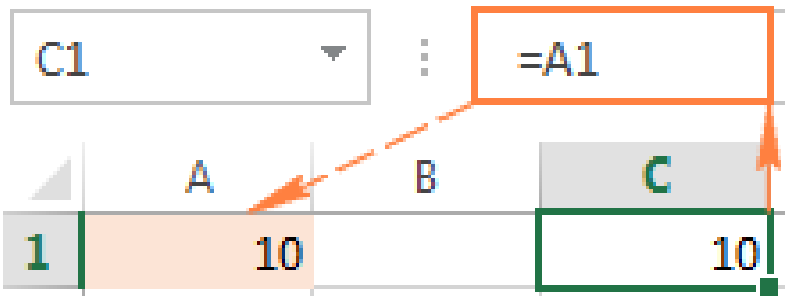
Perform Operations Using Formulas and Functions Session 1

Session: Perform Operations Using Formulas and Functions
Session 1

Cell Reference in Excel

A cell reference in Excel is a cell address. It tells Microsoft Excel where to look for the value you want to use in a formula.

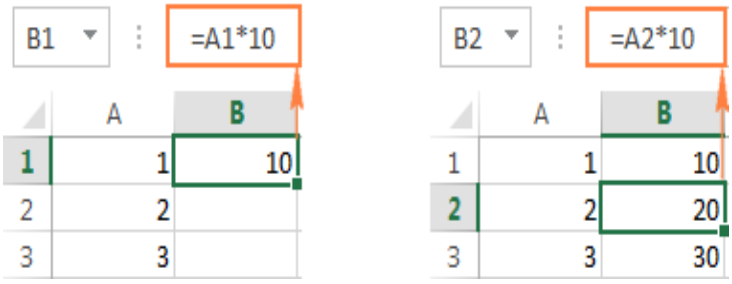
- For example, if you enter a simple formula =A1 in cell C1, Excel will pull a value from cell A1 into C1 as you see in the above image.
- The value which is in cell A1 will get copied in C1 too.
- If you change the value in A1, the value in C1 will also change automatically, as it is referencing to A1.



Types of Cell References

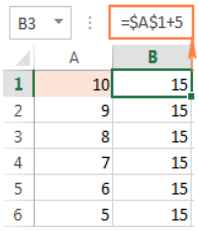
Relative cell reference

- A relative reference in Excel is a cell address without the $ sign in the row and column coordinates, like *A1*.
- By default, all references in Excel are relative.

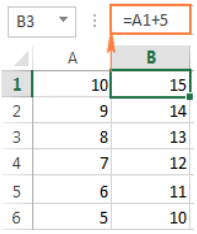


Absolute cell reference

Absolute reference



Relative reference



- An **absolute reference** in Excel is a cell address with the dollar sign ($) in the row or column coordinates, like *A1*.
- The dollar sign fixes the reference to a given cell, so that it **remains unchanged** even when the formula is copied to other cells.

Relative Reference Example

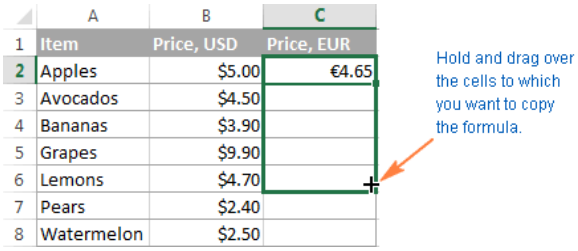
❑ **How Relative Reference Works**

1. Suppose you have a column of USD prices in Column B in your worksheet and you want to convert to EUR.
2. Assuming that USD - EUR conversion rate is 0.93, the formula for Row 2, will be **=B2*0.93.**
3. Pressing the Enter key will get the formula calculated and the result will immediately appear in the cell.

❑ **Copy the Formula Down the Column**

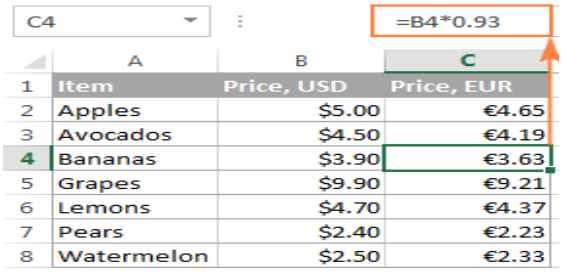
To copy the formula down the column:

- Hover the mouse over the fill handle (a small square in the bottom-right corner of the selected cell).
- The cursor will change to a thin black cross.
- Hold and drag it over the cells you want to auto-fill.



	A	B	C
1	Item	Price, USD	Price, EUR
2	Apples	$5.00	€4.65
3	Avocados	$4.50	
4	Bananas	$3.90	
5	Grapes	$9.90	
6	Lemons	$4.70	
7	Pears	$2.40	
8	Watermelon	$2.50	

- The formula is copied to other cells with relative references.

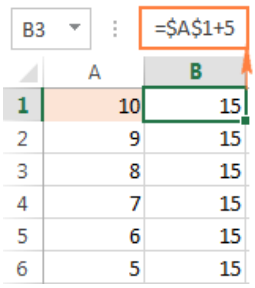


	A	B	C
1	Item	Price, USD	Price, EUR
2	Apples	$5.00	€4.65
3	Avocados	$4.50	€4.19
4	Bananas	$3.90	€3.63
5	Grapes	$9.90	€9.21
6	Lemons	$4.70	€4.37
7	Pears	$2.40	€2.23
8	Watermelon	$2.50	€2.33

Absolute Reference - Example

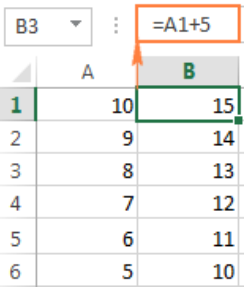
- If you have 10 in cell A1, the formula =A1+5, using an absolute reference, will always return 15, to whichever cell it is copied to.
- If you write the same formula with a relative cell reference (A1), and then copy it down to other cells in the column, a different value will be calculated for each row. The following image demonstrates the difference.

Absolute reference



	A	B
1	10	15
2	9	15
3	8	15
4	7	15
5	6	15
6	5	15

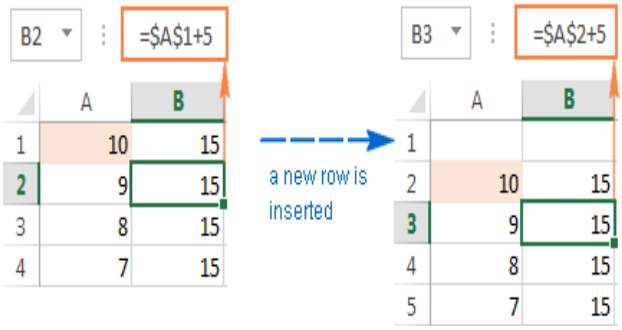
Relative reference



	A	B
1	10	15
2	9	14
3	8	13
4	7	12
5	6	11
6	5	10

❑ **Addition or Removal of Rows or Columns**

1. An absolute reference will change if rows or columns are added or removed.
2. Addition or removal of rows or columns in a worksheet changes the location of the referenced cell.
3. In the example, if you insert a new row at the top of the worksheet, the formula gets adjusted reflecting the change.



	A	B
1	10	15
2	9	15
3	8	15
4	7	15

	A	B
1		
2	10	15
3	9	15
4	8	15
5	7	15

Mixed Reference

A mixed reference is a combination of relative and absolute cell references. It is used in a single formula when it is required to lock either only rows or only columns.

- The formula will look like $A1, where column will get locked or A$1 where row will get locked.

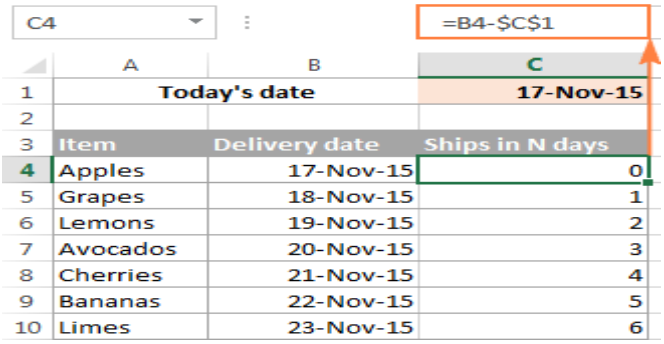
In the example with USD and EUR prices:

- You can enter the exchange rate in some cell. (Here, it is done in C1.)
- You can fix that cell reference in the formula by using the dollar sign ($).

	A	B	C
1	Exchange rate		0.93
2			
3	Item	Price, USD	Price, EUR
4	Apples	$5.00	€4.65
5	Avocados	$4.50	€4.19
6	Bananas	$3.90	€3.63
7	Grapes	$9.90	€9.21
8	Lemons	$4.70	€4.37
9	Pears	$2.40	€2.23
10	Watermelon	$2.50	€2.33

❑ **Relative and absolute cell references for calculating dates**

- Another common use of absolute and relative cell references in a single formula is calculating dates in Excel based on today's date.
- Suppose you have a list of delivery dates in Column B and you input the current date in C1 by using the TODAY() function.
- To find out how many days each item ships, you can calculate by using the formula =B4-C1.



	A	B	C
1	Today's date		17-Nov-15
2			
3	Item	Delivery date	Ships in N days
4	Apples	17-Nov-15	0
5	Grapes	18-Nov-15	1
6	Lemons	19-Nov-15	2
7	Avocados	20-Nov-15	3
8	Cherries	21-Nov-15	4
9	Bananas	22-Nov-15	5
10	Limes	23-Nov-15	6

Mixed Reference Examples

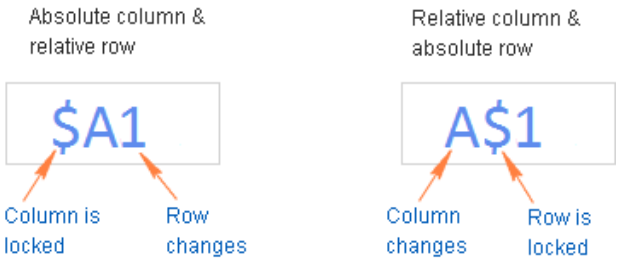
❑ **Mixed Cell Reference – Column or Row Fixed**

Absolute column and relative row like $A1.

- When a formula with this reference type is copied to other cells, the $ sign in front of the column letter locks the reference to the specified column so that it never changes.
- The relative row reference without the dollar sign varies depending on the row to which the formula is copied.

Relative column and absolute row like A$1.

- In this reference type, the row's reference will not change but the column's reference will.

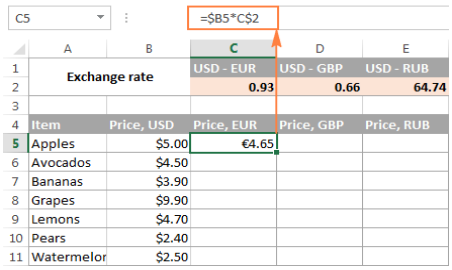


❑ **Mixed cell reference – Excel formula**

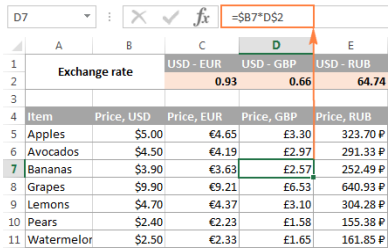
In the mixed cell reference $B5*C$2:

- $B5 - **absolute column and relative row**. $B is absolute reference and 5 is relative reference.
- C$2 - **relative column and absolute row**. C is the relative reference and 2 is the absolute reference.

- When the formula is copied to other cells, values of Column B and Row 2 remain fixed.



	A	B	C	D	E
1	Exchange rate		USD - EUR	USD - GBP	USD - RUB
2			0.93	0.66	64.74
3					
4	Item	Price, USD	Price, EUR	Price, GBP	Price, RUB
5	Apples	$5.00	€4.65		
6	Avocados	$4.50			
7	Bananas	$3.90			
8	Grapes	$9.90			
9	Lemons	$4.70			
10	Pears	$2.40			
11	Watermelor	$2.50			



	A	B	C	D	E
1	Exchange rate		USD - EUR	USD - GBP	USD - RUB
2			0.93	0.66	64.74
3					
4	Item	Price, USD	Price, EUR	Price, GBP	Price, RUB
5	Apples	$5.00	€4.65	£3.30	323.70 ₽
6	Avocados	$4.50	€4.19	£2.97	291.33 ₽
7	Bananas	$3.90	€3.63	£2.57	252.49 ₽
8	Grapes	$9.90	€9.21	£6.53	640.93 ₽
9	Lemons	$4.70	€4.37	£3.10	304.28 ₽
10	Pears	$2.40	€2.23	£1.58	155.38 ₽
11	Watermelor	$2.50	€2.33	£1.65	161.85 ₽

Reference Entire Column or Row

❑ How to Reference an Entire Column or Row

An entire column reference can be absolute or relative, for example:

- Absolute column reference like $A:$A
- Relative column reference like A:A

An entire row reference can be absolute or relative, for example:

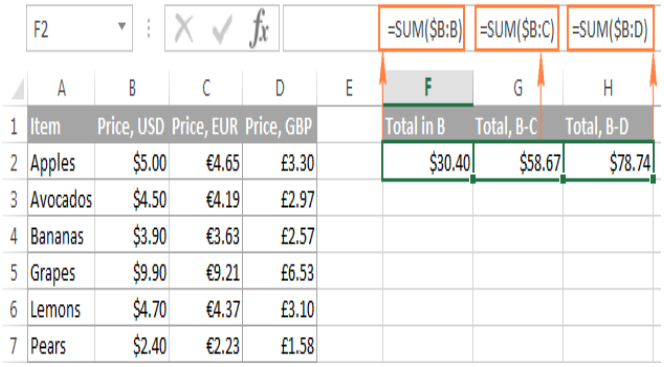
- Absolute row reference like $1:$1
- Relative row reference like 1:1

A relative column or row reference will:

- Change when the formula is copied or moved to other columns or rows
- Remain intact when you copy the formula to other cells within the same column or row

Scenario: The formula =SUM($B:B) is entered in cell F2.

- If the formula is copied to G2, it changes to =SUM($B:C) because the first B is fixed with the $ sign, while the second is not fixed.
- The formula will add up all the numbers in Columns B and C.



	A	B	C	D	E	F	G	H
1	Item	Price, USD	Price, EUR	Price, GBP		Total in B	Total, B-C	Total, B-D
2	Apples	$5.00	€4.65	£3.30		$30.40	$58.67	$78.74
3	Avocados	$4.50	€4.19	£2.97				
4	Bananas	$3.90	€3.63	£2.57				
5	Grapes	$9.90	€9.21	£6.53				
6	Lemons	$4.70	€4.37	£3.10				
7	Pears	$2.40	€2.23	£1.58				

Activity

1. An absolute reference in Excel is a cell address with _____ sign.
2. What is the formula of mixed cell reference?

Statistical Functions

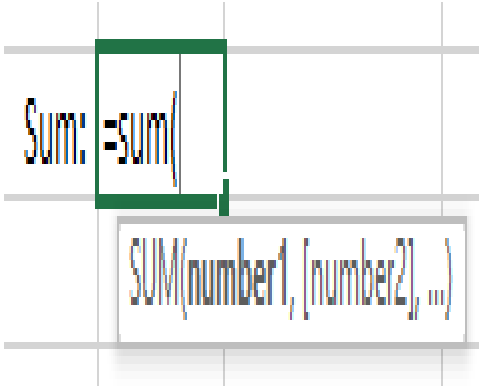
- **SUM**

The SUM function adds values. Individual values, cell references or ranges or a mix of all three can be added.

For example: =SUM(A2:A10) Adds the values in cells A2:10.

Enter the formula:

- Type = sum(
- Enter the range
- Type)

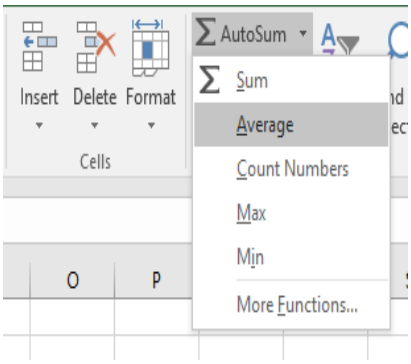


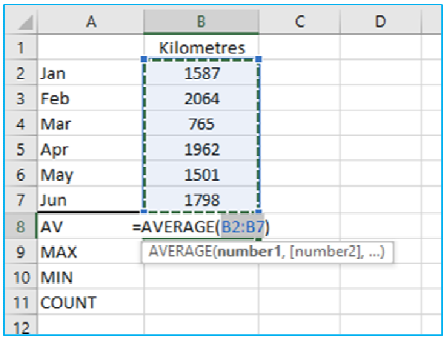
- **AVERAGE**

The **AVERAGE** function in **Excel** calculates the **average** or the arithmetic **mean** of a group of numbers.
The **AVERAGE** function ignores logical values (True/False), empty cells and cells that contain text.

To calculate average:

1. Select Cell B8.
2. Click the drop-down arrow on the AUTOSUM button.
3. Choose AVERAGE.
4. Press Enter to confirm the cell range.



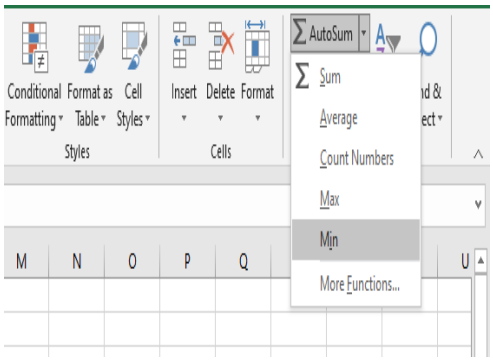


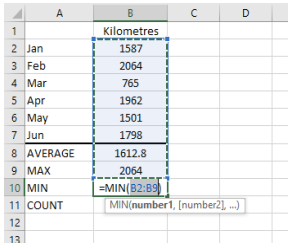
- **MIN**

The **MIN** function returns the smallest numeric value in a range of values. The **MIN function** ignores empty cells, the logical values (TRUE and FALSE) and text values.

To calculate MIN:

1. **Se**lect Cell B10.
2. Click the drop-down arrow on the AUTOSUM button.
3. Choose MIN.
4. Press Enter to confirm the cell range.



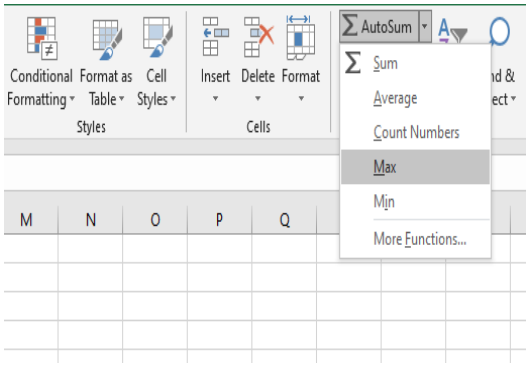


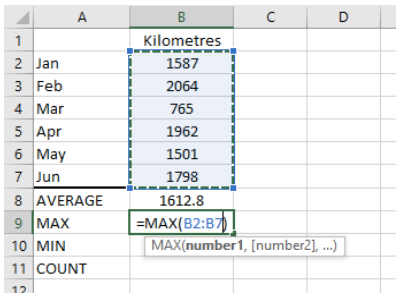
❑ **MAX**

The **MAX** function returns the largest numeric value in a range of values. The **MAX function** ignores empty cells, the logical values (TRUE and FALSE) and text values.

To calculate MAX:

1. Select Cell B9.
2. Click the drop-down arrow on the AUTOSUM button.
3. Choose MAX.
4. Press Enter to confirm the cell range.





❖ **COUNT Function**

The COUNT function counts the number of cells that contain numbers and counts the numbers within the list of arguments.

COUNT Function Syntax

=COUNT(value1, [value2], …)

There can be up to 30 'values'.

Example:

To count one range of cells, the formula will be:

=COUNT(A1:A500)

To count multiple ranges of non-continuous cells, the formula will be:

=COUNT(A1:A500,C1:C500,E1:G500)

❖ **COUNTA Function**

- Excel's COUNTA function counts cells that are not empty.
- It includes error values, like #VALUE!, numbers and blank spaces.
- It counts cells that contain numbers, text, logical values, error values, and empty text ("").
- It counts the number of cells that are not empty in a range.
- For example, =COUNTA("a",1,2,3,4,"") returns 6.

COUNTA Function Syntax

Formula:

=COUNTA(value1, [value2], …)

❖ **COUNTBLANK Function**

COUNTBLANK function is used to count the number of empty cells in a range of cells.

COUNTBLANK Function Syntax

=COUNTBLANK(range)

The COUNTBLANK function can handle only one range and not non-continuous ranges.

❖ **Excel IF Function - Syntax and Usage**

- The IF function is a logical function that evaluates a certain condition.
- It returns the value you specify if the condition is TRUE and another value if the condition is FALSE.
- The syntax for IF is:
    - IF(logical_test, [value_if_true], [value_if_false])

❖ **The IF function has 3 arguments but only the first one is mandatory; the other two are optional.**

1. logical_test (required) - a value or logical expression that can be either TRUE or FALSE.
    - In this argument, you can specify a text value, date, number or any comparison operator.
    - For example, your logical test can be expressed as B1="sold" or B1<12/1/2014 or B1=10 or B1>10.

2. value_if_true (optional) - the value that returns when the logical test evaluates to TRUE, i.e. if the condition is

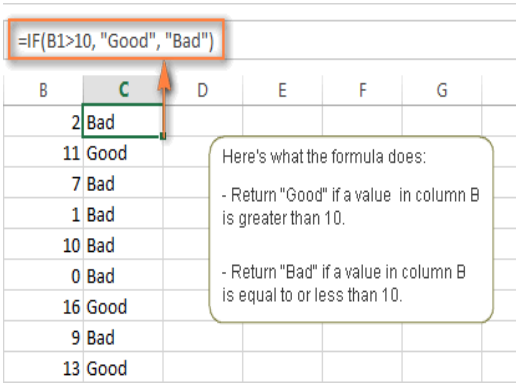
met.

- For example, the following formula will return the text "Good" if a value in cell B1 is greater than 10: =IF(B1>10, "Good")

3. value_if_false (optional) – is the value to be returned if the logical test evaluates to FALSE, that is, if the condition is not met.

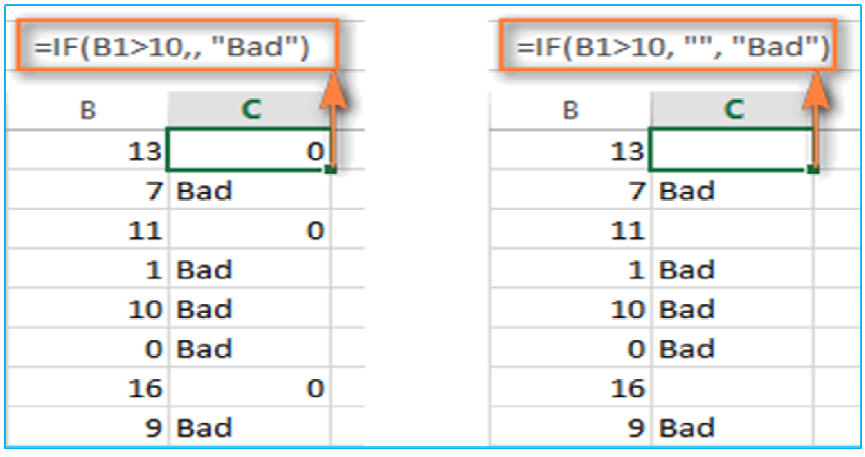
- For example, if you add "Bad" as the third parameter to the above formula, it will return the text "Good".
- If a value in cell B1 is greater than 10, otherwise, it will return "Bad":

=IF(B1>10, "Good", "Bad")



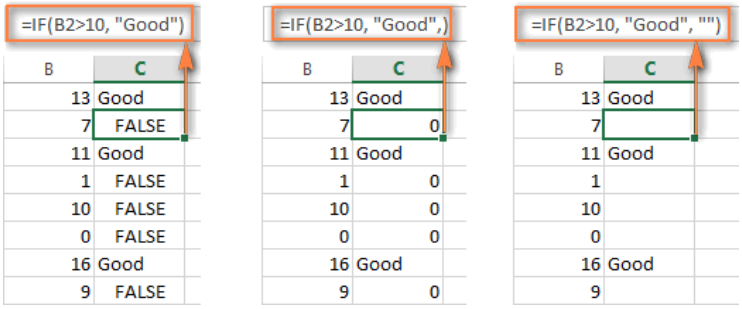
❖ **IF Function – Important Points**

- If the value_if_true argument is omitted, that is, there is only a comma following logical_test), the IF function returns zero (0) when the condition is met.
- Here is an example of such a formula: =IF(B1>10,, "Bad").
- If you want the Excel IF statement to display some value (blank in this case) when the condition is met, enter double quotes ("") in the second parameter, for example, =IF(B1>10, "", "Bad").
- In this case, the formula returns an empty string, which is invisible to the user but perceivable to other functions.



❖ **If value_if_false is omitted**

1. If the logical test evaluates to FALSE and the value_if_false parameter is omitted, that is, there is just a closing bracket after the value_if_true argument, the IF function returns the logical value FALSE. =IF(B1>10, "Good")
2. Putting a comma after the value_if_true argument forces the IF statement to return 0, which doesn't make much sense either: =IF(B1>10, "Good",)
3. The most reasonable approach is to put "" in the third argument. In this case, you will have empty cells when the condition is not met: =IF(B1>10, "Good", "")



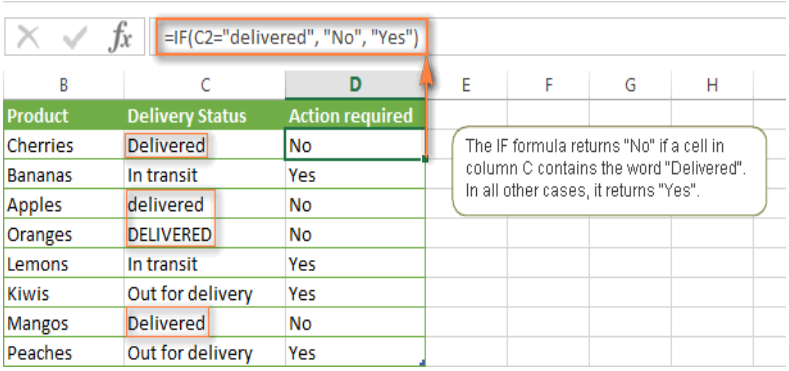
B	C
13	Good
7	FALSE
11	Good
1	FALSE
10	FALSE
0	FALSE
16	Good
9	FALSE

B	C
13	Good
7	0
11	Good
1	0
10	0
0	0
16	Good
9	0

B	C
13	Good
7	
11	Good
1	
10	
0	
16	Good
9	

❖ **Excel IF examples for text value**

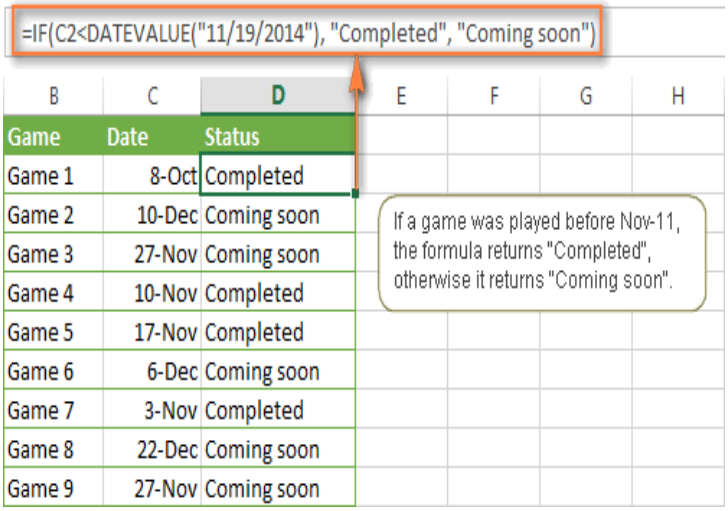
- Example 1. Case-insensitive IF formula for text values
- IF is case-insensitive by default. Logical tests for text values do not recognise case in usual IF formulas.
- For example, the following IF formula returns either "Yes" or "No" based on the "Delivery Status" (Column C): =IF(C2="delivered", "No", "Yes")



Product	Delivery Status	Action required
Cherries	Delivered	No
Bananas	In transit	Yes
Apples	delivered	No
Oranges	DELIVERED	No
Lemons	In transit	Yes
Kiwis	Out for delivery	Yes
Mangos	Delivered	No
Peaches	Out for delivery	Yes

❖ **Excel IF formula examples for dates**

- To make the IF function recognise a date in your logical test as a date, you have to wrap it in the DATEVALUE function. For example:
- DATEVALUE("11/19/2014"). The complete IF formula may take the following shape:
- =IF(C2<DATEVALUE("11/19/2014"), "Completed", "Coming soon")
- As illustrated in the screenshot, this IF formula evaluates the dates in Column C and returns "Completed" if a game was played before Nov-11. Otherwise, the formula returns "Coming soon".



Game	Date	Status
Game 1	8-Oct	Completed
Game 2	10-Dec	Coming soon
Game 3	27-Nov	Coming soon
Game 4	10-Nov	Completed
Game 5	17-Nov	Completed
Game 6	6-Dec	Coming soon
Game 7	3-Nov	Completed
Game 8	22-Dec	Coming soon
Game 9	27-Nov	Coming soon

Activity

1. COUNTA function counts cells that are not _____.
2. What will be the result if the value_if_false parameter is omitted in the IF formula?

❖ **RIGHT Function**

RIGHT() helps:

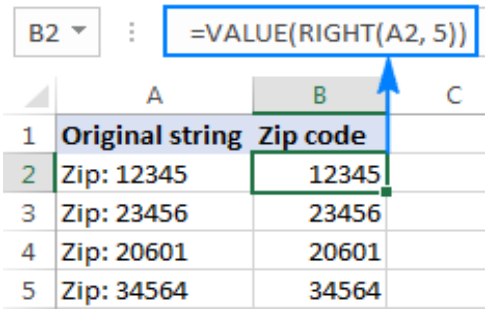
- To extract digits from the right; the formula will include the cell reference and the digits to be extracted.
- To extract 4 digits from the right, from the value in the cell B, the formula will be **=RIGHT(B2,4).**

❖ **Syntax**

- RIGHT Function: RIGHT(text, [num_chars]):
- **Text** (required) is the text string from which you want to extract characters.
- **Num_chars** (optional) is the number of characters to extract, starting from the rightmost character.

❖ **Extracting Numeric Value from RIGHT()**

1. To extract a numeric, nest a RIGHT formula within the VALUE function.
2. It will convert a string representing a number to a number.
3. For example, to pull the last 5 characters of a zip code from the string in A2 and convert the extracted characters to a number, the formula will be =VALUE(RIGHT(A2,5)).



❖ **Uses of RIGHT() Function**

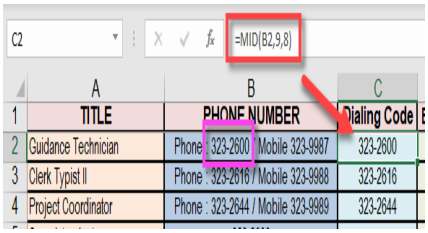
The RIGHT Excel function is mostly used along with other Excel functions, such as FIND, SEARCH, LEN, LEFT, etc.

It is used to:

- Obtain the domain name from the email address
- Format text
- Obtain the last name
- Obtain text occurring after a specific character

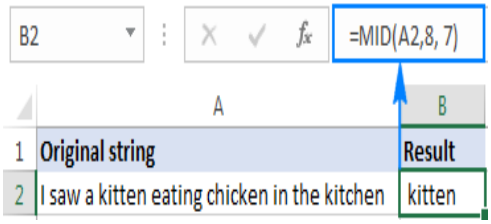
❖ **MID Function**

- In this example, we have the phone number from which we will extract the dialling code. This is the first 3 digits of the phone number.
- The LEFT function comprises the cell reference and the number of digits to be extracted.
- The formula to extract 3 digits from the left, from the value in the cell B will be **=LEFT(B2,3)**



❖ **Example**

- For example, to pull 7 characters from the text string in A2, starting from the 8th character, the formula will be: =MID(A2,8, 7).
- The result will be 'kitten'.

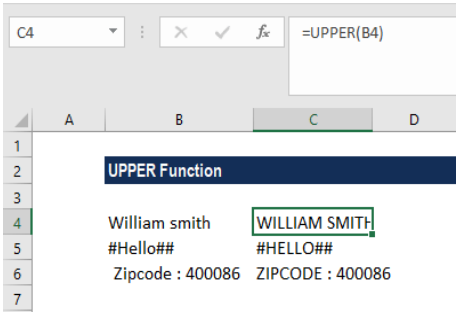


❖ **Extracting Numeric Value from MID Function**

1. The MID function always returns a **text string**, even if the extracted substring contains only digits.
2. To convert an output into a number, use MID in combination with the VALUE function.
3. If *start_num* is greater than the overall length of the original text, an Excel MID formula returns an empty string ("").
4. If *start_num* is less than 1, a MID formula returns the #VALUE! error.
5. If num_chars is less than 0 (negative number), a MID formula returns the #VALUE! error.
6. If num_chars is equal to 0, it outputs an empty string (blank cell).
7. If the sum of *start_num* and *num_chars* exceeds the total length of the original string, the MID function returns a substring starting from *start_num* and up to the last character.

❖ **UPPER Function**

- The UPPER function is an Excel Text function that will convert text to all capital letters (UPPERCASE).
- The formula is =UPPER(Text).
- Where **Text** is the text that we want to convert to uppercase. Text can be a text string or a reference to a cell.



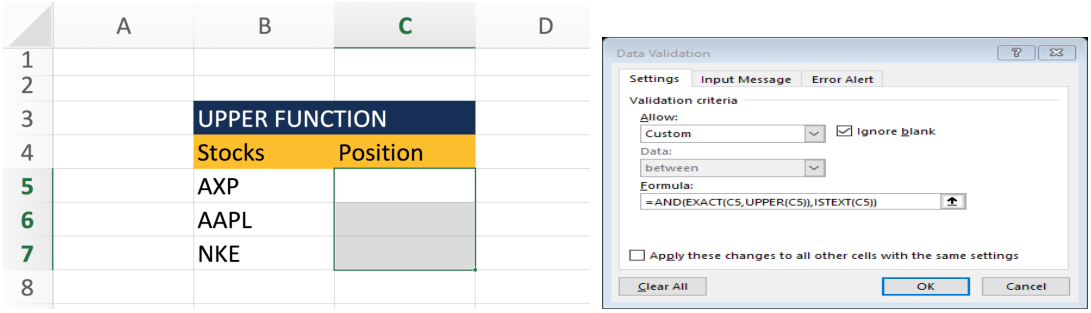
❖ **Example**

UPPER() changes only the letters of the alphabet. Numbers and symbols are left unchanged.

Data	Formula	Result	Explanation
William Smith	=UPPER(A2)	WILLIAM SMITH	Spaces are not affected here
#Hello!##	=UPPER(A3)	#HELLO##	Punctuation is not affected here
Zip Code: 400086	=UPPER(A4)	ZIP CODE: 400086	Numbers are not affected here

❖ **UPPER Function for Data Validation**

- In the following table, you want to prevent a user from inputting lowercase text in the cells C5 to C7.
- This can be done by using data validation and entering a customised formula with UPPER, AND and EXACT functions.
- Data validation is applied to the cells C5:C7 with the following function: **=AND(EXACT(C5, UPPER(C5)),ISTEXT(C5))**

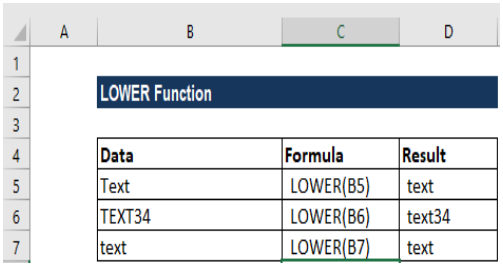


❖ **LOWER Function**

- The LOWER function will return the lowercase version of the text string given.
- For example, we can create an e-mail address from the names available in a data set.
- The formula is **=LOWER(text)** where **Text** is the text that you need to convert to lowercase.
- The function will change the characters in the text string that are letters. Numbers and punctuation marks will remain unaffected.

❖ **Example**

- Suppose we import data from an external source and wish to convert it into lowercase.
- Column B shows the source text and Column D shows the result after using the LOWER().

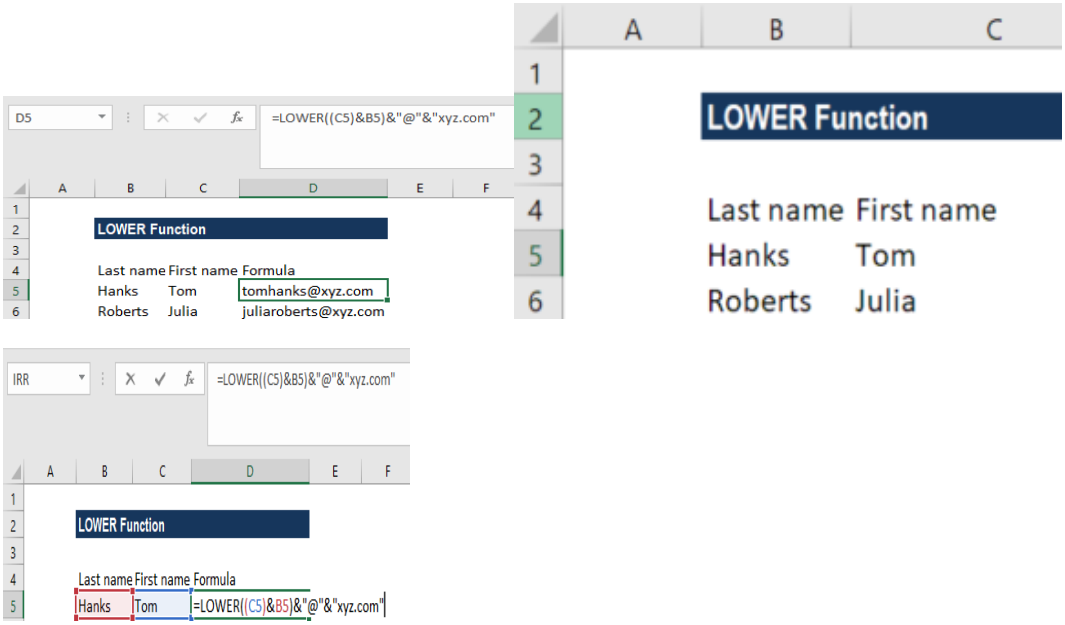


LOWER Function

Data	Formula	Result
Text	LOWER(B5)	text
TEXT34	LOWER(B6)	text34
text	LOWER(B7)	text

❖ **Using the LOWER Function in Excel**

1. Suppose we have the first name and the last name in a data set. If we wish to build e-mail addresses using the first and last names, LOWER function can be used.
2. The requirement is to have the e-mail IDs to be name@xyz.com.
3. The formula will be: =LOWER((C5)&B5)&"@"&"xyz.com"



❖ **LENGTH Function**

To use the LENGTH function:

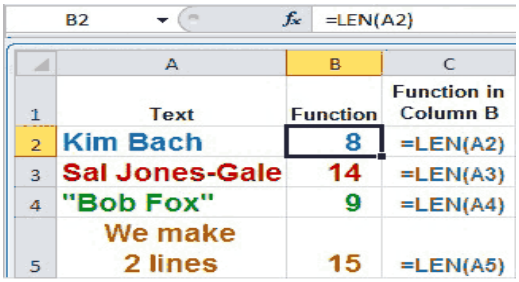
- Enter =**LEN**(cell) in the **formula** bar, then press Enter on your keyboard.
- To apply the same **formula** to multiple cells, enter the **formula** in the first cell and then drag the fill handle down or across the range of cells.
- The LEN function of Microsoft Excel returns the length or the number of characters of a specified

string.

- The LEN function will count all non-formatting letters, characters, numbers and spaces.

❖ **Example**

- Kim Bach results in a length of 8 and Sal Jones-Gale has a length of 14.
- Excel returns a length of 9 for "Bob Fox" and counts the quotation marks because they are part of the text in Cell A4.



❖ **TEXTJOIN Function**

- The Excel TEXTJOIN function joins together a series of supplied text strings into one combined text string.
- The user can specify a delimiter to add between the individual text items, if required.
- The syntax of TEXTJOIN function is **TEXTJOIN([delimiter], [ignore_empty], text1, [text2], …)**

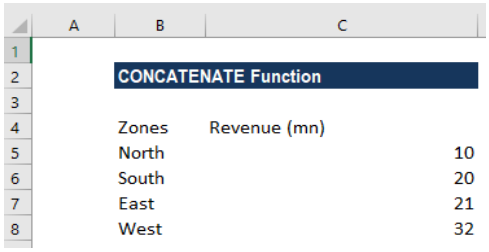
delimiter]	An optional delimiter, to be inserted between each text string. If omitted, no delimiter is used.
[ignore_empty]	An optional logical value, that specifies whether empty cells should be ignored. If omitted, the function uses the default value TRUE (ignore empty cells).
text1, [text2], ...	One or more text strings (or arrays of text strings), that you want to join together.

❖ **CONCATENATE Function**

- The CONCATENATE function helps to join two or more strings into one string.
- This function helps to combine data from one or more cells into one cell or split data from one cell into different cells.
- The formula is =CONCATENATE(text1, [text2], …).
- **Text1** (required argument) – This is the first item to join. The item can be a text value, cell reference or a number.
- **Text2** (required argument) – The additional text items that we wish to join.
- You can join up to 255 items that are up to 8192 characters.

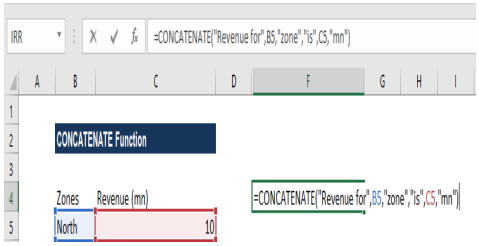
❖ **Example**

Sample Sales Data

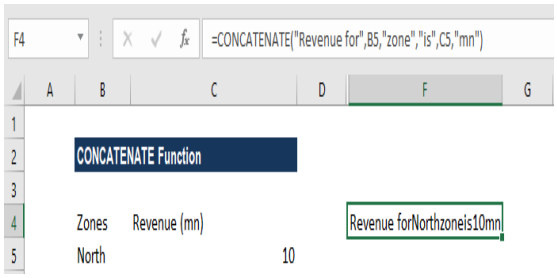


	A	B	C
1			
2		CONCATENATE Function	
3			
4		Zones	Revenue (mn)
5		North	10
6		South	20
7		East	21
8		West	32

Formula Used



Result



Activity

1. Which of the following is the correct length if formula LEN(7812.00) is used?
2. MID function always returns_____.