



Information Technology Module

2020/2021

Excel

Mathematical and Statistical Functions

Concepts

Formulas in Excel

- Formulas in Excel always begin with the "=" sign
- The most common elements in the formulas are the **operators**, **addresses** and **constants**
- If one cell is part of a formula, when its value is changed, the result of the formula will reflect this change

Samples of Formulas

formula	description
=20+A5	Adds 20 (constant) to the content of A5 cell
=(B1+B2)*5/4	Adds the content of B1 and B2 cells, and multiplies the result by 5 and afterwards divide the result by 4
=20*3/2	Multiplies 20 by 3 and divide result by 2
=A1/B4	Divide the content of A1 cell by the content of B4 cell

Calculation operators used in Excel

Type	Operator	Examples
Arithmetic	+ Addition - Subtraction * Multiplication / Division () Brackets % Percentage ^ Exponentiation	=A4*D5-10+D6/5 =300*(0,8-A5) =D4*21% =D5^2
Comparison or logical	= Equal to > Greater than < Less than >= Greater or equal than <= Less or equal than <> Different of	
Reference	: Range of cells between two coordinates ; Union (and) between a set of cells	A1:C10 B1;B5;B11
Text	& Concatenate	=A5*B8 & " kilos of carrots"

Rules of operator precedence

The term precedence - priority - of operators or factors refers to the order in which Excel performs calculations in a formula. Excel follows the following rules of precedence common to mathematics:

1. Expressions in brackets are calculated first
2. Then follows the Exponentiation
3. Multiplication and division are calculated before addition and subtraction
4. Operators with the same precedence level are calculated from left to right

Functions and Formulas (definition)

A **function** is a predefined formula that operates on a value or set of values, and returns a result.

With functions, we can greatly reduce the work of creating formulas. For example:

- formula without a function: = B1+B2+B3+B4+B5+B6+B7+B8
- function formula: = SUM (B1: B8)

All functions are defined by a name and set of parameters, enclosed in brackets. In the previous example, SUM is the function name, and B1:B8 is the parameter.

Attention: “B1:B8” ≠ “B1;B8”

B1:B8 refers to the **range** of cells from B1 to B8 (8 values)

B1;B8 refers to cell B1 and cell B8 (2 values)

SUM

In the image below, the sums shown can be easily obtained by positioning the cursor on the desired cell (e.g., D7) and clicking on the **Σ AutoSum** button.

Excel automatically suggests the cells D2 to D6 and uses D7 to calculate the sum. Then if we select cell D7, we can observe the formula: = SUM(D2 : D6)

	A	B	C	D
1	Product	# Units	€/ unit	Cost
2	eggs	10	5,26 €	52,60 €
3	bread	15	1,35 €	20,25 €
4	butter	2	5,23 €	10,46 €
5	cheese	8	7,89 €	63,12 €
6	ham	5	3,86 €	19,30 €
7	TOTAL			165,73

If we do not want to accept the suggested range of cells, we can manually select the cells that we want by dragging with the mouse

SUMIF (Conditional SUM)

	A	B	C
1	Category	Product	total sales
2	vegetables	tomatoes	2300
3	vegetables	turnips	5500
4	fruits	oranges	800
5	groceries	butter	400
6	vegetables	carrots	4200
7	fruits	apples	1200
8			
9	Formula	Description	Result
10	=SUMIF(A2:A7;"vegetables";C2:C7)	Total sales for category "vegetables"	12000
11	=SUMIF(A2:A7;"fruits";C2:C7)	Total sales for category "fruits"	2000
12	=SUMIF(A2:A7;"groceries";C2:C7)	Total sales for category "groceries"	400

Statistical Functions - Measures of Central Tendency

Average (addresses) - Arithmetic mean of the values on of a set of cells.

Mode (addresses) - Most frequent value (if there is not a more common, excel will show “#N/A”).

Median (addresses) - Central value of a set of values. Ex: (2, 3, 5, 10, 11).

Note:

These functions ignore empty cells, logical values and text.

Statistical Functions - Measures of Central Tendency

	A	B	C
1	Category	Product	total sales
2	vegetables	tomatoes	2300
3	vegetables	turnips	4200
4	fruits	oranges	800
5	groceries	butter	400
6	vegetables	carrots	4200
7	fruits	apples	1200
8			
9	Formula	Description	Result
10	=AVERAGE(C2:C7)	Average of values C2 to C7	2183,33
11	=MODE(C2:C7)	Mode of values C2 to C7	4200
12	=MEDIAN(C2:C7)	Median of values C2 to C7. If the number of values is even, Excel calculates the medium from the 2 central values	1750

Statistical Functions - Measures of Central Tendency

AVERAGEIF (average subject to a condition)

	A	B	C
1	Category	Product	total sales
2	vegetables	tomatoes	2300
3	vegetables	turnips	4200
4	fruits	oranges	800
5	groceries	butter	400
6	vegetables	carrots	4200
7	fruits	apples	1200
8			
9	Formula	Description	Result
10	=AVERAGEIF(A2:A7;"vegetables";C2:C7)	Average of sales values that belong to the "Vegetables" category	3566,67
11	=AVERAGEIF(C2:C7;"<=1200")	Average of sales values that were not higher than 1200	800

Statistical Functions - Measures of Dispersion

STDEV.P (addresses) - Standard deviation of a set of values that correspond to the entire population

STDEV.S (addresses) - Standard deviation of a set of values that correspond to a sample

VAR.P (addresses) - Variance of a set of values that correspond to a population

VAR.S (addresses) - Variance of a set of values that correspond to a sample

Statistical Functions - Measures of Dispersion

	A	B	C
1	Category	Product	total sales
2	vegetables	tomatoes	2300
3	vegetables	turnips	4200
4	fruits	oranges	800
5	groceries	butter	400
6	vegetables	carrots	4200
7	fruits	apples	1200
8			
9	Formula	Description	Result
10	=STDEV.P(C2:C7)	Standard Deviation os Sales	1538,85
11	=VAR.S(C2:C7)	Variance of the sample of sales	2841666,67

Maximum and Minimum Functions

	A	B	C
1	Category	Product	total sales
2	vegetables	tomatoes	2300
3	vegetables	turnips	4200
4	fruits	oranges	800
5	groceries	butter	400
6	vegetables	carrots	4200
7	fruits	apples	1200
8			
9	Formula	Description	Result
10	=MAX(C2:C7)	Maximum value	4200,00
11	=MIN(C2:C7)	Minimum value	400

Counting of Cells

	A	B	C
1	Category	Product	total sales
2	vegetables	tomatoes	2300
3	vegetables	turnips	4200
4	fruits	oranges	No values
5	groceries	butter	400
6	vegetables	carrots	4200
7	fruits	apples	1200
8			
9	Formula	Description	Result
10	=COUNT(C2:C7)	Number of values. Ignores cells that do not contain numbers	5
11	=COUNTA(C2:C7)	Number of values, including cells that contain values other than numbers	6
12	=COUNTIF(C2:C7;">1000")	Number of values over 1000	4



Information Technology Module

Year 2020/2021

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Logical Functions

Logical Functions - Introduction

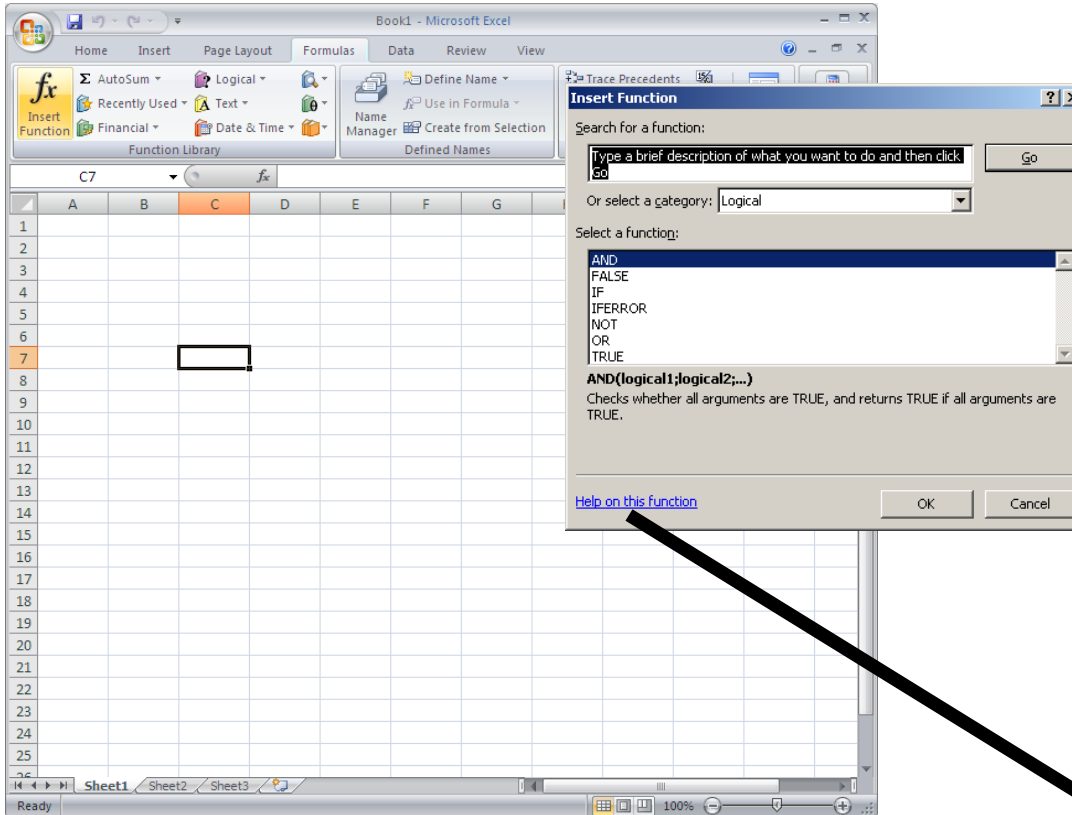
The logical conditions are composed of three words "**IF**", "**Then**", "**Else**" (If not). In our day-to-day we are using logical conditions

If driving at a speed higher than 120 km per hour on the motorway **then** I risk to get a mighty fine, **Else** I'll not get a speed limit fine.

If you eat this cake **then** you will ruin your diet, **Else** you will keep your elegance.

In Excel it is also possible to test logical conditions in a cell: **IF(logical_test; value_if_true; value_if_false)**

Logical Functions – summary of all functions



AND
IF
IFERROR
ISERROR
NOT
OR

[Help on this function](#)

In case of doubt **HELP**
"always solves"

AND

IF

ISERROR and IFERROR

NOT

OR

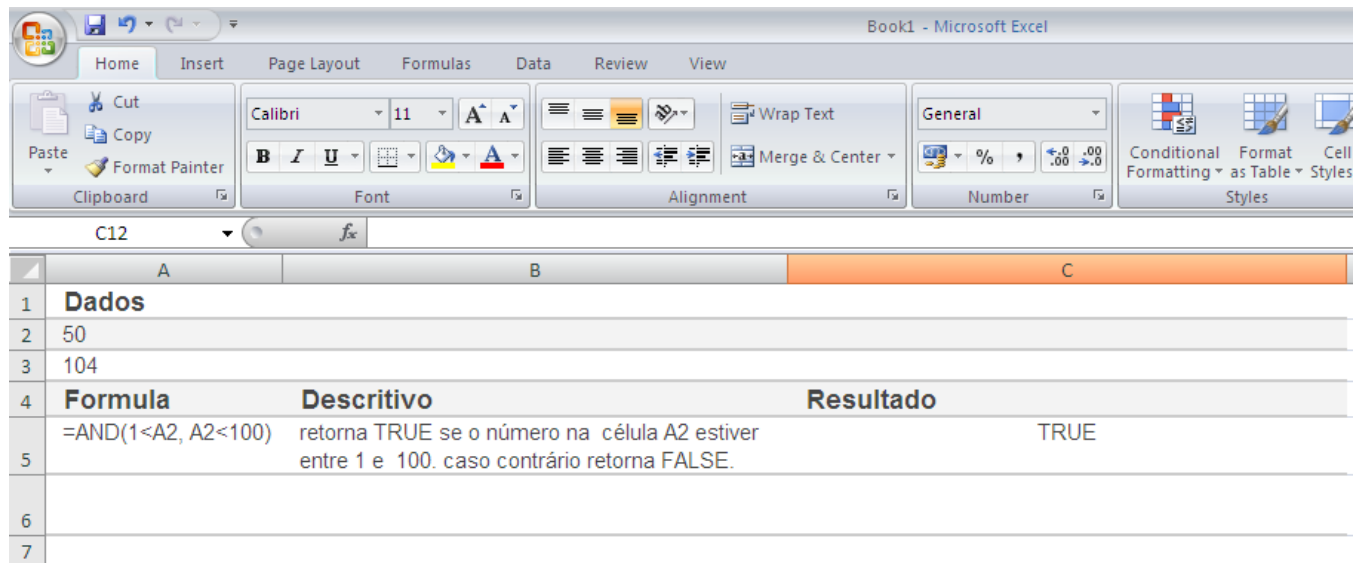
Logical Functions : AND

Syntax

Returns TRUE if all parameters return TRUE, FALSE if one or more arguments return FALSE

AND(logical1; [logical2]; ...) - logical1 mandatory

Example



The screenshot shows the Microsoft Excel interface with the following data in the worksheet:

	A	B	C
1	Dados		
2	50		
3	104		
4	Formula	Descritivo	Resultado
5	=AND(1<A2, A2<100)	retorna TRUE se o número na célula A2 estiver entre 1 e 100. caso contrário retorna FALSE.	TRUE
6			
7			

AND
IF
ISERROR and IFERROR
NOT
OR

Logical Functions: IF

Syntax

The IF function returns a value if the specified condition returns TRUE, and another value if the function returns FALSE.

IF(logical_test; value_if_true; [value_if_false])

Example

	A	B	C
1	Dados		
2	50	23	
3	Formularia	Descrição	Resultado
4	=IF(A2<=100,\"Dentro de Orçamento\",\"Acima orçamento\")	Se o numero na Celula A2 for menor ou igual a 100, a fórmula retorna \"Dentro de Orçamento\" Caso contrário retorna \"Acima Orçamento\"	Dentro de orçamento
5	=IF(A2=100,A2+B2,\"\")	Se o número na célula A2 for igual a 100, A2 + B2 será calculado e retornado Caso contrário é retornadotexto vazio (\"\") .	Texto Vazio (\"\")

AND
IF
ISERROR and IFERROR
NOT
OR

Logical Functions: ISERROR and IFERROR

Syntax

IFERROR(value;value_if_error)

Returns the desired value or, in case of error, the second parameter (ex. An error message)

ISERROR(value)

Returns true if the parameter is an error

Example

	A	B	C	D	E
1					
2	X	6,86	0	4,18	abc
3	Y	3,14	9,58	0	8,72
4	X/Y	2,184713376	0	#DIV/0!	#VALUE!
5	=IF(ISERROR(X/Y);"Got an Error";X/Y)	2,184713376	0	Got an Error	Got an Error
6	=IFERROR(B2/B3;"Got na Error")	2,184713376	0	Got na Error	Got na Error

AND
IF
ISERROR and IFERROR
NOT
OR

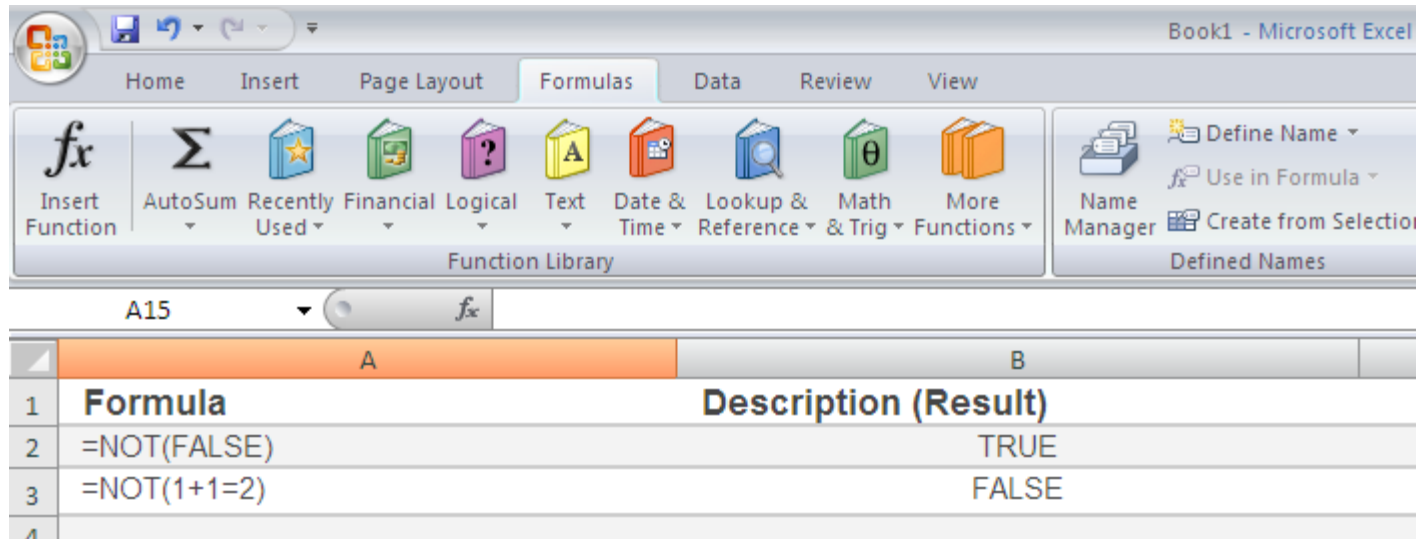
Logical Functions: NOT

Syntax

Returns the negation of logical, TRUE or FALSE

NOT(logical)

Example



The screenshot shows the Microsoft Excel interface with the Formulas ribbon selected. The Function Library group is visible, containing icons for Insert Function, AutoSum, Recently Used, Financial, Logical, Text, Date & Time, Lookup & Reference, Math, and More Functions. Below the ribbon, a table illustrates the NOT function's behavior:

	A	B
1	Formula	Description (Result)
2	=NOT(FALSE)	TRUE
3	=NOT(1+1=2)	FALSE
4		

AND
IF
ISERROR and IFERROR
NOT
OR

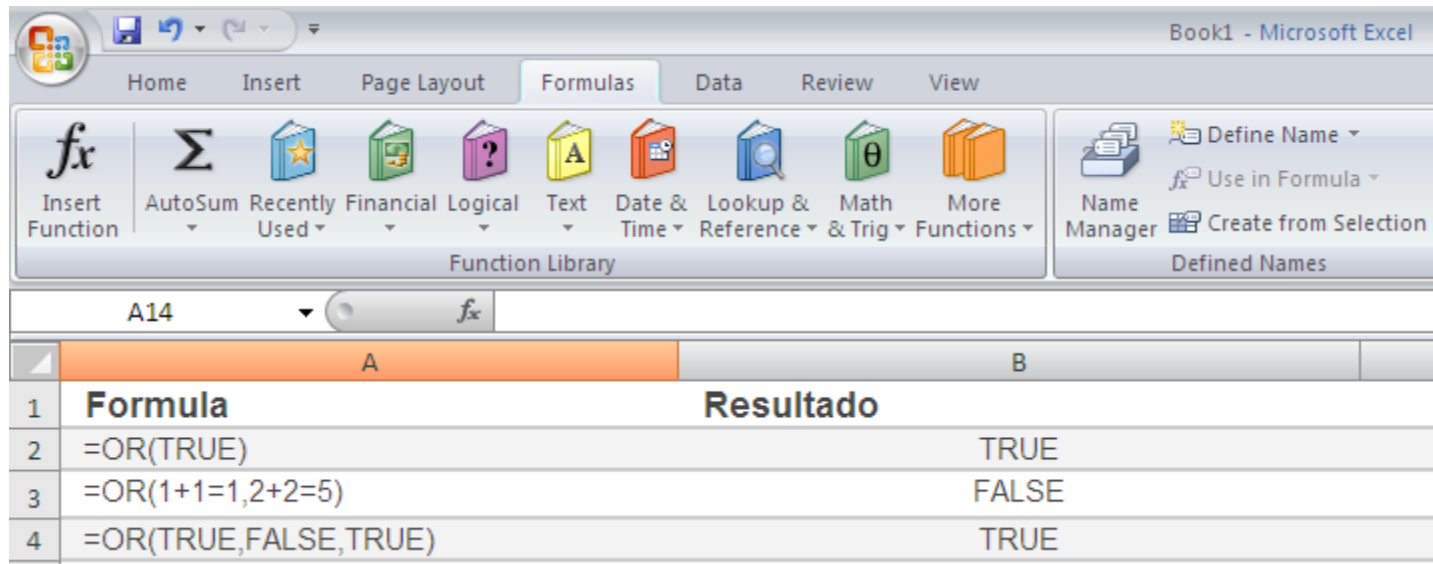
Logical Functions: OR

Syntax

Returns TRUE if any argument is TRUE, returns FALSE if all arguments are false

OR(logical1; logical2; ...)

Example



The screenshot shows the Microsoft Excel interface with the Formulas tab selected. The Function Library is open, showing the Logical category. Below the ribbon, a table displays the results of the OR function for various inputs.

	A	B
1	Formula	Resultado
2	=OR(TRUE)	TRUE
3	=OR(1+1=1,2+2=5)	FALSE
4	=OR(TRUE,FALSE,TRUE)	TRUE