

# Sociedade da Informação e do Conhecimento

## Aula 2 e 3

Tutorial Excel

DCT DEPARTAMENTO CIÊNCIA  
E TECNOLOGIA

## Formulas and Functions

A **formula** is an expression which calculates the value of a cell. **Functions** are predefined formulas and are already available in **Excel**.

For example, cell A3 below contains a formula which adds the value of cell A2 to the value of cell A1.

A3	✕	✓	<i>f<sub>x</sub></i>	=A1+A2		
	A	B	C	D	E	F
1	2					
2	3					
3	5					
4						

For example, cell A3 below contains the SUM function which calculates the sum of the range A1:A2.

A3	✕	✓	<i>f<sub>x</sub></i>	=SUM(A1:A2)		
	A	B	C	D	E	F
1	2					
2	3					
3	5					
4						

## Operator Precedence

Excel uses a default order in which calculations occur. If a part of the formula is in parentheses, that part will be calculated first. It then performs multiplication or division calculations.

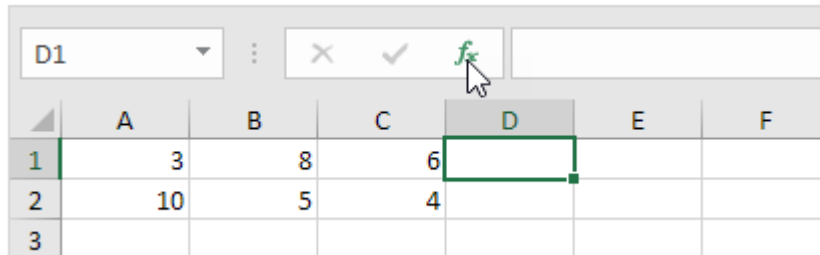
## Copy/Paste a Formula

When you copy a formula, Excel automatically adjusts the cell references for each new cell the formula is copied to.

## Insert a Function

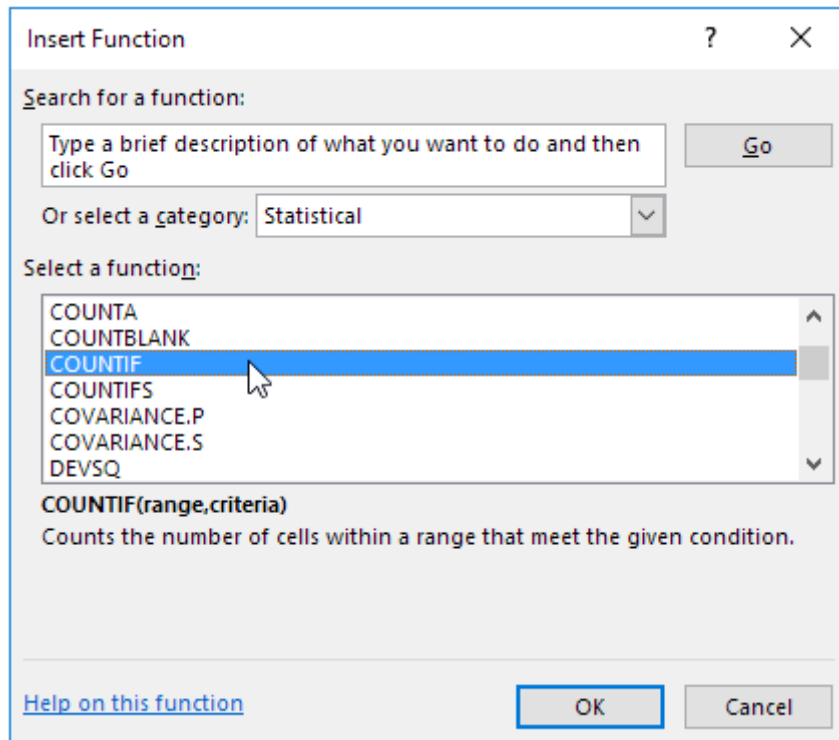
Every function has the same structure. For example, SUM(A1:A4). The name of this function is SUM. The part between the brackets (arguments) means we give Excel the range A1:A4 as input. This function adds the values in cells A1, A2, A3 and A4. It's not easy to remember which function and which arguments to use for each task. Fortunately, the Insert Function feature in Excel helps you with this. To insert a function, execute the following steps.

1. Select a cell.
2. Click the Insert Function button.



## Insert a Function

3. Search for a function or select a function from a category. For example, choose COUNTIF from the Statistical category.



## Insert a Function

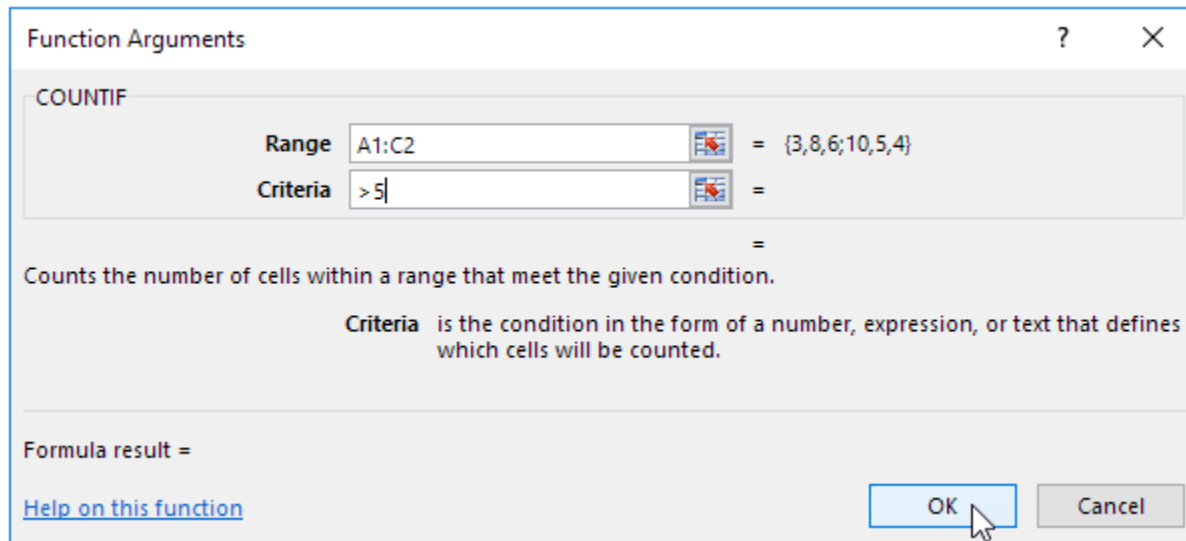
4. Click OK.

The 'Function Arguments' dialog box appears.

5. Click in the Range box and select the range A1:C2.

6. Click in the Criteria box and type >5.

7. Click OK.



The image shows the 'Function Arguments' dialog box for the COUNTIF function. The dialog has a title bar with a question mark and a close button. The function name 'COUNTIF' is displayed at the top. Below it, the 'Range' is set to 'A1:C2' and the 'Criteria' is set to '>5'. To the right of the Range box, the array {3,8,6;10,5,4} is shown. Below the input fields, there is a description: 'Counts the number of cells within a range that meet the given condition.' and a note: 'Criteria is the condition in the form of a number, expression, or text that defines which cells will be counted.' At the bottom, there is a 'Formula result =' field, a 'Help on this function' link, and 'OK' and 'Cancel' buttons. A mouse cursor is pointing at the 'OK' button.

Function Arguments

COUNTIF

Range A1:C2 = {3,8,6;10,5,4}

Criteria >5 =

Counts the number of cells within a range that meet the given condition.

Criteria is the condition in the form of a number, expression, or text that defines which cells will be counted.

Formula result =

[Help on this function](#)

OK Cancel

## Insert a Function

The COUNTIF function counts the number of cells that are greater than 5.

D1    :    ✕    ✓ <i>fx</i> =COUNTIF(A1:C2,">5")						
	A	B	C	D	E	F
1	3	8	6	3		
2	10	5	4			
3						

# Count

To count the number of cells that contain numbers, use the COUNT function.

A7									
	A	B	C	D	E	F	G	H	I
1	10								
2	1								
3	7								
4	20								
5	3								
6									
7	5								
8									



# Countif

To count cells based on one criteria (for example, greater than 9), use the following COUNTIF function.

A7									
	A	B	C	D	E	F	G	H	I
1	10								
2	1								
3	7								
4	20								
5	3								
6									
7	2								
8									

# Countifs

To count cells based on multiple criteria (for example, green and greater than 9), use the following COUNTIFS function.

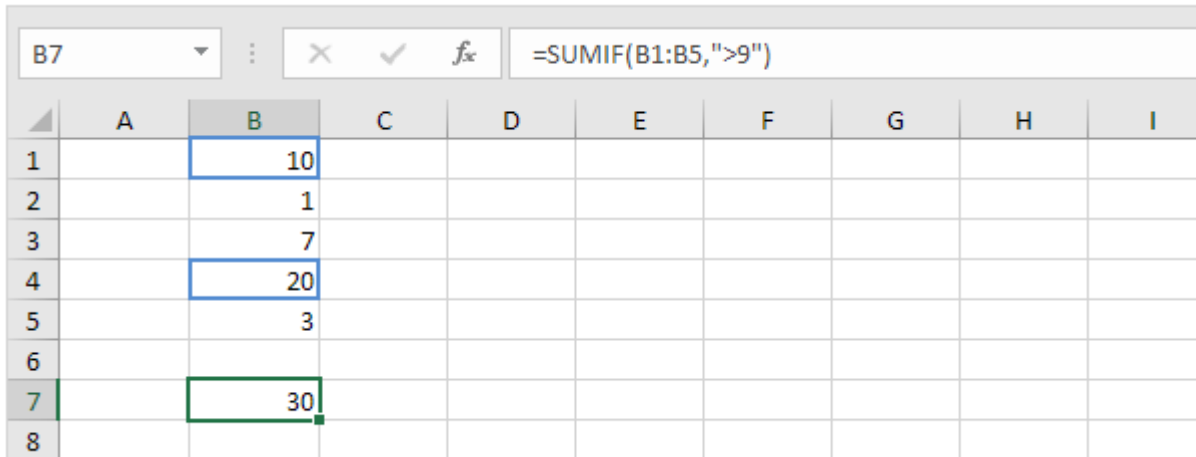
B7		=COUNTIFS(A1:A5,"green",B1:B5,">9")	
	A	B	
1	red	10	
2	green	1	
3	red	7	
4	green	20	
5	red	3	
6			
7		1	
8			

## Sum

To sum a range of cells, use the SUM function.

## Sumif

To sum cells based on one criteria (for example, greater than 9), use the following SUMIF function (two arguments).



The screenshot shows an Excel spreadsheet with a formula bar at the top. The formula bar displays the formula `=SUMIF(B1:B5,">9")`. The spreadsheet has columns A through I and rows 1 through 8. Column B contains the values 10, 1, 7, 20, and 3 in rows 1 through 5, respectively. Cell B7 contains the result of the formula, 30, which is highlighted with a green border. The formula bar also shows the active cell as B7.

	A	B	C	D	E	F	G	H	I
1		10							
2		1							
3		7							
4		20							
5		3							
6									
7		30							
8									

# If

The IF function checks whether a condition is met, and returns one value if true and another value if false.

1. For example, take a look at the IF function in cell C2 below.

C2    ✕    ✓ <i>fx</i> =IF(B2>=60,"Pass","Fail")									
	A	B	C	D	E	F	G	H	I
1	Name	Score	Result						
2	Richard	93	Pass						
3	Jennifer	60	Pass						
4	James	58	Fail						
5	Lisa	79	Pass						
6	Sharon	41	Fail						
7									

## And

The AND Function returns TRUE if all conditions are true and returns FALSE if any of the conditions are false.

1. For example, take a look at the AND function in cell D2 below.

D2									
	A	B	C	D	E	F	G	H	I
1	Name	Score 1	Score 2	Result					
2	Richard	93	80	FALSE					
3	Jennifer	60	91	TRUE					
4	James	58	75	FALSE					
5	Lisa	79	94	TRUE					
6	Sharon	41	33	FALSE					
7									

## Or

The OR function returns TRUE if any of the conditions are TRUE and returns FALSE if all conditions are false.

1. For example, take a look at the OR function in cell D2 below.

D2									
	A	B	C	D	E	F	G	H	I
1	Name	Score 1	Score 2	Result					
2	Richard	93	80	TRUE					
3	Jennifer	60	91	TRUE					
4	James	58	75	TRUE					
5	Lisa	79	94	TRUE					
6	Sharon	41	33	FALSE					
7									

# Cell References

## Relative Reference

By default, Excel uses **relative references**. See the formula in cell D2 below. Cell D2 references (points to) cell B2 and cell C2. Both references are relative.

COUNTIF    ✕    ✓ <i>f<sub>x</sub></i> =B2*C2									
	A	B	C	D	E	F	G	H	I
1	Product	Quantity	Price	Amount					
2	bread	2	1.5	=B2*C2					
3	butter	1	1.2						
4	cheese	3	2						
5	ham	3	1.8						
6									

1. Select cell D2, click on the lower right corner of cell D2 and drag it down to cell D5.

COUNTIF    ✕    ✓ <i>f<sub>x</sub></i> =B5*C5									
	A	B	C	D	E	F	G	H	I
1	Product	Quantity	Price	Amount					
2	bread	2	1.5	3					
3	butter	1	1.2	1.2					
4	cheese	3	2	6					
5	ham	3	1.8	=B5*C5					
6									

# Cell References

## Absolute Reference

To create an **absolute reference** to cell H3, place a \$ symbol in front of the column letter and row number (\$H\$3) in the formula of cell E3.

COUNTIF									
	A	B	C	D	E	F	G	H	I
1									
2		Length (cm)	Width (cm)		Length (inch)	Width (inch)		Conversion rate	
3		1	10		=B3*\$H\$3			0.3937008	
4		5	10						
5		4	8						
6		2	10						
7									

2. Now we can quickly drag this formula to the other cells.

COUNTIF									
	A	B	C	D	E	F	G	H	I
1									
2		Length (cm)	Width (cm)		Length (inch)	Width (inch)		Conversion rate	
3		1	10		0.3937008	3.937008		0.3937008	
4		5	10		1.968504	3.937008			
5		4	8		1.5748032	3.1496064			
6		2	10		0.7874016	=C6*\$H\$3			
7									

# Cell References

## Mixed Reference

Sometimes we need a combination of relative and absolute reference (**mixed reference**).

1. See the formula in cell F2 below.

COUNTIF    X    ✓    fx    =B2*(1-B6)								
	A	B	C	D	E	F	G	H
1	Product	Price			Prices / Month	Jan	Feb	Mar
2	Jeans	80			Jeans	=B2*(1-B6)		
3	Shirts	30			Shirts			
4								
5	Month	Jan	Feb	Mar				
6	Reduction	20%	40%	80%				
7								

2. We want to copy this formula to the other cells quickly. Drag cell F2 across one cell, and look at the formula in cell G2.

COUNTIF    X    ✓    fx    =C2*(1-C6)								
	A	B	C	D	E	F	G	H
1	Product	Price			Prices / Month	Jan	Feb	Mar
2	Jeans	80			Jeans	64	=C2*(1-C6)	
3	Shirts	30			Shirts			
4								
5	Month	Jan	Feb	Mar				
6	Reduction	20%	40%	80%				
7								



# Cell References

Do you see what happens? The reference to the price should be a fixed reference to column B. Solution: place a \$ symbol in front of the column letter (\$B2) in the formula of cell F2. In a similar way, when we drag cell F2 down, the reference to the reduction should be a fixed reference to row 6. Solution: place a \$ symbol in front of the row number (B\$6) in the formula of cell F2.

COUNTIF    ✕    ✓    fx    =\$B2*(1-B\$6)								
	A	B	C	D	E	F	G	H
1	Product	Price			Prices / Month	Jan	Feb	Mar
2	Jeans	80			Jeans	= \$B2*(1-B\$6)		
3	Shirts	30			Shirts			
4								
5	Month	Jan	Feb	Mar				
6	Reduction	20%	40%	80%				
7								

# Cell References

Note: we don't place a \$ symbol in front of the row number of \$B2 (this way we allow the reference to change from \$B2 (Jeans) to \$B3 (Shirts) when we drag the formula down). In a similar way, we don't place a \$ symbol in front of the column letter of B\$6 (this way we allow the reference to change from B\$6 (Jan) to C\$6 (Feb) and D\$6 (Mar) when we drag the formula across).

3. Now we can quickly drag this formula to the other cells.

COUNTIF    X    ✓    fx    =\$B3*(1-D\$6)								
	A	B	C	D	E	F	G	H
1	Product	Price			Prices / Month	Jan	Feb	Mar
2	Jeans	80			Jeans	64	48	16
3	Shirts	30			Shirts	24	18	=B3*(1-D\$6)
4								
5	Month	Jan	Feb	Mar				
6	Reduction	20%	40%	80%				
7								

# Functions

## Round

1. Round a number to two decimal places.

B1    :    ✕    ✓ <i>f<sub>x</sub></i> =ROUND(A1,2)									
	A	B	C	D	E	F	G	H	I
1	114.7261	114.73							
2									

2. Round a number to one decimal place.

B1    :    ✕    ✓ <i>f<sub>x</sub></i> =ROUND(A1,1)									
	A	B	C	D	E	F	G	H	I
1	114.7261	114.7							
2									

# Functions

## Average

To calculate the average of a range of cells, use the AVERAGE function.

A3																	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	
1	0	7	8	6	5	9	8	7	4	8	0	3	5	6	8		
2																	
3	5.6																
4																	

## Median

To find the median (or middle number), use the MEDIAN function.

A3																	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	
1	0	7	8	6	5	9	8	7	4	8	0	3	5	6	8		
2																	
3	6																
4																	

# Functions

## Mode

To find the most frequently occurring number, use the MODE function.

## Standard Deviation

To calculate the standard deviation, use the STEDV function.

## Min

To find the minimum value, use the MIN function.

## Max

To find the maximum value, use the MAX function.

# Formula Errors

## ##### error

When your cell contains this **error code**, the column isn't wide enough to display the value.

A2		✕ ✓ <i>f<sub>x</sub></i>		15000000		
	A	B	C	D	E	F
1	7,500,000					
2	#####					
3	500,000					
4						

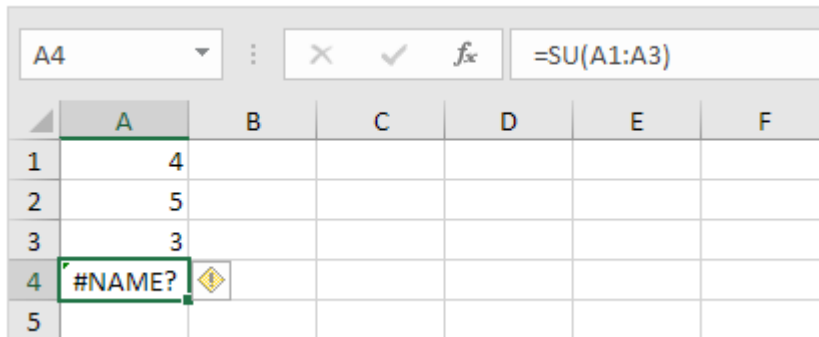
1. Click on the right border of the column A header and increase the column width.

A4		✕ ✓ <i>f<sub>x</sub></i>		=SU(A1:A3)		
	A	B	C	D	E	F
1	4					
2	5					
3	3					
4	#NAME?					
5						

# Formula Errors

## #NAME? error

The #NAME? error occurs when Excel does not recognize text in a formula.

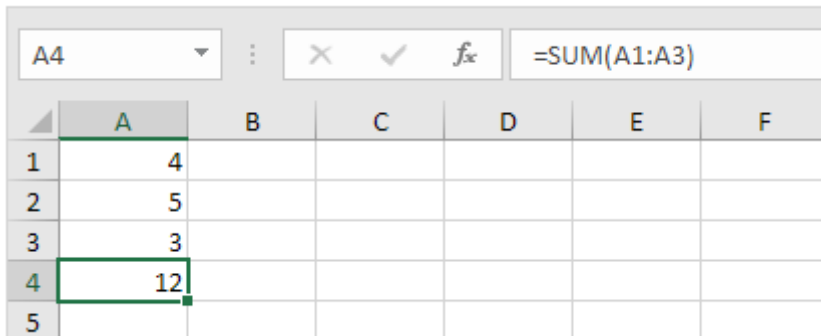


The screenshot shows an Excel spreadsheet with the following data:

	A	B	C	D	E	F
1	4					
2	5					
3	3					
4	#NAME?					
5						

The formula bar at the top shows the formula in cell A4: `=SU(A1:A3)`. The error #NAME? is displayed in cell A4, indicating that Excel cannot find the function 'SU'.

1. Simply correct SU to SUM.



The screenshot shows the same Excel spreadsheet after correcting the formula. The formula bar now shows `=SUM(A1:A3)`, and the value 12 is displayed in cell A4.

	A	B	C	D	E	F
1	4					
2	5					
3	3					
4	12					
5						

# Formula Errors

## **#VALUE! error**

Excel displays the #VALUE! error when a formula has the wrong type of argument.

## **#DIV/0! error**

Excel displays the #DIV/0! error when a formula tries to divide a number by 0 or an empty cell.

## **#REF! error**

Excel displays the #REF! error when a formula refers to a cell that is not valid.



# Array Formulas

## Without Array Formula

Without using an array formula, we would execute the following steps to find the greatest progress.

1. First, we would calculate the progress of each student.

D2									
	A	B	C	D	E	F	G	H	I
1	Student	Test A	Test B	Progress					
2	Jason	59	78	19					
3	Lisa	34	67	33					
4	Ryan	30	93	63					
5	Richard	35	83	48					
6	Anna	69	82	13					
7									

2. Next, we would use the MAX function to find the greatest progress.

D7									
	A	B	C	D	E	F	G	H	I
1	Student	Test A	Test B	Progress					
2	Jason	59	78	19					
3	Lisa	34	67	33					
4	Ryan	30	93	63					
5	Richard	35	83	48					
6	Anna	69	82	13					
7				63					
8									

# Array Formulas

## With Array Formula

We don't need to store the range in column D. Excel can store this range in its memory. A range stored in Excel's memory is called an **array constant**.

1. We already know that we can find the progress of the first student by using the formula below.

<div> <div>E1</div> <div>✕ ✓ <i>f<sub>x</sub></i></div> <div>=C2-B2</div> </div>									
	A	B	C	D	E	F	G	H	I
1	Student	Test A	Test B		19				
2	Jason	59	78						
3	Lisa	34	67						
4	Ryan	30	93						
5	Richard	35	83						
6	Anna	69	82						
7									

# Array Formulas

## With Array Formula

2. To find the greatest progress (don't be overwhelmed), we add the MAX function, replace C2 with C2:C6 and B2 with B2:B6.

COUNTIF				✕ ✓ f_x		=MAX(C2:C6-B2:B6)			
	A	B	C	D	E	F	G	H	I
1	Student	Test A	Test B		=MAX(C2:C6-B2:B6)				
2	Jason	59	78						
3	Lisa	34	67						
4	Ryan	30	93						
5	Richard	35	83						
6	Anna	69	82						
7									

3. Finish by pressing CTRL + SHIFT + ENTER.

E1				✕ ✓ f_x		{=MAX(C2:C6-B2:B6)}			
	A	B	C	D	E	F	G	H	I
1	Student	Test A	Test B		63				
2	Jason	59	78						
3	Lisa	34	67						
4	Ryan	30	93						
5	Richard	35	83						
6	Anna	69	82						
7									

# Conditional Formatting

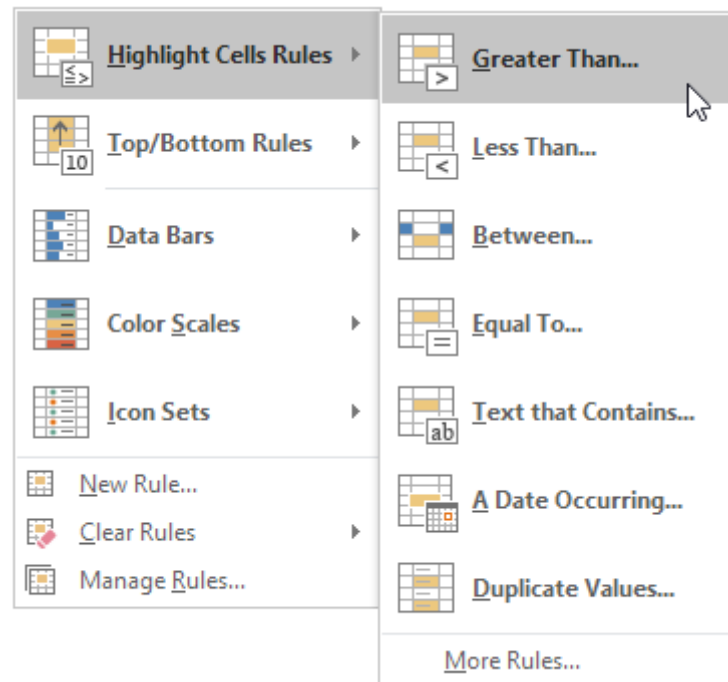
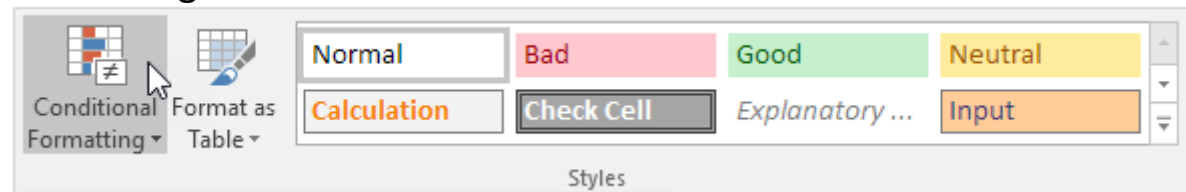
## Highlight Cells Rules

To highlight cells that are greater than a value, execute the following steps.

1. Select the range A1:A10.

	A	B
1	14	
2	6	
3	39	
4	43	
5	2	
6	95	
7	5	
8	11	
9	86	
10	57	
11		

2. On the Home tab, in the Styles group, click Conditional Formatting.

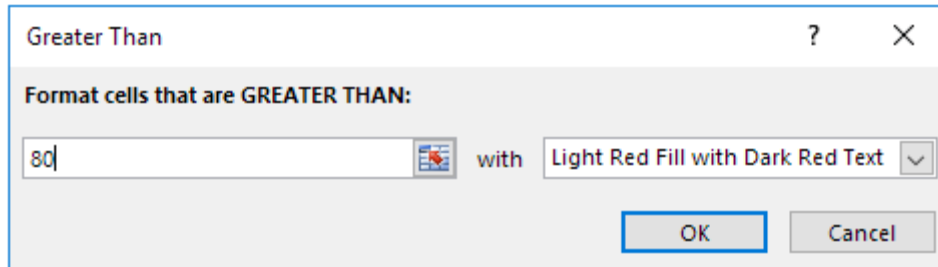


3. Click Highlight Cells Rules, Greater Than.

# Conditional Formatting

## Highlight Cells Rules

4. Enter the value 80 and select a formatting style.



The image shows a screenshot of the 'Greater Than' conditional formatting dialog box in Microsoft Excel. The dialog box has a title bar with a question mark and a close button. The main text reads 'Format cells that are GREATER THAN:'. Below this, there is a text input field containing the number '80', followed by a small icon of a cell with a red fill. To the right of the icon is the word 'with', followed by a dropdown menu showing 'Light Red Fill with Dark Red Text'. At the bottom of the dialog box, there are two buttons: 'OK' and 'Cancel'.

# Conditional Formatting

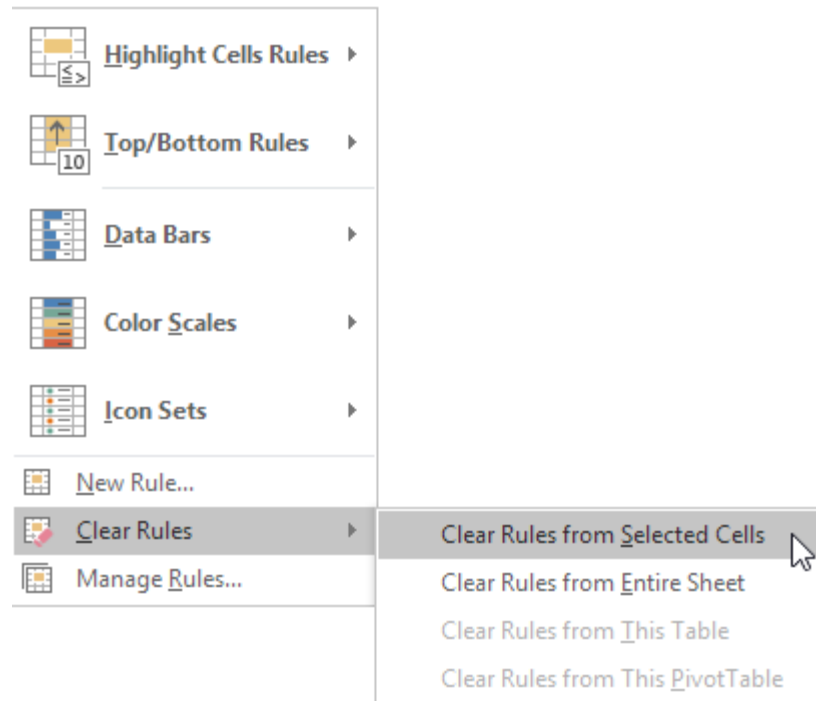
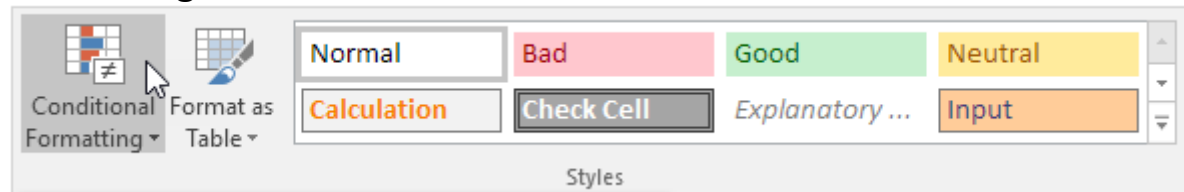
## Clear Rules

To clear a **conditional formatting rule**, execute the following steps.

1. Select the range A1:A10.

	A	B
1	81	
2	6	
3	39	
4	43	
5	2	
6	95	
7	5	
8	11	
9	86	
10	57	
11		

2. On the Home tab, in the Styles group, click Conditional Formatting.



3. Click Clear Rules, Clear Rules from Selected Cells.

# Charts

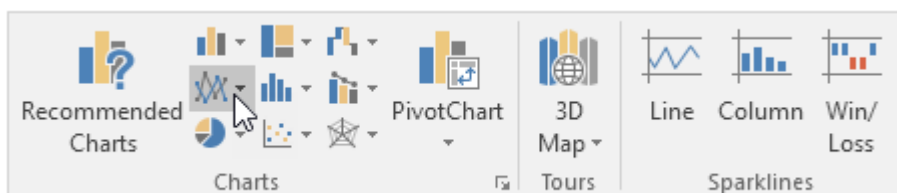
## Create a Chart

To create a line chart, execute the following steps.

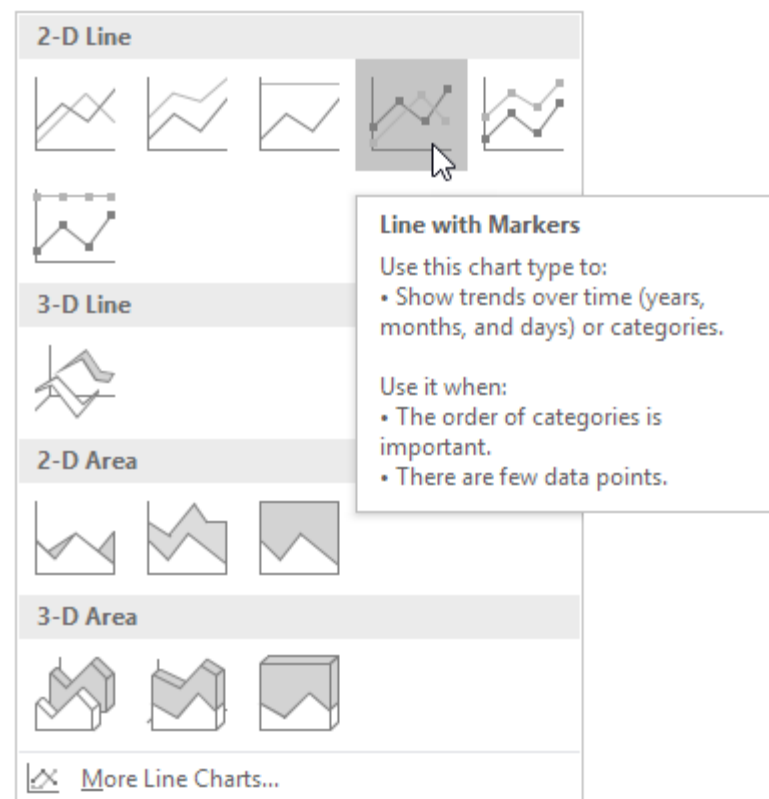
1. Select the range A1:D7.

	A	B	C	D	E
1	Month	Bears	Dolphins	Whales	
2	Jan	8	150	80	
3	Feb	54	77	54	
4	Mar	93	32	100	
5	Apr	116	11	76	
6	May	137	6	93	
7	Jun	184	1	72	
8					

2. On the Insert tab, in the **Charts** group, click the Line symbol.



3. Click Line with Markers.



# Charts

## Change Chart Type

You can easily change to a different type of chart at any time.

1. Select the chart.
2. On the Design tab, in the Type group, click Change Chart Type.
3. On the left side, click Column.

## Switch Row/Column

If you want to display the animals (instead of the months) on the horizontal axis, execute the following steps.

1. Select the chart.
2. On the Design tab, in the Data group, click Switch Row/Column.

## Legend Position

To move the legend to the right side of the chart, execute the following steps.

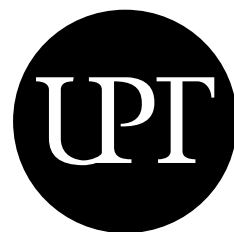
1. Select the chart.
2. Click the + button on the right side of the chart, click the arrow next to Legend and click Right.

## Data Labels

You can use data labels to focus your readers' attention on a single data series or data point.

1. Select the chart.
2. Click a green bar to select the Jun data series.
3. Use your arrow keys to select the population of Dolphins in June (tiny green bar).
4. Click the + button on the right side of the chart and click the check box next to Data Labels.





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