

Instructions for Working with EXCEL

Excel can be used for calculations and data processing. This involves using formulas and creating charts.

Important notes:

- Save files every few minutes in order to avoid data loss.
- It is recommended to close files that you are not working with at the moment.
- To handle pure data, create sheets in .xlsx files or create new .xlsx file and copy pure data there. Any formulas and therefore your solution will **BE LOST** if you will save it in file with .csv format.

Working with Formulas

Each cell in Excel has an address, consisting of a letter (column) and a number (row). You may need to perform algebraic operations with columns.

Let's take an example. Suppose there are three columns of data, and you need to find the ratio of the difference between the first and second columns to the third. To do this, in the upper cell of the empty column where the data should be displayed, you need to write the following formula: $= (A1-B1)/C1$, which contains links to the cells with which calculations will be performed. It is not necessary to enter the cell number into the formula manually: just click on the required cell after typing the = sign.

Press *Enter* to display the result.

	A	B	C	D
1	1	33	197	$= (A1-B1)/C1$
2	2	34	206	
3	3	35	203	
4	4	36	202	
5	5	37	204	
6	6	38	203	
7	7	39	200	
8	8	40	199	
9	9	41	206	
10	10	42	206	

	A	B	C	D
1	1	33	197	-0,16243655
2	2	34	206	
3	3	35	203	
4	4	36	202	
5	5	37	204	
6	6	38	203	
7	7	39	200	
8	8	40	199	
9	9	41	206	
10	10	42	206	

To apply this calculation to all rows, select empty cells and press *Ctrl+D*.

	A	B	C	D
1	1	33	197	-0,16243655
2	2	34	206	
3	3	35	203	
4	4	36	202	
5	5	37	204	
6	6	38	203	
7	7	39	200	
8	8	40	199	
9	9	41	206	
10	10	42	206	

	A	B	C	D
1	1	33	197	-0,16243655
2	2	34	206	-0,15533981
3	3	35	203	-0,15763547
4	4	36	202	-0,15841584
5	5	37	204	-0,15686275
6	6	38	203	-0,15763547
7	7	39	200	-0,16
8	8	40	199	-0,16080402
9	9	41	206	-0,15533981
10	10	42	206	-0,15533981

You may also need to calculate the logarithm of the number. To calculate decimal logarithms, use the formula $=\text{LOG10}(A1)$ for the common logarithm, or $=\text{LN}(A1)$ for the natural logarithm, replacing *A1* with the desired cell.

Excel allows swapping columns and rows of a selected table fragment. To do this, highlight the fragment, copy it with *Ctrl+C*, then paste it on an empty sheet, click on the paste options, and select *Transpose*.

	A	B	C	D	E
1	Pixel	0.0	0.6425197	1.2783525	1
2	0	32	528	552	553
3	1	33	744	775	776
4	2	34	736	767	768
5	3	35	750	769	770
6	4	36	741	768	769
7	5	37	733	770	771
8	6	38	726	775	776
9	7	39	737	772	773
10	8	40	738	773	774
11	9	41	737	777	778
12	10	42	738	770	771

The `=MAX(A1:A5)`, `=MIN(A1:A5)`, and `=AVERAGE(A1:A5)` functions allow to find the minimum, maximum and average values in the selected range. In this example, the range of cells A1:A5 is considered.

	A	B	C
1	10	MAX	771
2	42	MIN	10
3	738	AVERAGE	466,2
4	770		
5	771		

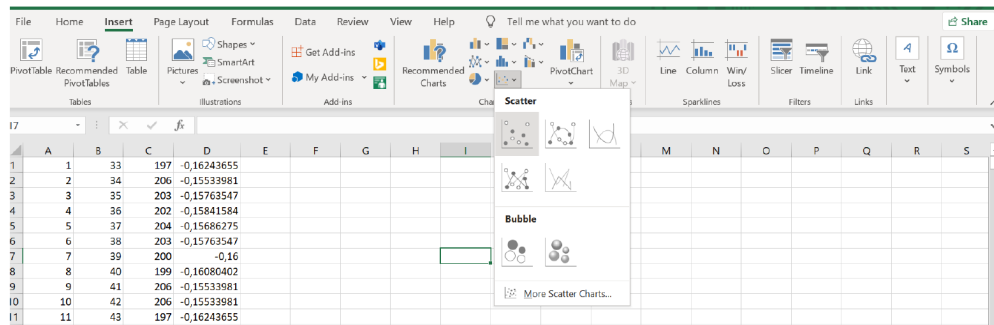
To add up all the numbers in a range, use the `=SUM(A1:A5)` function. It returns the sum of every value in the selected range — here the cells from A1 to A5. As with the other functions, you can either type the range by hand or, after typing `=SUM(`, select the cells with the mouse and *close the bracket*.

A note on separators

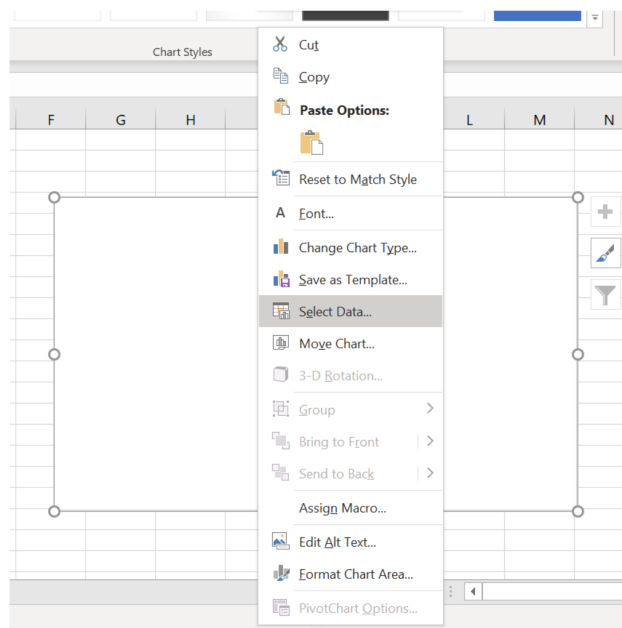
When a function has several arguments, they are divided by a separator. Depending on the regional settings of the computer, this separator is either a semicolon ";" or a comma ",". For the same reason the decimal point may be shown as a comma (for example 0,16 instead of 0.16). This means a formula that works on one computer can give an error on another. Simple rule: if a formula returns an error, try swapping the ; for , (or the other way round). The same applies to numbers you type yourself - if a value is not recognised, try writing the decimal separator as "," instead of "." (or the other way round), for example 1,5 instead of 1.5.

Creating Graphs

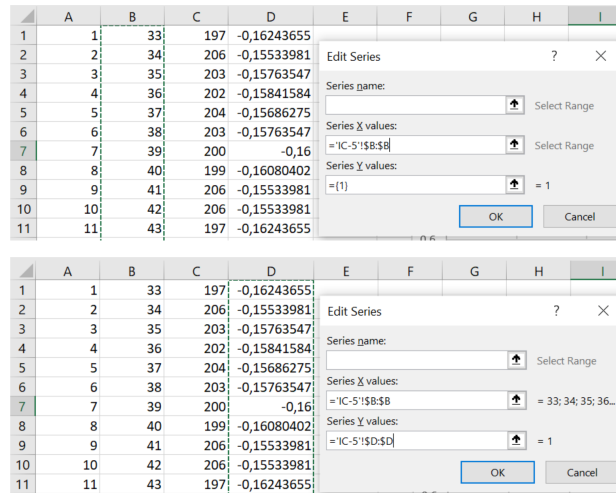
To create a graph, go to the *Insert* tab and select *Scatter*. An empty chart will appear.



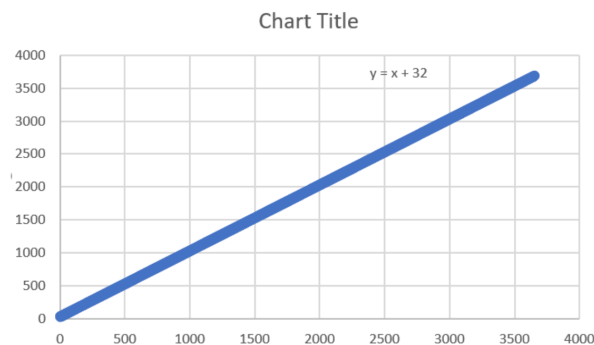
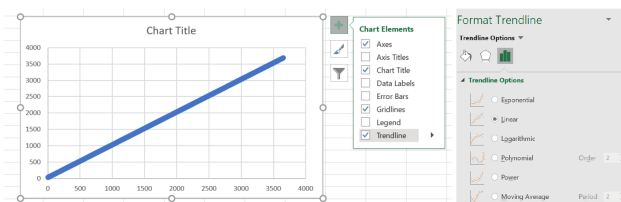
Right-click on the blank graph and select *Select Data*.



Click *Add* and highlight the columns for the X and Y values. For example, if column B values are on the X-axis and column D values on the Y-axis, select these columns. Click *OK* in both dialogs. You can select specific cell ranges instead of entire columns if needed. To add another data series, right-click the graph and repeat the process.



To display a linear trendline, click the green plus sign in the top right corner of the graph, check *Trendline*, hover over the arrow, and select *More options*. In the menu, select *Linear* and check *Display Equation on chart*. The equation of a trendline will appear on the graph.



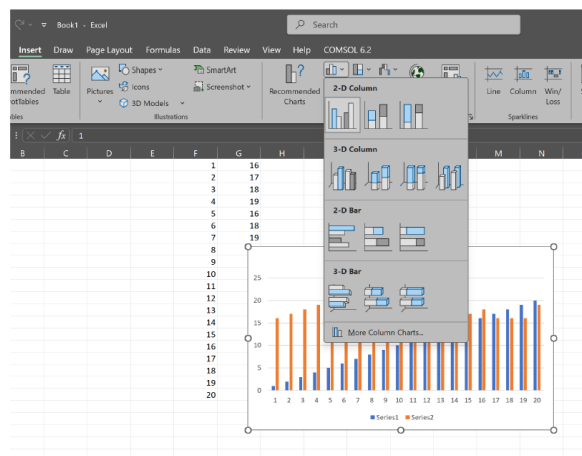
Don't forget to label the axes! To do this, click the green plus sign in the top right corner of the graph and check *Axis Titles*. Two text boxes will appear next to the horizontal and vertical axes — click each one

and type the name of the quantity together with its units (for example, *Time, s* or *Voltage, V*).

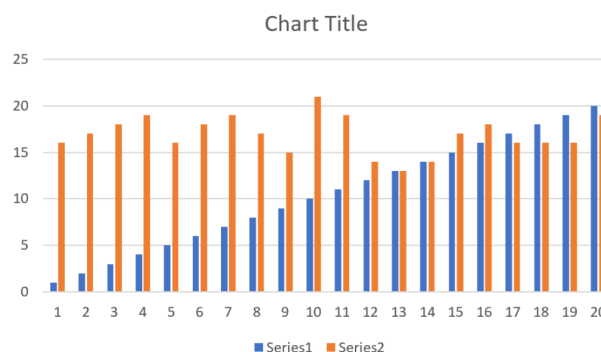
Creating a Column chart

A histogram shows a value for each category (or range) of your data as a vertical bar — the taller the bar, the larger the value. In this type of diagram your data already comes as two columns: a left column with the labels for the horizontal axis (for example the X value or the name of each range), and a right column with the corresponding value for the vertical axis (for example the number of counts). To build such a histogram in Excel, follow these steps:

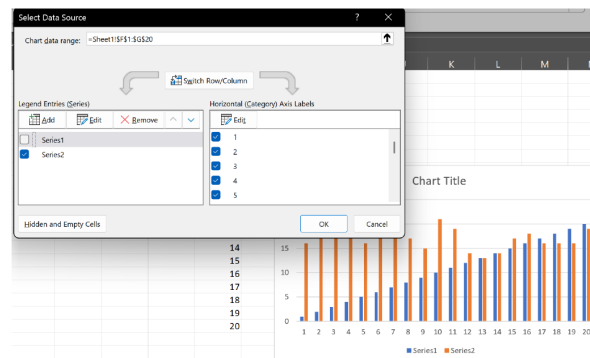
1. Place your data in two columns next to each other: the left column holds the labels for the X-axis, the right column holds the values for the Y-axis (one value per row).
2. Select both columns together, including all the rows you need.
3. Go to the *Insert* tab. In the *Charts* group, click the *Insert Column or Bar Chart* button and choose *Clustered Column* (the first option under *2-D Column*).



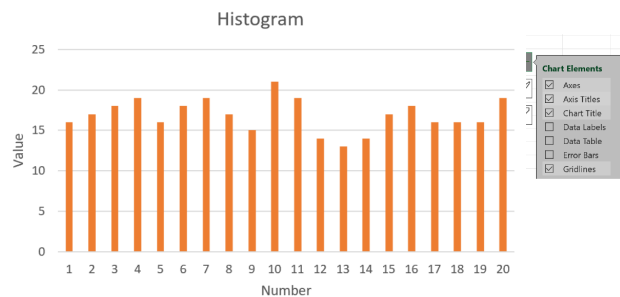
4. Excel draws one bar per row. You will get something like this:



If the left column contains numbers, Excel may treat it as a second set of bars instead of as labels. To fix this, right-click the chart and choose *Select Data*. On the right, under *Horizontal (Category) Axis Labels*, click *Edit* and select your left (label) column; on the left, keep only the value column as the data series. Click *OK*.

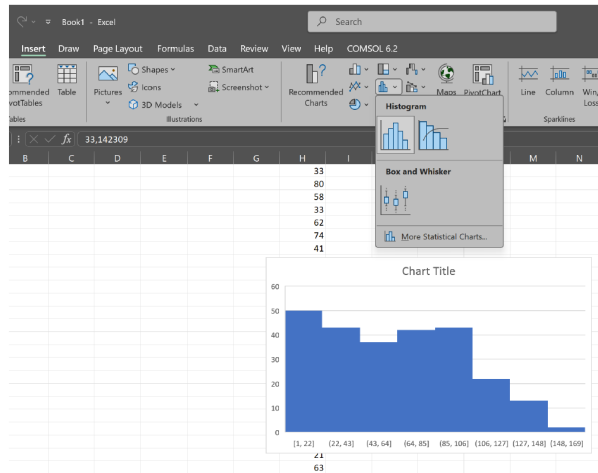


Label the axes the same way as for a graph: click the green plus sign and check *Axis Titles*.

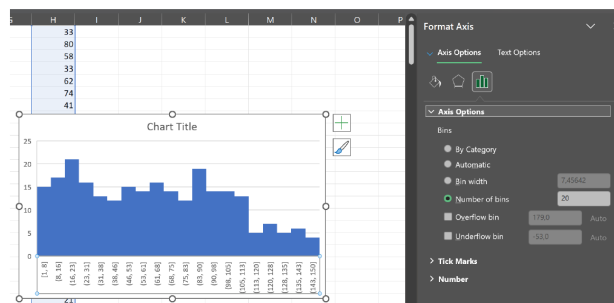


Creating a Histogram

Unlike the column chart above, a histogram takes a single column of raw values and counts automatically how many of them fall into each range (a bin). Select that column, then on the Insert tab click Insert Statistic Chart and choose Histogram.



To change the ranges, double-click the horizontal axis and, under *Axis Options* → *Bins*, set *Number of bins* or *Bin width*.



Fitting without graph

To fit data with second order polynomial without plotting the graph, you should follow these steps:

1. If you have data in columns *A* and *B* and the fitting formula is $Y = aX^2 + bX + c$ you should type the following expression `=LINEST(B2:B16;A2:A16^{1,2}; TRUE; FALSE)` in any cell. Here *B2:B16* is data corresponding to *Y*, *A2:A16* is data corresponding to *X*. In the example we use the *D2* cell.

	A	B	C	D	E	F	G
X	Y			a	b	c	
0.1	0.9323			<code>=LINEST(B2:B16;A2:A16^{1,2};TRUE;FALSE)</code>			
0.2	1.37721						
0.3	1.81361						
0.4	2.26153						
0.5	2.70842						
0.6	3.15561						
0.7	3.61795						
0.8	4.07387						
0.9	4.53545						
1	5.00221						
1.1	5.47769						
1.2	5.95463						
1.3	6.43592						
1.4	6.91787						
1.5	7.40526						

2. Next select this cell and two at the right

D	E	F
a	b	c
0.19267		

3. Press *F2* button

D	E	F	G
a	b	c	
<code>=LINEST(B2:B16;A2:A16^{1,2};TRUE;FALSE)</code>			

4. Press *Ctrl+Shift+Enter*

D	E	F
a	b	c
0.20072	4.29985	0.5037

Now you have the coefficient of polynomial. To fit the linear function without graph plotting you can use the same algorithm: just remove " $\wedge\{1,2\}$ " in the formula and use only two cells.