

How to Make a Straight-Line Fit Using Excel?

Let's consider the following *example*:

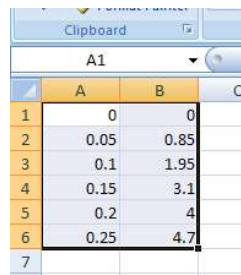
One has measured the force necessary to extend a spring from its rest (equilibrium position) for various extensions. The goal is to find the spring constant. The theory (Hook's Law) predicts the linear dependence between the force and the change of the length of the spring:

$$F = -kx$$

To find the spring constant k , one needs to plot the absolute value of force $-F$ as a function of x and find the straight-line fit. The slope of that line is equal to the spring constant k .

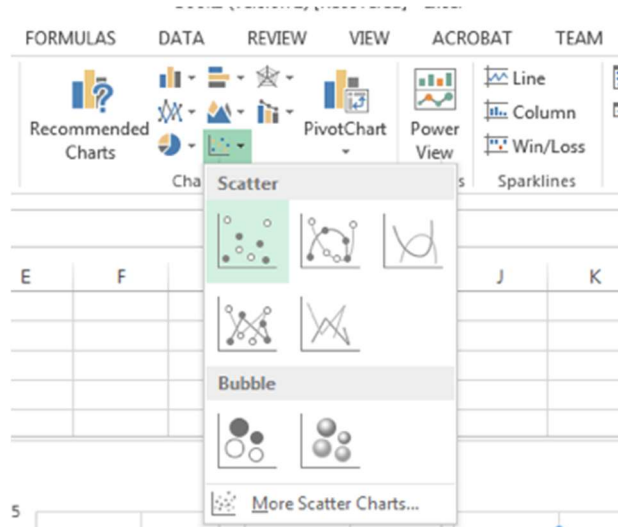
Finding the best straight-line fit could be quite time consuming if done with a calculator. Using Microsoft Excel program significantly simplifies the whole procedure. Follow the steps shown below **to make a chart and then draw a straight line that fits your data.**

- A. Start Excel 2016.
- B. Open a blank workbook and enter your data into Excel spreadsheet.
- C. Highlight all cells containing data. In our example, the first column (A) contains values of x , whereas the second column (B) contains values of force F :

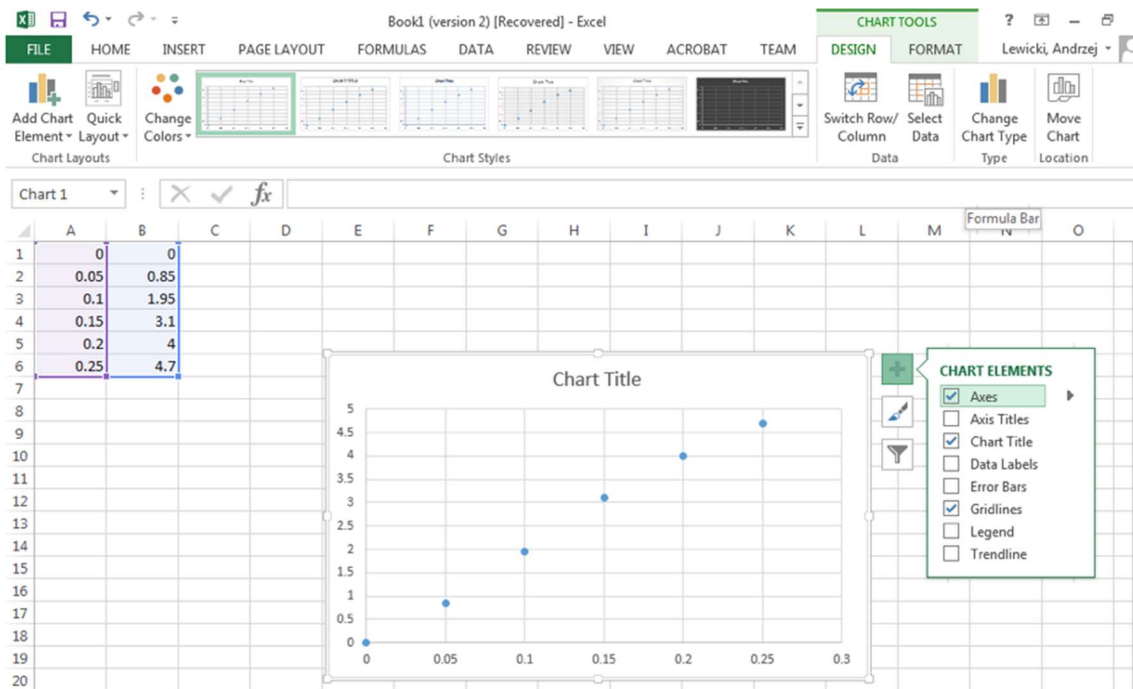


	A	B	C
1	0	0	
2	0.05	0.85	
3	0.1	1.95	
4	0.15	3.1	
5	0.2	4	
6	0.25	4.7	
7			

- D. Select "Charts" from the "Insert" tab and next select "Scatter" chart from "Insert Scatter (X,Y)...".



You should see a simple plot prepared by Excel.



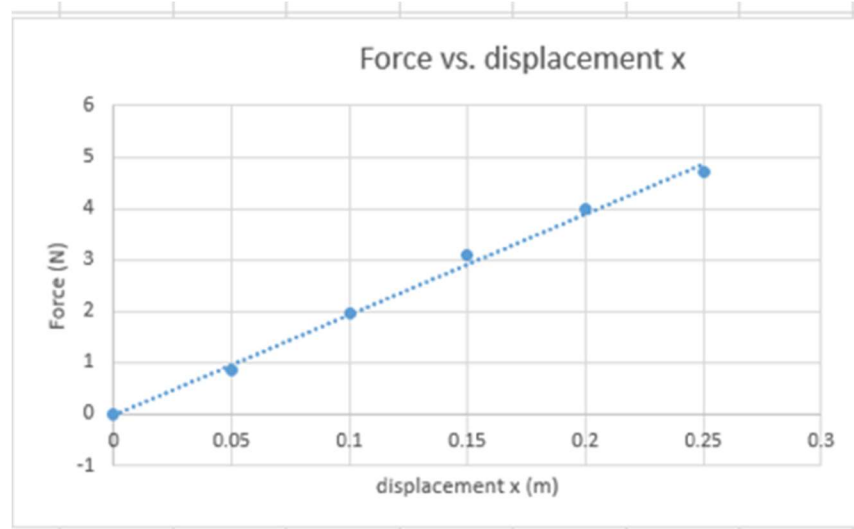
E. Next step is to add axis labels and the title to the graph. You should already see a generic title ("Chart Title"). Click on it and change it to something more specific. In our example, this could be "Force vs. displacement x". To add axis titles, click anywhere on the chart and then



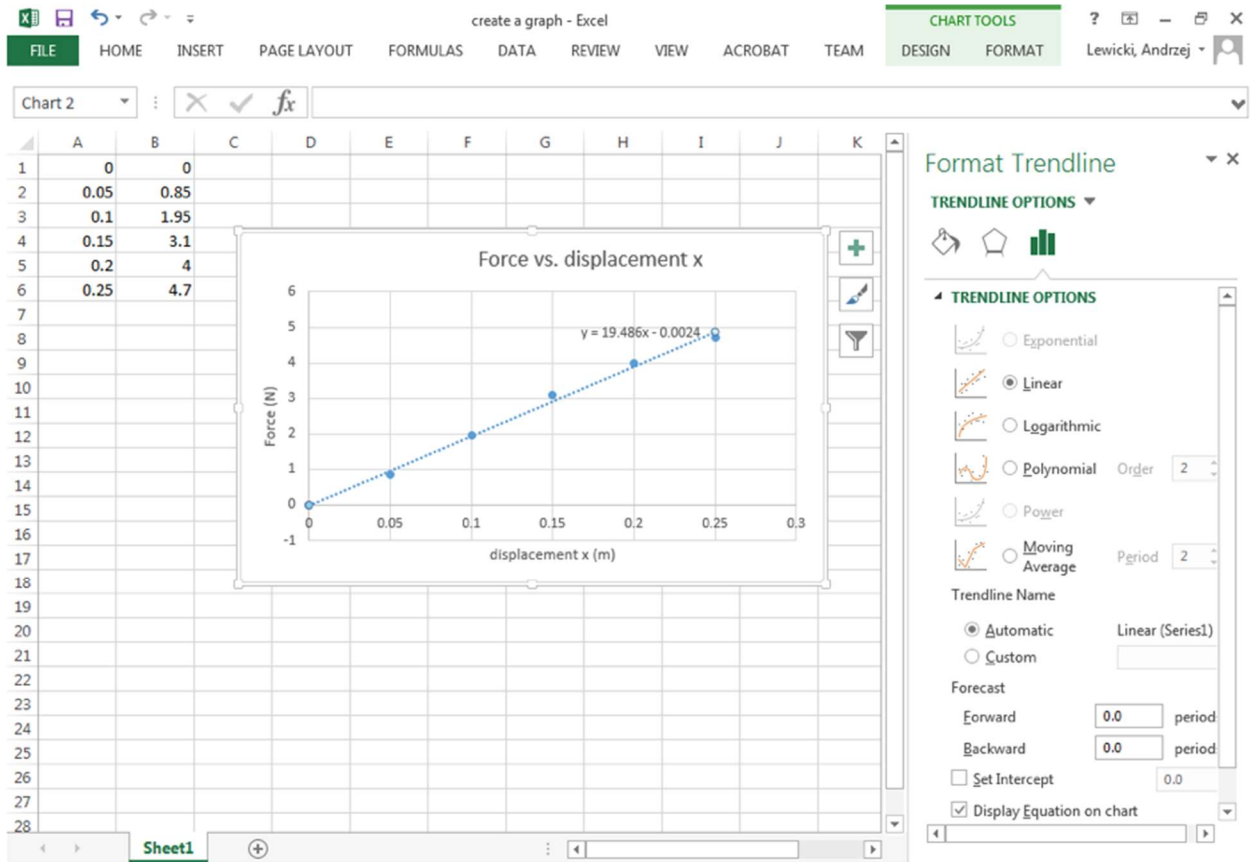
click on the "add" icon located next to the chart and checkmark "Axis Titles" option. Type the new axis titles. In our example, these titles are "Force (N)" for the vertical axis and "displacement x (m)" for the horizontal axis. To change the size of the chart, grab and drag a

corner of the graph (chart).

F. The last step is to add the linear fit (a straight line fit) to your graph (chart). Click anywhere on the chart and then click on the same "add" icon located next to the chart and checkmark "Trendline". The trendline has multiple options available. Select the "Linear" option. You should see a graph similar to this:



Now we can see the straight line of the fit, but we do not know the parameters of the equation. To show the equation, double-click on the trendline on your chart. Next, find the "Trendline Options" and check the "Display Equation on chart" box.



Trendline Name

Automatic Linear (Series1)
 Custom

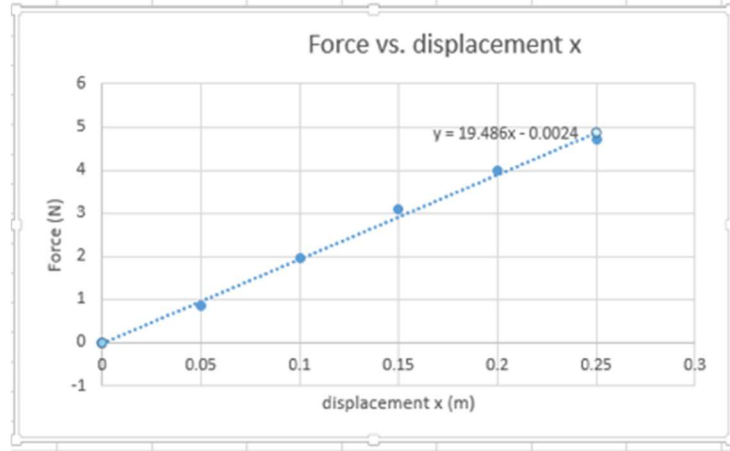
Forecast

Forward 0.0 period
 Backward 0.0 period

Set Intercept 0.0

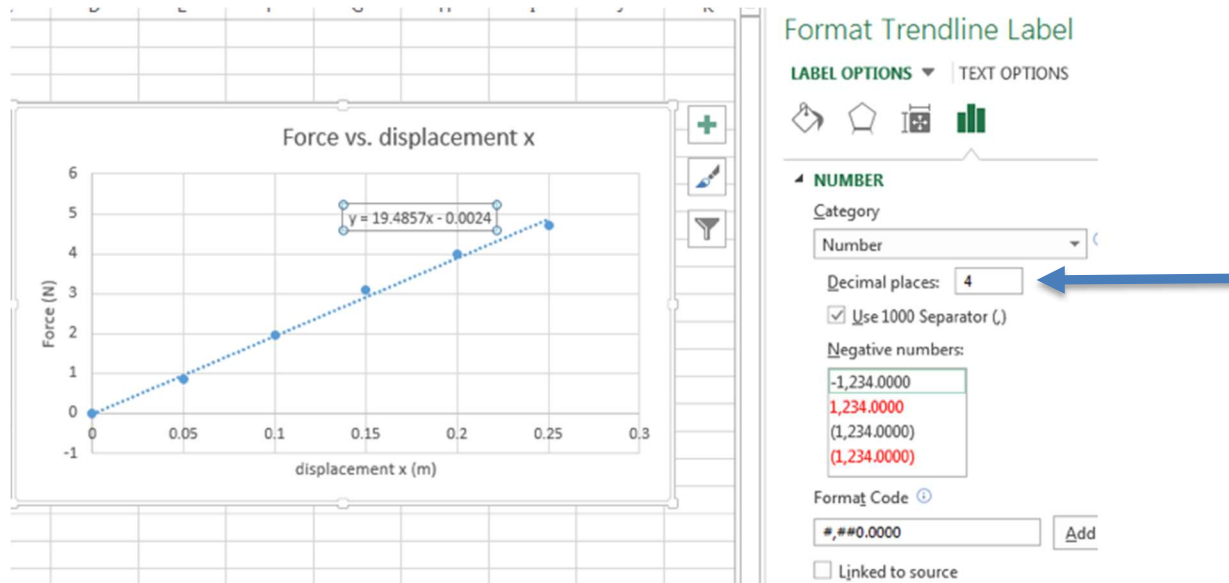
Display Equation on chart

The final graph should look similar to the example shown below.



From the equation for that straight line ($y = 19.486x - 0.002$) we can conclude that the best estimate of the spring constant is: $k = 19.49$ (N/m), where 19.49 (N/m) is the slope of the line and -0.002 (N) represents the y-intercept.

G. To change the number of decimal places in the trendline equation, click on the equation for the trendline and select option: "Format Trendline Label..." and then "LABEL OPTIONS".



Next, change Category to "Number" and increase or decrease the number of "Decimal places".

MS Excel can be also used to fit more complicated equations (e.g., polynomial, exponential, logarithmic, etc.) using the same procedure, but with different trendline options.