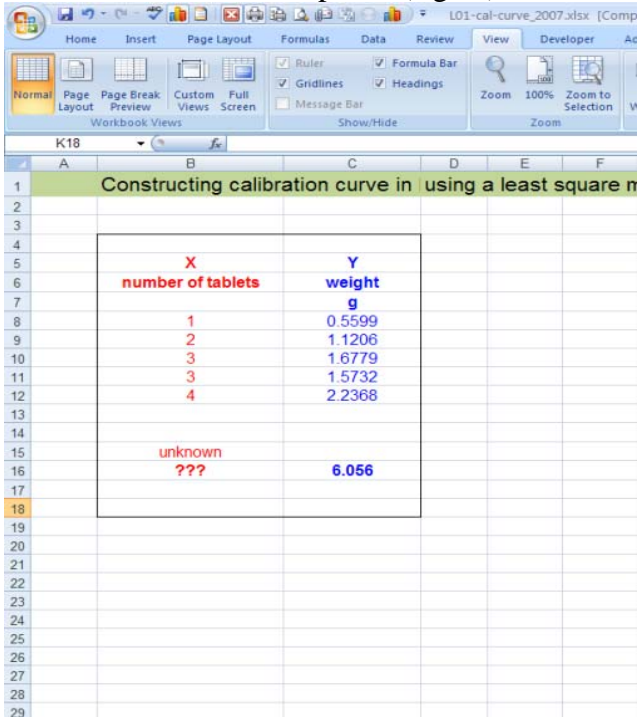


Generating calibration curve in MS Excel 2007

- 1) Graphical display (calibration curve) will allow to check visually that all your data points are on the curve
- 2) Simple calculation of slope and intercept
- 3) Using function LINEST allows us to get also standard deviations and R^2
- 4) Calculate unknown

Initial data consist of response (signal) of different concentrations of standard and response of unknown sample

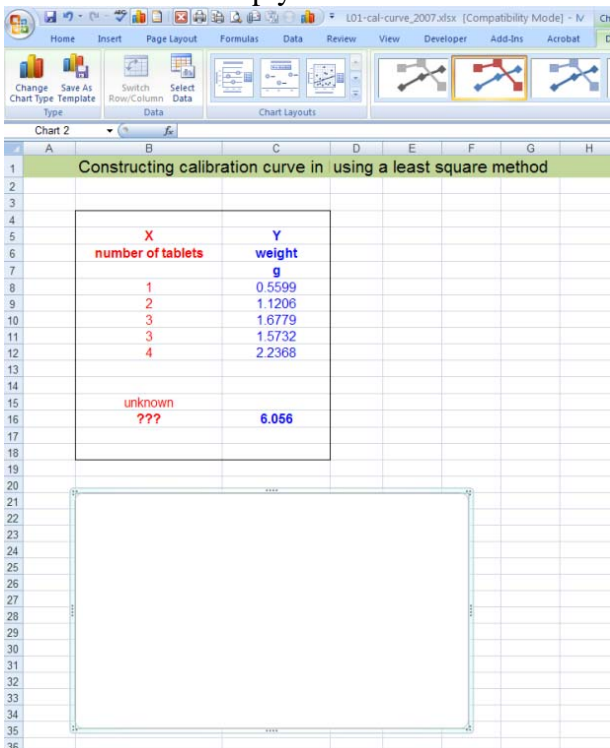


The screenshot shows the MS Excel 2007 interface with a spreadsheet titled "L01-cal-curve_2007.xlsx". The spreadsheet has a green header row with the text "Constructing calibration curve in using a least square method". The data is organized into two columns: "X number of tablets" and "Y weight g". The data points are as follows:

X	Y
1	0.5599
2	1.1206
3	1.6779
3	1.5732
4	2.2368
unknown	6.056

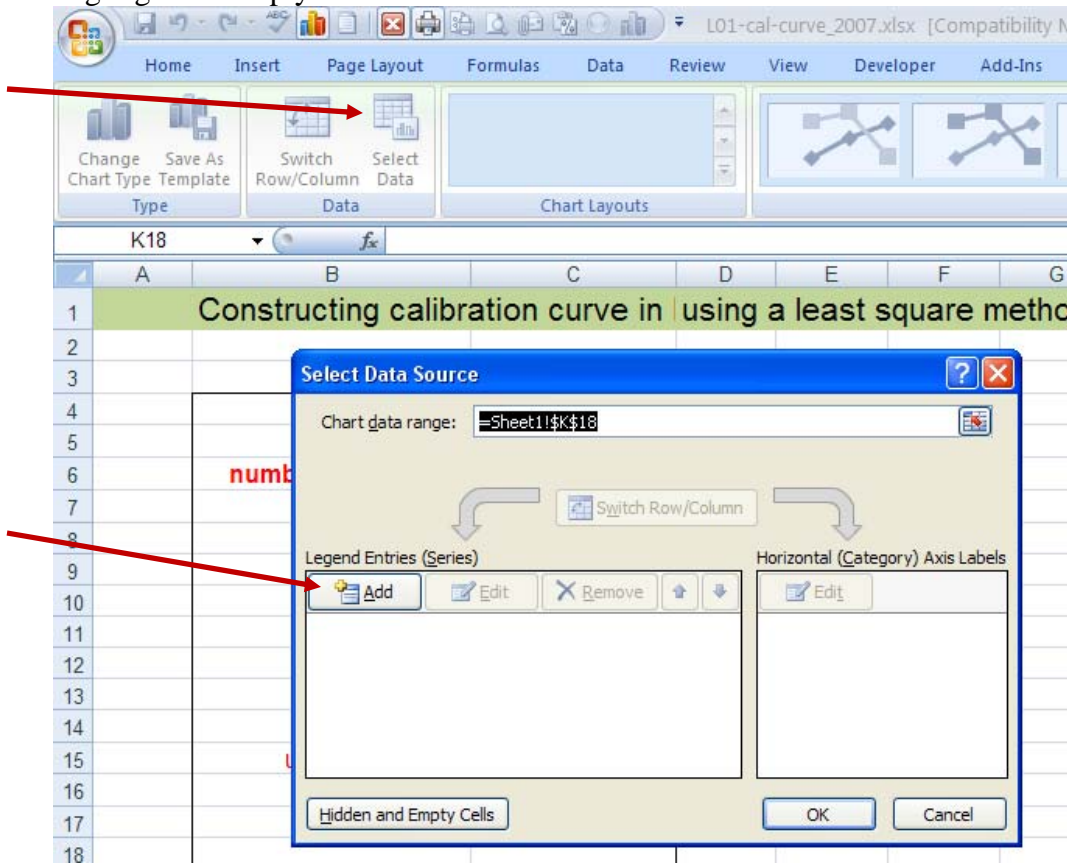
1) Calibration curve

To create calibration curve go to INSERT menu and select SCATTER only with markers. You will obtain empty chart screen.

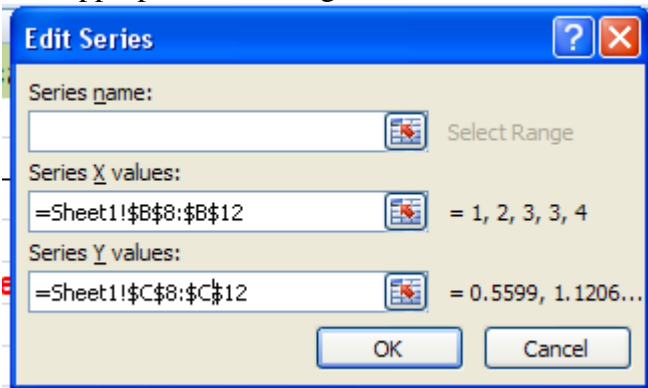


The screenshot shows the same MS Excel 2007 spreadsheet as above, but with an empty chart area created in the "Chart 2" window. The chart area is a large empty box with a blue border, indicating that the "SCATTER" chart type has been selected but no data points have been plotted yet.

Highlight the empty chart box and click on SELECT DATA and ADD

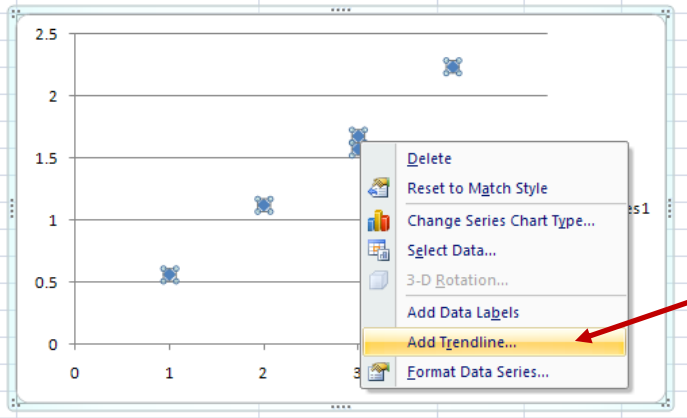


Add appropriate data ranges for X and Y axis and click OK (twice)



You should see chart with points to add calibration curve select the points in chart and click right see the option ADD TRENDLINE and left click on it

X number of tablets	Y weight g
1	0.5599
2	1.1206
3	1.6779
3	1.5732
4	2.2368
unknown ???	6.056



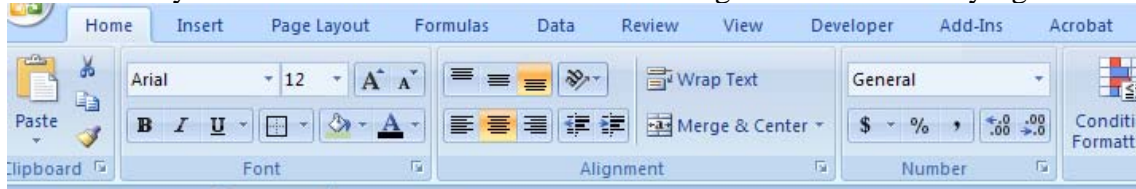
Select linear (trendline) and in options (top menu) select “Display equation and R²”

The 'Format Trendline' dialog box is shown. Under 'Trend/Regression Type', 'Linear' is selected. Under 'Trendline Name', 'Automatic' is selected, showing 'Linear (Series1)'. Under 'Forecast', 'Forward' and 'Backward' are both set to 0.0. The 'Set Intercept = 0.0' checkbox is unchecked. The 'Display Equation on chart' and 'Display R-squared value on chart' checkboxes are checked. Red arrows point to the 'Linear' option, the 'Display Equation on chart' checkbox, and the 'Display R-squared value on chart' checkbox.

The result is the calibration curve, and equation.

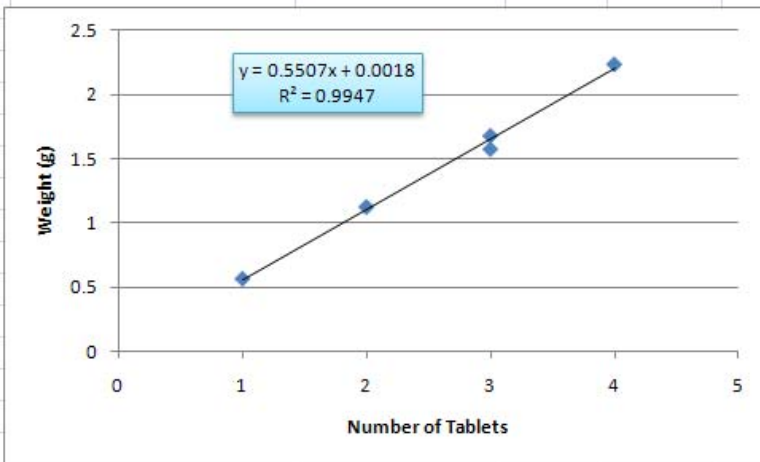
To add axis labels select chart, go to layout, click Axis titles and modify.

Note a variety modification of charts can be done through menu obtained by right click



1 Constructing calibration curve in using a least square method

X	Y
number of tablets	weight g
1	0.5599
2	1.1206
3	1.6779
3	1.5732
4	2.2368
unknown ???	6.056



2) Simple calculation of slope and intercept

To get slope, type “= slope” and in parenthesis select range for ys and xs ranges

For the Equation $Y=m*X + b$ m is slope, b is intercept, X is number of tablets, Y is weight

Screenshot of Excel showing the SLOPE formula being entered in cell E8. The formula bar shows `=slope(C8:C12,B8:B12)`. The spreadsheet contains a table with X (number of tablets) and Y (weight g) values. A red arrow points to the formula bar, and another red arrow points to the formula in cell E8.

X	Y
number of tablets	weight g
1	0.5599
2	1.1206
3	1.6779
3	1.5732
4	2.2368
unknown ???	6.056

To get intercept type the same formula as for slope, but replace slope by intercept.

Screenshot of Excel showing the INTERCEPT formula being entered in cell F8. The formula bar shows `=INTERCEPT(C8:C12,B8:B12)`. The spreadsheet contains the same table as the previous screenshot. A red arrow points to the formula bar, and another red arrow points to the formula in cell F8.

X	Y
number of tablets	weight g
1	0.5599
2	1.1206
3	1.6779
3	1.5732
4	2.2368
unknown ???	6.056

Note, the slope and intercept calculated are and should be the SAME as on the chart.

3) Using function LINEST allows us to get also standard deviations and R²

Select the area 2 x 4 cells and point at menu at insert function (above B column), click on fx

X	Y	SLOPE	INTERCEPT	SLOPE	INTERCEPT
number of tablets	weight g				
1	0.5599	0.5507	0.002		
2	1.1206				
3	1.6779				
3	1.5732				
4	2.2368				

select category STATISTICAL and function LINEST (you can also search for linest)

Insert Function

Search for a function:
Type a brief description of what you want to do and then click Go

Or select a category: Statistical

Select a function:
LARGE
LINEST
LOGEST
LOGINV
LOGNORMDIST
MAX
MAXA

LINEST(known_y's,known_x's,const,stats)
Returns statistics that describe a linear trend matching known data points, by fitting a straight line using the least squares method.

[Help on this function](#) OK Cancel

Select data X and Y ranges, and type in "true" for const and stats

Constructing calibration curve in using a least square method

X	Y
number of tablets	weight g
1	0.5599
2	1.1206
3	1.6779
3	1.5732
4	2.2368
unknown ???	6.056

Function Arguments

LINEST

Known_y's: C8:C12 = {0.5599;1.1206;1.6779;1.5732;2.2368}

Known_x's: B8:B12 = {1;2;3;3;4}

Const: TRUE = TRUE

Stats: TRUE = TRUE

Returns statistics that describe a linear trend matching known data points, by fitting a straight line using the least squares method.

Stats is a logical value: return additional regression statistics = TRUE; return m-coefficients and the constant b = FALSE or omitted.

Formula result = 0.550723077

[Help on this function](#)

OK Cancel

HIT keys **CTRL+SHIFT+ENTER** (all at the same time) and you will obtain the following data

LINEST	
SLOPE	INTERCEPT
0.55072	0.0018
0.02332	0.065126
0.99465	0.053175
557.764	3

Labels for the data above:

- Slope: 0.55072
- Intercept: 0.0018
- Standard Deviation of Slope: 0.02332
- Standard Deviation of Intercept: 0.065126
- r^2 : 0.99465
- Standard Deviation of Y: 0.053175
- F: 557.764
- Degrees of Freedom: 3

4) Calculate concentration of unknown

Rearrange equation for calibration curve to express X (concentration)

X	Y		
number of tablets	weight g	SLOPE	INTERCEPT
1	0.5599	0.5507	0.002
2	1.1206		
3	1.6779		
3	1.5732		
4	2.2368		
		$Y = m \cdot X + b$ where m is slope and B is intercept	
unknown ???	1.3	$X = (Y-b)/m$	

Based on the calibration we know slope (m) and intercept (b) and we measured response y. Thus we can insert the calculated cells into the formula.

The screenshot shows an Excel spreadsheet with the following content:

- Row 1: **Constructing calibration curve in using a least square method**
- Row 5: **X** (number of tablets)
- Row 6: **Y** (weight g)
- Row 7: **SLOPE** (0.5507) and **INTERCEPT** (0.002)
- Row 8: 1, 0.5599
- Row 9: 2, 1.1206
- Row 10: 3, 1.6779
- Row 11: 3, 1.5732
- Row 12: 4, 2.2368
- Row 13: $Y = m \cdot X + b$
- Row 14: where m is slope and B is intercept
- Row 15: $X = (Y-b)/m$
- Row 16: unknown (???) in cell C16, value 1.3 in cell C16
- Row 17: $= (C16-F8)/E8$ in cell E8

In this case, the results unknown amount of sample correspond to 2.36 tablets. You should be able to get the same estimate from graphical display of calibration curve.

