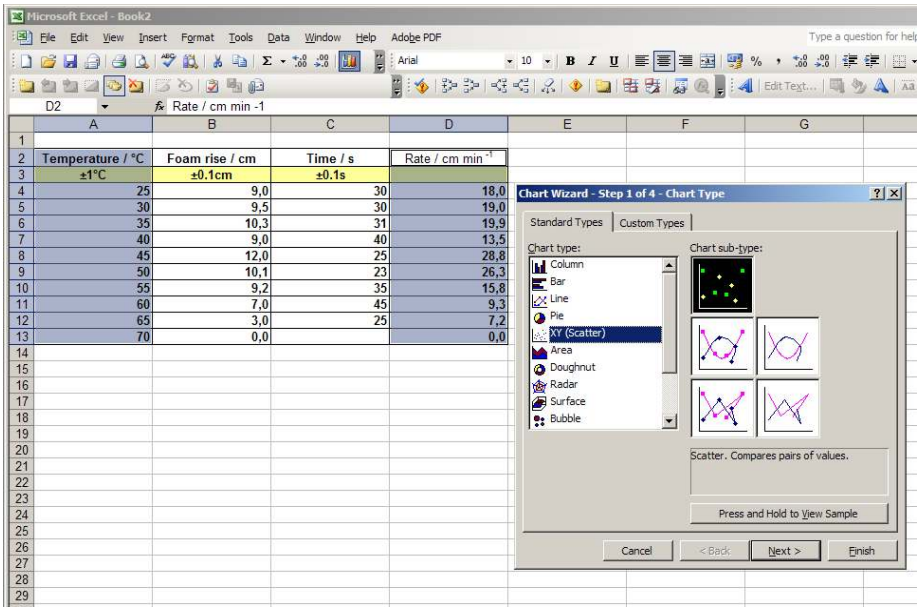
Going further with graphs I: Trend lines

Graphs are not only a way of presenting data, they can also be used a way of analysing data.

The simplest way is by using a trend line or line of best fit.

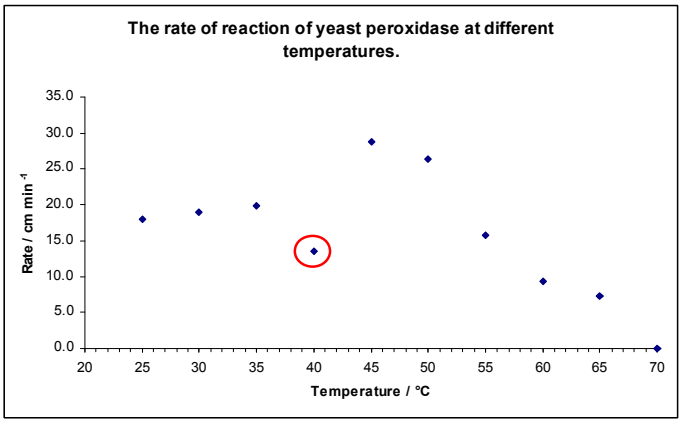
Enter your data on a spread sheet and select the variables that you want to plot.



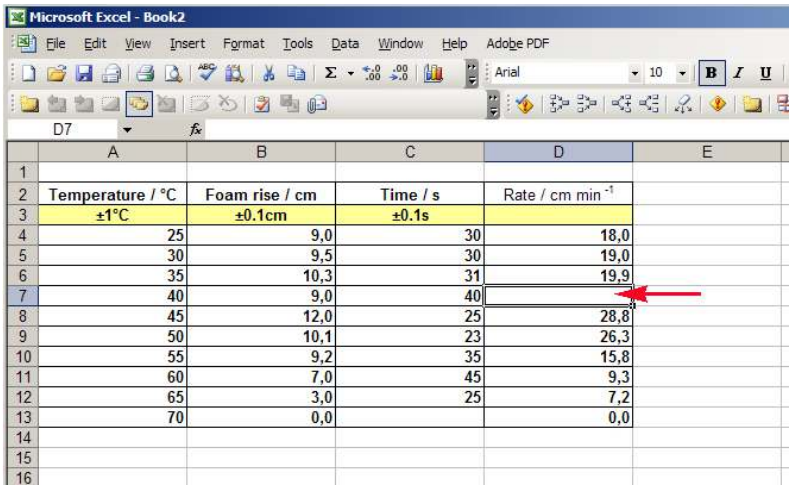
	A	B	C	D
2	Temperature / °C	Foam rise / cm	Time / s	Rate / cm min^{-1}
3	±1°C	±0.1cm	±0.1s	
4	25	9,0	30	18,0
5	30	9,5	30	19,0
6	35	10,3	31	19,9
7	40	9,0	40	13,5
8	45	12,0	25	28,8
9	50	10,1	23	26,3
10	55	9,2	35	15,8
11	60	7,0	45	9,3
12	65	3,0	25	7,2
13	70	0,0		0,0

Then select the **Graphing Wizard** to draw the graph. Select **XY (Scatter)** (Fr *Nuages de points*).

This reveals that one of the points is an outlier. Its position is significantly different from the main trend in the data.

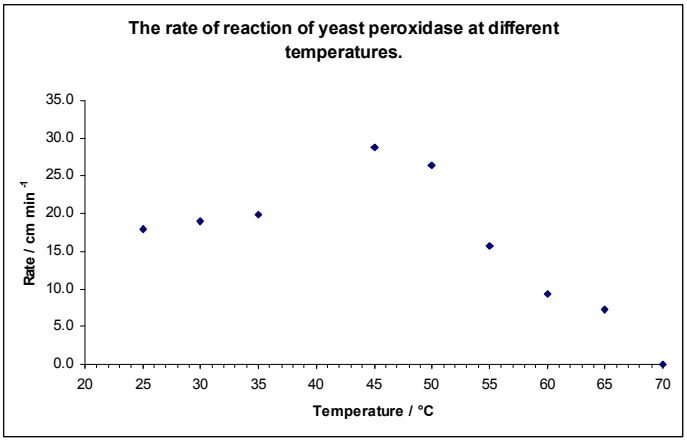


This data point can be removed from the graph by editing the data in the spread sheet.

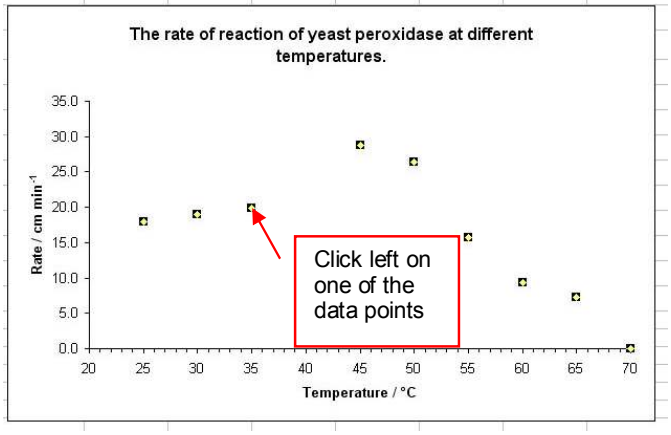


	A	B	C	D	E
1					
2	Temperature / °C	Foam rise / cm	Time / s	Rate / cm min $^{-1}$	
3	±1°C	±0.1cm	±0.1s		
4	25	9,0	30	18,0	
5	30	9,5	30	19,0	
6	35	10,3	31	19,9	
7	40	9,0	40		
8	45	12,0	25	28,8	
9	50	10,1	23	26,3	
10	55	9,2	35	15,8	
11	60	7,0	45	9,3	
12	65	3,0	25	7,2	
13	70	0,0		0,0	
14					
15					
16					

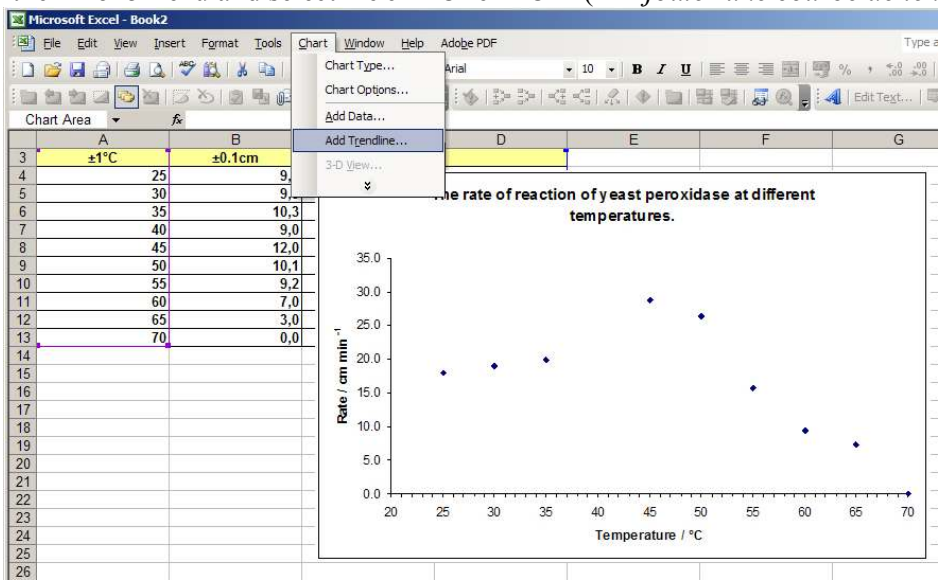
This results in a modification of the graph.



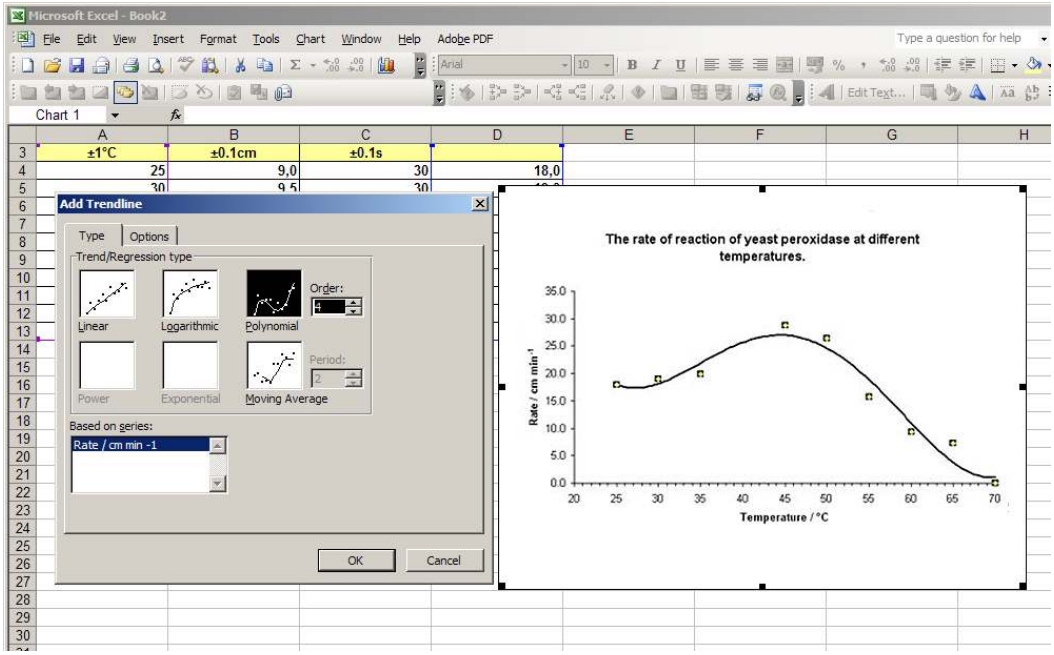
To add a trend line to this graph, use the trend line function of MSExcel. First click left on one of the data points. This will cause the whole series of points to be highlighted.



Click on the **Chart** menu and select **Add Trendline…** (Fr *Ajouter une courbe de tendance*)



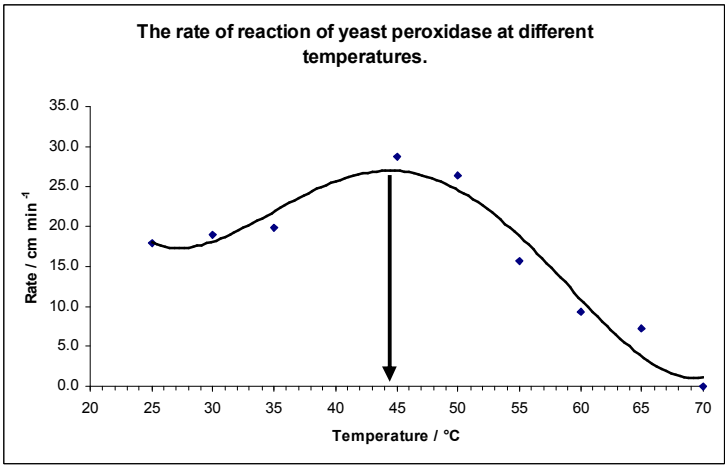
A series of lines will be presented. Select the one which looks the most appropriate and fits the data best. This may take a few trials.



In this example the trend line permits us to do two things:

- First we can see how well the points fit the line. The scatter of the points either side of the line shows how much variation there is in the data. This is a measure of the uncertainty.

- Second we can use the curve to estimate the optimum temperature of this enzyme. The fact that one of points (40°C) had to be excluded as an outlier will mean this estimate is less sure as it is near a critical part of the curve.



Some graphs do not permit a trend line to be drawn in Excel, the points do not fit one of the program's equations. Here it is necessary to draw a line by hand using the **Draw** tool bar after the graph has been cut and pasted into MSWord.