

# REGRESSION CURVES AND GEOGEBRA

We use two examples to illustrate how GeoGebra is used to calculate regression lines/curves. The first example demonstrates linear regression. The second is a model that fit well with both polynom- and exponential regression.

## Regression line using the Best Fit Line tool

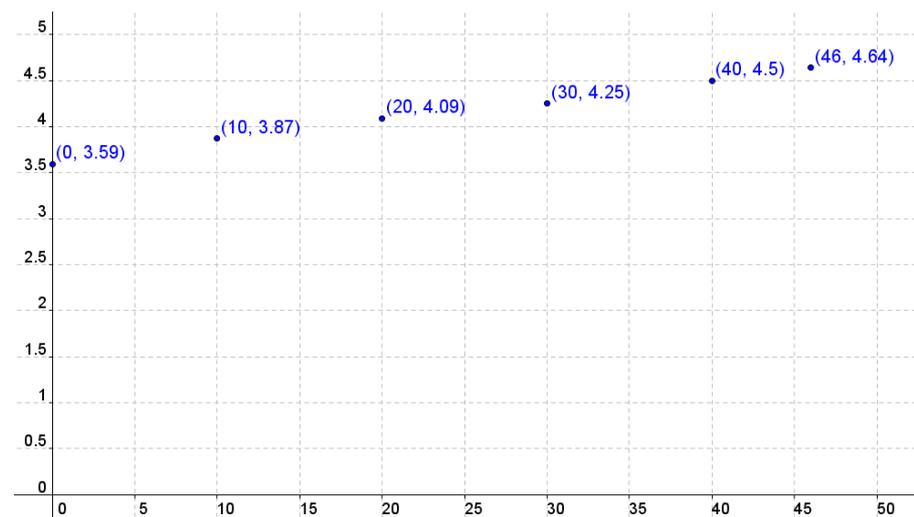
The table below shows how the population in Norway has evolved in the period 1960 – 2006. (Heir et al. 2007)

Year	1960	1970	1980	1990	2000	2006
Population in millions	3,59	3,87	4,09	4,25	4,45	4,64

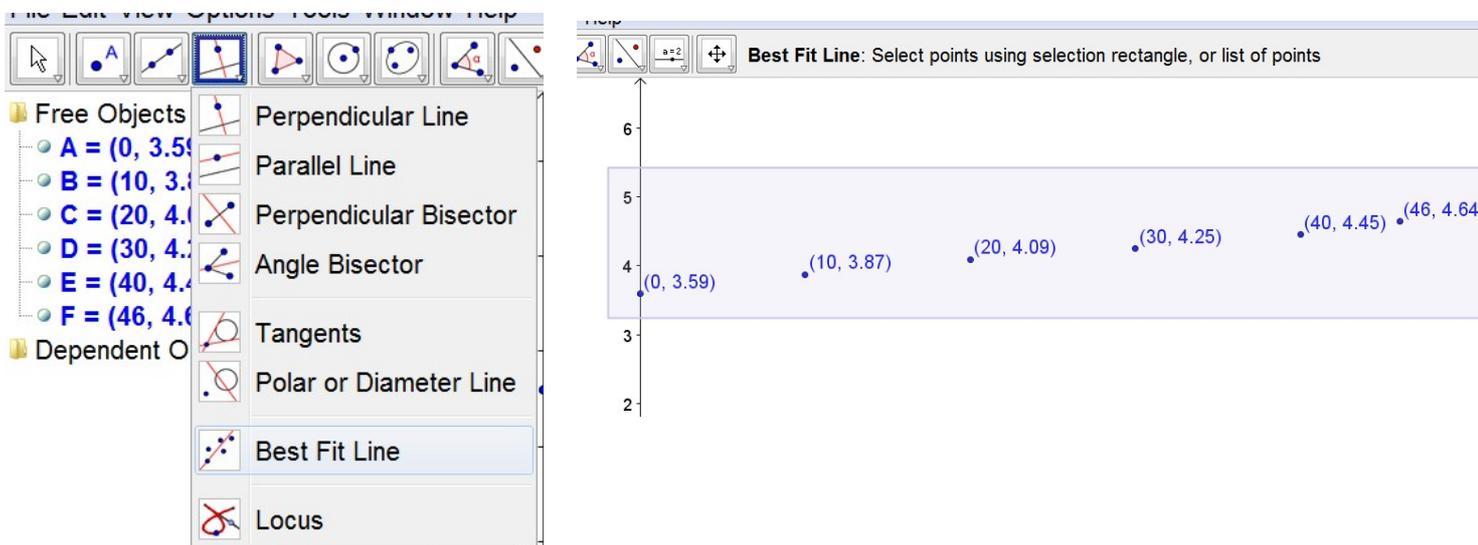
We set the axes so that they match the numbers in the table, and writes the points in the input bar. (1960 equals  $x = 0$ )



This is how the Graphic View appears when all the points are made. (The Object Properties of the points are set to show coordinates).



To find the line that best fits these points, select the tool Best Fit Line, and draw a rectangle containing all points. Alternatively you can click on the function in the algebra view.



## Regression lines and curves

The above method works only for linear models. If we use the spreadsheet in GeoGebra we can do far more regressions. In the next example we use data from the following table, (Heir, 2007). The sample data gives us the temperature in a bun  $t$  minutes after it is taken out of the oven.

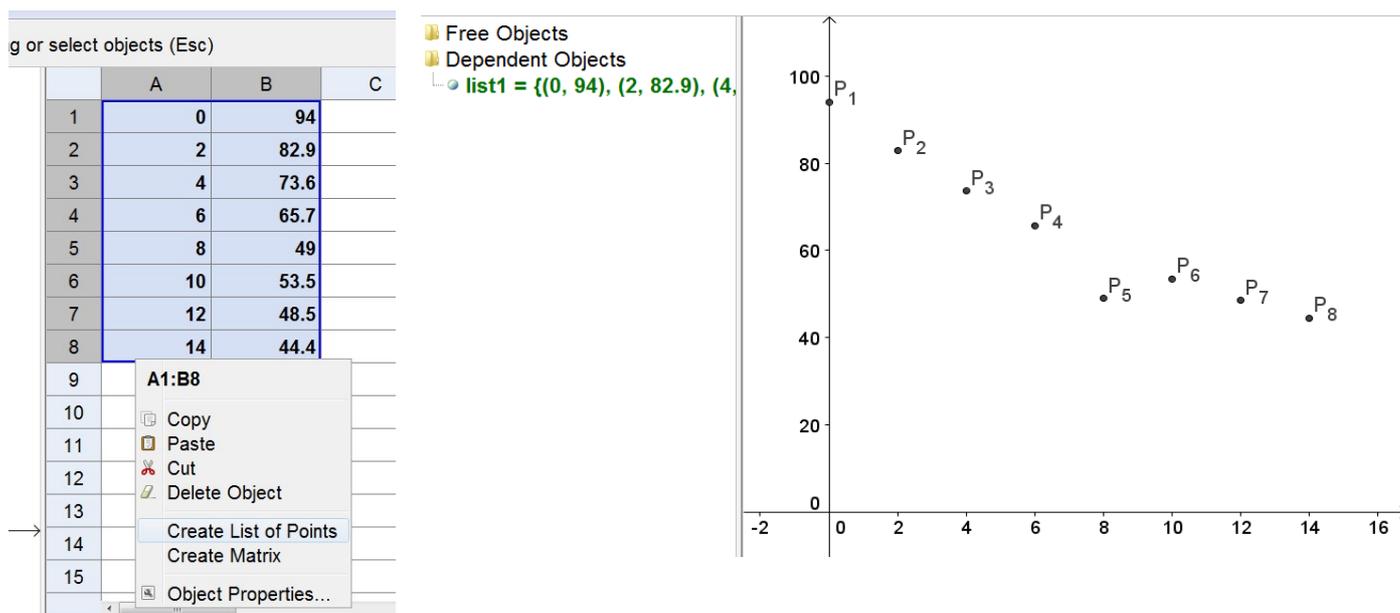
Time $t$ (minutes)	0	2	4	6	8	10	12	14
Temperature $T$ (°C)	94	82,9	73,6	65,7	49,0	53,3	48,5	44,4

Select the spreadsheet. In column A we write the time ( $t$ -values), and in column B the temperature ( $T$  values). Note that we use a dot instead of comma in decimals.

	A	B	C
1	0	94	
2	2	82.9	
3	4	73.6	
4	6	65.7	
5	8	49	
6	10	53.5	
7	12	48.5	
8	14	44.4	
9			

Now we have to make a list of these points. GeoGebra perform regression (create a mathematical model) based on this list. The points will also appear in the graphics view. Do the following:

1. Mark all the values in column A and B.
2. Right click and select "teams list of points."
3. Drag the axes so that the points are shown.
4. Use the regression command on the list (next section).



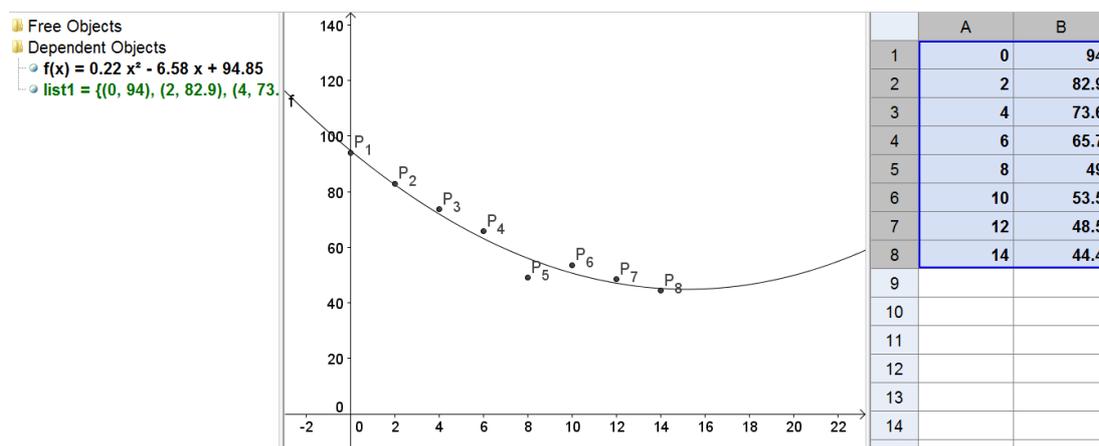
## Carry out the regression

In the input bar we write the command of the desired type of regression. Here the different regressions are listed :

Type of function	Command
Linear	Fitline[list of points]
Polynomial	FitPoly[list of points, Degree n of polynomial]
Exponential	FitExp[list of points]
Power	FitPow[list of points]
Logarithmic	FitLog[list of points]
Logistic	FitLogistic[list of points]
Sine	FitSin[list of points]

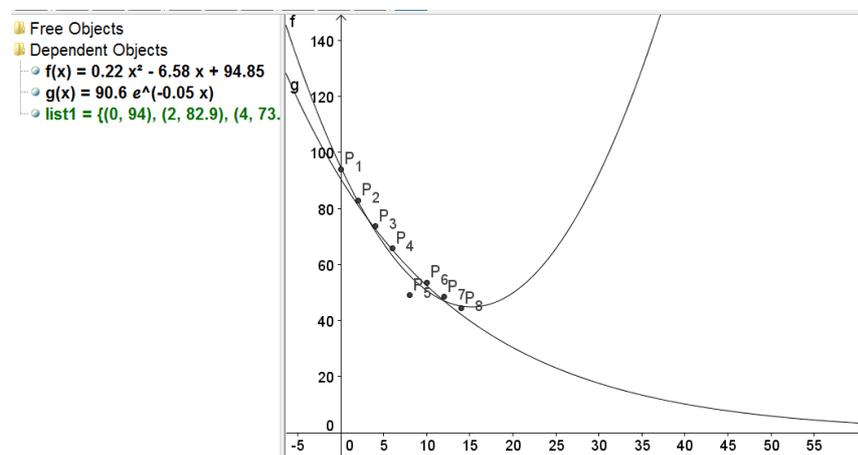
## Example – Quadratic regression

Type FitPoly[list1,2] in the input bar. The graph is shown in the graphic view, and the polynomial in the algebra view.



## Example – Eksponential regression curve

Type FitExp[list1] in the input bar. We now see a exponential curve in the graphic view, and the expression in the algebraic view. (Notice that the quadratic funtion is not removed).



**Comment on the result:**

Which function is most suitable? Both fit well, but the quadratic function show that the temperature of the buns will begin to rise again after about 15 minutes ...

**Challenge:**

It is not likely that the temperature will drop down to zero if the buns are placed in the kitchen. How can we find a model that depict real life?

**References:**

Heir, E.B. (2007). *Matematikk 2P*. Oslo: Aschehoug



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