Data Table from an Equation

How do you create a data table from an equation
- to present and export the values
- to plot the data

We will look at these features in SigmaPlot

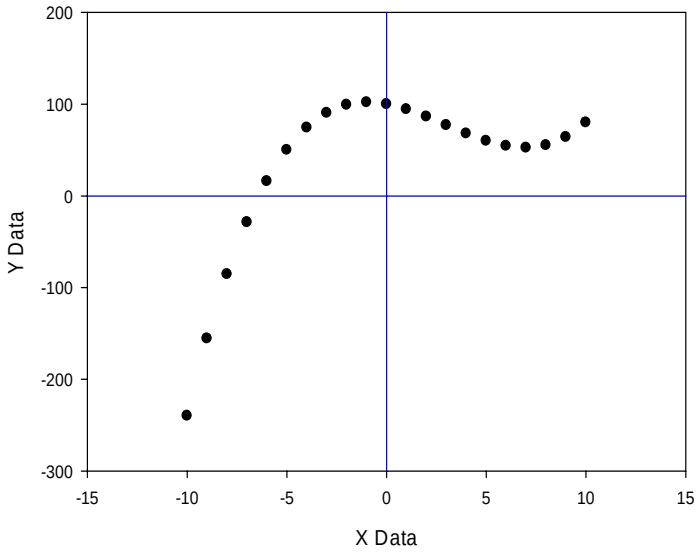
1. Linear Regression
2. Regression Wizard
3. Plot Equation
4. User-Defined Transforms

(1) and (2) generate an equidistant data table as a result of the Regression.
(3) and (4) generate a data table from user-defined coefficients.

In (3) you define the number of intervals for the table.
In (4) you define the stepsize for the X range, or even combine subranges with different spacings to the X range.

We will use this graph, created from the equation

```
y = 100 + (-4) * x + (-1,8) * x^2 + 0,2 * x^3
```



1. Linear Regression

Linear Regression in SigmaPlot actually is “Polynomial Regression”, with up to 10th order equations.

With a data set from this equation – we will show how to create this in (3) and (4) - select the plot in the graph (click on any of the symbols). In the Analysis ribbon, select Graph Analysis > Linear Regression.

In the Linear Regression dialog > Regression Line tab, select “All data in plot”, and “Line > Order”: 3. The curve will be added to the graph.

In the Results tab, you find the parameters:

```
Coefficients:
b[0]   100
b[1]    -4
b[2]    -1,8
b[3]     0,2
r ²      1
```

and a data table with equidistant x values (determined from the x data range):

```
Function values:
     x     f(x)
   -10     -240
    -9,6   -204,4352
    -9,2   -171,2896
    -8,8   -140,4864
    -8,4   -111,9488
   ...
     8       55,2
     8,4     57,9328
     8,8     61,7024
     9,2     66,5856
     9,6     72,6592
    10       80
```

You can copy Coefficients and Function values from this dialog.

2. Regression Wizard

The Regression Wizard uses a built-in equation library of about 100 equations, grouped in categories “Polynomial”, “Peak”, “Sigmoidal” etc.

Select the plot in the graph (click on any of the symbols). This tells the Regression Wizard in advance which data to use. In the Analysis ribbon, select Nonlinear Regression > Regression Wizard.

In the Regression Wizard > Equation dialog, select Category Polynomial, and Equation Name Cubic > Next. In the Variables dialog, you see the equation, and the selected variables. “Next” runs the fit. > Next.

In the Numeric Output dialog > Results, leave the checkbox “Predicted:First Empty” SET. This will write the fitted Y values (for the source X range) into the next free column. > Next.

In the Graph Options dialog, leave the “Add curve to...” checkbox set. This will add the fitted line to your raw data graph. > Next.

The Graph Data dialog: “x column: First empty” and “y column: First empty” shows that it will create an XY table for the fitted equation. By clicking in the worksheet’s column headings you can change the assignment.

This is similar to the Linear Regression (1) table, but with a much finer spacing:

x column	y column
-20,0000000000000000	-2140,0000000000000000
-19,4531250000000000	-1975,6569862365720000
-18,9062500000000000	-1819,3721008300780000
-18,3593750000000000	-1670,9490776062010000
-17,8125000000000000	-1530,1916503906250000
-17,2656250000000000	-1396,9035530090330000
-16,7187500000000000	-1270,8885192871090000
-16,1718750000000000	-1151,9502830505370000
-15,6250000000000000	-1039,8925781250000000
-15,0781250000000000	-934,5191383361816000
-14,5312500000000000	-835,6336975097656000
-13,9843750000000000	-743,0399894714355000
-13,4375000000000000	-656,5417480468750000
-12,8906250000000000	-575,9427070617676000
-12,3437500000000000	-501,0466003417969000
-11,7968750000000000	-431,6571617126465000
-11,2500000000000000	-367,5781250100000000
-10,7031250000000000	-308,6132240295410000
-10,1562500000000000	-254,5661926269531000
-9,6093750000000000	-205,2407646179199000
-9,0625000000000000	-160,4406738281250000
-8,5156250000000000	-119,9696540832520000
-7,9687500000000000	-83,6314392089843700
-7,4218750000000000	-51,2297630310058600
-6,8750000000000000	-22,5683593750000000
-6,3281250000000000	2,5490379333496090
...	

3. Plot Equation

Plot Equation creates a data table and graph, based on
- an equation
- coefficient values
- an independent variable(s) table

It uses the same equation library like the Regression Wizard (by default: Standard.jfl in you local SigmaPlot user directory), with the same equation categories and equations.

In the Analysis ribbon, select Graph Analysis > Plot Equation.

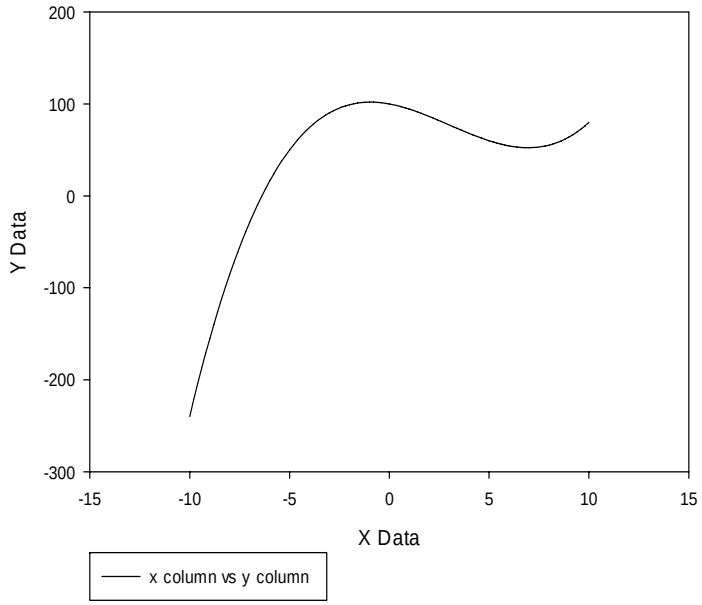
In the Plot Equation dialog > Library tab, select Category: Polynomial, Equation name: Cubic, and click on **Select.** The dialog title now shows **"**Plot Equation – Cubic".

In the Equation tab, select an x range which you want to be generated and plotted:
Minimum: -10
Maximum: 10
Intervals: 100

In the Options tab, edit in the Parameters window:
```
y0=100
a=-4
b=-1,8
c=0,2
```
and click on "Plot".

SigmaPlot has created a data table with the requested X Minimum, Maximum, and Intervals, and created a graph from these data.

x column	x column
-10,0000000000000000	-240,0000000000000000
-9,8000000000000010	-221,9104000000001000
-9,6000000000000000	-204,4352000000000000
-9,4000000000000000	-187,5648000000000000
-9,1999999999999990	-171,2896000000000000
-9,0000000000000000	-155,6000000000000000
-8,8000000000000010	-140,4864000000001000
-8,6000000000000000	-125,9392000000000000
-8,4000000000000000	-111,9488000000000000
-8,1999999999999990	-98,5055999999999600
-8,0000000000000000	-85,6000000000000100
-7,8000000000000000	-73,2224000000000100
-7,6000000000000000	-61,3631999999999900
...	


200
100
0
-100
-200
-300
Y Data
-15
-10
-5
0
5
10
15
X Data
x column vs y column

4. User-Defined Transforms

You can use SigmaPlot's User-Defined Transforms to generate an X data range, and calculate the Y values for this range.

The User-Defined Transforms use the same syntax like the Regression Wizard and Plot Equation. You can copy the equation from one of these equation windows, and paste it into the Transform Edit Window (use Ctrl-V).

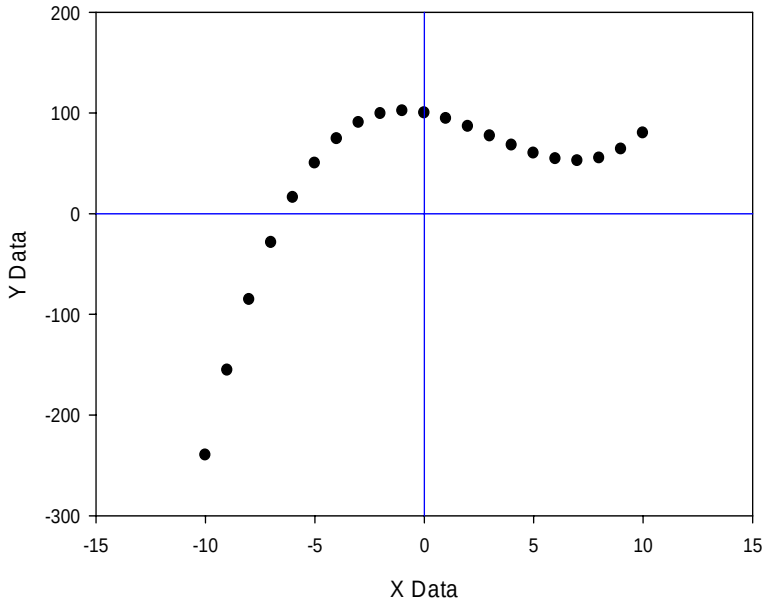
Here is a transform which will generate a data table for our cubic equation.

```
'create_datatable.xfm

xresultcol = 1
yresultcol = 2

'y = y0+a*x+b*x^2+c*x^3
y0 = 100
a = -4
b = -1,8
c = 0,2

x = data(-10; 10)
y = y0+a*x+b*x^2+c*x^3

put x into col(xresultcol)
put y into  col(yresultcol)

cell(1;0) = "X"     'column titles
cell(2;0) = "Y"
```

Create a new data worksheet, select User-Defined... from the Analysis ribbon > Transform section.
Copy the transform rows above, and paste them in with Ctrl-V. Click on Run.
It generates this data table:

X	Y
-10,0000	-240,0000
-9,0000	-155,6000
-8,0000	-85,6000
-7,0000	-28,8000
-6,0000	16,0000
-5,0000	50,0000
-4,0000	74,4000
-3,0000	90,4000
-2,0000	99,2000
-1,0000	102,0000
0,0000	100,0000
1,0000	94,4000
2,0000	86,4000
3,0000	77,2000
4,0000	68,0000
5,0000	60,0000
6,0000	54,4000
7,0000	52,4000
8,0000	55,2000
9,0000	64,0000
10,0000	80,0000

Now create a Scatterplot > XY Pair from these two columns.



P.S.:
The blue “axis” lines have been created by adding scatterplots (Graph Page ribbon > Add Plot...) from empty columns, and then in the Graph Properties setting Reference Lines > (any of the 5 lines) > Calc: “k Constant” = 0, and Appearance > Color: Blue.

P.S. 2:
For explicit spacing of the X range, use the “step” parameter of the data function:
`data(start; stop; step)`

`data(-10; 10; 0,5)` will generate the range `-10; -9,5; -9; ...; 8,5; 9; 9,5; 10`

To combine ranges, please see the notes on the “curly bracket notation” {...} in the Transform Help > User-Defined Transforms > Transform Syntax > Scalars and Ranges.