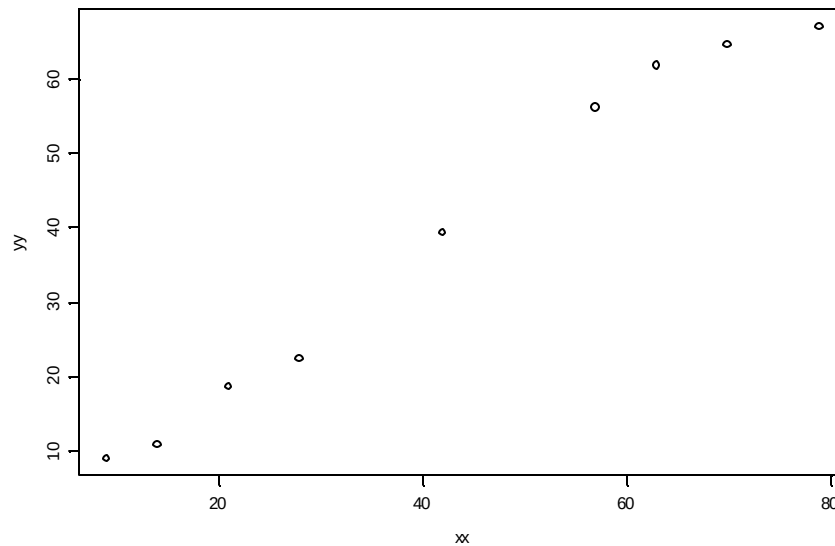


Plot of Original Data: fr Huet and Ratkowsky



```
data one;
  do x=9,14,21,28,42,57,63,70,79;
    input y @@; y=y/100; output;
  end; datalines;
893 1080 1859 2233 3935 5611 6173 6462 6708
;
data two;
  set one;
  ny=log(-log((70-y)/65)); nx=log(x);
proc reg data=two;
  model ny=nx;
run;
```

The REG Procedure
Model: MODEL1
Dependent Variable: ny

Number of Observations Read 9
Number of Observations Used 9

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	16.87291	16.87291	550.90	<.0001
Error	7	0.21439	0.03063		
Corrected Total	8	17.08730			

Root MSE	0.17501	R-Square	0.9875
Dependent Mean	-0.53872	Adj R-Sq	0.9857
Coeff Var	-32.48571		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	1	-7.18999	0.28932	-24.85	<.0001
nx	1	1.88511	0.08032	23.47	<.0001

```

proc nlin data=one;
  parms th1=70 th2=65 th3=-7 th4=2;
  model y=th1-th2*exp(-exp(th3)*(x**th4));
  output out=three r=resids p=preds;
run;

```

The NLIN Procedure
 Dependent Variable y
 Method: Gauss-Newton

Iterative Phase

Iter	th1	th2	th3	th4	Sum of Squares
0	70.0000	65.0000	-7.0000	2.0000	832.1
1	68.9082	64.3067	-6.1978	1.5712	276.5
2	63.5647	52.7166	-9.3162	2.4354	85.3555
3	69.8974	61.6943	-9.0989	2.3440	9.7022
4	69.9211	61.6539	-9.2072	2.3777	8.3768
5	69.9575	61.6846	-9.2082	2.3776	8.3759
6	69.9552	61.6815	-9.2089	2.3778	8.3759
7	69.9552	61.6815	-9.2089	2.3778	8.3759

NOTE: Convergence criterion met.

Estimation Summary

Method	Gauss-Newton
Iterations	7
R	2.818E-6
PPC(th4)	5.807E-7
RPC(th3)	4.275E-6
Object	1.17E-9
Objective	8.375884
Observations Read	9
Observations Used	9
Observations Missing	0

Source	DF	Sum of Squares	Mean Square	F Value	Approx Pr > F
Model	3	4639.7	1546.6	923.22	<.0001
Error	5	8.3759	1.6752		
Corrected Total	8	4648.1			

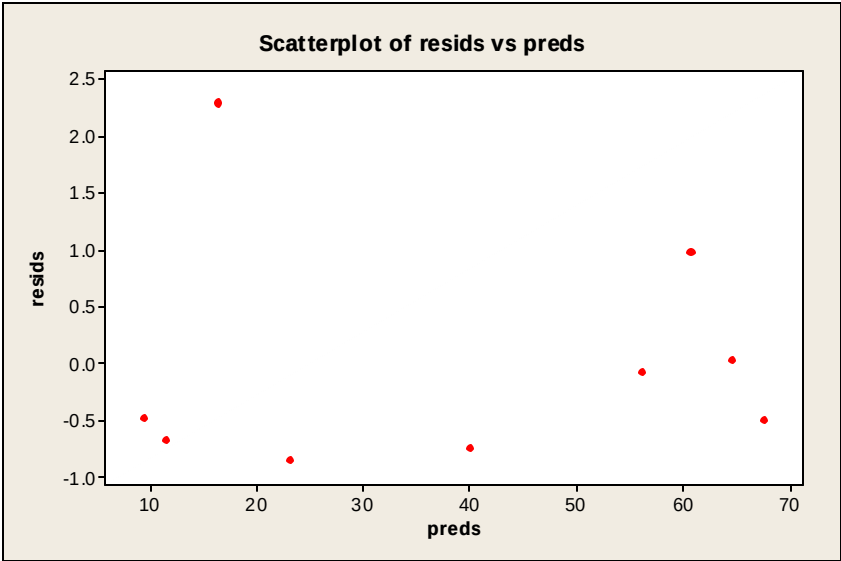
Parameter	Estimate	Approx Std Error	Approximate 95% Confidence Limits
th1	69.9552	2.3620	63.8835 76.0269
th2	61.6815	3.1927	53.4744 69.8885
th3	-9.2089	0.8173	-11.3098 -7.1080
th4	2.3778	0.2210	1.8098 2.9459

Approximate Correlation Matrix

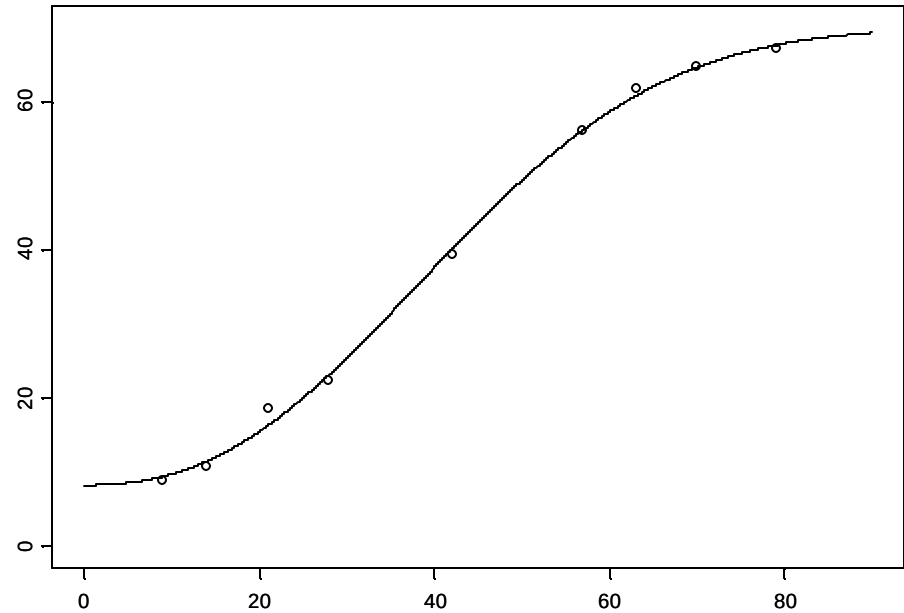
	th1	th2	th3	th4
th1	1.0000000	0.9251613	0.7095438	-0.7658736
th2	0.9251613	1.0000000	0.8615146	-0.8906628
th3	0.7095438	0.8615146	1.0000000	-0.9955752
th4	-0.7658736	-0.8906628	-0.9955752	1.0000000

```
proc print noobs; run;
```

	x	y	preds	resids
	9	8.93	9.4107	-0.48069
	14	10.80	11.4693	-0.66931
	21	18.59	16.3057	2.28432
	28	22.33	23.1737	-0.84374
	42	39.35	40.0846	-0.73458
	57	56.11	56.1766	-0.06655
	63	61.73	60.7442	0.98581
	70	64.62	64.5949	0.02506
	79	67.08	67.5803	-0.50032



Plot of Original Data and Fitted Nonlinear Curve



```

proc nlin data=one;
  parms th1=70 th2=55 th3=-12; th4=3;
  model y=th1-th2*exp(-exp(th3)*(x**th4));
run;

```

The NLIN Procedure
 Dependent Variable y
 Method: Gauss-Newton

Iterative Phase

Iter	th1	th2	th3	Sum of Squares
0	70.0000	55.0000	-12.0000	112.9
1	64.8344	53.7243	-11.5162	28.9029
2	66.7202	56.0710	-11.5451	19.2408
3	66.7573	56.0959	-11.5467	19.2384
4	66.7590	56.0969	-11.5469	19.2384
5	66.7592	56.0969	-11.5469	19.2384

NOTE: Convergence criterion met.

Estimation Summary

Method	Gauss-Newton
Iterations	5
R	5.278E-6
PPC(th1)	2.177E-7
RPC(th1)	2.359E-6
Object	3.566E-9
Objective	19.23839
Observations Read	9
Observations Used	9
Observations Missing	0

Source	DF	Sum of Squares	Mean Square	F Value	Approx Pr > F
Model	2	4628.8	2314.4	721.81	<.0001
Error	6	19.2384	3.2064		
Corrected Total	8	4648.1			

Parameter	Estimate	Approx Std Error	Approximate 95% Confidence Limits
th1	66.7592	1.4695	63.1633 70.3550
th2	56.0969	1.6005	52.1806 60.0133
th3	-11.5469	0.0999	-11.7912 -11.3026

Approximate Correlation Matrix

	th1	th2	th3
th1	1.0000000	0.7565905	-0.7648290
th2	0.7565905	1.0000000	-0.3861020
th3	-0.7648290	-0.3861020	1.0000000