

Mathematical Modelling.

This resource was written by Derek Smith with the support of CASIO New Zealand. It may be freely distributed but remains the intellectual property of the author and CASIO.

Select STAT mode from the main menu by using the arrow keys to highlight the STAT icon or pressing 2.



Example: The following measurements were found and there is thought that there is a relationship of the form $y = ae^{bx}$

X	1.4	2.6	3.7	4.9	7.8
Y	3.5	5.7	8.8	14.2	45.3

Find the equation of the relationship.

Answer: Enter the data into List 1 (X) and list 2 (Y), as shown here.

Mathematical theory: $y = ae^{bx}$
 $\ln y = \ln (ae^{bx})$
 $\ln y = \ln (a) + \ln (e^{bx})$
 $\ln y = \ln (a) + bx \ln (e)$
 $\ln y = \ln (a) + bx$

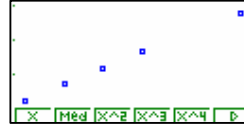
which is 'like' a straight line equation $y = mx + c$

Move the 'cursor' so that it is placed on top of List 3, press **ln**, then **OPTN** then **F1** (for LIST) and **F1** again for list, then **2**, as shown below, then **EXE**. This will place the natural logarithm values of Y into the List 3 column.

EXIT twice to get this 'window'

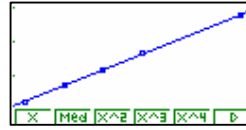
Press **F1** for **GRPH**, then **F6** for **SET** to set up the calculator for a Scattergraph,

then **EXIT** and **F1** for the graph.



To find the linear model, press **F1** and record the values of a and b shown, then **F6** to see the log - linear relationship

```
LinearReg
a =0.39959464
b =0.6965598
r =0.99999519
r²=0.99999037
y=ax+b
COPY DRAW
```



Relating this back to the theory: $\ln y = \ln(a) + bx$

$\ln(a) = 0.6965598$, so $a = 2.006836898$ and $b = 0.39959464$

Hence the required equation is:

$$y = 2.007e^{0.399x} \text{ (3dp accuracy)}$$

X	1.4	2.6	3.7	4.9	7.8
Y	3.5	5.7	8.8	14.2	45.3
Modelled Y values	See List 4 results				

List 1	List 2	List 3	List 4
1	1.4	3.5	1.2527
2	2.6	5.7	1.7404
3	3.7	8.8	2.1747
4	4.9	14.2	2.6532
5	7.8	45.3	4.5307
			3.511606292