Eg. 8 A population of bacteria is known to follow a growth pattern governed by the equation $N = N_0 e^{kt}$ $; t \geq 0$. It is observed that at t = 3 hours, there are 100 colonies of bacteria and that at t = 10 hours there are 10 000 colonies.

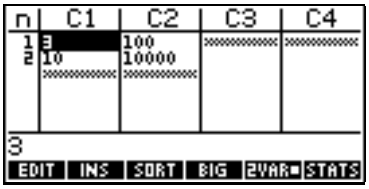
(i) Find the values of N_0 and of *k*.

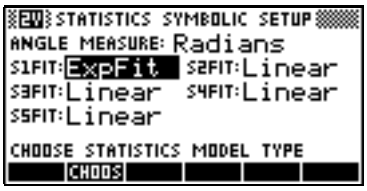
(ii) Predict the number of bacteria colonies after 15 hours.

(iii) How long does it take for the number of colonies to double?

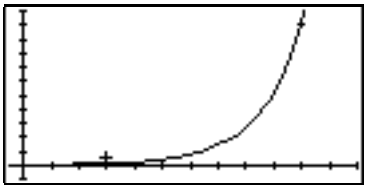
(i) Find N_0 and *k*.

Step 1. Start up the Statistics aplet, set it to **2VAR** and enter the data given. Change to the **SYMB SETUP** view and specify an *Exponential* line of best fit for the data.

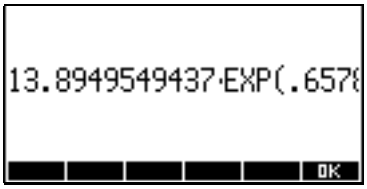




Step 2. Change to the **PLOT SETUP** view and adjust it so that it will display the data. (This is not really needed, since the line of best fit is what we need and it will be calculated even if the data doesn't show.) `YTick` is set to `1000` incidentally.
Now change to the **PLOT** view and press **FIT** (if not already set). Wait while the line draws.

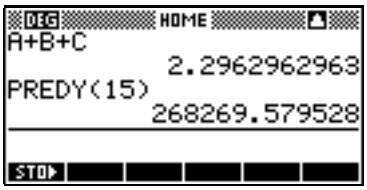


Step 3. Change to the **SYMB** view, move the highlight to the equation of the regression line and press **SHOW**. Rounded to 4 dec. places, this gives an equation of:



$$N = 13 \cdot 8950 e^{0 \cdot 6579 t}$$

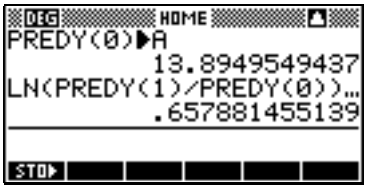
(ii) Predict N for t = 15 hours.



Step 1. Change to the **HOME** view and use the PREDY function.

Result: 268 269 colonies.

(iii) Find t so that $N = \frac{1}{2} N_0$.



Step 1. Store N_0 into memory A and k into K, so that I don't have to re-type them.
See page 106 for instructions on finding the parameters.

Step 2. Switch to the Solve aplet and enter the equation to be solved. Changing into the **NUM** view, you should find the values of A and K already defined, so move the highlight to T and press **SOLVE**.

Result: Doubling time is 1.0536 hours.