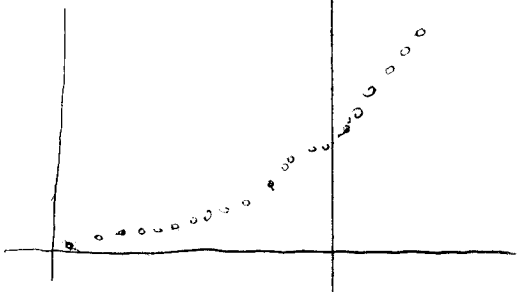
Modelling p 403-405 1,2,3,5,6

1a. Make a scatter plot



Enter the data into L1, L2 using STAT → Edit...
Goto STATPLOT (2nd Y=) and select Plot1 Turn On the plot
Be sure scatterplot is selected and XList = L1 and YList = L2.

b. Use ExpReg to find an exponential model for the data.
ExpReg should give a result
$y = a*b^x$
$a = 4.0418 E-16$
$b = 1.0210$
This means that $y = (4.0418 \times 10^{-16})(1.0210)^x$ is the best exponential curve that fits the data.

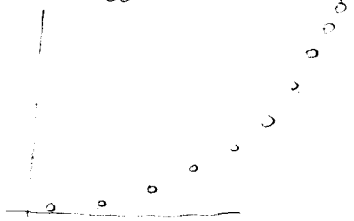
To get ExpReg:
STAT → CALC → ExpReg

c) Use the function from b to predict the 2000 population
You can save yourself the trouble of copying the digits from a and b by using VARS → Statistics → EQ → RegEQ.
This RegEQ writes out the equation. Try using it in conjunction with Y=.
Evaluate the function at X=2000, either in the calculation screen, or by TRACE on the graph.
You should get 457.9.

d) Evaluate the function at X=1962
You should get 221.2.

e) The prediction for 2000 looks too high for the given data, whereas the prediction for 1965 is too low. An exponential fit might not be appropriate.

2. a) Make a scatterplot

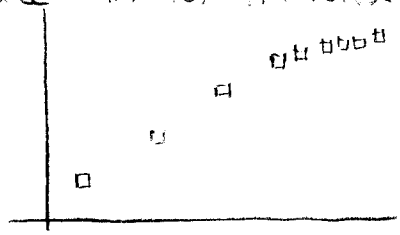


b) Find a power model.
For this use PwrReg which is just below ExpReg
You should get
$y = a * x^b$
$a = 4.962$
$b = 2.003$
This means the equation $y = 4.962 x^{2.003}$ is the best power curve to fit the data.

c) Evaluate the function in b at $X = 3.0$.
You can use RegEQ again if you want.
You should get about 44.792

3. a) Yes, the scatter plot suggests an exponential model.
b) Enter the data, but use ln for the values in L_2.

L_1	L_2
1960	ln(27.1)
1970	ln(74.3)
1980	ln(251.1)
⋮	⋮



c) Use LinReg (ax+b), in the same menu as ExpReg.
$y = ax + b$
$a = 0.1077$
$b = -207.773$
$y = 0.1077x - 207.773$

Modelling cont'd.

3 cont'd

d) Find an exponential model for heath-care expenditures, using part b.

I think they meen part c, first of all.

The y for the model in part c actually represent $\ln E$, where E is the expenditure. Thus the model in (c) could be written

$$\ln E = 0.1077x - 207.773$$

We can solve this equation for E.

$$E = e^{0.1077x - 207.773}$$

That is what we want.

e). Use the model in part d) to predict expenditures in 1996.

$$E = e^{0.1077 \cdot 1996 - 207.773} \approx 1310.9$$ (yours could vary if you rounded)

5. Enter the data into the calculator

a) Use Exp Reg

When I tried this, I got an overflow error. To avoid this I only used the last two digits of the year. So I used the chart

Year	Lead
70	199.1
75	143.8
80	68.0
85	18.3
⋮	⋮

So I got the model $y = 33282981 \cdot 0.8197^x$

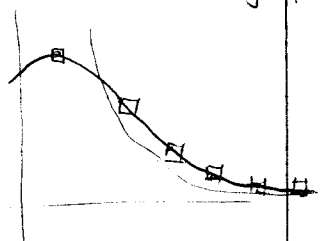
Use Reg EQ to put this in Y_1

b) I again used the adjusted value for the year to avoid overflow. You need to use Quart Reg to get a fourth degree polynomial.

I got $y = -0.0024x^4 + 0.816x^3 - 101.85x^2 + 5599.32x - 11410.07$

Use Reg EQ to put this in Y_2.

c) You should graph Y_1, Y_2 against the data points



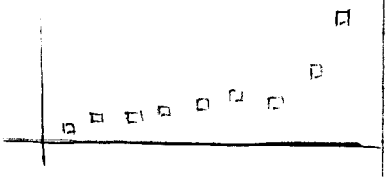
The polynomial is a better fit.

d) Find Y_2 at $X = 72$ and $X = 82$.

$Y_2(72) = 183.97$

$Y_2(82) = 43.52$

6. Enter the data into the calculator and make a scatterplot.



Try different models until one looks good.
Use *** Reg, then Reg EQ to graph each model and compare the curve to the plotted points.

I tried LinReg, QuadReg, CubicReg, QuartReg, ExpReg, and PwrReg

	Model	Good Fit?	
$ax+b$	Linear (LinReg)	Bad fit	← WORST FIT
ax^2+bx+c	Quadratic (QuadReg)	Better, but not good	
ax^3+bx^2+cx+d	Cubic (CubicReg)	Good fit	
$ax^4+bx^3+cx^2+dx+e$	Quartic (QuartReg)	Even better than Cubic	← BEST FIT
ab^x	Exponential (ExpReg)	Ok fit	
$a \cdot x^b$	Power (PwrReg)	Ok fit.	

Thus we see that the Quartic Regression is the best model.