

EXPONENTIAL REGRESSION EXPLORATION

We have already studied linear regressions and by this time, you should have already completed your work with quadratic regressions. In this investigation, we will be exploring Exponential Regressions. We will again make use of the TI-83 Plus as well as the Excel Workbook (REGRESSION CALCULATOR & GRAPHER) to give you experience using multiple resources in performing such calculations.

PART 1: USING THE TI-83 PLUS

Since we have already done linear and quadratic regressions, there is not much of a change to that procedure compared to the one we will use here.

BEFORE YOU PROCEED MAKE SURE YOU HAVE DIAGNOSTICS TURNED ON.

1. Enter the data below into your TI-83 Plus.

[As a reminder, the key sequence is $\boxed{\text{STAT}}$ → EDIT → 1:Edit → *type in your data.*]

TABLE 1:

x	y
0	1.5
0.5	3
1	6
1.5	12
2	24
2.5	48
3	96
3.5	192
4	384
4.5	768
5	1536

2. Create a scatterplot of the data on your calculator. [$\boxed{2\text{nd}}$ → $\boxed{\text{Y=}}$ to access STAT PLOT menu] Make sure that you set your graph window so that all 11 points can be seen.

3. Find the exponential regression equation that best fits your data.

$\boxed{\text{STAT}}$ \rightarrow CALC \rightarrow 0:ExpReg].

ExpReg works in the same manner that LinReg and QuadReg did. Make sure that if your data is not in L_1 and L_2 then you have to follow the command with the column headings separated by a comma.

Based on the calculator's output, what is the equation for the exponential function that best fits this data?

4. Graph the exponential regression function to see how well it fits the scatterplot.

This can be done 2 ways:

- (1) If your regression equation has little or no decimal places, then press $\boxed{Y=}$, type in the equation and then press $\boxed{\text{GRAPH}}$.
- (2) For more complicated regression equations follow the following key sequence/menu choices.

$\boxed{Y=}$ \rightarrow $\boxed{\text{VARS}}$ \rightarrow 5:Statistics \rightarrow EQ \rightarrow 1:RegEQ \rightarrow $\boxed{\text{ENTER}}$

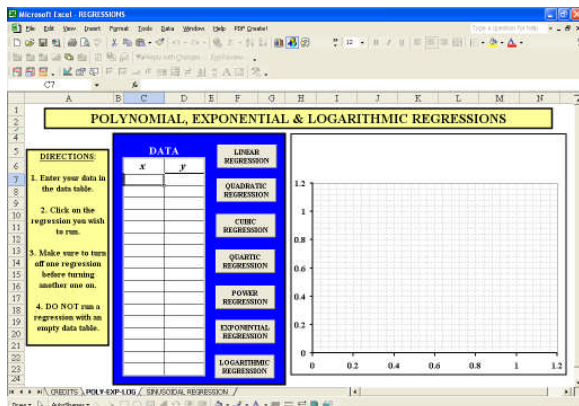
This will put the regression equation in the Y= window. Then graph as usual.

How well does the regression function fit the scatterplot?

PART 2: USING EXCEL

For this section we will be using an Excel workbook that I have set up for you entitled REGRESSION CALCULATOR & GRAPHER. This is the file REGRESSIONS found in the EXCEL-WKSHT folder. [See the DOWNLOADING EXCEL-WKSHT document for instructions in obtaining this file.]

Open the file and select the tab "POLY-EXP-LOG" your computer screen should look like the one on the next page.



As you can see, there is a table for entering in the data and a view of a graph. Along with that, there are several selectable buttons with many of the same regressions that are available on the TI-83 Plus.

1. Enter the data from Table 1 into the Excel Worksheet. You will notice that as you enter in each ordered pair, the data is plotted on the graph automatically. Also, the graph window adjusts to fit in the data. So when you complete entering in your data, the scatterplot is completed as well.
2. Now to perform the quadratic regression, now that your data table is complete, is quite easy. Just click on “EXPONENTIAL REGRESSION.” The graph and equation of the regression function appears.

According to the Excel file, what is the equation of the exponential regression curve ?

What is the value of $e^{1.3863}$?

Based on the answers to the above questions, do the results of the Excel worksheet agree with those of the TI-83 Plus calculator?

PART 3: MAKING PREDICTIONS

As discussed in the several of the regression labs that you have done already, the reason we find regression formulas is to predict data that goes beyond the given data.

Using the results we obtained from Parts 1 & 2, solve the following. You may use algebra or the TI-83 Plus to aide you in solving these problems.

- (A) Find the value of y when x is 3.75.
- (B) Find the value(s) of x when y is 1000.

PROBLEMS:

Use the techniques that you learned in this exploration to answer the following problems.

1. John bought a 2002 Pontiac Sunfire for \$16,310 in July 2005. He set up a payment plan where he would make 60 monthly payments. After every payment, John goes online and finds the current value of his car. One year's worth of the data John collected is shown below.

DATE	PAYMENT #	CAR VALUE
August 1, 2006	13	\$13,061
September 1, 2006	14	\$12,840
October 1, 2006	15	\$12,623
November 1, 2006	16	\$12,409
December 1, 2006	17	\$12,199
January 1, 2007	18	\$11,992
February 1, 2007	19	\$11,789
March 1, 2007	20	\$11,589
April 1, 2007	21	\$11,393
May 1, 2007	22	\$11,200
June 1, 2007	23	\$11,010
July 1, 2007	24	\$10,823
August 1, 2007	25	\$10,640

- (A) Determine the exponential regression function that best fits this data. [Use payment # as x and the car value as y]
- (B) Using the function you found in part (A), find the value of the car when the payment # is 0. Does this match the value of the car when John bought it?
- (C) Based on your findings, what will the car's value be...
 - i. on June 1, 2008.
 - ii. when John makes his last payment.

2. A patient is admitted into the hospital with a bacterial infection. A sample of blood is drawn and the patient has a bacteria count of 80 bacteria/ μL . The patient is hospitalized and given intravenous medication. Blood is drawn every 4 hours to do additional bacteria counts. The data from the patient's chart is shown below.

PATIENT NAME: Joe Smith

ROOM # 206

DOCTOR: McNully

HOUR	BACTERIA LEVEL (bacteria/μL)
0	80
4	70
8	61
12	53
16	47
20	39
24	33

The patient is able to fight the infection on his own and be released when the bacteria falls below 5 bacteria/ μL for 3 consecutive readings. Based on the data, how long will the patient have to stay in the hospital?