Modeling Real Life Data Master E

Steps to Finding the Regression Model for your Statistical Data:

1. Turn on your calculator and go to 2^{nd} 0 (Catalog). Type x^{-1} to get to the letter D. Scroll down until you see Diagnostics ON and press enter to turn your diagnostics on. This will cause the correlation coefficient to show up on the home screen when you calculate a regression equation.

2. Once you have entered in your stats in L1 and L2, turn on your Scatter Plot and ZOOM 9 to see your model. You might have to extend the window to see what function best models your data.

3. Once you determine what function best models your picture, go to STAT → CALC → Specific Regression. You will have to pick the type of regression that best models your data. In many cases, more than one model could fit your data, but the best model can be determined by comparing the correlation coefficients.

   a. The correlation coefficient, r, measures the strength and direction of a linear relationship between two variables. A value of |r| near one may indicate a "good fit."

   b. The coefficient of determination, r^2, represents the percent of the data that is closest to the line of best fit. For example if r = 0.922, then r^2 = 0.850, which means that 85% of the total variation in y can be explained by the linear relationship between x and y (as described by the regression equation). The other 15% of the variation in y remains unexplained.

   c. Do not place too much importance on small differences between r^2 values, such as r^2 = 0.987 and r^2 = 0.984. Also, keep in mind that r, r^2 and R^2 values cannot be directly compared when calculating certain regression models

Practice Problems:

1. Below is the data relationship between time and public education expenditures (in billions) in the United States.

Time	1940	1950	1960	1970	1980	1990
Expenses	3.3	8.9	23.9	68.5	165.6	377.5

R = .999

R^2 = .998

Function that best models your data:

Exponential

Regression Equation *(round to the hundredth):*

$y = .0...7(1.10)^x$

7.00 x E81 means ☞ move the decimal over 81 times!

2. This data shows the relationship between the selling price(s) of a graphing calculator and the daily profit earned (P) from the sale of all calculators sold that day at that selling price.

s	50	55	60	65	70	75	80	85	90
P	15890	17540	18690	19340	19490	19140	18290	16940	15090

R = None

R^2 = 1

Function that best models your data:

Quadratic

Regression Equation *(round to the hundredth):*

$y = -10x^2 + 1380x - 28110$

3. Below is data showing the concentration of a particular drug in the body over time.

t	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
c	0.82	0.88	0.93	0.97	1.0	1.0	0.96	0.89	0.77	0.60	0.37

R = None

R^2 = .999 (cubic)
.978 (quad)
.999 (quart.

Function that best models your data:

Cubic = Best Model!
same value Quadratic
Quartic = Best Model

Regression Equation *(round to the hundredth):*

$y = -1.15x^3 + .11x^2 + .58x + .82$
$y = -1.61x^2 + 1.24x + .78$
$y = .12x^4 - 1.38x^3 + .26x^2 + .55x + .82$

4. This data shows the number of people enrolled in Medicare for the last few years (numbers rounded to the nearest 100).

t	1975	1980	1985	1990	1991	1992	1993
b	23,800	27,500	30,100	33,100	33,800	34,400	35,100

R = .999

R^2 = .998

Function that best models your data:

Linear

Regression Equation *(round to the hundredth):*

$y = 611.06x - 1182789.66$

5. The average monthly temperature in Savannah is given in the table below.

Month (m)	Jan. 1	Feb. 2	Mar. 3	Apr. 4	May 5	June 6	July 7	Aug. 8	Sept. 9	Oct. 10	Nov. 11	Dec. 12
Temperature (Fahrenheit)	48.9	51.8	59.2	66	73.5	79.1	81.8	81	76.6	67.3	59.1	51.7

R = None

R^2 = .964 (cubic)
.931 (quad)
.997 (quart

Function that best models your data:

Cubic
Quadratic
Quartic — Best Model!

Regression Equation *(round to the hundredth):*

$y = .07x^3 + .30x^2 + 6.95x + 39.28$
$y = -1.03x^2 + 14.13x + 29.98$
$y = .02x^4 - .69x^3 + 5.65x^2 - 10.0x + 54.2$

6. The human population of the earth has been steadily increasing as time passes. Below is the data showing the relationship between time and population (in billions).

t (year)	1000	1750	1800	1850	1900	1950	1994	2001	2004
P (Human Population)	0.2	0.8	1	1.2	1.7	2.8	5.4	6.2	6.4

R = .883

R^2 = .779

Quad: R^2 = .887
Cubic R^2 = .985

Function that best models your data:

Exponential - Not a good model!!
Quadratic
Cubic — Best Model!

Regression Equation *(round to the hundredth):*

$y = .01(1.00)^x$
$y = 2.31x^2 - .06x + 41.27$
$y = 1.47x^3 - 6.81x^2 + 1.02x - 484.35$