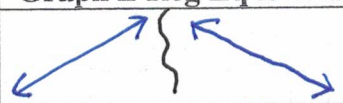
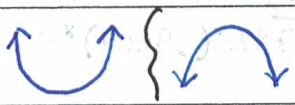
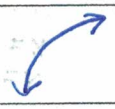
# 5.2 – Other Types of Regression

*IMPORTANT NOTE*: *Not all data is linear (most are not) so we will look at various types of data that produces different type of regression equations that BEST FITS the data set.*

– **regression equation** → a trend line that shows the relationship between two sets of data that can be used to make predictions shown in a scatter plot

- We will focus on different types of regression equations for various sets of data that are always LINEAR:

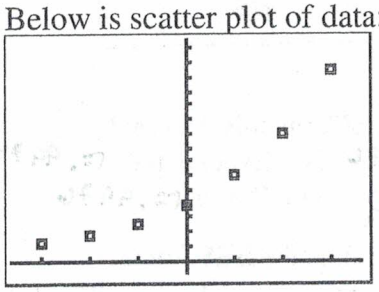
| Name of Reg Eq | Function for Reg Eq | Graph if Reg Eq is BEST FIT |
|---|---|---|
| Linear<br>STAT → CALC #4 | $y = ax + b$ |  |
| Quadratic<br>STAT → CALC #5:Quad | $y = ax^2 + bx + c$ |  |
| Logarithmic<br>STAT → CALC #9:LnReg | $y = a + b\ln(x)$ |  |
| Exponential<br>STAT → CALC #0:ExpReg | $y = a(b)^x$ |  |
| Power<br>STAT → CALC #A:PwrReg | $y = a(x)^b$ |  |

- Remember: Must put data in calculator in list 1 ( $L_1$ (x) ) and list 2 ( $L_2$ (y) ) and create a scatter plot
- Remember: After finding the regression equation → will also state the equation's correlation coefficient

  The closer "r" is to $-1$ or $1$, then the **stronger the correlation** (points will cluster together)

**Example 1: Complete each problem.**

a.) Below is scatter plot of data:



Which type of equation BEST represents this set of data?

A.) Quadratic
B.) Linear
C.) Exponential
D.) Logarithmic

b.) Below is a table of data:

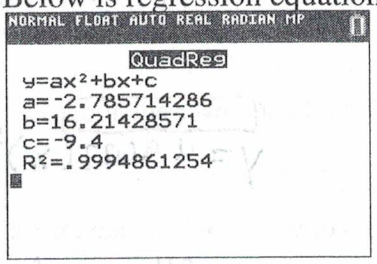
| L1 | L2 | L3 1 |
|---|---|---|
| 1 | 2 | ------ |
| 2 | 2.3784 | |
| 3 | 2.6321 | |
| 4 | 2.8284 | |
| 5 | 2.9907 | |
| | ------ | |

L1(6)=

Which regression equation BEST represents this set of data?

A.) $y = 1.89(1.103)^x$ r = .9733 (Exp)
B.) $y = -0.034x^2 + 0.453x + 1.592$ r = .9993 (Quad)
C.) $y = 0.63x + 0.71$ r = .9851 (Linear)
D.) $y = 2(x)^{0.25}$ r = .9999 (Power)

c.) Below is regression equation:




a.) If x = 24, then what is y?
A.) – 799.4 B.) – 1225
B.) – 2343 D.) – 216

b.) If y = 9, then what is x?
A.) 4.3 B.) – 1.5
C.) 3.5 D.) 4.6

* must find all the "r" values for each type of regression listed and then compare the "r" values.

**Example 2: Complete each problem about various types of regression.** Round to nearest ten-thousandths.

a.) A student is trying to determine the half-life of a radioactive iodine-131. He measures the amount of iodine-131 in a sample solution every 8 hours. Below is his data:

| Time (h) | Amount (g) |
|---|---|
| 0 | 4.80 |
| 8 | 4.66 |
| 16 | 4.51 |
| 24 | 4.39 |
| 32 | 4.29 |
| 40 | 4.14 |
| 48 | 4.04 |

a.) Write an exponential model that fits this data set:

$y = 4.7925(.9964)^x$

b.) How much is left of iodine-131 after 55 hours?

about 3.9302g  X = 55, Y =

c.) What is the half-life of the substance iodine-131?

about 191.8 hrs  X =, Y = 2.4

4.8 ÷ 2 = 2.4g

b.) The average daily amount of waste (in pounds) generated by each person in the United States is given below. This includes all wastes: industrial, demolition, and sewage. The given data is best represented by a 2nd degree model where x = the number of years since 1980.

| | 0 | 5 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|
| Year | 1980 | 1985 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 |
| Pounds of Waste per Person per Day | 3.7 | 3.8 | 4.5 | 4.4 | 4.5 | 4.5 | 4.5 | 4.4 | 4.3 |

→ 2nd Degree Model means Quadratic Regression.

a.) Write a regression equation that fits this data set:

$y = -.0042x^2 + .1195x + 3.5926$

b.) Predict the amount of waste produced per day in 2010.

about 3.3976 lbs  X = 30, Y =  2010 − 1980 = 30

c.) Predict the year in which the amount of waste will drop to 3 pounds per day.

2012  X =, Y = 3  X = 32.7593  1980 + 32.7593 ≈ 2012

c.) In a physics experiment, a lead ball is dropped from a height of 5 m. The students record the distance the ball has fallen every one-tenth of a second.

| Time (s) | Distance (m) |
|---|---|
| 0.1 | 0.048 |
| 0.2 | 0.197 |
| 0.3 | 0.441 |
| 0.4 | 0.882 |
| 0.5 | 1.227 |
| 0.6 | 1.765 |
| 0.7 | 2.401 |
| 0.8 | 3.136 |
| 0.9 | 3.969 |
| 1.0 | 4.902 |

a.) Write a power equation that models this data set:

$y = 4.9622(x)^{2.0027}$

b.) How long will it take the ball to be 3.5 m high?

.84 seconds  X =, Y = 3.5

c.) How high will the ball be in one minute of falling?

18,062 m  X = 60, Y =

d.) The table below represents the amount of coal production (in metric tons) from a small mine in northern British Columbia.

| Year | Metric tons of coal |
|---|---|
| 1950 | 882 |
| 1960 | 889 |
| 1970 | 894 |
| 1980 | 899 |
| 1990 | 905 |
| 2000 | 909 |

a.) Which model is BEST fits this data set?

A.) Linear r = .9976  B.) Exponential r = .9974

C.) Logarithmic r = .9978  D.) Power r = .9976

b.) How did you determine the BEST model?

by comparing the r values of each regression

c.) Predict the amount of coal production in 2005?

912.3688 metric tons  X = 2005, Y =

Plug "x" into "ln" regression equation!

$y = -7154.8881 + 1061.0066 \ln(2005)$