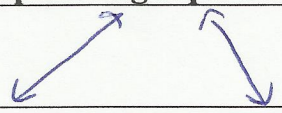
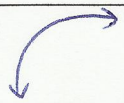
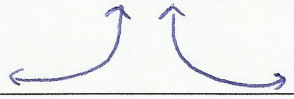
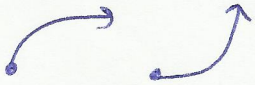
5.2 – Other Types of Regression

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 equation that shows the relationship between two sets of data that can be used to make predictions shown in a scatter plot

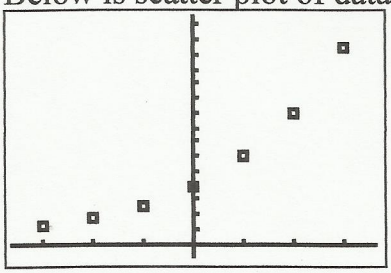
- We will focus on different types of regression equations for various sets of data that are always LINEAR:

Name of Reg Eq	Function for Reg Eq	Graph if Reg Eq is BEST FIT
Linear	#4 $y = ax + b$	
Quadratic	#5 $y = ax^2 + bx + c$	
Logarithmic	#9 $y = a + b\ln x$	
Exponential	#0 $y = a(b)^x$	
Power	A $y = a(x)^b$	

- Remember: Must put data in calculator in list 1 (L1 / x) and list 2 (L2 / 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:

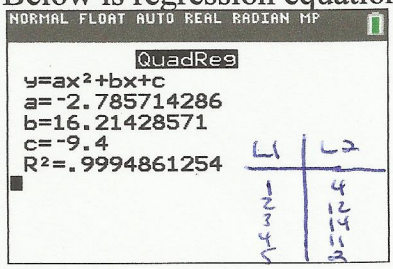
L1	L2	L3 1
1	2	------
2	2.3784	
3	2.6321	
4	2.8284	
5	2.9907	

L1(6)=

Which regression equation BEST represents this set of data?

A.) $y = 1.89(1.103)^x$ exp $r = .9933$
B.) $y = -0.034x^2 + 0.453x + 1.592$ quad
C.) $y = 0.24x + 1.835$ linear $r^2 = .9956$ → $r = .9978$
D.) $y = 2(x)^{0.25}$ power $r = .9851$ $r = .9999$

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 $y = 8.8$ B.) – 1.5 $y = -3.9$
C.) 3.5 $y = 13.25$ D.) 4.6 $y = 6.24$

Example 2: Complete each problem about various types of regression.

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? $x = 55$, $y = ?$ table

about 3.93 g

c.) What is the half-life of the substance iodine-131? $x = ?$, $y = 2.4$ ($4.8 \div 2$)

about 192.7 hrs. zoom at twice intersect

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. Quad model

Year	1980	1985	1990	1991	1992	1993	1994	1995	1996
	0	5	10	11	12	13	14	15	16
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

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 3.4 lbs

$x = 30$ $y = ?$ table

c.) Predict the year in which the amount of waste will drop to 3 pounds per day. $x = 32.750 = 2013$ (1980 + 32.7)

$x = ?$ $y = 3$ zoom or table intersection → years after t.

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? $x = ?$ $y = 3.5$ intersection

about .84 seconds

c.) How high will the ball be in one minute of falling? $x = 60$ $y = ?$ table

about 18,062 m

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?

who r was closest to 1 (or -1)

c.) Predict the amount of coal production in 2005? $x = 2005$ $y = ?$ table

about 912.5 metric tons