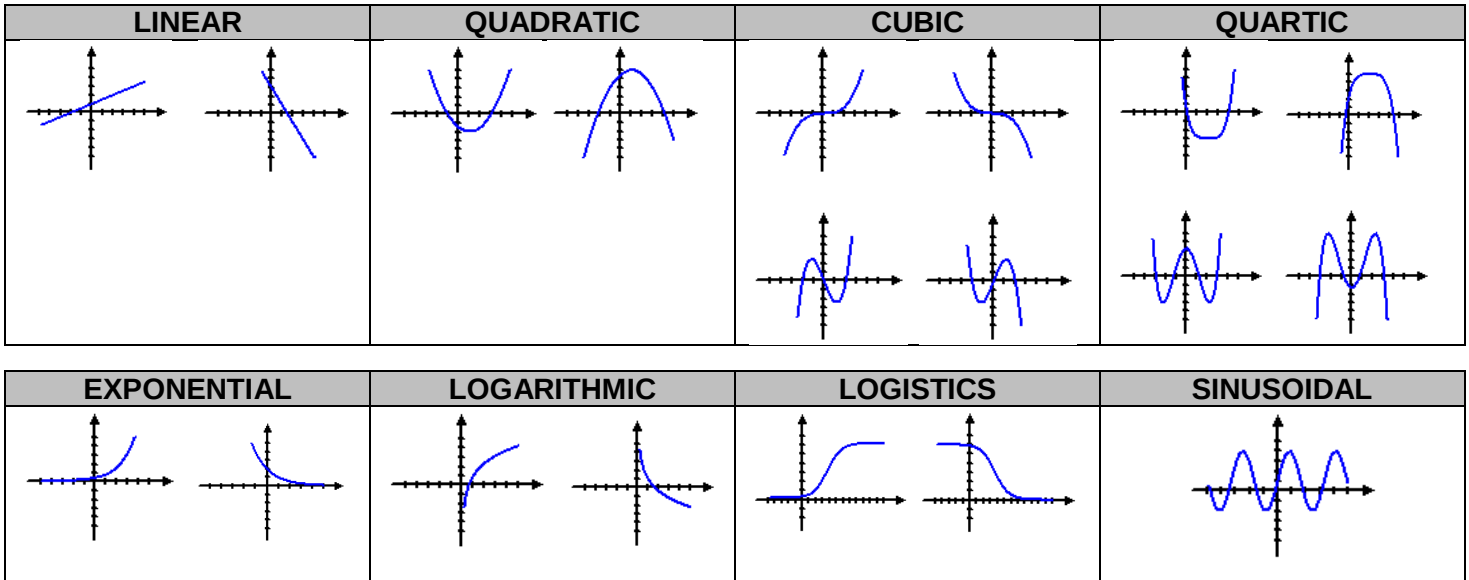
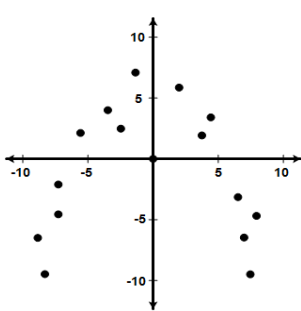


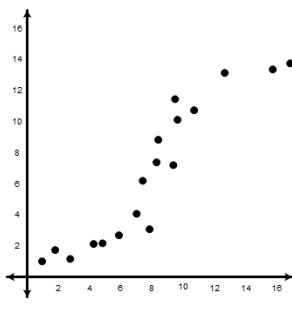
Common Function Models:



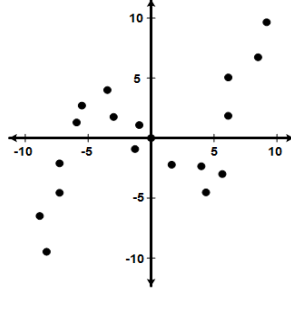
1. Which model do you think is the most appropriate for the following data sets?



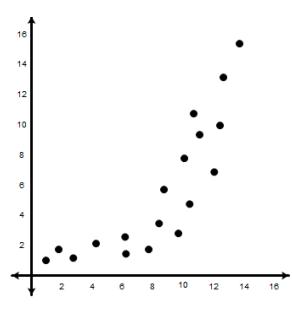
Model: **QUADRATIC**



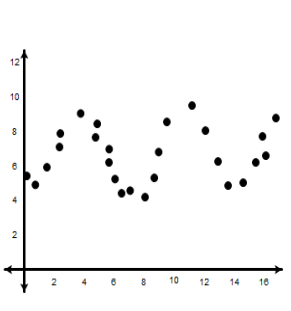
Model: **LOGISTICS**



Model: **CUBIC**



Model: **EXPONENTIAL**



Model: **SINUSOIDAL**

2. Determine which model would be best for each of the following data sets and then determine an equation.

x	1	2	3	4	5	6	7	8	9	10
y	1	1.5	2	3	7	12	15	16	16.5	16.6

Model: **LOGISTICS**
Equation: $Y = \frac{16.884}{1 + 273.698 e^{-1.071x}}$

Logistic
 $y = c / (1 + a e^{(-bx)})$
 $a = 273.6986873$
 $b = 1.070766789$
 $c = 16.88450464$

x	1	2	3	4	5	6	7	8	9	10
y	-9	-2	3	5	6	6.1	5.5	2	-1	-7

Model: **QUADRATIC**
Equation: $y = -7.08x^2 + 7.918x - 15.435$

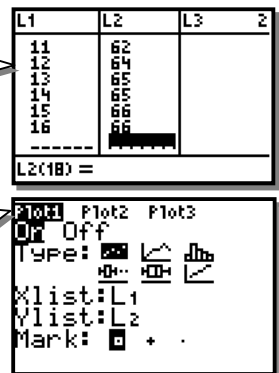
QuadReg
 $y = ax^2 + bx + c$
 $a = -.7079545455$
 $b = 7.918409091$
 $c = -15.435$
 $R^2 = .9887878991$

Make a graph of the data on your calculator and o

- Press **STAT** **ENTER**
- If there is OLD data already in the lists that needs to be cleared press the up arrow, **↑**, to highlight **L1** and then press **CLEAR** **ENTER** to clear out the old data. Do the same for L2 if it has OLD data that needs to be cleared.
- Next, enter all of the ~~Cost~~ in L1 and the ~~Number Sold~~ in L2.
- After entering the data, press **2nd** **Y=** **ENTER** and select all of the options shown in the screen at the right. To do this move the cursor to the appropriate option (**On**, **Off**, **Off**, **Off**) and press **ENTER**. To change the Xlist to L₁ if needed move the cursor to Xlist and press **2nd** **1** and to the Ylist and press **2nd** **2**.
- Finally, press **ZOOM** **9**. To make further adjustments to the graph window press **WINDOW**.
- Additionally, you can type the equation you calculated earlier in the **Y=** to see the scatter plot and regression equation

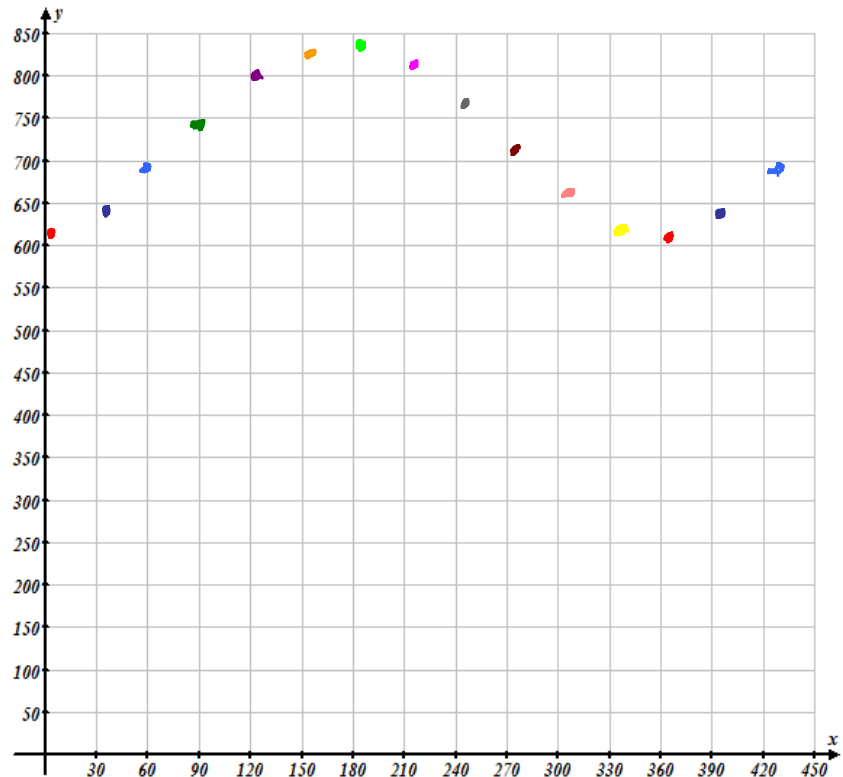
Enter the data from the chart into L1 and L2

Select each of the following options by moving your cursor to each and Pressing **ENTER**.



- To make the graph easier, make January 1 = Day 1 and December 31 = Day 365. In addition, graph the length of daylight in terms of minutes.

Date	Day Number	Houston	
		HH:MM	Min.
Jan. 1	1	10:17	617
Feb. 1	32	10:48	648
March 1	60	11:34	694
Apr. 1	91	12:29	749
May 1	121	13:20	800
June 1	152	13:57	837
July 1	182	14:01	841
Aug. 1	213	13:33	813
Sept. 1	244	12:45	765
Oct. 1	274	11:52	712
Nov. 1	305	11:00	660
Dec. 1	335	10:23	623



- ```
SinRe9
y=a*sin(bx+c)+d
a=113.2590144
b=.016795612
c=-1.318813263
d=727.3705364
```

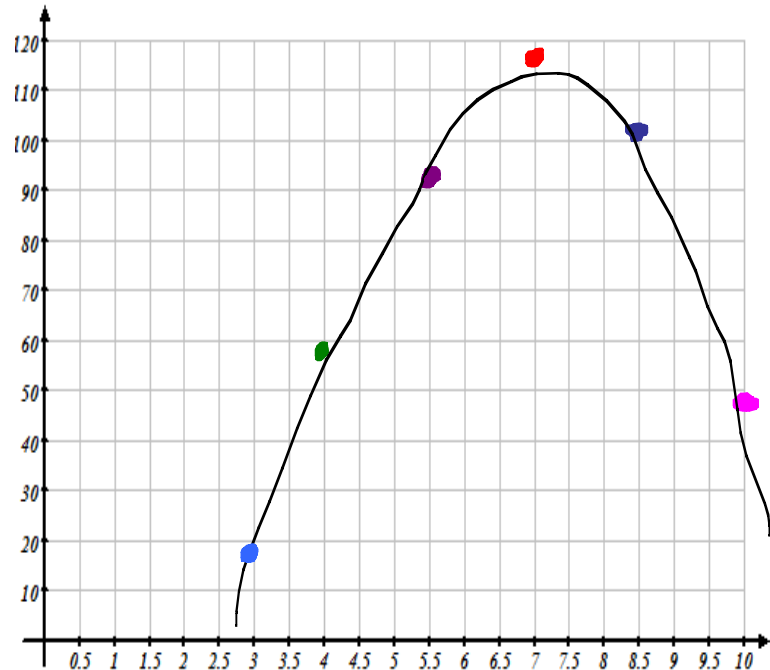
4. A company in California is test marketing a new line of lipsticks. The lipstick only costs the company \$0.90 to make due to the volume production. The company located several different cities with approximately the same demographics and sold the exact same lipstick at different prices. They wanted to know which price would yield the largest profit. The following table shows the prices at which they were sold and the number sold at that price over a period of 3 months.

|             |        |        |        |        |        |         |
|-------------|--------|--------|--------|--------|--------|---------|
| Cost        | \$3.00 | \$4.00 | \$5.50 | \$7.00 | \$8.50 | \$10.00 |
| Number Sold | 19     | 59     | 91     | 117    | 101    | 48      |



- Make a Scatter Plot.
- Draw a trend line or curve if more appropriate.
- What type of association does the data show? (Is it linear?)

QUADRATIC



- Explain why you think the data looks the way it does.

PROBABLY DUE TO THE IDEA THAT MOST PEOPLE ASSOCIATE PRICE WITH QUALITY. SO, NOT TOO MANY PEOPLE PURCHASED THE LIP STICK WHEN IT WAS TOO CHEAP OR TOO EXPENSIVE.

- The TI-83/84 is capable of calculating quadratic, cubic, and quartic regression equations. Determine an appropriate regression model using the data.

|     |     |    |   |
|-----|-----|----|---|
| L1  | L2  | L3 | 2 |
| 3   | 19  |    |   |
| 4   | 59  |    |   |
| 5.5 | 91  |    |   |
| 7   | 117 |    |   |
| 8.5 | 101 |    |   |
| 10  | 48  |    |   |

QuadReg  
 $y = ax^2 + bx + c$   
 $a = -6.30070975$   
 $b = 86.93940979$   
 $c = -187.7585544$   
 $R^2 = .9783799674$

$$Y = -6.301x^2 + 86.94x - 187.8$$

$\uparrow$  # SOLD                       $\uparrow$  PRICE                       $\uparrow$  PRICE

- According to your model, what might be the suggested number sold if the store charges \$9?

$$-6.301(9)^2 + 86.94(9) - 187.8$$

$\hat{Y}_1(9)$                       84.338644

$$Y = -6.301(9)^2 + 86.94(9) - 187.8$$

$\approx 84$  SOLD

- According to your model, what might be the suggested number sold if the store charges \$12?

$$-6.301(12)^2 + 86.94(12) - 187.8$$

$\hat{Y}_1(12)$                       -51.78784087

$$Y = -6.301(12)^2 + 86.94(12) - 187.8$$

$\approx -52$  SOLD ??

- What constraints should be put on your model?

$\uparrow$  WHAT WOULD THIS SUGGEST?

OUR MODEL IS PROBABLY ONLY REASONABLE FOR A DOMAIN OF SOMETHING LIKE  $3 \leq x \leq 11$

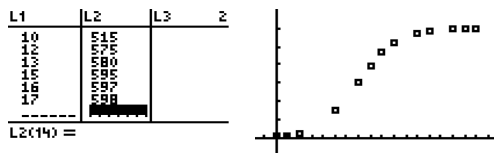
5. A rancher has decided to dedicate a 400-square-mile portion of his ranch as a black bear habitat. Working with his state, he plans to bring 10 young black bears to the habitat in an effort to grow the population. His research shows that the annual growth rate of black bears is about 0.8. Black bears thrive when the population density is no more than about 1.5 black bears per square mile.



After bringing the initial 10 bears. The researcher noticed the following population growth:

| Year             | 1995 | 1996 | 1997 | 2000 | 2002 | 2003 | 2004 | 2005 | 2007 | 2008 | 2010 | 2011 | 2012 |
|------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Years after 1995 | 0    | 1    | 2    | 5    | 7    | 8    | 9    | 10   | 12   | 13   | 15   | 16   | 17   |
| Number of Bears  | 10   | 18   | 30   | 148  | 302  | 391  | 465  | 515  | 575  | 580  | 595  | 597  | 598  |

- a. Which model would be best? **LOGISTICS**



- b. Determine a regression model using the calculator.

Logistic  
 $y = c / (1 + ae^{(-bx)})$   
 $a = 59.82538309$   
 $b = .5898228684$   
 $c = 599.9494612$

$$Y = \frac{599.95}{1 + 59.825 e^{-0.58982x}}$$

↑  
Pop
↑  
# OF YEARS  
AFTER 1995

- c. What appears to be the maximum population of bears? (Hint: just predict the number of bears far off in to the future and see if it levels out. You could predict the number of bears in 2055 where  $x = 60$ )

$$(599.95) / (1 + 59.825 e^{(-0.58982 \cdot 60)})$$

599.95

$$Y1(60) = 599.9494612$$

**≈ 600 BEARS**