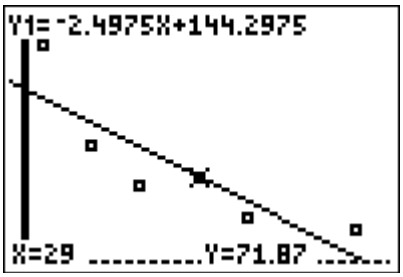
Name_____ Date_____ Period_____

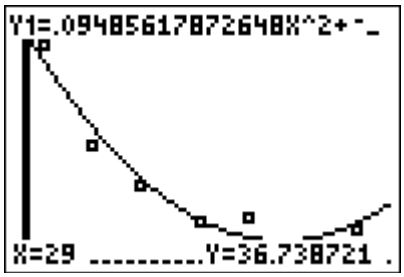
MODELING WITH EXP AND LOG FUNCTIONS WORKSHEET

1. The table shows the atomic number x and the melting point y (in degrees Celsius) for five alkali metals. Which model best fits the data? *Explain* your reasoning.

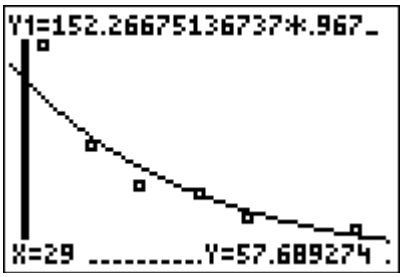
Atomic number, x	3	11	19	37	55
Melting point, y	180.5	97.7	63.4	39.3	28.4



Linear



Quadratic



Exponential

2. A sport utility vehicle that costs $23,300 new has a book value of $12,500 after two years.

a. Find the linear model for the SUV value. Round to three decimal places if needed.

b. Find the exponential model for the SUV value. Round to three decimal places if needed.

c. Find the book values of the SUV after 1 year and after 3 years using each model.

d. Explain the advantages and disadvantages of using each model to a buyer and seller.

3. The table shows the populations (in millions) of five countries in 2000 and the projected populations (in millions) for the year 2015. Let $t = 0$ correspond to 2000. Find the exponential growth or decay model for each country. Use each model to predict the population of each country in 2030.

Country	2000	2015	Exponential Growth or Decay Model	Population in 2030
Bulgaria	7.8	6.9		
Canada	31.1	35.1		
China	1268.9	1393.4		
United Kingdom	59.5	62.2		
United States	282.2	325.5		

a) You can see that the populations of the United States and the United Kingdom are growing at different rates. What constant in the equation $y = ae^{bt}$ is determined by these different growth rates? Discuss the relationship between the different growth rates and the magnitude of the constant.

b) You can see that the population of China is increasing while the population of Bulgaria is decreasing. What constant in the equation $y = ae^{bt}$ reflects this difference? Explain.

4. At 8:30 AM, a coroner was called to the home of a person who had died during the night. In order to estimate the time of death, the coroner took the person's temperature twice. At 9:00 AM the temperature was $85.7^{\circ}F$, and at 11:00 AM the temperature was $82.8^{\circ}F$. He also noted that the temperature inside the room was a constant $70^{\circ}F$. From these readings, the coroner used the formula $t = -10 \ln \frac{T-70}{98.6-70}$, where t is the time in hours elapsed since the person died and T is the temperature (in degrees Fahrenheit) of the person's body. What time did the person die? Show your work.

5. Assuming that air resistance is proportional to the velocity of a falling object, the velocity (in feet per second) of the object t seconds after it has been dropped is given by $v = 82\left(1 - e^{-0.39t}\right)$.

a) Determine when the velocity will be 70 feet per second.

b) The graph of v has $v = 82$ as a horizontal asymptote. Explain the meaning of this asymptote in the context of this example.

6. A diamond merchant has determined the values of several white diamonds that have different weights (measured in carats), but are *similar in quality*. Find a function that models the values of the diamonds as a function of their weights, and use the function to predict the value of a 3.5-carat diamond of similar quality.

Weight:	0.50	0.75	1.00	1.25	1.50	1.75	2.00	3.00	4.00
Value	$4600	$5000	$5800	$6200	$6700	$7300	$7900	$10,700	$14,500

7. The table shows the winning times in the women's Olympic 100-meter freestyle event for the years 1960 to 2004. Find a function to model the data, and use the function to predict the winning time in the women's Olympic 100-meter freestyle event for the year 2012.

Year	Time (in seconds)	Year	Time (in seconds)
1960	61.2	1984	55.92
1964	59.5	1988	54.93
1968	60.0	1992	54.64
1972	58.59	1996	54.50
1976	55.65	2000	53.83
1980	54.79	2004	53.84

Source: Time Almanac 2006.

8. According to the U.S. Environmental Protection Agency, the amount of garbage generated per person has been increasing over the last few decades. The following table shows the per capita garbage, in pounds per day, generated in the United States.

Year	1960	1970	1980	1990	2003
Pounds per day, p	2.7	3.3	3.7	4.5	4.5

a) Find a linear model and a logarithmic model for the data. Use t as the independent variable (domain) and p as the dependent variable (range). Represent the year 1960 by $t = 60$ and the year 1970 by $t = 70$.

b) Examine the correlation coefficients to determine which model provides a better fit for the data.

c) Use the model you selected in b) to predict the amount of garbage that will be generated per capita per day in 2009. Round to the nearest tenth of a pound.