Key

Math 1

Name_____

4-5 Exponential Regression Practice

- *I can identify linear and exponential situations and distinguish between the two.*
- *I can construct a linear or exponential function from an arithmetic sequence, table of values or verbal description.*

Your family is planning on moving across the country to the city of Smithville. The tables on this sheet show some historical statistics about Smithville that were gathered through online resources. Your parents are wondering if it is possible to use this data to make some predictions about the future of Smithville.

Year	Median Price of a New House
1990	$112,000
1992	$124,500
1994	$150,000
1996	$174,000
1998	$199,500
1999	$214,000
2000	$222,000
2002	$248,000
2005	$285,000

1. On your calculator, make a scatterplot of the *(year, median price of a new home)* data. When looking at the year data, just type in the number of years **after 1990**. Example: 1992 = 2.

   a. What type of model would fit this data better: linear or exponential? Explain your answer. Linear. The scatterplot resembles a line (constant rate of change).

   b. Find the equation of the linear regression line for this data. Write the equation below. Also, find the correlation coefficient and list it below.

   $r =$ 0.998 $f(x) =$ 11,864x + 105110

   c. Now find the exponential regression for the data. Write the equation below.

   $f(x) =$ 114,600(1.067)^x

   d. Graph the equations from 2a and 2b along with your scatterplot from Number 1. Which regression line fits your data better?

   Linear regression fits better since it does not curve.

Year	Population		Year	Crimes per Year
1990	100,000		1990	13996
1992	132,000		1992	9641
1994	174,000		1994	6587
1996	232,000		1996	4575
1998	305,000		1998	3100
1999	351,000		1999	2745
2000	405,000		2000	2255
2002	535,000		2002	1515
2005	813,000		2005	854

2. Now make a scatterplot of the *(year, population)* data.

   a. Decide which type of regression would be best to model this data set and write its equation below using function notation.

   Exponential! $p(x) = 99,845.49(1.15)^x$

   b. Explain what the numbers in your equation mean in the context of this data set.

   There were about 99,845 people in the city in 1990. The population increases by about 15% each year.

   c. Use your regression equation to predict the population for 2015.

   $p(25) = 99845.49(1.15)^{25} \approx$ 3,286,809 people ↳ $x=25$

   d. In what year will the population each 2 million ?

   $2{,}000{,}000 = 99,845.49(1.15)^x$

   $x \approx 21.44$

   During the year 2011.

3. Make one last scatterplot for the *(year, crimes per year)* data.

   a. Determine which type of regression will best model this data set. Write the explicit equation below.

   Exponential. $C(x) = 13,972.17(0.83)^x$

   b. Explain what the numbers in your equation mean in the context of this data set.

   13,972 crimes in 1990 + the crimes decrease by 17% each year.

   c. What is the half life for the number of crimes?

   $\frac{13996}{2} = 6998$ $\quad 6998 = 13972.17(0.83)^x$

   $x \approx 3.71$ years

   d. Predict how many crimes there will be in 2023.

   $C(33) = 13,972.17(0.83)^{33} \approx$ 30 crimes