Exponential Regression

Name: key Date: ______________

Hot Coffee

Time (mins)	Temp (° F)
0	179.5
5	168.7
8	158.1
11	149.2
15	141.7
18	134.6
22	125.4
25	123.5
30	116.3
34	113.2
38	109.1
42	105.7
45	102.2
50	100.5

The data at the right shows the cooling temperatures of a freshly brewed cup of coffee after it is poured from the brewing pot into a serving cup. The brewing pot temperature is approximately 180° F.

a) Determine an exponential regression model equation to represent this data.

$y = 171.5(.988)^x$

$r = .97$

b) Decide whether the equation is a "good fit" to represent this data.

yes Linear = .96

c) Based upon the equation, what was the initial temperature of the coffee? What is the decay rate?

179.5° start / 1.2% decay

d) Interpolate data: When is the coffee at a temperature of 106 degrees? (y)

$106 = 171.5(.988)^x$ btw 38-42 mostly mult choice

e) Extrapolate data: What is the predicted temperature of the coffee after 1 hour? (x)

$y = 171.5(.988)^{60} = 83.1°$ 60 min

f) In 1992, a woman sued McDonald's for serving coffee at a temperature of 180° that caused her to be severely burned when the coffee spilled. An expert witness at the trial testified that liquids at 180° will cause a full thickness burn to human skin in two to seven seconds. It was stated that had the coffee been served at 155°, the liquid would have cooled and avoided the serious burns. The woman was awarded over 2.7 million dollars. As a result of this famous case, many restaurants now serve coffee at a temperature around 155°. How long should restaurants wait (after pouring the coffee from the pot) before serving coffee, to ensure that the coffee is not hotter than 155°?

$155 = 171.5(.988)^x$ 8-11 min

g) If the temperature in the room is 76° F, what will happen to the temperature of the coffee, after being poured from the pot, over an extended period of time?

Practice Problems:

1. Estimates for world population vary, but the data in the accompanying table are reasonable estimates of the world population from 1800 to 2000.

Year		Total Population (millions)
1800	0	980
1850	50	1260
1900	100	1650
1950	150	2520
1970	170	3700
1980	180	4440
1990	190	5270
2000	200	6080

a. Identify your independent and dependent variables.

time / pop

b. Generate a best fit exponential function using your variables. Round to 3 decimals.

$y = 817.2(1.009)^x$

c. What does your model give for the growth rate? Describe this in the context of the problem.

$.009 \approx .9\%$

d. Using the function, estimate the world population in 1750 and 2050 to 3 decimal places. (7 billion)

-50 250

522.12 7675.734

---

2. **Town Planning**: The town planners designed their town for an optimal growth of 8% per year. The present school construction will serve a population of 200,000. Below is a table representing the growth from 1997 to 2003.

	Year	Population
0	1997	50,000
1	1998	54,000
2	1999	58,000
3	2000	62,986
4	2001	68,024
5	2002	73,466
6	2003	79,344

a) Find and write the model of a linear regression. Use the model to determine what the population was in 1977. Round to 2 decimals.

$t = -20$ $-48,829$

$y = 4892x + 49011$

~~-48,000ish~~

b) Find and write the model of an exponential regression. Use the model to determine what the population was in 1977. Round to 2 decimals.

$y = 49931(1.08)^x =$ ~~49931~~ 10,712.61

c) Determine which model is better to use. Explain why you selected your model.

exp.

d) Using the better model, predict what the population will be in the year 2017.

232,726.25

e) In what year will the population double for the better model?

→100,000

10 years/ 2007