7.2 Application and Extension

1. Expand: $\log\left(\frac{\sqrt{x}}{y^4}\right)^3 = \log \frac{x^{3/2}}{y^{12}}$

$= \log x^{3/2} - \log y^{12}$

$= \frac{3}{2}\log x - 12\log y$

2. Solve for x: $3^x = 99$

$\log 3^x = \log 99$

$x \log 3 = \log 99$

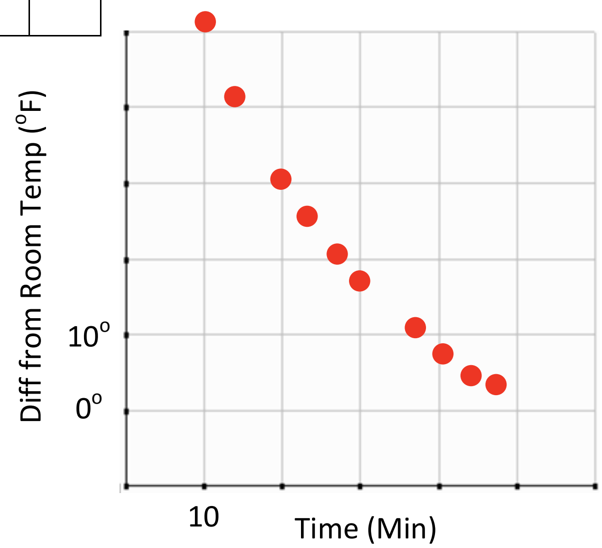
$x = \frac{\log 99}{\log 3}$

$x \approx 4.183$

3. When Sully is ready to retire, he has plans of moving to New York City to become a butcher. In fact, he wants to open his own butcher shop, "The New York Metzgerei," where he can sell his signature product: ***Sullamy Picante***! Sully has to cook the meat and then let it cool while recording the temperature during the production process. One day, Sully observes the following temperatures:

Time (min)	10	14	20	22	26	30	36	40	42	44
Temperature (degrees above room temp in F)	51	41	30	26	21	17	11	8	6	5

a. Plot the data on the graph to the right. Enter Time into L_1 and Temp into L_2..



b. Would a linear model be appropriate for this data? Why or why not? NO, it is a curve

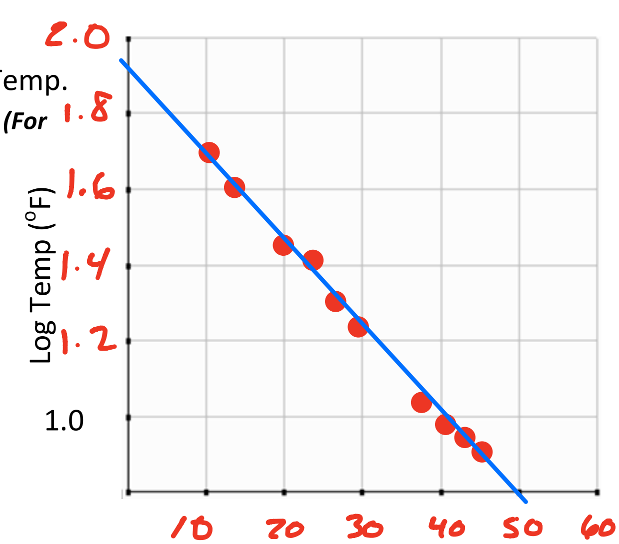
c. To "straighten" the data, take the common log of each of the temperatures. (Log $L_2 \rightarrow L_3$)

Complete the table:

Time (min)	10	14	20	22	26	30	36	40	42	44
Log (Temp)	1.7076	1.6128	1.4771	1.4150	1.3222	1.2304	1.0414	.9031	.7782	.6990

d. Calculate the linear regression for Time vs. Log Diff Temp. Plot the data and graph line of best fit on the graph. ***(For help with your calculator, watch the Application Help Video!)***

$\log y = -0.029x + 2.045$



e. Is the data straighter?

Yes

(Flip it like an Algebro!)

f. Now complete a **LINEAR REGRESSION** using your calculator on Time and Log Temp. Write your linear equation below, accurate to 4 decimal places. Remember, we aren't using y, we are using log y.

(Use LinReg L_1, L_3)

a = $^{-}0.0291$

Log y = ax + b

b = 2.0451

Log y = $^{-}0.0291x + 2.0451$

g. In statistics, straighter data leads to more accurate predictions. We take the log of the dependent variable to straighten out exponential data. But you know what? We like the ORIGINAL variable and we hate equations with logs in them. Let's use our Log rules to reverse transform the equation into an exponential equation. For even more fun, let's bust out the 2 column proof:

Regression Equation Statements	Reasons
1. Log y = $^{-}0.029x + 2.045$ Your equation from above!	1. Given
2. $10^{\log y} = 10^{-0.029x + 2.045}$	2. Raise 10 to the power of each side of the equation.
3. $y = 10^{-0.029x} \cdot 10^{2.045}$	3. Write the exponent sum as the product of a common base.
4. $y = 10^{-0.029x} \cdot 110.917$	4. Compute $10^{\text{y-intercept value}}$
5. $y = (10^{-0.029})^x \cdot 110.917$	5. Rewrite the exponent product as a power to a power.
6. $y = .935^x \cdot 110.917$	6. Compute $10^{\text{slope of equation}}$.
7. $y = 110.917(.935^x)$	7. Rewrite your equation in the form $y = ab^x$

h. Confirm your exponential regression equation with ExpReg in your calculator. (Stat→ Calc→ ExpReg L_1, L_2.) Be sure you use the original data and not the transform data in L_3. Congrats! You just learned how the calculator calculates an exponential regression… call it ***"The Great Regression of 7.2!"***

$y = 110.947(.935^x)$

i. How hot was the Sullamy Picante when Sully took it out of the oven? (Assume a room temperature of 72°) Use your equation to figure it out. Show your work below.

$y = 110.947(.935^0)$

$y = 110.947°F$