

Group Quiz 3
 Dusty Wilson
 Math 111

Name: KEY

No work = no credit

1.) Answer the following:

a.) Use the properties of logs to write the expression $\log(x) + \log(2x+1) - \frac{1}{3}\log(x+1)$ as a single logarithm.

$$\log\left(\frac{x(2x+1)}{\sqrt[3]{x+1}}\right)$$

b.) Write the expression $\ln\left(\frac{x^3}{\sqrt{x+4}}\right)$ as the sum or difference of logarithmic functions containing no exponents.

$$3 \ln x - \frac{1}{2} \ln(x+4)$$

2.) Seahawk fans at the Clink are competing with Chief fans at Arrowhead stadium for the distinction of being the loudest fans in the world. At present, the Chief fans are tops having generated fan noise of 142.2 db shattering our record of 137.6 db.

How much louder must the 12's be than their previous high if they are to once again hold the distinction of being the loudest fans?

Use the fact that $db = 10 \log(I_{fans} / I_0)$ where I_0 is the threshold of hearing for the average

human ear. Then find the ratio $\frac{I_{Chief\ fans}}{I_{12's}}$.

$$142.2 = 10 \log(I_c / I_0) \Rightarrow 14.22 = \log(I_c / I_0)$$

$$\Rightarrow I_c = 10^{14.22} I_0$$

Similarly $137.6 = 10 \log(I_{12} / I_0) \Rightarrow I_{12} = 10^{13.76} I_0$

So $\frac{I_c}{I_{12}} = \frac{10^{14.22} I_0}{10^{13.76} I_0} = 10^{.46} = 2.88$. So we need

to be 2.88 times louder

3.) The table below shows Washington State's population, in millions, from 1980 to 2010.

Year	1980	1985	1990	1995	2000	2005	2010
Washington Population (in millions)	4.23	4.46	5.02	5.47	5.89	6.26	6.81

- a.) Find the linear model $L(t) = at + b$ for Washington State's population (in millions) t years since 1980. Round a and b to two decimal places.

$$L(t) = 0.0872t + 4.1404$$

- b.) Explain the meaning of the coefficient a and b in your linear model using everyday language.

The pop grows by 87,000/yr

The pop in 1980 was 4.14 mil

- c.) Find the exponential model $E(t) = a \cdot b^t$ for Washington State population (in millions) t years since 1980. Round a to two decimal places and round b to the four decimal places.

$$E(t) = 4.2183 \cdot 1.0163^t$$

- d.) Explain the meaning of the coefficient a and b in your exponential model using everyday language.

The pop grows 1.6% per year

The pop in 1980 was 4.22 mil

- e.) Use your exponential model to find Washington State's population in 2020. Interpret your result.

$$E(40) \approx 8.05$$

The pop in 2020 will be about 8.05 mil.

- f.) Use your exponential model to algebraically determine when Washington State's population will reach 10 million. Interpret your answer.

$$\text{solve } 10 = 4.2183 \cdot 1.0163^t$$

$$\Rightarrow 2.3706 = 1.0163^t$$

$$\Rightarrow t = \log_{1.0163}(2.3706)$$

$$= 53.38$$

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The pop will hit 10 mil. in about 2033.