

Group Quiz 3
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Math 111 - Spring 2012

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.

$$\begin{aligned} \ln(x^3) - \ln(\sqrt{x+4}) \\ = 3\ln x - \frac{1}{2}\ln(x+4) \end{aligned}$$

2.) Simran invests \$15,000 at 11%, compounded semiannually. How many years until Simran has \$255,000?

$$255,000 = 15,000 \left(1 + \frac{0.11}{2}\right)^{2t}$$

$$\Rightarrow 17 = \left(1 + \frac{0.11}{2}\right)^{2t}$$

$$\Rightarrow \ln 17 = 2t \ln(1.055)$$

$$\Rightarrow t = \frac{\ln 17}{2 \ln(1.055)}$$

$$\approx 26.46$$

It will take
Simran about 26 yrs
to have \$255,000.

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 $P(t) = at + b$ for Washington State's population (in millions) t years since 1980. Round a and b to two decimal places.

$$P(t) = 0.09t + 4.14$$

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

The pop in 1980 was 4.14 mil.

The pop grows by 0.09 mil/yr.

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

$$P(t) = 4.22(1.0163)^t$$

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

The pop in 1980 was 4.22 mil

The pop grows 1.63% each year.

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

$$P(40) = 8.06. \text{ The pop in 2020 will be about 8.06 mil.}$$

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

$$\begin{aligned} \text{Solve } 10 &= 4.22(1.0163)^t &\Rightarrow t &= \log_{1.0163} \left(\frac{10}{4.22} \right) \\ &\Rightarrow \frac{10}{4.22} = 1.0163^t &&= \frac{\ln \left(\frac{10}{4.22} \right)}{\ln(1.0163)} \\ &&&\approx 53.26 \end{aligned}$$

The pop. of WA will reach 10 mil. in 2033.

3.) The population in India was 1.21 billion people in 2010 and growing at a rate of 1.44% each year.

- a.) Construct an exponential model $P(t)$ for the population of India. Make sure to clearly define your variables.

$$P(t) = 1.21(1.0144)^t$$

where t is in years since 2010
and P is the pop. in billions.

- b.) Find and interpret $P(25)$.

$$P(25) = 1.73$$

India's pop. will reach 1.73 billion in 2035.

- c.) Find and interpret the number of years required for India's population to double.

$$\text{solve } 2.42 = 1.21(1.0144)^t$$

$$\Rightarrow 2 = 1.0144^t$$

$$\Rightarrow t = \log_{1.0144} (2)$$

$$= \frac{\ln 2}{\ln 1.0144}$$

$$\approx 49.5$$

It will take about 49 yrs for India's pop. to double.