Math 146 Quiz Dec 10, 2019 name:________________

1. Use the logarithm rules to expand this logarithmic expression as much as possible:

$$\log_{10}\left(\frac{\sqrt{xy}}{2z^3}\right) = \log\left(\frac{x^{1/2}\cdot y^{1/2}}{2\cdot z^3}\right)$$

$$= \log x^{1/2} + \log y^{1/2} - \log 2 - \log z^3$$

$$= \frac{1}{2}\log x + \frac{1}{2}\log y - \log 2 - 3\log z$$

2. Use the logarithm rules to combine these into a single logarithm:

$$2\ln(x+1)+\ln x-\ln(x+3) = \ln(x+1)^2 + \ln x - \ln(x+3)$$

$$\ln\left(\frac{(x+1)^2\cdot x}{(x+3)}\right)$$

The interest rate equations are: $A = P\left(1+\frac{r}{n}\right)^{nt}$ for interest compounded n times per year and $A = \mathrm{Re}^{rt}$ for interest compounded continuously.

12

3. How much should be invested at a rate of 3%, compounded monthly, so that the investment is worth \$20,000 in 10 years?

$$20{,}000 = P\left(1+\frac{.03}{12}\right)^{12\cdot 10}$$

$$20{,}000 = P(1.0025)^{120}$$

keep lots of decimal places

$$P = \frac{20{,}000}{(1.0025)^{120}} = \$14{,}821.91$$

(4.6)

Invest 20,000 at a rate of 3% compounded monthly.

How long until my investment doubles?

$$A = P\left(1+\frac{r}{n}\right)^{nt}$$

$$\underset{2P}{40{,}000} = \underset{P}{20{,}000}\left(1+\frac{.03}{12}\right)^{12t}$$

$$\frac{40{,}000}{20{,}000} = \frac{20{,}000\,\boxed{(1.0025)^{12t}}}{20{,}000} \leftarrow \text{need logs}$$

$$2 = \boxed{(1.0025)^{12t}} \leftarrow \text{need logs.}$$

$$\log 2 = \log (1.0025)^{12t}$$

Log rule!

$$\log 2 = 12t \log(1.0025)$$

Calculator first

$$\frac{.3010}{12\cdot(.0011)} = \frac{12\cdot t\cdot(.0011)}{12(.0011)}$$

$22.8 = t$

years.

Calculator last

$$\frac{\log 2}{12\log(1.0025)} = \frac{12\cdot t\cdot \log(1.0025)}{12\log(1.0025)}$$

$$\frac{\log 2}{12\log(1.0025)} = t$$

$23.1 = t$

$$A = A_0 e^{-.00043t}$$

$\uparrow$ beginning amount

10 g how long until there are 8 g

$$\frac{8}{10} = \frac{10\, e^{-.00043t}}{10}$$

radium

$$.8 = e^{-.00043t}$$

$$\ln .8 = \ln e^{-.00043t}$$

$$\ln .8 = -.00043t \ln e$$ $=1$

$$\frac{\ln .8}{-.00043(\ln e)} = t = \frac{\log .8}{-.00043 \log e}$$

$t = \underline{519 \text{ years}}$

$$3\boxed{(1.4)^{x+2}} - 4 = \overset{62}{\cancel{61}}$$

$$+4 \qquad +4$$

$$\frac{3(1.4)^{x+2}}{3} = \frac{66}{3}$$

$$1.4^{(x+2)} = 22$$

$$\log 1.4^{(x+2)} = \log 22$$

$$\frac{(x+2)\cancel{\log 1.4}}{\cancel{\log 1.4}} = \frac{\log 22}{\log 1.4}$$

$$x + 2 = \frac{\log 22}{\log 1.4} - 2$$

$$-2$$

$$x = \frac{\log 22}{\log 1.4} - 2 = 7.2$$

$$\log_2(2x+8) + \log_2(x+4) = 5$$

$$\log_2\big((2x+8)(x+4)\big) = 5$$

$$2^5 = (2x+8)(x+4)$$

$$\cancel{32} = 2x^2 + 8x + 8x + \cancel{32}$$

$$0 = 2x^2 + 16x \qquad = 2x(x+8) \quad x=0 \quad x=-8$$

$$0 = x(2x+16)$$

$x = 0$!

$2x + 16 = 0$

$\cancel{x = -8}$

$$\log_2(\overset{2\cdot 0+8}{8}) + \log_2(\overset{0+4}{4}) = 5$$

$$\log(-16+8) + \log(-8+4)$$

$$\log(-8)$$

$\cancel{\ln(10-x) + \ln(-6-x) = 2}$

$$\log_2(5x-6) - \log_2(x+1) = \log_2 3$$

$$\log_2\left(\frac{5x-6}{x+1}\right) = \log_2(3)$$

$$(x+1)\left(\frac{5x-6}{x+1}\right) = 3(x+1)$$

$$5x-6 = 3x+3$$

$$-3x \quad +6 \qquad -3x \quad +6$$

$$2x = 9$$

$$x = 9/2$$

4.5 # 21, 23, 25, 27
47, 53, 55, 61

4.6 # 11, 25, 26, 27, 29