Learning Activity – Section 9.4 – Properties of Logarithms

Names: _____ _____

_____ _____

1. Write each logarithm as a sum and then simplify each term, if possible.

a. $\log_3 81x$

b. $\log 1,000yz$

2. Write each logarithm as a difference and then simplify each term, if possible.

a. $\ln\left(\frac{11}{e}\right)$

b. $\log_{12}\left(\frac{144}{7}\right)$

3. Apply the power property of logarithms.

a. $\log 5^{2x+3}$

b. $\log_9 \sqrt[3]{w^7}$

4. Write the expression as the sum or difference of logarithms, and simplify terms wherever possible. Follow the steps to guide you through the process.

$$\log_{1/8}\left(\frac{8\sqrt{a^3}}{3b^4c}\right)$$

a. Rewrite the logarithmic expression, changing any radicals to rational exponents.

b. There are _____ factors in the numerator of the argument of the logarithm. Therefore, when I expand the expression, I will write _____ positive logarithmic terms.

c. There are _____ factors in the denominator of the argument of the logarithm. Therefore, when I expand the expression, I will write _____ negative logarithmic terms.

d. Apply the product and quotient properties to the expression to write the expected number of positive and negative logarithmic terms. Do not apply the power property yet.

e. For any logarithmic term with exponential argument, apply the power property.

f. Simplify logarithmic terms with numerical arguments, if possible. Ask: For $\log_b a$, can a be written as a power of b? If $b^p = a$, then $\log_b a = p$.

5. Write the expression as a single logarithm, and simplify the result, if possible. Follow the steps to guide you through the process.

$$\frac{1}{3}\ln x+\frac{4}{3}\ln y+\ln\left(x-6\right)-\ln\left(x^2-36\right)$$

a. Apply the power property to any terms with a coefficient.

b. Rewrite any rational powers in radical form.

c. There are _____ positive logarithmic terms in the expression. Therefore, when I write the single logarithm, the numerator of its argument will initially contain _____ factors.

d. There is _____ negative logarithmic term in the expression. Therefore, when I write the single logarithm, the denominator of its argument will initially contain _____ factor.

e. Write the single logarithm, placing the arguments of the individual logarithmic terms as factors in the numerator or denominator, as appropriate.

f. Begin to simplify the argument of the single logarithm. Apply the product property of radicals: Let $\sqrt[n]{a}$ and $\sqrt[n]{b}$ be real numbers. Then $\sqrt[n]{a}\cdot\sqrt[n]{b}=\sqrt[n]{ab}$.

g. Factor any polynomial expressions in the argument and then cancel factors common to numerator and denominator.

6. Consider the expression $\log_3 18$.

a. Find the indicated powers of 3.

$3^1 =$, $3^2 =$, $3^3 =$, $3^4 =$

b. Is there an integer p such that $3^p = 18$?

c. $\log_3 18$ between two consecutive integers by filling in the blanks.

Because $3^{\square} < 18 < 3^{\square}$, _____ $< \log_3 18 <$ _____ .

d. Use the change of base formula to approximate $\log_3 18$ by using either the common logarithm or the natural logarithm. Round to 4 decimal places.

e. Check the result by using the related exponential form: $y = \log_b x$ is equivalent to $x = b^y$