Name: _____ Date: _____ **Unit 7 Class Work**

Introduction to Logarithms Class Work

Objective: *You will be able to convert between logarithmic & exponential form.*

★ **See if you can figure out the missing values...**

$2^{?} = 32$ $3^{?} = \frac{1}{81}$ $4^{?} = 64$

Another word for such exponents is "logarithms."

★ **FORMAL DEFINITION:**

Logarithm – a quantity representing the power to which a number (called the base) must be raised to produce a given number (called the argument)

*Logarithms are the "opposite" of exponentials.

★ **EXPONENTIAL FORM VS. LOGARITHMIC FORM**

$\text{base}^{\text{exponent}} = \text{argument} \Leftrightarrow \log_{\text{base}}\text{argument} = \text{exponent}$

$b^x = a \Leftrightarrow \log_b a = x$

*Examples:

A. $2^3 = 8 \Leftrightarrow$ _____ B. $3^2 = 9 \Leftrightarrow$ _____

C. $\log_2(\frac{1}{4}) = -2 \Leftrightarrow$ _____ D. $\log_5(125) = 3 \Leftrightarrow$ _____

E. Evaluate $\log_7(343)$. F. Evaluate $\log_6\left(\frac{1}{36}\right)$.

✎ **Practice:** If given exponential form, convert to logarithmic form. If given logarithmic form, convert to exponential form.

1. $4^{-5} = \frac{1}{1024}$
2. $\log_{12}1728 = 3$
3. $\log_{20}400 = 2$
4. $8^3 = 512$
5. $\log_m n = p$
6. $w^v = z$
7. $\log_{-7}1 = 0$
8. $3^{-1/2} = \frac{1}{9}$

✎ **Practice:** Evaluate each logarithm.

9. $\log_3 \frac{1}{27} =$
10. $\log_8 16 =$
11. $\log_4 \frac{1}{64} =$
12. $\log_{10}10000 =$
13. $\log_3 1 =$
14. $\log_{11}121 =$
15. $\log_4 2 =$
16. $\log_8 \frac{1}{2} =$
17. $\log_{16}8 =$
18. $\log_{1/3}3 =$
19. $\log_{4096}8 =$
20. $\log_{256}64 =$

★ **EXPONENTIAL FORM VS. LOGARITHMIC FORM**

✧ One of the most common logarithm is **log base 10**, which you can evaluate using the "**LOG**" button on your calculator! ☺

***Example:** The formula for pH, a measure of acidity, is $pH = -\log(H^+)$, where H^+ is the concentration of hydrogen ions in a substance, in moles per liter.

a. During an experiment, a student finds that in juice from an unidentified fruit, the concentration of hydrogen ions is approximately .0003548 moles per liter. The student knows that the pH of cantaloupe is typically around 6.335, the pH of strawberries is typically around 3.45, and that of peaches is typically around 3.675. Which fruit is the juice most likely from?

b. The pH of human blood should be in the "slightly alkaline" range, from 7.35 to 7.45. Determine the range of healthy concentration of hydrogen ions for a given person's blood sample. (Cannot use the "LOG" button to evaluate here!)

✍ ***Now You Try!***

21. During an experiment, a student finds that in an unidentified fruit juice, the concentration of hydrogen ions is approximately .00025119moles per liter. The student knows that the pH of watermelon is typically around 5.39, the pH of blueberries is typically around 3.165, and that of pineapple is typically around 3.6. Which fruit is the juice most likely from?

22. The average pH of green olives is approximately 4.1, while that of black olives is approximately 6.5. Which is more highly concentrated with hydrogen ions, and approximately how many times more?

✧ Another common logarithm is **log base e** (also known as the **natural log**). You can evaluate the natural log of a number using the "**LN**" button on your calculator! ☺

e is a mathematical constant, also known as Euler's number, which is helpful in solving exponential functions. The number is irrational and begins with 2.718281828459…

*We will use the natural logarithm to our advantage pretty soon!

Exit Slip:

1. Write $3^{-2} = 1/9$ in logarithmic form.
2. Write $\log_2 32 = 5$ in exponential form.
3. Evaluate $\log_{343}(49)$.

Homework: pages 442-444

#7, 11, 13, 15, 17, 21, 25, 27, 31, 41, 43, 45, 53, 57, 59, 61, 93, & 95

Throwback: p.444 #107 & 109