Guided Notes: Review of Logarithms

We are beginning a new unit on exponential functions. Before we embark on this journey together, it is important to review logarithmic functions and how to solve exponential functions using logarithms.

In this exercise, we are simply converting between the exponential and logarithmic forms of functions in order to solve for the unknown variables in the exponent.

$$y = \log_b x \text{ is equivalent to } x = b^y$$

Part I: First, let's practice converting between exponential and logarithmic form.

Example:

1. $\log_4 16 = 2$ is equivalent to $4^2 = 16$
2. $5^3 = 125$ is equivalent to $\log_5 125 = 3$

Practice: Write the following in the logarithmic or exponential form, depending on which form it is given to you in.

1. $8^3 = 512$ _____
2. $\log_2 256 = 8$ _____

Part II: Now, let's practice with variables.

Example:

1. $9^x = 729$ is equivalent to $\log_9 729 = x$
2. $\log_3 243 = x$ is equivalent to $3^x = 243$

Practice: Write the following in the logarithmic or exponential form.

1. $5^x = 625$ _____
2. $\log_7 2401 = 4$ _____

Part III: Now, your task is to solve the exponential and logarithmic equations for the unknown variables.

Example: $25^{x} = 15625$

Step 1: Re-write as $\log_{25} 15625 = x$

Step 2: To solve for x, use the log button in your calculator and type in $\frac{\log 15625}{\log 25}$.

(The rule says that $\log_a b = \frac{\log b}{\log a}$) **x=3**

****Additional Examples:**

1. $9^{n+10} + 3 = 81$ → $9^{n+10} = 78$ → $\log_9 78 = n + 10$ → 1.9828=n+10 → n= -8.0172
2. $5 \times 6^{3m} = 20$ → $6^{3m} = 4$ → $\log_6 4 = 3m$ → $0.7737 = 3m$ → $m = 0.2579$

Part IV: Natural Log and Common Log Practice

- Common Log- log *x* → understood to be base 10
- Natural log - $\log_e x = \ln x$ → understood to be base "*e*"

Examples: Solve for the missing variable, *x*, in the following equations.

1. $e^{x} = 54.5982$ → $\log_e 54.5982$→ $\frac{\log(54.5982)}{\log(e)}$
2. $-5.1 \times e^{10n+2} + 7.9 = 2$ → $-5.1 \times e^{10n+2} = -5.9$ → $e^{10n+2} = 1.15686$ → $\log_e 1.15686 = 10n + 2$→$\frac{\log(1.15686)}{\log(e)} = 10n + 2$ → $\frac{0.14571-2}{10}$= -0.1854

Practice: Solve for x.

1. $3 \times e^{4-3x} + 1.6$= 45.6

2. $-2 \times e^{-3n-8} - 3 = -45$

****HOMEWORK: Solving Exponential Equations with Logarithms Worksheet (Even questions ONLY)**