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Math 48B, Quiz 4, Lessons 11 – 17: Exponential and Logarithmic Functions

In your first draft solutions to this quiz, I encourage you to take extra space and make your work very easy to read. I might encourage you to write one solution per page. I want to focus your mind here on two goals. First, this is designed to help build understanding of the material. Second, as you write your solutions, think about creating a document that you can look back on and understand years into the future. In this way, your solutions can become a so-called second brain where you store math knowledge for future reference. For more about ideas on how to format your solutions, please take a look at Jeff's Conquering College Study Skills Activity 5.

1. EXPONENT NOTATION

For each of the following problems, rewrite each expression as a^n, where $n \neq 1$.

1A. 256 1B. $\frac{1}{243}$ 1C. $\frac{1}{\sqrt[3]{7^2}}$ 1D. $\frac{1}{125}$

2. PROPERTIES OF EXPONENTS

For each of the following statements, simplify the expression as much as possible and eliminate any negative exponents. Please show your work and explain which rules of exponents you used to get your final answers.

2A. $\left(\frac{-6x^5y^3}{2x^2y}\right)^3$ 2B. $\sqrt[3]{8x^3y^6}$ 2C. $(6m^2)^{-\frac{2}{3}} \cdot \left(36m^{\frac{4}{3}}\right)^{\frac{1}{2}}$

3. TRANSFORMATIONS OF EXPONENTIAL FUNCTIONS

Consider each of the following functions:

$$f(x) = 2^x \quad \text{and} \quad g(x) = 5 - \frac{1}{2} \cdot 2^{x+3}$$

3A. Graph each of these functions $f(x)$ and $g(x)$.

3B. For the functions $f(x)$ and $g(x)$ identify the domain, range, x-intercept, y-intercept, and the end behavior as $x \to -\infty$ as well as $x \to +\infty$.

3C. Consider the exponential functions $f(x) = 2^x$ and $g(x) = a \cdot f(x-h) + k$ from this problem.

- Specifically identify the values of parameters a ,h, and k.
- Explain what each value a ,h, and k in $g(x)$ does to the graph of $f(x) = 2^x$. Show this on the graphs that you created from Problem 3A above.

4. TRANSLATE FROM LOGARITHMIC INTO EXPONENTAIL FORM

Express each of the following in exponential form.

4A. $\log_3(81) = 4$ 4B. $\log_{10}(0.001) = -3$ 4C. $\log_2(512) = 9$

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5. TRANSLATE FROM EXPONENTIAL INTO LOGARITHMIC FORM

Express each of the following in logarithmic form.

5A. $0.125 = 4^{-3/2}$ 5B. $27 = 9^{2x}$ 5C. $7^3 = 343$

6. TRANSLATE FROM EXPONENTIAL INTO LOGARITHMIC FORM

Consider each of the following functions:

$$f(x) = \log_2(x) \quad \text{and} \quad g(x) = 4 + 2 \cdot \log_2(3 - x)$$

6A. Graph each of these functions $f(x)$ and $g(x)$.

6B. For the functions $f(x)$ and $g(x)$ identify the domain, range, x-intercept, y-intercept, and the end behavior as $x \to -\infty$ as well as $x \to +\infty$.

6C. Consider the logarithmic functions $f(x) = \log_2(x)$ and $g(x) = a \cdot f(-x - h) + k$ from this problem.

- What is the effect of multiplying the input by a negative inside the parenthesis.
- Specifically identify the values of parameters a ,h, and k.
- Explain what each value a ,h, and k in $g(x)$ does to the graph of $f(x) = 2^x$. Show this on the graphs that you created from Problem 6A above.

7. PROPERTIES OF LOGARITHMS

Use the laws of logarithms to evaluate each of the following expressions.

4A. $\log_4(2) + \log_4(32)$ 4B. $\log_2(80) - \log_2(5)$ 4B. $-\frac{1}{3}\log(1000)$

8. SOLVING EXPONENTIAL AND LOGARITHMIC EQUATIONS

Please solve each of the equations. Show your work and explain how you got your

8A. $8^x = 2^{2x-1}$ 8B. $\left(\frac{1}{9}\right)^{2x} = 27^{2-x}$ 8C. $3\log_2(2x) - 15 = 0$

Optional Challenge Problem:

8D. $\log_3(x + 6) - \log_3(x + 2) = \log_3(x)$