Warm-Up - Evaluate

1) $\log_4 (1/32)$

2) $\log_{(\sqrt[3]{9})} (9^2)$

3) $\log_2 8 + \log_2 4$

4) $\log_3 81 - \log_3 3$

Logarithmic Functions

EQ: What are logarithms? How are they used?

Standards:

MCC9-12.F.BF.5 Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents

MCC9-12.A.SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. *(Limit to exponential and logarithmic functions.)*

MCC9-12.A.SSE.3c Use the properties of exponents to transform expressions for exponential functions.

MCC9-12.F.IF8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. *(Limit to exponential and logarithmic functions.)*

MCC9-12.A.CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. *(Limit to exponential and logarithmic functions.)*

What am I learning today?

How to manipulate and evaluate logarithms using their properties

How will I show that I learned it?

Expand and condense logarithmic functions using their properties

Inverse Property of Logarithms

The logarithmic function $f(x) = \log_b x$ is the **inverse** of the exponential function $g(x) = b^x$

Verify that they are inverses...

$g(f(x)) = b^{\log_b x}$ and $f(g(x)) = \log_b b^x$

$g(f(x)) = x$ $f(g(x)) = x$

Since $f(g(x)) = g(f(x)) = x$, then $f(x)$ & $g(x)$ are inverses

Evaluate again WITHOUT a calculator.

1. $19^{\log_{19} x} = x$

2. $\log_3 3^{2x} = 2x$

3. $\log 10000^x$

$\log_{10} (10^4)^x$

$\log_{10} 10^{4x} = \boxed{4x}$

4. $e^{\ln 3x} = 3x$

$\ln e^5 = 5$

Find the inverse of a Logarithmic Function

1. **Switch x and y first!!**
2. **Isolate $\log_B$(y) or $B^{b(y-\ )}$**
3. **Convert from log to exponent form** or vice versa
4. **Solve for y.**

FORMATS: $y = aB^{b(x-h)} + k$

$y = a \log_B(b(x-h)) + k$

Examples:

1. $y = \log_3 x$

$x = \log_3 y$

$3^x = 3^{\log_3 y}$

$y = 3^x$

2. $f(x) = \ln(x+1)$

$x = \ln(y+1)$

$e^x = e^{\ln(y+1)}$

$e^x = y+1$

$f^{-1}(x) = e^x - 1$

3. $f(x) = \log_{3/4} x + 5$

$x = \log_{\frac{3}{4}} y + 5$

$x - 5 = \log_{\frac{3}{4}} y$

$\left(\frac{3}{4}\right)^{x-5} = \left(\frac{3}{4}\right)^{\log_{\frac{3}{4}} y}$

$f^{-1}(x) = \left(\frac{3}{4}\right)^{x-5}$

4. $y = \log_5(x + 3) - 6$

$x = \log_5(y+3) - 6$

$x + 6 = \log_5(y+3)$

$5^{x+6} = 5^{\log_5(y+3)}$

$5^{x+6} = y+3$

$y = 5^{x+6} - 3$

5. $y = -3\log(x-7) + 12$ D: $(7,\infty)$ R: $(-\infty,\infty)$

$x = -3\log(y-7) + 12$

$x - 12 = -3\log(y-7)$

$-\frac{1}{3}(x-12) = \log(y-7)$

$10^{-\frac{1}{3}(x-12)} = 10^{\log(y-7)}$

$10^{-\frac{1}{3}(x-12)} = y-7$

$y = 10^{-\frac{1}{3}(x-12)} + 7$ D: $(-\infty,\infty)$ R: $(7,\infty)$

6. $y = \ln(\frac{1}{2}x + 8) - 6$

$x = \ln(\frac{1}{2}(y+16)) - 6$

$x + 6 = \ln(\frac{1}{2}(y+16))$

$e^{x+6} = e^{\ln(\frac{1}{2}(y+16))}$

$e^{x+6} = \frac{1}{2}(y+16)$

$2e^{x+6} = y + 16$

$y = 2e^{x+6} - 16$

7. $y = 5^{x-4} + 7$ D: $(-\infty,\infty)$ R: $(7,\infty)$

$x = 5^{y-4} + 7$

$x - 7 = 5^{y-4}$

$\log_5(x-7) = \log_5 5^{y-4}$

$\log_5(x-7) = y - 4$

$y = \log_5(x-7) + 4$ D: $(7,\infty)$ R: $(-\infty,\infty)$

8. $y = e^{2x-6} - 2 = e^{2(x-3)} - 2$

$x = e^{2(y-3)} - 2$

$x + 2 = e^{2(y-3)}$

$\ln(x+2) = \ln e^{2(y-3)}$

$\ln(x+2) = 2(y-3)$

$\frac{1}{2}\ln(x+2) = y - 3$

$y = \frac{1}{2}\ln(x+2) + 3$

Attachments

Brody_Roll Like a Log.xspf

Brody_Roll Like a Log 2.xspf