

Logarithms

Section 1: Introduction to Logarithms (KA link)

1. $\log_{10} 100 = \log_{10}(10^2) = 2$

what power of 10, gives 100?

$10^? = 100$
 $10 \cdot 10 = 100$
 $10^2 = 100$

2. $\log_2 64 = \log_2(2^6) = 6$

$2^? = 64$

3. $\log_2 1/2 = \log_2(2^{-1}) = -1$

$2^x = 1/2 \quad 2^{-1} = 1/2$

4. $\log_{1/2} 4 = \log_{1/2}((1/2)^{-2}) = -2$

$(1/2)^x = 4 \quad (1/2)^{-2} = 1/4 \quad (1/2)^{-2} = 4$

5. $\log_{0.3} 0.027 = \log_{0.3}(0.3^3) = 3$

$(0.3)^? = .027 \quad 0.3^1 = 0.3 \quad 0.3^2 = 0.09 \quad 0.3^3 = .027$

Section 2: Properties of Logarithms (KA link)

1. Expand the following:

a. $\log(2x) = \log(2) + \log(x)$

$\log(2 \cdot x) = \log 2 + \log x$

$\log(a \cdot b) = \log a + \log b$
 $x^a \cdot x^b = x^{a+b}$

b. $\log(10/x) = \log(10) - \log(x) = 1 - \log(x)$

$\log x = \log_{10} x \quad 10^1 = 10 \geq 1$

$\log(a/b) = \log(a) - \log(b)$

$\log(a^b) = b \cdot \log(a)$

c. $\log_5(x^{10}) = 10 \log_5(x)$

d. $\log_2(10/x^2) = \log_2(10x) - \log_2(y^2) = \log_2(10) + \log_2(x) - 2 \log_2(y)$

$2^1 = 10$

2. Condense the following:

a. $10 \log(x) = \log(x^{10})$

b. $2 \log_2(x) + 4 \log_2(y) = \log_2(x^2) + \log_2(y^4) = \log_2(x^2 y^4)$

c. $\frac{1}{2} \log_8(a) - \frac{1}{4} \log_8(b) = \log_8(a^{1/2}) - \log_8(b^{1/4}) = \log_8(a^{1/2} / b^{1/4})$

d. $\frac{1}{3} \log_6(a) - 3 \log_6(b) + 5 \log_6(c/2) = \log_6(a^{1/3}) - \log_6(b^3) + \log_6(c^5/2^5) = \log_6(a^{1/3} c^5 / 32 b^3)$

$\log_6(a^{1/3}) + \log_6(c^5/32) - \log_6(b^3)$