Math-3A
Lesson 8-2

Log of a Quotient Property of Logarithms

The Change of Base formula,

Simplifying Logarithms

1. $f(x) = 3(4)^{x-1} + 5$ Find $f^{-1}(x)$

2. $\log_3 x^4 y$

Expand the log:

3. $3\log 2 + 2\log x + \log 3 + 5\log y$

Condense the log:

4. $$7 = 2(3)^x$$

Convert to a logarithm:

5. $$3\log_5(x-6) = 6$$

Convert to an exponential;

6. $$f(x) = 3\log(x+2) - 5$$

What is the
Domain and range?

7. $f(x) = 2\log(2x-4) - 6$

What is the logarand?

8. What is the asymptote?

9. What do I mean when I say: “A log is an exponent”?

Log of a Product Property of Logarithms:

$$\log_b(RS) = \log_b R + \log_b S$$

$$\log_2 15 = \log_2 3 + \log_2 5$$

log of a product = sum of the logs of the factors.

Log of Power Property of Logarithms

$$c \; \log_b R^c \rightarrow c\log_b R$$

$$\log_2 3^4 \qquad = 4\log_2 3$$

$$\log 32 \quad = \log 2^5 \quad = 5\log 2$$

$$\frac{x^2}{y^3}$$

Using properties of exponents: rewrite this so the 'y' term is NOT in the denominator.

$$x^2 y^{-3}$$

$$\log_3\left(\frac{5}{2}\right) = \log_3\left(5 * 2^{-1}\right)$$

Negative Exponent Property

$$= \log_3(5) + \log_3(2)^{-1}$$

Log of a Product Property

$$= \log_3 5 + (-1)\log_3 2$$

Log of a Power Property

$$= \log_3 5 - \log_3 2$$

Definition of Subtraction: (adding a negative is subtraction)

Log of a Quotient Property

$$\log_b\left(\frac{R}{S}\right) = \log_b R - \log_b S$$

$\log_3\left(\frac{5}{2}\right)$ “expand the quotient” $\log_3 5 - \log_3 2$

$\ln 8 - \ln 3$ “condense the quotient” $\ln \frac{8}{3}$

“Negative Log”→ denominator of the logarand

Expand the Quotient

$$\log\frac{4}{5} = \log 4 - \log 5 = \log 2 + \log 2 - \log 5$$

$$= 2\log 2 - \log 5$$

$$\ln\frac{3}{7} = \ln 3 - \ln 7$$

Condense the quotient

$$\log_4 5 - \log_4 2 = \log_4 \frac{5}{2}$$

$$\log_5 8 - \log_5 16 = \log_5 \frac{8}{16} = \log_5 \frac{1}{2}$$

Expand the Logarithm

$$\log\left(\frac{2x}{3y^5}\right) = \log 2x - \log 3y^5$$

The denominator is a product!

$$= \log 2x - (\log 3 + 5\log y)$$

Distributive property!

$$= \log 2x - \log 3 - 5\log y$$

$$= \log 2 + \log x - \log 3 - 5\log y$$

Logs of factors in the numerator will be positive.

Logs of factors in the denominator will be negative.

Expand the quotient

$$\ln \frac{zx^2}{5y^3} = \ln zx^2 - \ln 5y^3$$
$$= \ln z + \ln x^2 - (\ln 5 + \ln y^3)$$
$$= \ln z + 2\ln x - (\ln 5 + 3\ln y)$$
$$= \ln z + 2\ln x - \ln 5 - 3\ln y$$

$$= \log_4 \left(\frac{w^5}{x^7} \right)^2 = \log_4 \frac{w^{10}}{x^{14}}$$
$$= \log_4 w^{10} - \log_4 x^{14}$$
$$= 10\log_4 w - 14\log_4 x$$

$$\log_4 \frac{2\sqrt{x}}{4yz} = \log_4 2\sqrt{x} - \log_4 4yz$$

$$= \log_4 2 + \log_4 \sqrt{x} - \log_4 4 - \log_4 y - \log_4 z$$

$$= \log_4 2 + \frac{1}{2}\log_4 x - \log_4 4 - \log_4 y - \log_4 z$$

Change-of-Base Formula for Logarithms

$$\log_c a = \frac{\log_b a}{\log_b c}$$

Change to log base 10 or base 'e' (your calculator can do these).

Convert to base 10.

$$\log_4 5 = \frac{\log_{10} 5}{\log_{10} 4} = \frac{0.699}{0.6021} = 1.161$$

$$\log_4 5 = \frac{\ln 5}{\ln 4} = \frac{1.609}{1.386} = 1.161$$

Simplify

$$\log_2 2$$

$$\log_2 2 = x$$

$$2^x = 2$$

$$x = 1$$

Using Change of base:

$$\log_2 2 = \frac{\log 2}{\log 2} = 1$$

Simplify: $\log_4 16$ "4 raised to what power equals 16?"

$$\log_4 4^2 \qquad 2\log_4 4 \qquad 2(1) = 2$$

$$\log_2 \sqrt{2}$$

"2 raised to what power equals the square root of 2?"

$$\log_2 2^{1/2} \qquad {}^1\!/_2 \log_2 2 \qquad {}^1\!/_2(1) \qquad {}^1\!/_2$$

Simplify: $5\log_3 27$

$5\log_3 3^3$ $(3*5)\log_3 3$ 15

$6\log_2(16)-4$

$6\log_2(2^4)-4$

$(4*6)\log_2(2)-4$

$(24)(1)-4$

20

Simplify:

$$8\log_5(125)+3 \qquad = 27$$

$$2\log_9(81)-5 \qquad = -1$$

$$-6\log_3(\sqrt[2]{3})+4 \qquad = 1$$