Logarithm Review

Objectives:

- Identify and understand the product and quotient laws for logarithms
- Use the product and quotient laws to solve problems involving logarithms

Logarithmic and Exponential forms

$\log_b m = n$ is the same as $b^n = m$

The Logarithmic Product Law (equal bases)

$\log_b (m \times n) = \log_b m + \log_b n$

The Logarithmic Quotient Law (equal bases)

$$\log_b\left(\frac{m}{n}\right) = \log_b m - \log_b n$$

The Logarithmic Power Laws

$\log_b m^n = n \log_b m$ $\qquad$ $\log_b \sqrt[y]{m^x} = \frac{x}{y}\log_b m$

Examples:

1. Express each in logarithmic form.

a) $n = 4^x$ $\qquad$ b) $243 = 3^5$ $\qquad$ c) $2^{-4} = \frac{1}{16}$

$\log_4 n = x$ $\qquad$ $\log_3 243 = 5$ $\qquad$ $\log_2 \frac{1}{16} = -4$

2. Express each in exponential form

a) $\log_{10} 10000 = 4$ $\qquad$ b) $\log_5 \frac{1}{25} = -2$ $\qquad$ c) $\log_k t = x$

$10^4 = 10000$ $\qquad$ $5^{-2} = \frac{1}{25}$ $\qquad$ $k^x = t$

3. Find the value of each logarithm LIKE BASES...

a) $\log_2 64$ $\qquad$ b) $\log_4 \frac{1}{16}$ $\qquad$ c) $\log_4 4^5 = 5$

$\log_2 2^6$

$= 6$

$2^x = 64$

$2^x = 2^6$

$\log_4 (4^{-2})$

$= -2$

$4^x = \frac{1}{16}$

$4^x = 4^{-2}$

1.0 Log Review

4. Solve for x.

a) $\log_2(25-x)=3$

change forms ... exp

$2^3 = 25 - x$

$8 = 25 - x$

$x = 17$

same base

b) $3^{x+2}=7$

$\log 3^{x+2} = \log 7$

$(x+2)\log 3 = \log 7$

$x\log 3 + 2\log 3 = \log 7$

$x = \dfrac{\log 7 - 2\log 3}{\log 3}$

5. Use the laws of logarithms to rewrite the following.

a) $\log_2(6x)$

product law

$= \log_2 6 + \log_2 x$

b) $\log_5 x^3 y^6$

product

power

$\log_5 x^3 + \log_5 y^6$

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

c) $\log_{10} \dfrac{ab}{\sqrt[3]{c}}$

quotient

$\log_{10} a + \log_{10} b - \log_{10} c^{1/3}$

$= \log a + \log b - \frac{1}{3}\log c$

LIKE BASES!

6. Express $3\log_2 s+\frac{1}{2}\log_2 t-4\log_2(t^2+1)$ as a single logarithm.

power

$= \log_2 s^3 + \log_2 t^{1/2} - \log_2 (t^2+1)^4$

sum + diff $\Rightarrow$ prod + quotients

$= \log_2 \dfrac{s^3\sqrt{t}}{(t^2+1)^4}$

A Study of Exponential and Logarithmic Graphs

Objectives Use the graphs of exponential and logarithmic functions to evaluate limits and transformations.

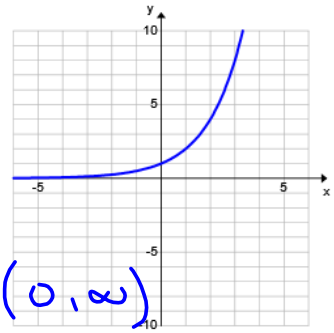
$(x, y) \Rightarrow (y, x)$

Warm up:
Graph each of log functions; the graphs are inverses of each other.

$x = 2^y$

a) $y = 2^x$

x	y
0	1
1	2
2	4
-1	½



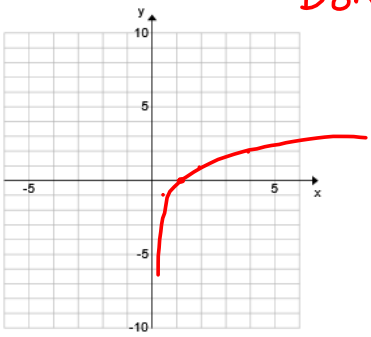
$y = 0$

Range $(0, \infty)$

b) $y = \log_2 x$

Domain $(0, \infty)$

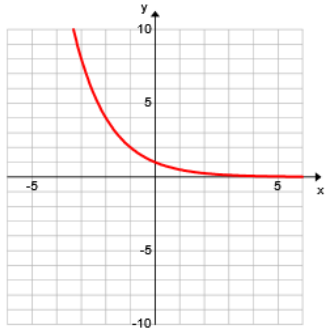
$x = 0$



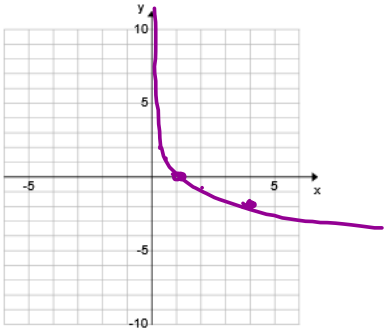
c) $y = \left(\frac{1}{2}\right)^x$

$(1/2)^x$

x	y
0	1
1	½
2	¼
-1	2
-2	4



d) $y = \log_{\frac{1}{2}} x$



Use the graphs to evaluate each function: $\lim_{x \to -\infty}$, $\lim_{x \to 0^-}$, $\lim_{x \to 0^+}$, $\lim_{x \to \infty}$

a) $y = 2^x$ b) $y = \log_2 x$ c) $y = \left(\frac{1}{2}\right)^x$ d) $y = \log_{\frac{1}{2}} x$