March 19th/20th

Goal: evaluate logarithms
solve logarithmic equations

Topic: Logarithms and Logarithmic Functions

Question: Make a story to help you remember how to convert logarithms to exponents.

Exponential Function

$$b^x = y$$

The inverse of an exponential function is a Logarithmic function.

$$b^y = x \xrightarrow[\text{it like}]{\text{we write}} \log_b x = y$$

"y equals log base b of x"

Example 1.

Write in Exponential Form:

$\log_b x = y$

$b^y = x$

a.) $\log_8 1 = 0$

$\boxed{8^0 = 1}$

b.) $\log_2 \frac{1}{16} = -4$

$\boxed{2^{-4} = \frac{1}{16}}$

Example 2.

Write in Exponential Form:

a.) $\log_3 9 = 2$

$\boxed{3^2 = 9}$

b.) $\log_{10} \frac{1}{100} = -2$

$\boxed{10^{-2} = \frac{1}{100}}$

Example 3

Evaluate $\log_2 64$

$\log_b x = y$

$b^y = x$

$2^y = 64$

$2^y = 2^6$

$b^x = b^y$

$x = y$

$y = 6$

$\boxed{6}$

Example 4.

Evaluate $\log_3 243$

$\log_b x = y$

$3^5 = 243$

$b^y = x$

5

Example 5.

Solve for n:

$\log_8 n = \frac{4}{3}$

$\log_b x = y$

$b^y = x$

$\frac{3}{1}\left(\frac{4}{3}\right)$

$\frac{12}{3}$

4

$8^{4/3} = n$

$2^{3(4/3)} = n$

$2^4 = n$

$16 = n$

Example 6.

solve for n...

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

$$4^{\frac{5}{2}} = n$$

$$2^{2 \cdot \frac{5}{2}} = n$$

$$2^5 = n$$

$$32 = n$$

Solve Logarithmic Equations and Inequalities

Logarithmic to Exponential Inequality	If $b > 1$, $x > 0$, and $\log_b x > y$, then $x > b^y$. If $b > 1$, $x > 0$, and $\log_b x < y$, then $0 < x < b^y$.
Property of Equality for Logarithmic Functions	If b is a positive number other than 1, then $\log_b x = \log_b y$ if and only if $x = y$.
Property of Inequality for Logarithmic Functions	If $b > 1$, then $\log_b x > \log_b y$ if and only if $x > y$, and $\log_b x < \log_b y$ if and only if $x < y$.

Example 7. Solve for x:

$\log_5 x < 2$

$0 < x < b^y$

Logarithm to Exponential inequality

$0 < x < 5^2$

$0 < x < 25$

Example 8. Solve for x:

$\log_6 x > 3$

$x > b^y$

Logarithm to Exponential Inequality

$x > 6^3$

$x > 216$

Example 9. Solve for p:

$$\log_5(p^2-2)=\log_5 p$$

$$p^2-2=p$$

$$p^2-p-2=0$$

$$(p^2-2p)+(p-2)=0$$

$$p(p-2)+1(p-2)=0$$

$$(p+1)(p-2)=0$$

-2, 1, -2, -1

$p+1=0$ $\quad$ $p-2=0$

$\cancel{p=-1}$ $\quad$ $p=2$

$b^x=b^y$

$x=y$

$\log_b x=\log_b y$

$x=y$

$ab=0$

then $a=0$ or $b=0$

Example 10. Solve for x...

$$\log_4 x^2=\log_4(4x-3)$$

$$x^2=4x-3$$

$$x^2-4x=-3$$

$$x^2-4x+4=-3+4$$

$$(x-2)^2=1$$

$$x-2=\pm\sqrt{1}$$

$$x-2=\pm 1$$

$x-2=1$ $\quad$ $x-2=-1$

$x=3$ $\quad$ $x=1$

$$x^2-4x+3=0$$

-3, -1, -3, -4

$$x^2-3x-1x+3=0$$

$$x(x-3)-1(x-3)=0$$

$$(x-1)(x-3)=0$$

$x-1=0$ $\quad$ $x-3=0$

$x=1$ $\quad$ $x=3$

Homework:
pages 536-538
#21-37 ODD
#47-57 ODD
#85-90 ODD

Solve for n:

$$5n^2 + 46n + 48 = 0$$

$$\left(r^3 + 18r^2 + 83r + 16\right) \div \left(r + 9\right)$$