# Warmup:

$-8-12=-20$

**Simplify. Your answer should contain only positive exponents.**

$$\frac{m^3}{(n^3)^{-3}} = \frac{m^3}{n^{-9}} = m^3 n^9$$

$$\left(\frac{2x^{-4}y^3}{(2x^2y^4)^3}\right)^2 = \left(\frac{2x^{-4}y^3}{2^3x^6y^{12}}\right)^2$$

$$\frac{2^2 x^{-8} y^6}{2^6 x^{12} y^{24}}$$

$$\frac{m^3}{m^{-9}} = m^{3--9}$$

$$m^{3+9}$$

$$m^{12}$$

$$2^{-4} x^{-20} y^{-18}$$

$$= \frac{1}{2^4 x^{20} y^{18}}$$

# Introduction to Logarithmic Functions

**Logarithmic Expression**: inverse of an exponential expression

# Exponential Expression vs Logarithmic expression

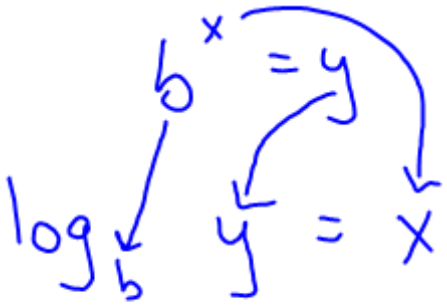
$b^x = y$ $\longleftrightarrow$ $\log_b y = x$

"b to the x = y"

"log base b of y = x"

$10^3 = 1000$

$3 = \log_{10} 1000$



**example**: Convert the following

1. $10^2 = 100$ ⟺ $\log_{10} 100 = 2$ or $\log 100 = 2$

"common log" [base is 10]

2. $2^3 = 8$ ⟺ $\log_2 8 = 3$

3. $4^2 = 16$ ⟺ $\log_4 16 = 2$

4. $3^{-2} = \frac{1}{9}$ ⟺ $\log_3 1/9 = -2$

$$y = x + 3$$

or

$$y = |x| + 3$$

**example**: Write in logarithmic form.

$5^3 = 125$

$\log_5 125 = 3$

$6^4 = 1{,}296$

$\log_6 1296 = 4$

$3^{-3} = 1/27$

$\log_3 \frac{1}{27} = -3$

example: Write in exponential form.

$\log_8 512 = 3$ $\log_3 81 = 4$ $\log_4 (1/16) = -2$

$8^3 = 512$ $3^4 = 81$ $4^{-2} = 1/16$

For any *Positive* Base B, where $B \neq 1$, $B^x = y$ if and only if $\log_B y = x$.

$B^x = y$

$\log_B y = x$

# one-to-one property --- if $b^x = b^y$ then $x = y$

If $3^{2} = 3^{y}$, then 2 = y.

ex. Solve.

$v = \log_5 125$

$5^v = 125$

$5^v = 5^?$

$5^v = 5^3$

$v = 3$

$5 = \log_v 32$

$v^5 = 32$

$v^5 = 2^5$

$v = 2$

$5\overline{)32}$

$4 = \log_3 v$

$3^4 = v$

$3 \cdot 3 \cdot 3 \cdot 3$

$v = 81$

$\log_{64} 4 = \frac{1}{3}$

$v = \log_{64} 4$

$(64)^v = 4^1$

$(4^3)^v = 4^1$

$4^{3v} = 4^1$

$3v = 1$

$v = \frac{1}{3}$

$64^{\frac{1}{3}} = 4$

$6 = \log_3 v$

$3^6 = v$

$729 = v$

$2 = \log_v 25$

$v^2 = 25$

$v^2 = 5^2$

$v = 5$

$\frac{1}{2} = \log_v 9$

$(v^{\frac{1}{2}})^2 = (9)^2$

$v = 81$

$v = \log_2 1$

$2^v = 1$

$v = 0$

$3 = \log_7 v$

$7^3 = v$

$v = 343$

# common logs --- base 10 ; (base used in calculator)

ex. Use common logs to solve each equation.

$10^x = 85$

$10^0 = 1$

$10^1 = 10$

$10^2 = 100$

$10^3 = 1000$

$\log_{10} 85 = x$

or

$\log 85 = x$

$x = 1.929$

$10^x = 1/109$

$\log_{10} 1/109 = x$

$x = -2.037$

$10^x = 14.5$

$\log 14.5 = x$

$x = 1.161$

$10^{1.9} = 79.4$

$10^{1.93} = 85.1$

$10^{1.929} = 84.918$

$10^{1.9294} = 84.996$

In Class Practice

- Check off when finished
- Get HW Assignment when finished

# Homework:
# Log WS #2