

$$8^x = 256$$
$$(2^3)^x = 2^8$$

$$2^{3x} = 2^8$$

$$\frac{3x}{3} = \frac{8}{3}$$

$$x = \frac{8}{3}$$

## Logarithms

Inverses

Multiplication  $\longleftrightarrow$  Division  
 $3x$

Addition  $\longleftrightarrow$  Subtraction

Exponential functions  $\longleftrightarrow$  Logarithmic Functions

$y = b^x$   $\leftarrow$  exponent  
 $\leftarrow$  base Inverse  $x = b^y$

Logs

$$y = \log_2 256$$

$$y = \log_b x$$

$$y = \log_3 9$$

"Y" equals log base "b" of "x"

"What is the exponent "Y" if 3 is the base and 9 is the answer?"

$$100 = 10^2 \leftarrow \text{exp.}$$

$\leftarrow$  base

$$2 = \log_{10} 100$$

$$Y = \text{base}^x \iff X = \log_{\text{base}} Y$$

$$81 = 3^4 \iff 4 = \log_3 81$$

$$3 = \log_5 125 \iff 125 = 5^3$$

## Evaluating a log Steps

$$\log_8 32 = X$$

$$32 = 8^x$$

$$2^5 = (2^3)^x \quad 8 = 2^3$$

$$2^5 = 2^{3x}$$

$$\frac{5}{3} = \frac{3x}{3}$$

$$\frac{5}{3} = x$$

What is the value of

$$\log_4 32 = X$$

$$32 = 4^x$$

$$2^5 = (2^2)^x$$

$$2^5 = 2^{2x}$$

$$\frac{5}{2} = \frac{2x}{2}$$

$$x = \frac{5}{2}$$

1) write as a log function

2) rewrite as an exponential function

3) write each side using a common base.

4) Drop the bases and set the exponents equal to each other.

Dec 2004, 9.3 Earth Quake

March 2005, 8.7 magnitude

$$\boxed{\text{Formula:}} \log \frac{I_1}{I_2} = M_1 - M_2$$

$$9.3 - 8.7$$

$I$  = Intensity level

$$\log \frac{I_1}{I_2} = 9.3 - 8.7 \quad 10 \boxed{\wedge} 0.6$$

$$\log_{10} \frac{I_1}{I_2} = 0.6 \quad 3.981$$

$$\frac{I_1}{I_2} = 10^{0.6} = 3.981 \approx 4$$

December was 4 times as powerful as the March quake