7-3 Day 2: Logarithmic Functions and Inverses

Objectives: 1. Convert from exponential to log. form.
2. Evaluate logs.

CONVERSION

Exponential Form: ⟷ **Logarithmic Form:**

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

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

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Ex. Write in logarithmic form:

1.) $\boxed{25}=\boxed{5}^{\boxed{2}}$ $\log_5 25 = 2$

2.) $\boxed{3}^{\boxed{-2}} = \boxed{1/9}$ $\log_3 \frac{1}{9} = -2$

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Ex. Write in exponential form:

3.) $\log_{2} 128 = 7$

$2^7 = 128$

4.) $\log_{1/3} 1/27 = 3$

$\left(\frac{1}{3}\right)^3 = \frac{1}{27}$

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Evaluate logs:

Before we get to the logs......

Solve for x.

1.) $2^x = 8$

rewrite with base of 2.

$2^x = 2^3$

$\boxed{x=3}$

2.) $81^x = 27$

$3^{4x} = 3^3$

$4x = 3$

$\boxed{x = 3/4}$

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Ex. Evaluate each log:

5.) $\log_3 729 = \boxed{6}$

Convert into exponential form

$3^x = 729$

$3^x = 3^6$

$x = 6$

6.) $\log_{25} 5 = \boxed{\frac{1}{2}}$

$25^x = 5$

$5^{2x} = 5^1$

$2x = 1$

$x = \frac{1}{2}$

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Ex. Evaluate each log:

7.) $\log_8 32 = \boxed{\frac{5}{3}}$

$8^x = 32$

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

$3x = 5$

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

8.) $\log_{64} 1/32 = \boxed{-\frac{5}{6}}$

$64^x = \frac{1}{32}$

$2^{6x} = 2^{-5}$

$6x = -5$

$x = \frac{-5}{6}$

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Common Log (log base 10):

log a = x

A **common logarithm** is a logarithm with base 10. You can write a common logarithm $\log_{10} x$ simply as $\log x$, without showing the 10.

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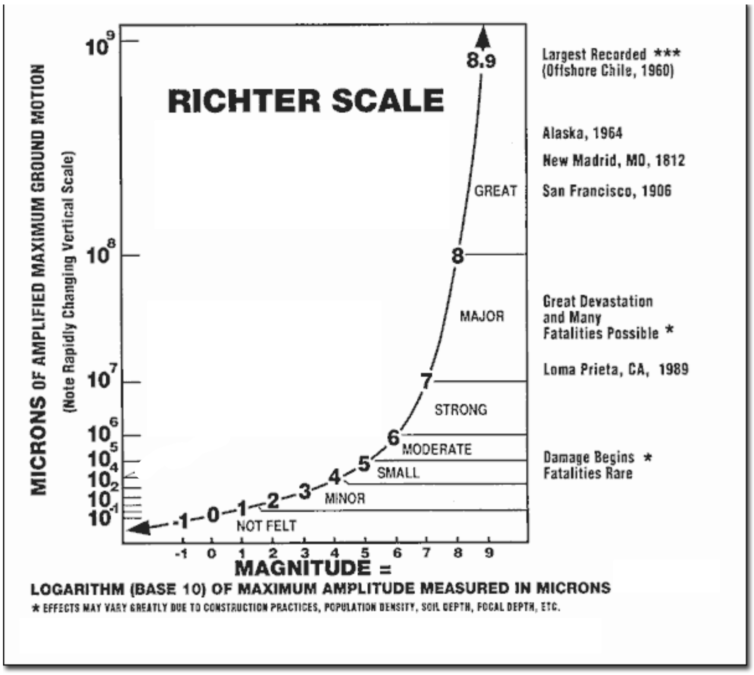
Many measurements of physical phenomena have such a wide range of values that the reported measurements are logarithms (exponents) of the values, not the values themselves. When you use the logarithm of a quantity instead of the quantity, you are using a **logarithmic scale**. The Richter scale is a logarithmic scale. It gives logarithmic measurements of earthquake magnitude.



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The formula $\log \frac{I_1}{I_2} = M_1 - M_2$ compares the intensity levels of earthquakes where I is the intensity level determined by a seismograph, and M is the magnitude on a Richter scale.

Ex.

In 1995, an earthquake in Mexico registered 8.0 (M_1) on the Richter scale. In 2001, an earthquake of magnitude 6.8 (M_2) shook Washington state. How many times more intense was the 1995 earthquake than the 2001 earthquake?

$$\log \frac{I_1}{I_2} = 8.0 - 6.8$$

$$\log_{10} \frac{I_1}{I_2} = 1.2$$

$$10^{1.2} = \frac{I_1}{I_2}$$

$$\boxed{15.85 = \frac{I_1}{I_2}}$$

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HW:

p. 456:

#'s: 12 - 35 all, 46 - 53 all, 59

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