Logarithmic Functions – Intermediate Algebra



Definition - $y = \log_b(x)$ is the power to which you raise *b* in order to get *x*.

Fact - $y = \log_b(x)$ is the same as $b^y = x$. So all a logarithm is, is an exponent.

Fact – The base most commonly used is base b = 10 so this is called the common logarithm. It is used so frequently that we do not even write the *b* value. In the sciences, the most natural base to use is b = e so this is called the <u>natural logarithm</u>. As it is so special to the sciences it has a special notation: $\log_e x = \ln x$. Please note that these are "L's" and not "I's" as the word logarithm starts with an L.

Examples: Evaluate the following logarithms.

- 2. log10,000
- what power (lug) do I put un 10 (no base written) to get 10,000, = $3. \log_5 125$

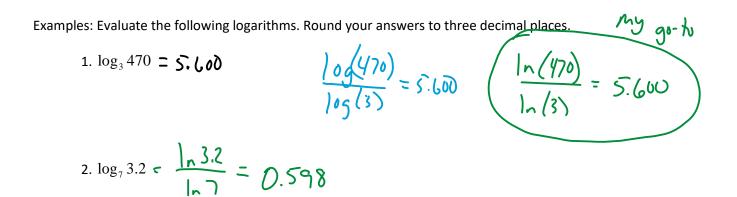
4. $\log_2 16$

Properties of Logarithms

- Basic 3 prof
- 1. The logarithm of 1 for any base will always equal zero. $\log_b 1 = 0$ since $b^0 = 1$ 2. The logarithm of its base is always equal to 1. $\log_b b = 1$ since $b^1 = b$
- 3. The logarithm of the base to a power is just that power. $\log_b (b^m) = m$ since $b^m = b^m$.

Since any base *b* is possible for b > 0, it would be impossible to have all of them on the calculator. We can use the change of base formula in order to evaluate any logarithm.

Change of Base Formula - $\log_b a = \frac{\log a}{\log b} = \frac{\log_c a}{\log_c b}$ for any base *c*.



3.
$$\log_{17} 11 = 0.840$$

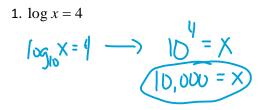
Examples: Rewrite the equation into the opposite form.

1.
$$6^{5} = 7776$$
 5 is the power 1^{-} put on 6
5 = $\log_{6} 7776$ to get 7776.

2. $\log_7 2401 = 4$

Fact: To solve a logarithmic equation, we switch to exponential form.

Examples: Solve.



2.
$$\log_5 x = 3$$



$$3. \log_2(5x) = 6$$

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

$$\frac{64}{5} = \frac{5x}{5} \rightarrow \chi = \frac{64}{5} = 12.8$$

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