Properties of Logarithms

Exponential Form	**Transforms in both directions**	**Logarithmic Form**
$b^y = x$	←→	$y = \log_b x$

Rules: $x > 0$, $b > 0$, $b \neq 1$

and $\log_b u = \log_b v$ *if and only if* $u = v$

$\log_b nk = \log_b n + \log_b k$	Product Rule: The log of the product of two numbers is equal to the sum of the log of each of the numbers.
$\log_b \frac{n}{k} = \log_b n - \log_b k$	Quotient Rule: The log of the quotient of two numbers is equal to the difference between the log of each number.
$\log_b n^k = k \log_b n$	Power Rule: The log of a number that is raised to a power is equal to the exponent times the log of the number.
$\log x = \log_{10} x$	Definition: The word "log" with no base shown is a shorthand way of writing a log with the base of 10. This is called a Common Log.
$\ln x = \log_e x$	Definition: The symbol "ln" is a shorthand way of writing a log with the base of *e*. This is called a Natural Log.
$\log_b 1 = 0$	The log of 1 equals zero because if we go back to exponential form, we see that $b^0 = 1$ $(b \neq 0)$ (see definition of zero exponent)
$\log_b b = 1$	The log of *b* to the base *b* equals 1 because if we go back to exponential form, we see that $b^1 = b$ $(b \neq 0)$
$\log_b b^x = x$	The log of b^x to the base *b* is equal to just the exponent *x* because if we go back to exponential form, we see that $b^x = b^x$ $(b \neq 0)$
$b^{\log_b x} = x$	A base *b* raised to the power of a log to that same base is equal to just the argument *x* because if we go into logarithmic form, we see that $\log_b x = \log_b x$ $(b \neq 0)$
$\log_b x = \frac{\log x}{\log b} = \frac{\ln x}{\ln b}$	Change of Base Theorem: Allows you to find the value of a logarithm with a base other than 10 or *e* using your calculator (use either of the fractions shown)