Logarithm Summary Sheet—Explanation

Meaning of Logarithms
$\text{Log } x = \log_{10} x$
$\ln x = \log_e x$

Properties of Logarithms	
Property	**Reason**
1. $\log_a 1 = 0$	We must raise *a* to the power 0 to get 1.
2. $\log_a a = 1$	We must raise *a* to the power 1 to get *a*.
3. $\log_a a^x = x$	We must raise *a* to the power *x* to get a^x
4. $a^{\log_a x} = x$	$\text{Log}_a x$ is the power to which *a* must be raised to get *x*.

Properties of Natural Logarithms	
Property	**Reason**
1. $\ln 1 = 0$	We must raise *e* to the power 0 to get 1.
2. $\ln e = 1$	We must raise *e* to the power 1 to get *e*.
3. $\ln e^x = x$	We must raise *e* to the power *x* to get e^x
4. $e^{\ln x} = x$	In *x* is the power to which *e* must be raised to get *x*.

Laws of Logarithms	
Let *a* be a positive number, with $a \neq 1$. Let $A > 0$, $B > 0$, and *C* be any real numbers.	
Law	$\frac{\log B}{\log a}$ **Description**
1. $\log_a (AB) = \log_a A + \log_a B$	The logarithm of a product of numbers is the sum of the logarithms of the numbers.
2. $\log_a \left(\frac{A}{B}\right) = \log_a A - \log_a B$	The logarithm of a quotient of numbers is the difference of the logarithms of the numbers.
3. $\log_a (A^C) = C \log_a A$.	The logarithm of a power of a number is the exponent times the logarithm of the number.

Change of Property Base
$\text{Log}_a B = \frac{\log B}{\log a}$