Logarithmic Properties:

$(b > 0 \ \ and \ b \neq 1)$

$f(x) = b^x \quad \Leftrightarrow \quad f^{-1}(x) = log_b X$

$b^E = N \ \Leftrightarrow \ \log_b N = E$	$e^E = N \ \Leftrightarrow \ \ln N = E$
$\log_b b = 1$	$\ln e = 1$
$\log_b X^n = n \log_b X$	$\log_b a = \frac{1}{\log_a b}$
$b^{\log_b N} = N$	$\log_b \frac{1}{a} = \ - \ \log_b a$
$\log_b X + \log_b Y = \log_b XY$	$\log_b X - \log_b Y = \log_b \frac{X}{Y}$

$$\log_b a = \frac{\log(a)}{\log(b)} = \frac{\ln(a)}{\ln(b)}$$

$$\log_{a^m}(a^n) = \frac{n}{m}, \quad m \neq 0$$

$$\log_{\left(\frac{1}{a}\right)} b = -\log_a b$$

$$\log_a b \cdot \log_b c = \log_a c$$