Logarithm's and Properties

$y = log_a x$ if and only if $x = a^y$

EX: Evaluate:
- $f(x) = log_6 x, x = 1$

- $f(x) = log_5 x, x = \frac{1}{125}$

- $f(x) = log_7 x, x = 343$

Properties of Logarithms
- $log_a 1 = 0$
- $log_a a = 1$
- $log_a a^x = x$
- If $log_a x = log_a y$ Then x = y

EX: Simplify:
- $log_9 9$
- $20^{log_{20} 3}$
- $log_{\sqrt{3}} 1$
- Solve: $log_5(x^2 + 3) = log_5 12$

Natural Logarithm: Log base *e*
$f(x) = log_e x = lnx$

Properties of Natural Log
- $ln1 = 0$
- $lne = 1$
- $lne^x = x$
- If $lnx = lny$ then x = y

EX: Simplify
- $lne^{\frac{1}{3}}$
- $5ln1$
- $\frac{3}{4} lne$
- e^{ln7}

More Properties of Logarithms

- $\log_b mn = \log_b m + \log_b n$
- $\log_b \frac{m}{n} = \log_b m - \log_b n$
- $\log_b m^n = n \log_b m$
- $\log_b m = \frac{\log_c m}{\log_c b}$
- Log on your calculator is $\log_{10}$
- Examples:
  - What is each expression written as a single logarithm? If possible, simplify the single logarithm.
    - $\log_3 x - 2\log_3 7$

    - $\log_8 48 + \log_8 \frac{4}{3}$

  - What is each logarithm expanded? Simplify your answer, if possible.
    - $\log_5 \frac{125}{xy}$

    - $\log x^2 y^2 z^{-1}$

  - What is the value of each expression?
    - $\log_9 111$

    - $\log_{216} 36$