

Properties of Logarithms

Product property: $\log_a xy = \log_a x + \log_a y$

Quotient property: $\log_a \frac{x}{y} = \log_a x - \log_a y$

Power Property: $\log_a x^r = r \log_a x$

$$\log_a 1 = 0 \Rightarrow a^0 = 1$$

$$\log_a a = 1 \Rightarrow a^1 = a$$

Ex 5 (a) $\log_6 (7 \cdot 9) = \log_6 7 + \log_6 9$

(b) $\log_9 \frac{15}{7} = \log_9 15 - \log_9 7$

(c) $\log_a \frac{mnq}{p^2t^4} = \log_a m + \log_a n + \log_a q$
 $- 2 \log_a p - 4 \log_a t$

Ex 6 (a) $\log_3 (x+2) + \log_3 x - \log_3 2$
 $= \log_3 \frac{(x+2)x}{2}$

$$\begin{aligned} \text{Ex 6 (b)} \quad & 2 \log_a m - 3 \log_a n \\ &= \log_a m^2 - \log_a n^3 \\ &= \log_a \frac{m^2}{n^3} \end{aligned}$$

Ex 7 Given that $\log_{10} 2 \approx 0.3010$, find each logarithm without using a calculator.

$$\begin{aligned} \text{(a)} \quad \log_{10} 4 &= \log_{10} 2^2 = 2 \log_{10} 2 \\ &= 2 (.3010) = \boxed{.6020} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad \log_{10} 5 &= \log_{10} \frac{10}{2} = \log_{10} 10 - \log_{10} 2 \\ &= 1 - .3010 \approx \boxed{.6990} \end{aligned}$$