

$$\log_a b = x \Leftrightarrow b = a^x$$

$$\text{ex: } 3^x = 15 \Leftrightarrow x = \log_3 15$$

$$\log_a 1 = 0$$

$$\text{ex: } \log_3 1 = 0$$

Definition

$$\log_a a = 1$$

$$\text{ex: } \log 10 = 1$$

$$\log_a a^b = b$$

$$\text{ex: } \ln e^2 = 2$$

Product

$$\log_a (u \times v) = \log_a u + \log_a v$$

$$\text{ex: } \log_6 10 + \log_6 2 = \log_6 (10 \times 2) = \log_6 20$$

Quotient

$$\log_a \left(\frac{u}{v} \right) = \log_a u - \log_a v$$

$$\text{ex: } \log_4 9 - \log_4 3 = \log_4 \left(\frac{9}{3} \right) = \log_4 3$$

Exponential

$$\log_a u^v = v \times \log_a u$$

$$\text{ex: } \log_4 36 = \log_4 6^2 = 2 \times \log_4 6$$

Change of Base

$$\log_a u = \frac{\log_b u}{\log_b a}$$

$$\text{ex: } \log_4 5 \times \log_5 6 = \log_4 5 \times \frac{\log_4 6}{\log_4 5} = \log_4 6$$