

Logarithms.

$$4^2 = 16 \rightarrow \text{represented by } \log_4 16 = 2$$

$$8^3 = 512 \rightarrow \text{represented by } \log_8 512 = 3$$

$\downarrow$
 $\log 512$ to the base 8
 $\downarrow$
 base

$\Rightarrow$ key properties

$$\log_a a \rightarrow 1$$

$$\log_a 1 \rightarrow 0$$

$$\log_a a^x \rightarrow \text{can also be written as } x \log_a a = x$$

$$a^{\log_a x} = x$$

Conditions

$$\rightarrow a > 0 \text{ and } a \neq 1$$

$$\rightarrow x > 0$$

$$\rightarrow y = a^x \rightarrow \log_a y = x$$

$\Rightarrow$ key properties

$\rightarrow$ Multiplication law

$$\log_a (xy) = \log_a x + \log_a y$$

$\rightarrow$ Division law

$$\log_a \left[\frac{x}{y} \right] = \log_a x - \log_a y$$

$\rightarrow$ Power law

$$\log_a (x)^m = m \log_a x$$