Formulas

Logarithmic Expression

$\log_b c$

$\log_b$ is the operator

b is the base

c is the argument

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

$c > 0$

Logarithmic Functions

$f(x) = a \log_b x$

$f(x)$ is the value or output

x is the argument or input

$\log_b$ is the operator

b is the base

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

$a \neq 0$

Product Property for Logarithms

$$f(x) = \log_b(dx) = \log_b d + \log_b x$$

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

$d > 0$

d is a real number

A vertical translation is equivalent to the horizontal dilation of the logarithmic function.

$$f(x) = \log_b(dx) = \log_b d + \log_b x = c + \log_b x$$

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

$d > 0$

c and d are real numbers

If $c > 0$, then the function is shifted up c units.

Quotient Property for Logarithms

$$f(x) = \log_b\left(\frac{x}{d}\right) = \log_b x - \log_b d$$

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

$d > 0$

d is a real number

A vertical translation is equivalent to the horizontal dilation of the logarithmic function.

$$f(x) = \log_b\left(\frac{x}{d}\right) = \log_b x - \log_b d = -c + \log_b x$$

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

$d > 0$

c and d are real numbers

If $c < 0$, then the function is shifted down c units.

Power Property for Logarithms

$$f(x) = \log_b(x^n) = n \log_b x$$

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

n is a real number

If $n < 0$, the function is reflected over the x-axis.

Change of Base Property for Logarithms

$$f(x) = \log_b x = \frac{\log_m x}{\log_m b}$$

$m > 0$ and $m \neq 1$

$\log_m b$ is a constant