Properties of Logarithms

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Preliminaries and Objectives

Preliminaries

- Laws of Exponents
- Definition of Logarithm

Objectives

- Law of Logarithms

Zero Exponents

Exponential Notation	Logarithmic Notation
$b^m = x$	$m = \log_b x$
$b^0 = 1$	$0 = \log_b 1$

Exponent is 1

Exponential Notation	Logarithmic Notation
$b^m = x$	$m = \log_b x$
$b^1 = b$	$1 = \log_b b$

Combining Exponents and Logarithms

Exponential Notation	Logarithmic Notation
$b^m = x$	$m = \log_b x$

$$\log_b b^m = \log_b x = m$$

Combining Exponents and Logarithms

Exponential Notation	Logarithmic Notation
$b^m = x$	$m = \log_b x$

$$b^{\log_b x} = b^m = x$$

Negative Exponents = Reciprocals

Exponential Notation	Logarithmic Notation
$b^m = x$	$m = \log_b x$
$\frac{1}{x} = \frac{1}{b^m} = b^{-m}$	$-\log_b x = \log_b \frac{1}{x}$

Adding Exponents = Multiply Numbers

Exponential Notation	Logarithmic Notation
$b^m = x$	$m = \log_b x$
$b^n = y$	$n = \log_b y$
$xy = b^m \cdot b^n = b^{m+n}$	$\log_b x + \log_b y = \log_b xy$

Subtracting Exponents = Dividing Numbers

Exponential Notation	Logarithmic Notation
$b^m = x$	$m = \log_b x$
$b^n = y$	$n = \log_b y$
$\frac{x}{y} = \frac{b^m}{b^n} = b^{m-n}$	$\log_b x - \log_b y = \log_b \frac{x}{y}$

Combining Exponents and Logarithms

Exponential Notation	Logarithmic Notation
$b^m = x$	$m = \log_b x$
$x^n = (b^m)^n = b^{mn} = b^{n \cdot m}$	$\log_b x^n = n \cdot \log_b x$

Recap

$b^m = x$	$\log_b x = m$
$b^n = y$	$log_b y = n$
$\log_b 1 = 0$	$\log_b \frac{1}{x} = -\log_b x$
$\log_b b = 1$	$\log_b xy = \log_b x + \log_b y$
$\log_b b^m = m$	$\log_b \frac{x}{y} = \log_b x - \log_b y$
$b^{\log_b x} = x$	$\log_b x^n = n \cdot \log_b x$