Properties of Logarithms

Preliminaries and Objectives

Preliminaries
• Laws of Exponents
• Definition of Logarithm

Objectives
• Law of Logarithms

Exponent is 1

Exponential Notation
\( b^1 = x \)

Logarithmic Notation
\( \log_b x \)

Exponent is 1

Exponential Notation
\( b^1 = x \)

Logarithmic Notation
\( \log_b x \)

Negative Exponents = Reciprocals

Exponential Notation
\( b^m = x \)

Logarithmic Notation
\( m = \log_b x \)

Adding Exponents = Multiply Numbers

Exponential Notation
\( b^m \cdot b^n = b^{m+n} \)

Logarithmic Notation
\( \log_b x + \log_b y = \log_b xy \)

Subtracting Exponents = Dividing Numbers

Exponential Notation
\( \frac{x}{y} = b^{m-n} \)

Logarithmic Notation
\( \log_b x - \log_b y = \log_b \frac{x}{y} \)

Zero Exponents

Exponential Notation
\( b^0 = 1 \)

Logarithmic Notation
\( 0 = \log_b 1 \)
Combining Exponents and Logarithms

**Exponential Notation**

\[ b^m = x \]

\[ x^n = (b^m)^n = b^{mn} = b^{m \cdot n} \]

**Logarithmic Notation**

\[ m = \log_b x \]

\[ \log_b x^n = n \cdot \log_b x \]

Recap

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