Properties of Logarithms

UNIVERSITY OF MINNESOTA

Preliminaries and Objectives

Preliminaries

- Laws of Exponents
- Definition of Logarithm

Objectives

- Law of Logarithms

Zero Exponents

Exponential Notation

$$b^m = x$$

$$b^0 = 1$$

Logarithmic Notation

$$m = \log_b x$$

$$0 = \log_b 1$$

Exponent is 1

Exponential Notation

$$b^m = x$$

$$b^1 = b$$

Logarithmic Notation

$$m = \log_b x$$

$$1 = \log_b b$$

Combining Exponents and Logarithms

Exponential Notation

$$b^m = x$$

Logarithmic Notation

$$m = \log_b x$$

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

Combining Exponents and Logarithms

Exponential Notation

$$b^m = x$$

Logarithmic Notation

$$m = \log_b x$$

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

Negative Exponents = Reciprocals

Exponential Notation

$$b^m = x$$

$$\frac{1}{x} = \frac{1}{b^m} = b^{-m}$$

Logarithmic Notation

$$m = \log_b x$$

$$-\log_b x = \log_b \frac{1}{x}$$

Adding Exponents = Multiply Numbers

Exponential Notation

$$b^m = x$$

$$b^n = y$$

$$xy = b^m \cdot b^n = b^{m+n}$$

Logarithmic Notation

$$m = \log_b x$$

$$n = \log_b y$$

$$\log_b x + \log_b y = \log_b xy$$

Subtracting Exponents = Dividing Numbers

Exponential Notation

$$b^m = x$$

$$b^n = y$$

$$\frac{x}{y} = \frac{b^m}{b^n} = b^{m-n}$$

Logarithmic Notation

$$m = \log_b x$$

$$n = \log_b y$$

$$\log_b x - \log_b y = \log_b \frac{x}{y}$$

Combining Exponents and Logarithms

Exponential Notation

$$b^m = x$$

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

Logarithmic Notation

$$m = \log_b x$$

$$\log_b x^n = n \cdot \log_b x$$

Recap

$$b^m = x$$

$$b^n = y$$

$$\log_b x = m$$

$$\log_b y = n$$

$$\log_b 1 = 0$$

$$\log_b \frac{1}{x} = -\log_b x$$

$$\log_b b = 1$$

$$\log_b xy = \log_b x + \log_b y$$

$$\log_b b^m = m$$

$$\log_b \frac{x}{y} = \log_b x - \log_b y$$

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

$$\log_b x^n = n \cdot \log_b x$$