The Logarithm Function

UNIVERSITY OF MINNESOTA

Preliminaries and Objectives

Preliminaries
- Exponential functions
- Inverse functions and their graphs

Objectives
- Write exponential equations in logarithmic form
- Understand properties of the graphs of logarithmic functions

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$y = 10^x$
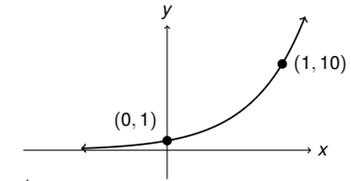
- increasing
- goes through $(0, 1)$
- approaches x-axis to the left
- bends upward
- Domain : $\mathbb{R}$
- Range : $y > 0$

$y = 10^x$ and $y = \log(x)$
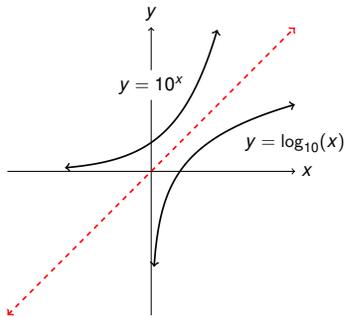
Example 1

$$\log_{10} 1000 = y$$

$$10^y = 1000$$

Inverse of $y = 10^x$
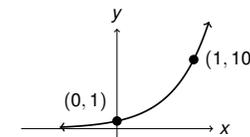
- increasing
- goes through $(0, 1)$
- approaches x-axis to the left
- bends upward
- Domain : $\mathbb{R}$
- Range : $y > 0$
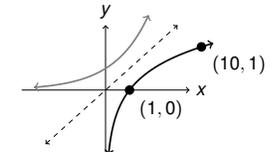
- increasing
- goes through $(1,0)$
- approaches y-axis downward
- bends to the right
- Domain : $x > 0$
- Range : $\mathbb{R}$

Example 2

$$\log_2 8 = 3 \qquad\qquad \log_b 4 = x$$

$$2^3 = 8 \qquad\qquad b^x = 4$$

Example 3

Find the exact value of x without using a calculator

$$\log_2 1 = x \quad\rightarrow\quad 2^x = 1 \quad\rightarrow\quad x = 0$$

$$\log_8 8 = x \quad\rightarrow\quad 8^x = 8 \quad\rightarrow\quad x = 1$$

$$\log_5 25 = x \quad\rightarrow\quad 5^x = 25 \quad\rightarrow\quad x = 2$$

$$\log_{10} \sqrt{10} = x \quad\rightarrow\quad 10^x = 10^{\frac{1}{2}} \quad\rightarrow\quad x = \frac{1}{2}$$

$$\log_7 \sqrt[3]{49} = x \quad\rightarrow\quad 7^x = (49)^{\frac{1}{3}} = (7^2)^{\frac{1}{3}} \quad\rightarrow\quad x = \frac{2}{3}$$