

# Logarithmic Functions

By Houbin Fang

# Logarithmic Functions

- $A = 100(2^t)$
- 1600? 3200? 6400?
- to be 5000? 5001 5002

$$t = ? \quad A = 5000$$

$$5 < t < 6$$


$$t = 3 \quad A = 100 \cdot 2^3 = 800$$

$$t = 4 \quad A = 100 \cdot 2^4 = 1600$$

$$t = 5 \quad A = 100 \cdot 2^5 = 3200$$

$$t = 6 \quad A = 100 \cdot 2^6 = 6400$$

# Logarithms

- $y = \log_b x$  is equivalent to  $x = b^y$
- $b > 0, b \neq 1$

~~$2 \cdot 2^a = 500$~~

$2^a = 50$

$5 < a < 6 \Rightarrow \log_2 50 = a$

$2^a = 4$

$a = \log_2 4 = 2$

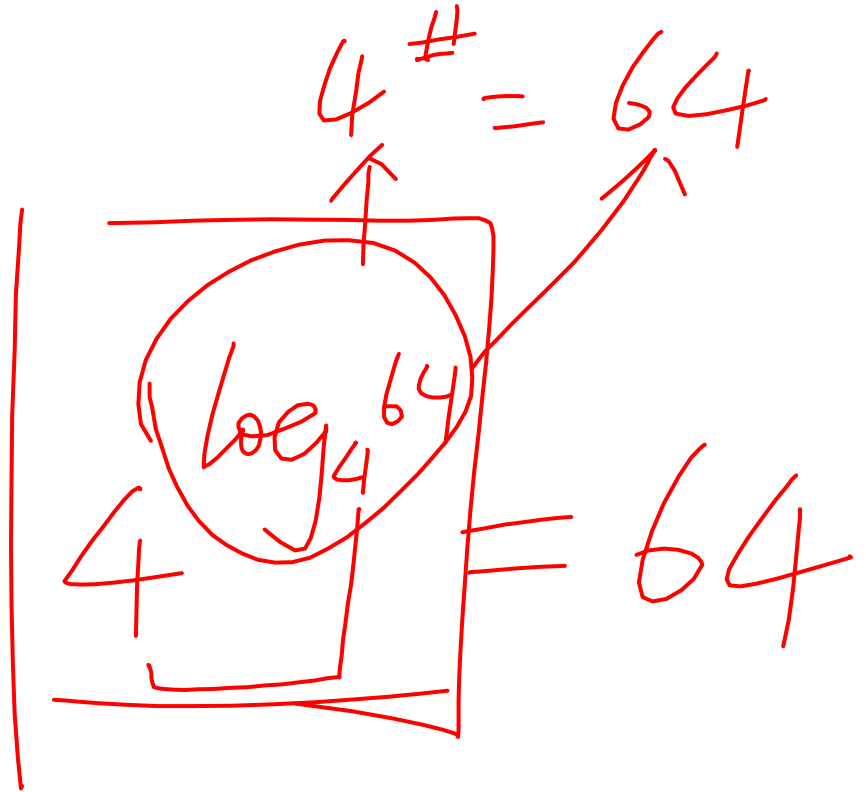
Exponential	Logarithmic
$2^a = 50$	$a = \log_2 50$
$3^x = 12$	$x = \log_3 12$
$13^t = 25$	$t = \log_{13} 25$

# Logarithms

• 4<sup>3</sup> = 64?



A handwritten diagram consisting of a red square box. Inside the box, the expression  $\log_4 64$  is written in red ink. The '4' in the denominator of the logarithm is positioned below the '64'.



A handwritten diagram illustrating the relationship between 4, 64, and the logarithm. It features a large red square box. Inside the box, the expression  $\log_4 64$  is written in red ink. The '4' in the denominator of the logarithm is positioned below the '64'. To the left of the box, a red '4' is written with a vertical line extending upwards from it. To the right of the box, a red '=' is written, followed by a red '64'. Above the box, the expression  $4^{\#} = 64$  is written in red ink. An arrow points from the '#' symbol to the top of the box, and another arrow points from the '64' to the right side of the box.

# Logarithms and Exponential Functions

- 2 =  $\log_{\underline{10}}(x + 5)$  in exponential form.

$$10^2 = x + 5$$

- ~~$2^{3x} = 64$  in logarithmic form.~~

$$\log_2 64 = 3x$$

# Evaluate Logarithmic Expressions

---

•  $\log_4 64 = a \Rightarrow 4^a = 64 \Rightarrow a = \{ \Rightarrow \log_4 64 = \}$

•  $\log_2 \left( \frac{1}{16} \right) = -4$

$$\boxed{2^a = \frac{1}{16} = \left( \frac{1}{2} \right)^4 = 2^{-4}}$$

# Solve a Logarithmic Equation

• Solve:  $\log_2 x = 4$   $\Rightarrow 2^4 = x$   
 $16 = x$

# Common and Natural Logarithms

- $f(x) = \log_{10} x$ : common logarithmic function:  $f(x) = \log x$ .
- $f(x) = \log_e x$ : natural logarithmic function:  $f(x) = \ln x$ .
- Examples:

$$\ln x = \log_e x$$

$$\log 100 = 2$$

and

$$\ln e^2 = 2$$

$$\log_{10} 100 = x = 2$$

$$10^x = 100$$

$$x = 2$$

$$\ln e^2 = \log_e e^2 \Rightarrow x = 2$$

$$e^x = e^2 \Rightarrow x = 2$$



# Solve Common and Natural Log Equations

- Solve each of the following equations. Round to the nearest thousandth.

- $\log x = -2.5$

$$\Rightarrow \log x = \log_{10} x = -2.5$$

- $\ln x = 5$

$$e^5 = x$$

$$10^{-2.5} = \text{(X)}$$

# Other Logarithmic Graphs (1,0)

- The base:

