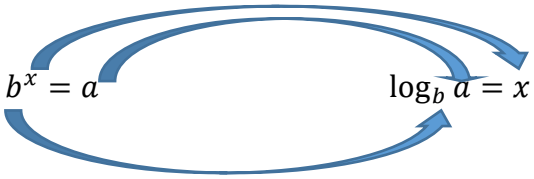
7-3

Logarithmic Functions

Logarithm – *is the exponent to which a specified based is raised to obtain a given value.*

Exponential Equation Logarithmic Equation



Example 1 and 2: Converting between Exponential to Logarithmic Forms

Exponential Equation	Logarithmic Form
$2^6 = 64$	$\log_2 64 = 6$
$4^1 = 4$	$\log_4 4 = 1$
$5^0 = 1$	$\log_5 1 = 0$
$5^{-2} = 0.04$	$\log_5 0.04 = -2$
$3^x = 81$	$\log_3 81 = x$
$9^2 = 81$	$\log_9 81 = 2$
$3^3 = 27$	$\log_3 27 = 3$
$x^0 = 1 \quad x \neq 0$	$\log_x 1 = 0$

Logarithmic Equation	Exponential Form
$\log_{10} 100 = 2$	$10^2 = 100$
$\log_7 49 = 2$	$7^2 = 49$
$\log_8 0.125 = -1$	$8^{-1} = 0.125$
$\log_5 5 = 1$	$5^1 = 5$
$\log_{12} 1 = 0$	$12^0 = 1$
$\log_{10} 10 = 1$	$10^1 = 10$
$\log_{12} 144 = 2$	$12^2 = 144$
$\log_{\frac{1}{2}} 8 = -3$	$\left(\frac{1}{2}\right)^{-3} = 8$

Special Properties of Logarithms

For any base b such that $b > 0$ and $b \neq 1$.

Logarithmic Form	Exponential Form	Example
Logarithm of Base b $\log_b b = 1$	$b^1 = b$	$\log_{10} 10 = 1$ $10^1 = 10$
Logarithm of 1 $\log_b 1 = 0$	$b^0 = 1$	$\log_{10} 1 = 0$ $10^0 = 1$

Common Logarithm – *a logarithm with base 10.*

If no base is written, the base is assumed to be 10.

3. Evaluating Logarithms Using Mental Math

a) log 1000 =

$10^? = 1000$

3

b) $\log_4 ¼$ =

$4^? = \frac{1}{4}$

-1

c) log 0.00001=

$10^? = 0.00001$

-5

d) $\log_{25} 0.04$ =

$25^? = 0.04$

-1

7-3
LOGARITHMIC FUNCTIONS

- Students will be able to write equivalent forms for exponential and logarithmic functions
- Students will be able to evaluate logarithmic functions
- Students will be able to graph logarithmic functions

Logarithm –
is the exponent to which a specific base is raised to obtain a given value.

Exponential Equation	Logarithmic Equation
$b^x = a$	$\log_b a = x$

"log base b of a"

Example 1 and 2: Converting between Exponential to Logarithmic Forms

Exponential Equation	Logarithmic Form	Logarithmic Equation	Exponential Form
$2^6 = 64$	$\log_2 64 = 6$	$\log_{10} 100 = 2$	$10^2 = 100$
$4^1 = 4$	$\log_4 4 = 1$	$\log_7 49 = 2$	$7^2 = 49$
$5^0 = 1$	$\log_5 1 = 0$	$\log_8 0.125 = -1$	$8^{-1} = .125$
$5^{-2} = 0.04$	$\log_5 .04 = -2$	$\log_5 5 = 1$	$5^1 = 5$
$3^x = 81$	$\log_3 81 = x$	$\log_{12} 1 = 0$	$12^0 = 1$
$9^2 = 81$	$\log_9 81 = 2$	$\log_{10} 10 = 1$	$10^1 = 10$
$3^3 = 27$	$\log_3 27 = 3$	$\log_{12} 144 = 2$	$12^2 = 144$
$x^0 = 1$ $(x \neq 0)$	$\log_x 1 = 0$	$\log_{\frac{1}{2}} 8 = -3$	$\left(\frac{1}{2}\right)^{-3} = 8$

Special Properties of Logarithms

For any base b such that $b > 0$ and $b \neq 1$.

Logarithmic Form	Exponential Form	Example
Logarithm of Base b $\log_b b = 1$	$b = b$	$\log_{10} 10 = 1$ $10^1 = 10$
Logarithm of 1 $\log_b 1 = 0$	$b^0 = 1$	$\log_2 1 = 0$ $2^0 = 1$

Common Logarithm –

a logarithm with base 10.

If no base is written, it is assumed it is base 10.

3. Evaluating Logarithms using Mental Math

a) $\log 1000 = 3$

$10^? = 1000$

b) $\log_4 \frac{1}{4} = -1$

c) $\log 0.00001 = -5$

d) $\log_{25} 0.04 = -1$

Name: _____ Date: _____ Period: _____

Worksheet 7-3

Rewrite each equation in exponential form.

1. $\log_2 64 = 6$

2. $\log_{15} \frac{1}{225} = -2$

3. $\log_6 36 = 2$

4. $\log_y 71 = x$

5. $\log_y x = -8$

Rewrite each equation in logarithmic form.

6. $2^6 = 64$

7. $8^{-2} = \frac{1}{64}$

8. $6^1 = 6$

9. $12^y = x$

10. $5^y = x$

Evaluate each expression.

11. $\log_6 216$

12. $\log_2 64$

13. $\log_6 36$

14. $\log_7 343$

15. $\log_5 \frac{1}{25}$