

# Section 6.3 Logarithmic Functions Logarithmic Functions

## A

Chapter 6 Exponential and Logarithmic Functions

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3.3 Logarithmic Functions and Their Graphs

6.6 Solving Exponential and Logarithmic Equations

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Section 3.6: Derivatives of Log Functions

Section 6-2 : Logarithm Functions - Lamar University

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#### Chapter 6 Exponential and

Logarithmic Functions Section 6.3

Logarithmic Functions 312 Chapter 6

Exponential and Logarithmic Functions

Using Inverse Properties By the definition

of a logarithm, it follows that the

logarithmic function  $g(x) = \log_b x$  is the

inverse of the exponential function  $f(x) = b^x$ .

This means that  $g(f(x)) = \log_b b^x = x$

and  $f(g(x)) = b^{\log_b x} = x$ .

6.3 Logarithms and Logarithmic

Functions Section 6.3 Logarithmic

Functions A class of functions that are

closely related to exponential functions

are logarithmic functions. If  $a > 1$ ,  $x > 0$ ,

then the function  $\log_a x$  is called the

logarithmic function with base  $a$ ; the

notation for the function is equivalent to

the exponential notation indicated below:

$\log_a x = y \Leftrightarrow a^y = x$ : Section 6.3

Logarithmic Functions logarithmic

functions a ... SECTION 6.3 logarithmic

functions 493 Example 1 Converting from

Logarithmic Form to Exponential Form

Write the following logarithmic equations

in exponential form. a.  $\log_6 (\sqrt{\quad}) = \frac{1}{2}$

b.  $\log_3 (9) = 2$  Solution First, identify the

values of  $b$ ,  $y$ , and  $x$ . SECTION 6.3

logarithmic functions 491 Section 6.4:

Graphs of Logarithmic Functions 1. A

logarithm base  $b$  of a positive number  $x$

satisfies the following definition:  $\log_b(x) =$

$y$  is equivalent to  $by = x$ ; where  $x; b > 0; b$

$\neq 1$ : where if  $b = 10$  this is the common

logarithm and is written  $\log(x)$ . if  $b = e$  this

is the natural logarithm and is written

$\ln(x)$ . range of  $\log$  is  $(1; \infty)$  domain of  $\log$  is

$(0; \infty)$ . [Note this says you cannot take the

$\log$  of a negative number!] Section 6.3:

Logarithmic Functions Section 6.4: Graphs

of ... Section 6.3: Logarithms & Logarithmic

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Logarithmic Functions Section 3.6:

Derivatives of Logarithmic Functions

Derivatives of Logarithmic Functions: Let  $a$

$> 0$ , then  $\frac{d}{dx} (\ln x) = \frac{1}{x}$   $\frac{d}{dx} (\ln |x|) = \frac{1}{x}$

$\frac{d}{dx} \ln(g(x)) = \frac{1}{g(x)} g'(x)$   $\frac{d}{dx} (\log_a x)$

$= \frac{1}{x \ln a}$   $\frac{d}{dx} \log_a(g(x)) = \frac{1}{g(x) \ln a} g'(x)$

Example: Differentiate the following

functions. 1.  $f(x) = \ln(x^2 - 3x)$  2.  $y =$

$x \ln \cos x$  3.  $F(x) = \sin(4 \ln x)$  4.  $g(t) =$

$\ln(\ln(10t))$  1 Section 3.6: Derivatives of

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Functions one-to-one = [] Chapter 6

Exponential and Logarithmic

Functions SECTION 3.3 Logarithmic

Functions and Their Graphs 301 Basic

Properties of Logarithms For  $0 < b \neq 1$ ,  $x > 0$ ,

and any real number  $y$ , •  $\log_b 1 = 0$  because

$b^0 = 1$ . •  $\log_b b = 1$  because  $b^1 = b$ . •  $\log_b by = y$

because  $b^y = by$ . •  $b^{\log_b x} = x$  because  $\log_b x =$

$y$   $\log_b x$ . These properties give us efficient

ways to evaluate simple logarithms and

some exponential expressions. 3.3

Logarithmic Functions and Their

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Section 6.6 - Logarithmic and Exponential

... Example If  $3^x = 35$ , then  $x = 5$ . If  $5 = 3^x$ ,

then  $3 = 35$ . Section 6.6 Solving

Exponential and Logarithmic Equations

335 An important application of

exponential equations is Newton's Law of

Cooling.  $R$  is the surrounding temperature

and  $r$  is the cooling rate of the

substance. 6.6 Solving Exponential and

Logarithmic Equations The Log of a Product

Equals the Sum of the Logs  $\log_a(MN) =$

$\log_a M + \log_a N$  The Log of a Quotient Equals

the Difference of the Logs (3) (4)  $\log_a \log_b$

$M - N$  The Log of a Power Equals the

Product of the Power and the Log  $\log_a |a|^x =$

$x$  Properties of Logarithms In the following

properties,  $M$ ,  $N$ , and  $a$  are positive real

numbers, with  $a \neq 1$ . Section 6.5 Properties

of Logarithms GUIDED NOTES - 6.3

LOGARITHMIC FUNCTIONS LEARNING

OBJECTIVES In this section, you will:

Convert from logarithmic to exponential

form. Convert from exponential to

logarithmic form. Evaluate logarithms. Use

common logarithms. Use natural

logarithms. CONVERTING FROM

LOGARITHMIC TO EXPONENTIAL

FORM GUIDED NOTES 6.3 LOGARITHMIC

FUNCTIONS Logarithmic Functions •

Logarithms are used to find unknown

exponents in exponential models. • A

logarithmic function is a function of the form  $y = \log_b x$  with base  $b$ , or  $x = b^y$ , which is the inverse of the exponential function  $y = b^x$ , where  $b \neq 1$  and  $b > 0$ .

- One-to-One Property of Exponents: If  $b^x = b^y$ , then  $x = y$ .

**Section 6 - monroe.k12.ky.us**  
 5 25 5 2 b.  $\log_5 1000 = 3$   
 5 3 c.  $\log_5 25 = 2$  indicates that you must raise the base 5 to the power 2 to get 25.  
 5 25. b.  $\log_5 1000 = 3$  is equivalent to  $10 = 5^3$ .  
 5 1000. c. is equivalent to  $10 = 5^3$ .

**Reteaching 6.3 Logarithmic Functions - WordPress.com**  
 In this section, you will study procedures for solving equations involving these exponential and logarithmic functions. There are two basic strategies for solving exponential or logarithmic equations. The first is based on the One-to-One Properties and was used to solve simple exponential and logarithmic equations in Sections 3.1 and 3.2.3.4 Exponential and Logarithmic Equations

**Section 6-2 : Logarithm Functions.** Similarly, the natural logarithm is simply the log base  $e$  with a different notation and where  $e$  is the same number that we saw in the previous section and is defined to be  $e = 2.718281827\dots$ . Let's take a look at a couple more evaluations.

**Section 6-2 : Logarithm Functions - Lamar University**  
**Section 6.3 Logarithmic Functions** A class of functions that are closely related to exponential functions are logarithmic functions. If  $a > 0$ ,  $x > 0$ , then the function  $\log_a x$  is called the logarithmic function with base  $a$ ; the notation for the function is equivalent to the exponential notation indicated below:

**Section 6.3 Logarithmic Functions**  
 logarithmic functions a ... One pair of inverse functions we will look at are exponential functions and logarithmic functions. Here we will look at exponential functions and then we will consider logarithmic functions in another section.

**GRAPHING EXPONENTIAL FUNCTIONS**  
 Exponential functions have the form  $f(x) = b^x$  where  $b \neq 0$  and  $b \neq 1$ . Notice that

**Section 5.3: Exponential Functions and Equations**  
 Unit 6: Exponential and Logarithmic Functions. Day 1: 3/3 Section 6.1 Paper Cutting Page 347 #1-16. HW: None. Day 2: 3/4 Finish Section 6.1 (1-16) Section 6.1 Assignment Page 350 #1-4 (as class) Section 6.2 Moose Population Page 351 #1-6. HW: Section 6.2 Assignment Page 353 #1-4. Day 3: 3/5 Show PARCC Practice Test,

**SECTION 3.3 Logarithmic Functions and Their Graphs**  
 301 Basic Properties of Logarithms For  $0 < b \neq 1$ ,  $x > 0$ , and any real number  $y$ ,

- $\log_b 1 = 0$  because  $b^0 = 1$ .
- $\log_b b = 1$  because  $b^1 = b$ .
- $\log_b b^y = y$  because  $b^y = b^y$ .
- $\log_b b^x = x$  because  $\log_b b^x = x$ .

These properties give us efficient ways to

evaluate simple logarithms and some exponential expressions.

### GUIDED NOTES 6.3 LOGARITHMIC FUNCTIONS

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### 3.3 Logarithmic Functions and Their Graphs

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### 6.6 Solving Exponential and Logarithmic Equations

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### Section 6.3: Logarithms & Logarithmic Functions

one-to-one = [ ]  
**Section 6.3: Logarithmic Functions**  
 Section 6.4: Graphs of ...

**Logarithmic Functions** • Logarithms are used to find unknown exponents in exponential models. • A logarithmic function is a function of the form  $y = \log_b x$  with base  $b$ , or  $x = b^y$ , which is the inverse of the exponential function  $y = b^x$ , where  $b \neq 1$  and  $b > 0$ .

- One-to-One Property of Exponents: If  $b^x = b^y$ , then  $x = y$ .

### Section 6 3 Logarithmic Functions

**SECTION 6.3 logArithmetic fuNctioNs 493**  
 Example 1 Converting from Logarithmic Form to Exponential Form Write the following logarithmic equations in exponential form.  
 a.  $\log_6(\sqrt{6}) = \frac{1}{2}$   
 b.  $\log_3(9) = 2$   
 Solution First, identify the values of  $b$ ,  $y$ , and  $x$ .

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**Section 6.3 Logarithmic Functions**  
 A class of functions that are closely related to exponential functions are logarithmic functions. If  $a > 0$ ,  $x > 0$ , then the function  $\log_a x$  is called the logarithmic function with base  $a$ ; the notation for the function is equivalent to the exponential notation

indicated below:

### Section 6.3 Logarithmic Functions

**logarithmic functions a ...**  
 The Log of a Product Equals the Sum of the Logs  $\log_a(MN) = \log_a M + \log_a N$   
 The Log of a Quotient Equals the Difference of the Logs  $\log_a \left(\frac{M}{N}\right) = \log_a M - \log_a N$   
 The Log of a Power Equals the Product of the Power and the Log  $\log_a M^p = p \log_a M$ .  
 Properties of Logarithms  
 In the following properties,  $M$ ,  $N$ , and  $a$  are positive real numbers, with  $a \neq 1$ .

### 6.3 Logarithms and Logarithmic Functions

**Unit 6: Exponential and Logarithmic Functions.** Day 1: 3/3 Section 6.1 Paper Cutting Page 347 #1-16. HW: None. Day 2: 3/4 Finish Section 6.1 (1-16) Section 6.1 Assignment Page 350 #1-4 (as class) Section 6.2 Moose Population Page 351 #1-6. HW: Section 6.2 Assignment Page 353 #1-4. Day 3: 3/5 Show PARCC Practice Test,

### SECTION 6.3 logArithmetic fuNctioNs 491

**Section 6.3 Logarithmic Functions**  
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312 Chapter 6 Exponential and Logarithmic Functions Using Inverse Properties By the definition of a logarithm, it follows that the logarithmic function  $g(x) = \log_b x$  is the inverse of the exponential function  $f(x) = b^x$ . This means that  $g(f(x)) = \log_b b^x = x$  and  $f(g(x)) = b^{\log_b x} = x$ .

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**GUIDED NOTES - 6.3 LOGARITHMIC FUNCTIONS LEARNING OBJECTIVES**  
 In this section, you will: Convert from logarithmic to exponential form. Convert from exponential to logarithmic form. Evaluate logarithms. Use common logarithms. Use natural logarithms.

**CONVERTING FROM LOGARITHMIC TO EXPONENTIAL FORM**  
**Section 3.6: Derivatives of Log Functions**  
**Section 6.4: Graphs of Logarithmic Functions**  
 1. A logarithm base  $b$  of a positive number  $x$  satisfies the following definition:  $\log_b(x) = y$  is equivalent to  $b^y = x$ ; where  $x > 0$ ;  $b \neq 1$ ; where if  $b = 10$  this is the common logarithm and is written  $\log(x)$ . if  $b = e$  this is the natural

logarithm and is written  $\ln(x)$ . range of log is  $(1;1)$  domain of log is  $(0;1)$ . [Note this says you cannot take the log of a negative number!]

### Section 6-2 : Logarithm Functions - Lamar University

Example If  $3^x = 35$ , then  $x = 5$ . If  $5 = 5$ , then  $3 = 35$ . Section 6.6 Solving Exponential and Logarithmic Equations 335 An important application of exponential equations is Newton's Law of Cooling. R is

the surrounding temperature and r is the cooling rate of the substance.

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Section 6.3 Logarithmic Functions

### Section 3.6: Derivatives of Logarithmic Functions

5 25 5 2 b.  $\log_5 1000 = 5^3$  c.  $\blacklozenge$  Solution a.  $\log_5 25 = 5^2$  indicates that you must raise the base 5 to the power 2 to get 25.  $5^2 = 25$ . b.  $\log_5 1000 = 5^3$  is equivalent to  $10^3 = 5^3 = 1000$ . c. is equivalent to .

### 3.4 Exponential and Logarithmic Equations

In this section, you will study procedures for solving equations involving these exponential and logarithmic functions. There are two basic strategies for solving exponential or logarithmic equations. The first is based on the One-to-One Properties and was used to solve simple exponential and logarithmic equations in Sections 3.1 and 3.2.

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