

## Section 3.3 Properties of Logarithms

**Objective:** In this lesson you learned how to rewrite logarithmic functions with different bases and how to use properties of logarithms to evaluate, rewrite, expand, or condense logarithmic expressions.

Course Number

Instructor

Date

### I. Change of Base (Page 240)

Let  $a$ ,  $b$ , and  $x$  be positive real numbers such that  $a \neq 1$  and  $b \neq 1$ . The **change-of-base formula** states that . . .

***What you should learn***

How to rewrite logarithmic functions with different bases

Explain how to use a calculator to evaluate  $\log_8 20$ .

### II. Properties of Logarithms (Page 241)

Let  $a$  be a positive number such that  $a \neq 1$ ; let  $n$  be a real number; and let  $u$  and  $v$  be positive real numbers. Complete the following properties of logarithms:

1.  $\log_a(uv) =$  \_\_\_\_\_

2.  $\log_a \frac{u}{v} =$  \_\_\_\_\_

3.  $\log_a u^n =$  \_\_\_\_\_

***What you should learn***

How to use properties of logarithms to evaluate or rewrite logarithmic expressions

### III. Rewriting Logarithmic Expressions (Page 242)

To expand a logarithmic expression means to . . . .

***What you should learn***

How to use properties of logarithms to expand or condense logarithmic expressions

**Example 1:** Expand the logarithmic expression  $\ln \frac{xy^4}{2}$ .

To condense a logarithmic expression means to . . . .

**Example 2:** Condense the logarithmic expression  
 $3\log x + 4\log(x - 1)$ .

#### IV. Applications of Properties of Logarithms (Page 243)

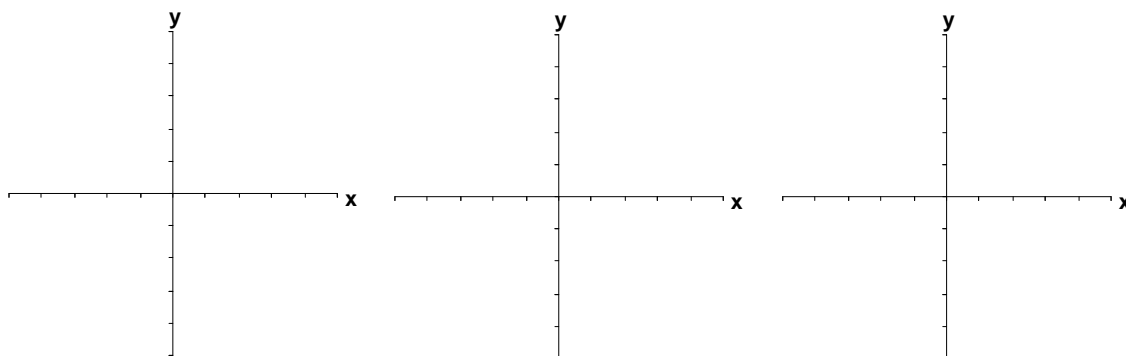
One way of finding a model for a set of nonlinear data is to take the natural log of each of the  $x$ -values and  $y$ -values of the data set. If the points are graphed and fall on a straight line, then the  $x$ -values and the  $y$ -values are related by the equation:

\_\_\_\_\_ , where  $m$  is the slope of the straight line.

***What you should learn***  
 How to use logarithmic functions to model and solve real-life problems

**Example 3:** Find a natural logarithmic equation for the following data that expresses  $y$  as a function of  $x$ .

$x$	2.718	7.389	20.086	54.598
$y$	7.389	54.598	403.429	2980.958



#### Homework Assignment

Page(s)

Exercises