## 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.

**I.  Change of Base**  (Page 207)

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
logarithms with different
bases

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

**II.  Properties of Logarithms**  (Page 208)

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:

*What you should learn*
How to use properties of
logarithms to evaluate or
rewrite logarithmic
expressions

1.  $\log_a (uv) = $ _____

2.  $\log_a \dfrac{u}{v} = $ _____

3.  $\log_a u^n = $ _____

**III.  Rewriting Logarithmic Expressions**  (Page 209)

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 $\ln \dfrac{xy^4}{2}$.

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 210)

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.

**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 |
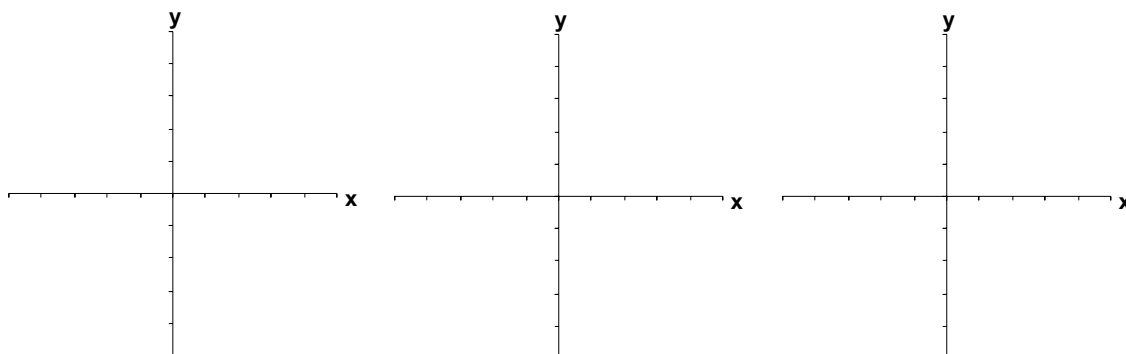


**Homework Assignment**

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Exercises