

- To rewrite logarithms with different bases
- To use the properties of logarithms to evaluate or rewrite logarithmic expressions
- To use the properties of logarithms to expand or condense logarithmic expressions
- To use logarithmic functions to model and solve real-life problems

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Change of Base

Most calculators have only 2 types of keys
-Common Logs (Base 10)
-Natural Logs (Base e)

You may occasionally have to evaluate logs with other bases

Change-of-Base Formula

Let a, b and x be positive real numbers s.t. $a \ne 1$ and $b \ne 1$. Then log ax can be converted to a different base using any of the following formulas

$$\frac{\text{Base } b}{\log ax} = \frac{\log bx}{\log ha}$$

$$\log ax = \frac{\log 10x}{\log 10a}$$

$$\log ax = \frac{\ln x}{\ln a}$$

One way to look at it... logs to base a are constant multiples of logs to base b $\frac{1}{\log ba}$

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Example 1- Changing Bases Using Common Logs

a.) log425

b.) log212

Example 2 - Changing Bases Using Natural Logs

a.) log425

b.) log212





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Properties of Logarithms

Let a be a positive number s.t. $a \ne 1$. Let n be a real number. Let u and v be positive real numbers.

Logs with Base a

- $1. \quad logauv = logau + logav$
- 2. $loga \frac{u}{v} = logau logav$
- 3. logaun = n logau

Natural Logs

- 1. ln uv = ln u + ln v
- $2. \quad \ln \frac{u}{v} = \ln u \ln v$
- 3. ln un = n ln u

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Example 3 - Using Properties of Logs

Write each logarithm in terms of ln 2 and ln 3

a.) ln 6

b.)
$$ln \frac{2}{27}$$

Example 4 - Using Properties of Logs

Use the properties of logarithms to verify that

$$log10\frac{1}{100} = log 10100$$

See p. 203; exercise 21

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Rewriting Logarithmic Expressions

Example 5 - Expanding Logarithmic Expressions

Use the properties of logs to expand each expression.

a.)
$$log 45x 3y$$

b.)
$$ln \sqrt{\frac{3x-5}{7}}$$

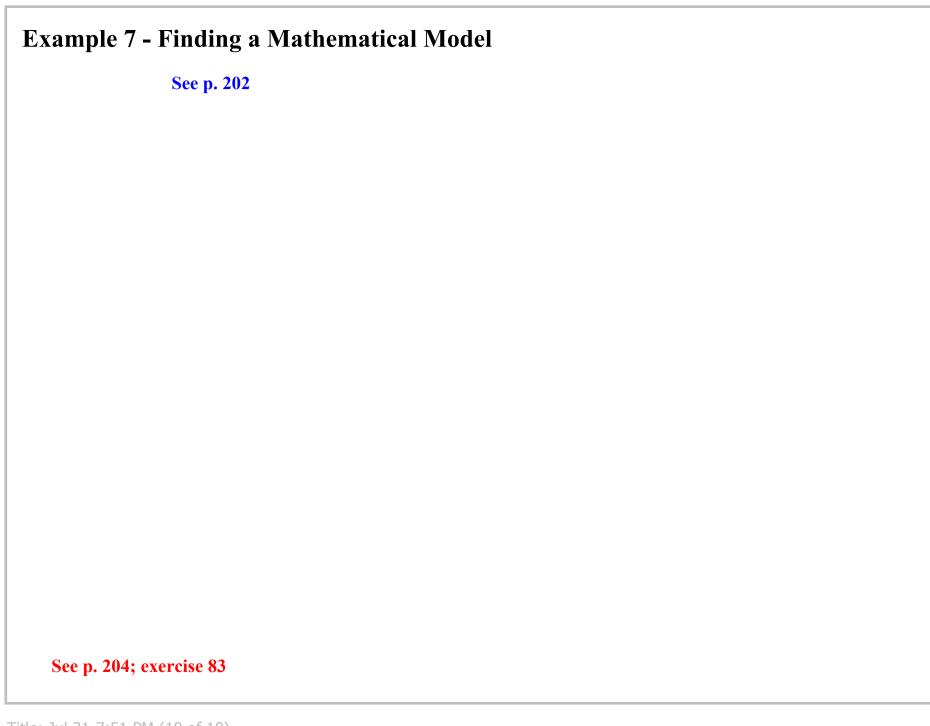
Example 6 - Condensing Logarithmic Expressions

Use the properties of logs to condense each logarithmic expression.

a.)
$$\frac{1}{2} \log 10x + 3 \log 10(x+1)$$

b.)
$$2 \ln (x+2) - \ln x$$

c.)
$$1/3 [log 2x + log 2(x-4)]$$



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