

## 7-4 Properties of Logarithms

Obj: To use properties of logs to simplify equations.

take note

### Properties Properties of Logarithms

For any positive numbers  $m$ ,  $n$ , and  $b$  where  $b \neq 1$ , the following properties apply.

**Product Property**  $\log_b mn = \log_b m + \log_b n$

**Quotient Property**  $\log_b \frac{m}{n} = \log_b m - \log_b n$

**Power Property**  $\log_b m^n = n \log_b m$

Must be memorized!!!

Feb 24-9:41 AM

What is each expression written as a single logarithm?

**A**  $\log_4 32 \ominus \log_4 2$

$$\log_4 \frac{32}{2}$$

$$\log_4 16$$

**B**  $6 \log_2 x + 5 \log_2 y$

$$\log_2 x^6 + \log_2 y^5$$

$$\log_2 x^6 y^5$$

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Condense into a single logarithm then convert into exponential form.

$$\frac{1}{2} \log_2 1024 + \frac{1}{3} \log_2 216 - \log_2 3 = 6$$

$$\log_2 32 + \log_2 6 - \log_2 3 = 6$$

$$\log_2 192 - \log_2 3 = 6$$

$$\log_2 \frac{192}{3} = 6$$

$$\log_2 64 = 6$$

Expo. Form:

$$2^6 = 64$$

✓

Feb 15-8:04 AM

What is each logarithm expanded?

a.  $\log \frac{\sqrt{x}}{y}$

$$\log \sqrt{x} - \log y$$

$$\frac{1}{2} \log x - \log y$$

b.  $\log_3 9x^5$

$$\log_3 9 + \log_3 x^5$$

$$\log_3 9 + 5 \log_3 x$$

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Expand.

$$\log \frac{\sqrt[3]{a}}{bc}$$

$$\log \sqrt[3]{a} - \log bc$$

$$\frac{1}{3} \log a - \log bc$$

$$\frac{1}{3} \log a - (\log b + \log c)$$

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You have seen logarithms with many bases. The **log** key on a calculator finds  $\log_{10}$  of a number. To evaluate a logarithm with any base, use the **Change of Base Formula**.

Take note

### Property Change of Base Formula

For any positive numbers  $m$ ,  $b$ , and  $c$ , with  $b \neq 1$  and  $c \neq 1$ ,

$$\log_b m = \frac{\log_c m}{\log_c b}$$

What is the value of each expression?

**A**  $\log_{81} 27$

$$\frac{\log(27)}{\log(81)} \approx \boxed{\frac{3}{4}}$$

**B**  $\log_5 36$

$$\frac{\log(36)}{\log(5)} \approx \boxed{2.2266}$$

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Check for understanding?

Write each expression as a single logarithm.

1.  $(2 \log_3 x + \log_3 5) - \log_3 y$

→

$$\log_3 \frac{5x^2}{y}$$

Expand each logarithm.

2.  $\log_4 5 \sqrt{x}$

→

$$\log_4 5 + \frac{1}{2} \log_4 x$$

Use the Change of Base Formula to evaluate each expression.

3.  $\log_7 30$

$$\log(30)/\log(7)$$

$$\approx 1.7479$$

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Homework:

p. 466:

**#'s: 9 - 43 odds,  
47, 57, 59, 60, 75**

Feb 24-9:58 AM