Algebra 2

Ch. 8 Handout 8.4

Properties of Logarithms

Properties of Logarithms

For any positive numbers M, N, and b where $b \neq 1$.

Product Property

Pull

single form → Expanded

$$\log_b MN = \log_b M + \log_b N$$

$\log_3 2x = \log_3 2 + \log_3 x$

$\log_5 xy = \log_5 x + \log_5 y$

Properties of Logarithms

For any positive numbers M, N, and b where $b \neq 1$.

Quotient Property

Pull

Single → expanded

$$\log_b \frac{M}{N} = \log_b M - \log_b N$$

$\log_7 \frac{x}{5} = \log_7 x - \log_7 5$

$\log_3 \frac{x}{y} = \log_3 x - \log_3 y$

Properties of Logarithms

For any positive numbers M, N, and b where $b \neq 1$.

Power Property

Pull

Single ⟶ expanded

$$\log_b M^x = x \log_b M$$

$\log_3 x^2 = 2 \log_3 x$

$\log x^4 = 4 \log x$

1. State the property or properties used to rewrite each expression.

a) $\log 6 = \log(2 \cdot 3) = \log 2 + \log 3$

Pull

Product Property

1. State the property or properties used to rewrite each expression.

$\log_b x^2 - \log_b y$

b) $\log_b \frac{x^2}{y} = 2\log_b x - \log_b y$

Pull

Power Property and Quotient Property

2. Write each expression as a single logarithm.

Expanded → single

a) $\log_4 64 - \log_4 16$

$\log_4 \frac{64}{16}$

$\log_4 4$

b) $6\log_5 x + \log_5 y$

$\log_5 x^6 + \log_5 y$

$\log_5 x^6 y$

3. Expand each logarithm.

single → expanded

a) $\log_7\left(\frac{t}{u}\right)$

$\log_7 t - \log_7 u$

b) $\log(4 \cdot p^3)$

$\log 4 + \log p^3$

$\log 4 + 3\log p$

$\log\left(\frac{x^2 y}{z^{\frac{1}{3}}}\right)^3 = \log \frac{x^6 y^3}{z}$

$= \log x^6 + \log y^3 - \log z$

$= 6\log x + 3\log y - \log z$

4. Evaluate.

a) $\log_2 4 - \log_2 32 = x$ (single form)

$\log_2 \frac{4}{32} = x$

$\log_2 \frac{1}{8} = x$

$2^x = \frac{1}{8}$

$2^x = \frac{1}{2^3}$

$2^x = 2^{-3}$

$x = -3$

4. Evaluate.

b) $\log_9 \frac{1}{3} + 4\log_9 3 = x$

$\log_9 \frac{1}{3} + \log_9 3^4 = x$

$\log_9 \frac{1}{3} + \log_9 81 = x$

$\log_9 \frac{1}{3}(81) = x$

$\log_9 27 = x$

$9^x = 27$

$3^{2x} = 3^3$

$2x = 3$

$x = 3/2$

5. Assume that $\log_{10} 2 \approx .39$, $\log_{10} 9 \approx .95$, and $\log_{10} 3 \approx .48$.

$\log_{10} 10 = 1$

a. $\log 18 = \log 2 \cdot 9 = \log 2 + \log 9$

$\approx .39 + .95$

≈ 1.34

$$\begin{array}{r} .39 \\ +.95 \\ \hline 1.34 \end{array}$$

5. Assume that $\log 2 \approx .39$, $\log 9 \approx .95$, and $\log 3 \approx .48$.

$\log 10 = 1$

b. $\log \frac{27}{2} = \log \frac{9 \cdot 3}{2}$

$= \log 9 + \log 3 - \log 2$

$\approx .95 + .48 - .39$

≈ 1.04

$$\begin{array}{r} .95 \\ +.48 \\ \hline 1.43 \\ -.39 \\ \hline 1.04 \end{array}$$

5. Assume that $\log 2 \approx .39$, $\log 9 \approx .95$, and $\log 3 \approx .48$.

$\log 10 = 1$

c. $\log 270 = \log 3 \cdot 9 \cdot 10$

$= \log 3 + \log 9 + \log 10$

$\approx .48 + .95 + 1$

≈ 2.43

.48
.95
1.43
+1

Quick Check

1 State the property or properties used to rewrite each expression.

a) $\log_5 2 + \log_5 6 = \log_5 12$

Product Property

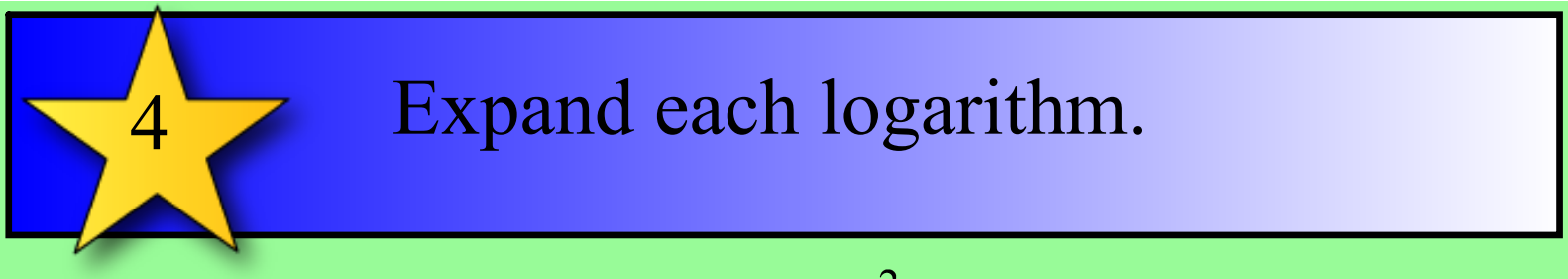
b) $3\log_b 4 - 3\log_b 2 = \log_b 8$

Power Property/ Quotient Property

Write $3\log 2 + \log 4 - \log 16$ as a single logarithm.

Can you write $3\log_2 9 - \log_6 9$ as a single logarithm? Explain.

Pull



a) $\log_2 7b$

b) $\log\left(\frac{y}{3}\right)^2$

c) $\log_7 a^3 b^4$

Assignment

Day 1

pgs 457-459 11-29 odds, 33-41 odds, 45-55 odds