2.3 Properties of Logarithms

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1. Product Property - multiply
2. Quotient Property - divide
3. Power Property - exponents

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:

$$log_b m^n = n log_b m$$

$$\log_3 9 + \log_3 24$$

Product

$m = 9$ $n = 24$

$$\log_3 (9)(24)$$

$$\log_4 16^3$$

power

$$3 \log_4 16$$

$$\log_b mn = \log_b m + \log_b n$$

(product)

$$\log_b \frac{m}{n} = \log_b m - \log_b n$$

(quotient)

$$\log_b m^n = n \log_b m$$

(power)

$$\log_2 7 - \log_2 9$$

Quotient

$$\log_2 \frac{7}{9}$$

$$\log_3 8^5$$

power

$$5 \log_3 8$$

$$\log_4 x - \log_4 y$$

Quotient

$$\log_4 \frac{x}{y}$$

$$\log 5 + \log 7$$

$$\frac{1}{2}\log r + \frac{1}{3}\log s - \frac{1}{4}\log t$$

product
Quotient > from left to right
1st - power

$$\log r^{\frac{1}{2}} + \log s^{\frac{1}{3}} - \log t^{\frac{1}{4}}$$

$$\log r^{\frac{1}{2}} s^{\frac{1}{3}} - \log t^{\frac{1}{4}}$$

$$\log \frac{r^{\frac{1}{2}} s^{\frac{1}{3}}}{t^{\frac{1}{4}}}$$

$$\frac{1}{3}\log 3x + \frac{2}{3}\log 3x$$

product ✓

power ✓

$$\log 3x^{\frac{1}{3}} + \log 3x^{\frac{2}{3}}$$

$$\log\left(3x^{\frac{1}{3}}\right)\left(3x^{\frac{2}{3}}\right)$$

$\log_5 y - 4(\log_5 r + 2\log_5 t)$

Expand each logarithm. Simplify if possible.

$\log_3 27x$

m n

Product

log m + log n

$\log_3(27) + \log_3(x)$

$\log \frac{3}{7}$

Quotient

$\log m - \log n$

$\log(3) - \log(7)$

$\log_4 y^2 z^3$

Product
power - last

$\log_4 y^2 + \log_4 z^3$

$2\log_4 y + 3\log_4 z$

$$\log_5 \frac{3^2}{x}$$

power - last
Quotient - 1st (subtract)

$\log_5(3^2) - \log_5(x)$

$2\log_5 3 - \log_5 x$

$\log_3 15xy$ product

$\log_3 15 + \log_3 x + \log_3 y$