EXPANDING AND CONDENSING LOGARITHMS

Product Property: $\log_b AC = \log_b A + \log_b C$

Quotient Property: $\log_b \frac{A}{C} = \log_b A - \log_b C$

Power Property: $\log_b A^k = k \cdot \log_b A$

PROPERTIES OF LOGARITHMS

Product Property: $\log_b AC = \log_b A + \log_b C$

PROPERTIES OF LOGARITHMS

EX. EXPRESS AS A SUM OF LOGARITHMS.

1) $\log_a MN = \log_a M + \log_a N$

2) $\log_b AT = \log_b A + \log_b T$

3) log MATH

$= \log M + \log A + \log T + \log H$

EX. EXPRESS AS A SINGLE LOGARITHM

4) $\log_5 19 + \log_5 3 = \log_5 (19 \cdot 3)$

$= \log_5 57$

5) $\log C + \log A + \log B + \log I + \log N$

$= \log CABIN$

- **Expanding the Logarithm (Write as a sum of logarithms):**

$$\log_3(81 \cdot 9) =$$

$$\log_2(8 \cdot 4) =$$

$$\log(5x) =$$

ON YOUR OWN

- **Expanding the Logarithm (Write as a sum of logarithms):**

$\log_3(81 \cdot 9) =$ $\log_3 81 + \log_3 9$

$\log_2(8 \cdot 4) =$ $\log_2 8 + \log_2 4$

$\log(5x) =$ $\log 5 + \log x$

ON YOUR OWN

EX. EXPRESS AS A SUM OF LOGARITHMS, THEN SIMPLIFY.

6) $\log_2 (4 \cdot 16)$ = $\log_2 4 + \log_2 16$

$2^{?} = 4$

$2^{?} = 16$

= 2 + 4

= 6

Quotient Property $\log_b \frac{A}{C} = \log_b A - \log_b C$

PROPERTIES OF LOGARITHMS

8) $\log_a \frac{M}{N} = \log_a M - \log_a N$

9) $\log_a \frac{1}{4} = \log_a 1 - \log_a 4$

EX. EXPAND (EXPRESS AS A DIFFERENCE)

- **Expanding the Logarithm (Write as a difference of logs):**

$$\log_3\left(\frac{1}{27}\right)=$$

$$\log_2\left(\frac{4}{64}\right)=$$

$$\log_5\left(\frac{3}{4}\right)=$$

ON YOUR OWN

- **Expanding the Logarithm (Write as a difference of logs):**

$$\log_3\left(\frac{1}{27}\right) = \log_3 1 - \log_3 27$$

$$\log_2\left(\frac{4}{64}\right) = \log_2 4 - \log_2 64$$

$$\log_5\left(\frac{3}{4}\right) = \log_5 3 - \log_5 4$$

ON YOUR OWN

Power Property: $\log_b A^k = k \cdot \log_b A$

PROPERTIES OF LOGARITHMS

EX. EXPRESS AS A PRODUCT.

11) $\log_b 9^{-5}$ = **-5 • $\log_b 9$**

12) $\log_a \sqrt[4]{5} = \log_a 5^{\frac{1}{4}}$

$= \frac{1}{4} \cdot \log_a 5$

- **Expanding the Logarithms:**

$$\log_3 (81)^5 =$$

$$\log_3 \sqrt{27} =$$

$$\log_2 (32)^3 =$$

$$\log_2 \sqrt{32} =$$

ON YOUR OWN

- **Expanding the Logarithms:**

$\log_3(81)^5 =$ $5\log_3 81$

$\log_3\sqrt{27} =$ $\log_3 27^{1/2} = \frac{1}{2}\log_3 27$

$\log_2(32)^3 =$ $3\log_2 32$

$\log_2\sqrt{32} =$ $\log_2 32^{1/2} = \frac{1}{2}\log_2 32$

ON YOUR OWN

EX. 14 EXPAND $\log 5x^3y$

$$= \log 5 + \log x^3 + \log y$$

$$= \log 5 + 3\log x + \log y$$

QUO

PRO

POW

EX. 15 EXPAND $\log_{10}\frac{4\pi}{\sqrt{23}}$

QUO

PRO

POW

$$=\log_{10}4\pi-\log_a\sqrt{23}$$

$$=\log_{10}4+\log_{10}\pi-\log_a\sqrt{23}$$

$$=\log_{10}4+\log_{10}\pi-\log_a 23^{\frac{1}{2}}$$

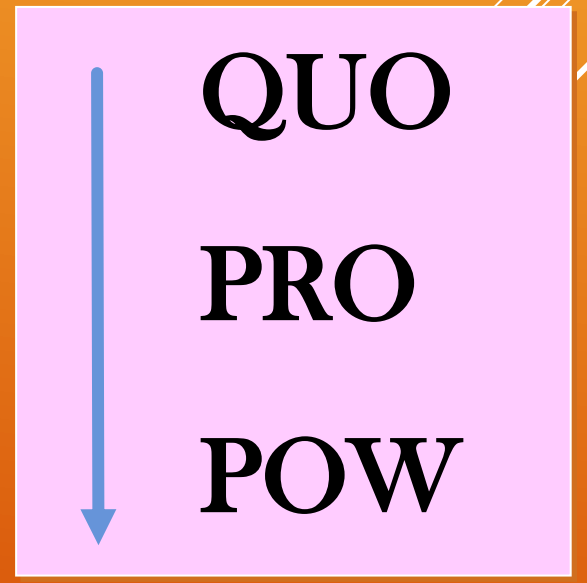
$$=\log_{10}4+\log_{10}\pi-\frac{1}{2}\log_a 23$$

- **Expanding the Logarithms:**

$$\log\left(\frac{xy}{z}\right)=$$

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

$$\log x^2 y=$$



ON YOUR OWN

- **Expanding the Logarithms:**

$$\log\left(\frac{xy}{z}\right) =$$

$\log xy - \log z$

$\log x + \log y - \log z$

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

$\log x^3 y - \log z$

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

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

$$\log x^2 y =$$

$\log x^2 + \log y$

$2\log x + \log y$

ON YOUR OWN

Complete Practice Lesson 4.6 (1– 4, 11 – 28).

CLASSWORK

EX. CONDENSE.

16) $3\log x + \frac{1}{2}\log y = \log x^3 + \log y^{1/2}$

$= \log x^3 + \log \sqrt{y}$

$= log x^3 \sqrt{y}$

17) $2\log(x+2) - \log x = \log(x+2)^2 - \log x$

$= \log \frac{(x+2)^2}{x}$

EX 18 CONDENSE

$$\log_a x^5 - \log_a y + \frac{1}{4}\log_a z$$

$$= \log_a x^5 - \log_a y + \log_a z^{\frac{1}{4}}$$

$$= \log_a x^5 - \log_a y + \log_a \sqrt[4]{z}$$

$$= \log_a \frac{x^5}{y} + \log_a \sqrt[4]{z}$$

$$= \log_a \frac{x^5 \sqrt[4]{z}}{y}$$

- Express all products as exponents
- Change the fractional exponent to a radical sign.
- Simplify the subtraction.
- Simplify the addition.

PROPERTIES OF LOGARITHMS

$\log_a 1 = 0$	because $a^0 = 1$
$\log_a a = 1$	because $a^1 = a$
$\log_a a^x = x$	$a^{\log_a x} = x$
If $\log_a x = \log_a y$	then $x = y$
$\log_a (uv) = \log_a u + \log_a v$	**Product Property**
$\log_a \frac{u}{v} = \log_a u - \log_a v$	**Quotient Property**
$\log_a u^n = n \log_a u$	**Power Property**
$\log_a x = \frac{\log_{10} x}{\log_{10} a}$	**Change-of-Base**

Warning!! Be careful!!

$$\log(x+y) \neq \log x + \log y$$

$$\log(x-y) \neq \frac{\log x}{\log y}$$

$$\log(x+y) \neq \log x \cdot \log y$$