The properties of logarithms work both ways.

Use the Properties of Logarithms to expand each logarithm:

$$\log \frac{\sqrt[3]{G}}{H^4 W^2}$$

$\sqrt[3]{G} \rightarrow G^{1/3}$

$\frac{1}{3}\log G - 4\log H - 2\log w$

Expand using all the properties of logarithms.

one method

$$\log_2\left(\frac{m^4}{n^5}\right)^3$$

$\log_2\left(\frac{m^{12}}{n^{15}}\right)$

$12\log_2 m - 15\log_2 n$

2nd method

$$\log_2\left(\frac{m^4}{n^5}\right)^3$$

$3\log_2\left(\frac{m^4}{n^5}\right)$

$3(4\log_2 m - 5\log_2 n)$

Equivalent answers. Both answers are acceptable.

Expand using all the properties of logarithms.

One Method

$$\log_7 \sqrt{\frac{M^5\sqrt[3]{P}}{N^2}}$$

$\log_7 \left(\frac{m^5 \sqrt[3]{P}}{N^2}\right)^{1/2}$

$\frac{1}{2}\left(5\log_7 M + \frac{1}{3}\log_7 P - 2\log_7 N\right)$

2nd Method

$$\log_7 \sqrt{\frac{M^5\sqrt[3]{P}}{N^2}}$$

$\log_7 \left(\frac{m^5 \sqrt[3]{P}}{N^2}\right)^{1/2}$

$\log_7 \left(\frac{m^{\frac{5}{2}} P^{\frac{1}{6}}}{N}\right)$

$\frac{5}{2}\log_7 m + \frac{1}{6}\log_7 P - \log_7 N$

These are equivalent answers. Either one is acceptable.

Expand using all the properties of logarithms.

$$\log \frac{1}{G^4 H^{-8} \sqrt{K}}$$

$$\log \frac{H^8}{G^4 \sqrt{K}}$$

$$8 \log H - 4 \log G - \tfrac{1}{2} \log K$$

Expand using all the properties of logarithms.

$$\log \left[\frac{1}{A^4} \left(\frac{\sqrt{B}}{C^2} \right)^3 \right]^2$$

$$\left[\frac{1}{A^4} \left(\frac{B^{1/2}}{C^2} \right)^3 \right]^2$$

$$\log \left[\frac{1}{A^8} \left(\frac{B^3}{C^{12}} \right) \right]$$

$$-8 \log A + 3 \log B - 12 \log C$$

Expand using all the properties of logarithms.

$$\log \sqrt[3]{\frac{X^4 Y^9}{\sqrt{W^5}}}$$

$$= \log \left(\frac{X^4 Y^9}{W^{5/2}} \right)^{1/3}$$

$$\log \frac{X^{4/3} Y^3}{W^{5/6}}$$

$$\frac{4}{3} \log X + 3 \log Y - \frac{5}{6} \log W$$

You can now finish Hwk #19

Page 457

Problems 20, 21, 24, 26, 28, 29, 80, 82