

## Properties of Logarithms

## Definition:

Properties of Logarithms –

Product Property:  $\log_b mn = \frac{\log_b m + \log_b n}{}$

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

Power Property:  $\log_b m^n = \frac{n \log_b m}{}$

Expand the following logs using the properties of logarithms.

$$\begin{aligned} \log_8 \left( \frac{a}{b^6} \right)^6 \\ \log_8 \frac{a^6}{b^{36}} \\ = \log_8 a^6 - \log_8 b^{36} \\ = \boxed{6 \log_8 a - 36 \log_8 b} \end{aligned}$$

$$\begin{aligned} \log_9 (a^5 b^6)^2 \\ \log_9 a^{10} b^{12} \\ = \log_9 a^{10} + \log_9 b^{12} \\ = \boxed{10 \log_9 a + 12 \log_9 b} \end{aligned}$$

$$\begin{aligned} \log_5 (c^4 \sqrt[3]{a}) \\ \log_5 c^4 a^{\frac{1}{3}} \\ = \log_5 c^4 + \log_5 a^{\frac{1}{3}} \\ = \boxed{4 \log_5 c + \frac{1}{3} \log_5 a} \end{aligned}$$

Condense each expression into a single logarithm.

$$\begin{aligned} \ln x + \ln y + 4 \ln z \\ \ln x + \ln y + \ln z^4 \\ = \boxed{\ln(xyz^4)} \end{aligned}$$

$$\begin{aligned} 6 \log_2 x + 2 \log_2 y \\ \log_2 x^6 + \log_2 y^2 \\ = \boxed{\log_2 (x^6 y^2)} \end{aligned}$$

$$\begin{aligned} 4 \log_5 x - 4 \log_5 y \\ \log_5 x^4 - \log_5 y^4 \\ = \boxed{\log_5 \frac{x^4}{y^4}} \end{aligned}$$

$$\begin{aligned} 3 \log_4 z + \frac{\log_4 x}{3} \\ \log_4 z^3 + \frac{1}{3} \log_4 x \\ = \log_4 z^3 + \log_4 x^{\frac{1}{3}} \\ = \boxed{\log_4 (z^3 x^{\frac{1}{3}})} \end{aligned}$$

Use the properties of logarithms and the logarithms provided to rewrite each logarithm in terms of the variables given.

$$\log_3 7 = X$$

$$\log_3 10 = Y$$

$$\log_3 4 = Z$$

$$\text{Find } \log_3 \frac{5}{2}$$

$$\frac{\log_3 10}{\log_3 4}$$

$$\log_3 4$$

$$= \log_3 10 - \log_3 4$$

$$= \boxed{Y - Z}$$

$$\log_5 11 = U$$

$$\log_5 4 = V$$

$$\log_5 6 = W$$

$$\text{Find } \log_5 \frac{5}{121}$$

$$\log_5 5 - \log_5 11^2$$

$$= \log_5 5 - 2\log_5 11$$

$$= \boxed{1 - 2U}$$