PROPERTIES OF LOGARITHMS

$$\log_a 1 = 0 \qquad \log_a 0 = 1$$

$$\alpha' = \alpha$$

$$\log_a g = 1$$

Evaluate using the properties of logarithms: (a) log_81 and (b) log_66 .

INVERSE PROPERTIES OF LOGARITHMS

For a > 0, x > 0 and $a \neq 1$,

$$\underline{a^{\log_{\underline{a}} x}} = x$$

$$\underbrace{a^{\log_a x} = x} \qquad \qquad \log_a a^x = x$$

$$c^x = c^x$$

$$\alpha^{\times} = \alpha^{\times}$$

Evaluate using the properties of logarithms: (a)
$$4^{\log_4 9}$$
 and (b) $\log_3 3^5$.

$$4^{\log_4 9} = \times$$

$$\log_3 3^5 = ?$$

$$\log_3 4^8 = \log_4 9$$

$$3^7 = 3^5$$

$$\times = 9$$

$$? = 5$$

Evaluate using the properties of logarithms: (a) $\underline{5}^{\log_2(5)}$ (b) $\log_2(7^4)$.

If M>0, N>0, a>0 and $a\neq 1$, then,

$$\log_{\underline{a}}(M\cdot N) = \log_{\underline{a}}M + \log_{\underline{a}}N$$

The logarithm of a product is the sum of the logarithms.

Use the Product Property of Logarithms to write each logarithm as a sum of logarithms. Simplify, if possible.

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If M>0, N>0, a>0 and $a\neq 1$, then,

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

The logarithm of a quotient is the difference of the logarithms.

Use the Quotient Property of Logarithms to write each logarithm as a difference of logarithms.

Simplify, if possible.

(a)
$$\log_5 \frac{5}{7}$$
 and (b) $\log \frac{x}{100}$

Use the Quotient Property of Logarithms to write each logarithm as a difference of logarithms. Simplify, if possible.

If $M>0,\ a>0,\ a\neq 1$ and p is any real number then, $\overbrace{\log_a M} p = p \log_a M$ The log of a number raised to a power as the product product of the power times the log of the number. Use the Power Property of Logarithms to write each logarithm as a product of logarithms. Simplify, if possible.

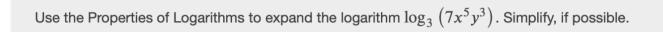
Jse the Power Property possible.	 	 3	,,,,,
$\log_7 5^4 \log \log x^{100}$			

PROPERTIES OF LOGARITHMS

If $M>0,\ N>0,$ a >0, a $\neq 1$ and p is any real number then,

Property	Base a	Base e
	$\log_a 1 = 0$	ln 1 = 0
	$\log_a a = 1$	ln e = 1
Inverse Properties	$a^{\log_a x} = x$ $\log_a a^x = x$	$e^{\ln x} = x$ $\ln e^x = x$
Product Property of Logarithms	$\log_a (M \cdot N) = \log_a M + \log_a N$	$\ln\left(M \cdot N\right) = \ln M + \ln N$
Quotient Property of Logarithms	$\log_a \frac{M}{N} = \log_a M - \log_a N$	$\ln \frac{M}{N} = \ln M - \ln N$
Power Property of Logarithms	$\log_a M^p = p \log_a M$	$ \ln M^p = p \ln M $

Use the Properties of Logarithms to expand the logarithm $\log_4\left(2x^3y^2\right)$. Simplify, if possible.



Use the Properties of Logarithms to expand the logarithm
$$\log_2 \sqrt[4]{\frac{x^3}{3y^2z}}$$
. Simplify, if possible.
$$\log_2 \sqrt[4]{\frac{x^3}{3y^2z}}$$

$$\log_3 \left(\frac{x^3}{3y^2z}\right)$$

$$\log_3 \left(\frac{x^3}{3y^2z}\right)$$

Use the Properties of Logarithms to expand the logarithm $\log_3 \sqrt[3]{\frac{x^2}{5yz}}$. Simplify, if possible. $\log_3 \sqrt[3]{\frac{x^2}{5yz}}$

$$\frac{1}{3} \log_{3} \frac{x^{2}}{5y^{2}}$$

$$\frac{1}{3} \log_{3} \frac{x^{2}}{5y^{2}}$$

$$\frac{1}{3} \left[\log_{3} x^{2} - \log_{5} 5y^{2} \right]$$

$$\frac{1}{3} \left[2 \log_{3} x - (\log_{5} 5 + \log_{5} y + \log_{5} z) \right]$$

$$\frac{1}{3} \left[2 \log_{3} x - (\log_{5} 5 - \log_{5} y - \log_{5} z) \right]$$

Use the Properties of Logarithms to condense the logarithm $\log_4 3 + \log_4 x - \log_4 y$. Simplify, if possible.

Use the Properties of Logarithms to condense the logarithm $\log_2 5 + \log_2 x - \log_2 y$. Simplify, if possible.