Pre-Calculus 12 Laws of Logarithms

Let "n" be any real number, and M, N and "a" are positive real numbers with $a \neq 1$

Name of Law	Law	Example
Product Law	$\log_a MN = \log_a M + \log_a N$	$\log 6 = \log 2 + \log 3$
Quotient Law	$\log_a\left(\frac{M}{N}\right) = \log_a M - \log_a N$	$\log \frac{3}{4} = \log 3 - \log 4$
Power Law	$\log_a M^x = x \log_a M$	$\log 5^2 = 2\log 5$

Ex. 1) Simplify the expression. Use a calculator to verify.

$$\begin{array}{ccc}
\log 7 + \log 8 & \longrightarrow & 1.748 \\
\text{product} & \log (56) & \longrightarrow & 1.748
\end{array}$$

Ex. 2) Write each as a single logarithm

a)
$$\log x + 3 \log y$$
 $\log x + \log x + \log x$
 $\log x + \log x + \log x$

b)
$$\log x + 2 \log y - 4 \log z$$

 $\log x + \log y^2 - \log z^4$
 $\log \left(\frac{xy^2}{z^4}\right)$ quotient law

c)
$$\log_2 6 - 3$$
 e change to a log
$$\log_2 6 - 3\log_2 2 = \log_2 2 = 1$$

$$\log_2 6 - \log_2 2 = 1$$

$$\log_2 (\frac{6}{2})$$

$$\log_2 (\frac{3}{4})$$

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Ex. 3) Expand, using the laws of logarithms.

a)
$$\log(\frac{x}{y^2})$$

 $\log x - \log y^2 \leftarrow \text{quotient law}$
 $\log x - 2\log y - \text{power law}$

b)
$$\log\left(\frac{x^2y^{1/2}}{z}\right)$$
 $\log x^2 + \log y^{\frac{1}{2}} - \log z$
Each term has its own log
 $2\log x + \frac{1}{2}\log y - \log z$

Ex. 4) Evaluate:

a)
$$3\log_96 - \log_972$$

$$\log_99 \left(\frac{6^3}{72}\right)$$
Use log laws
$$\log_99 \left(\frac{216}{72}\right)$$

$$\log_99 \left(\frac{216}{72}\right)$$

$$\log_99 \left(\frac{216}{72}\right)$$

$$\sin_99 \left(\frac{2}{72}\right)$$

$$\sin_99$$

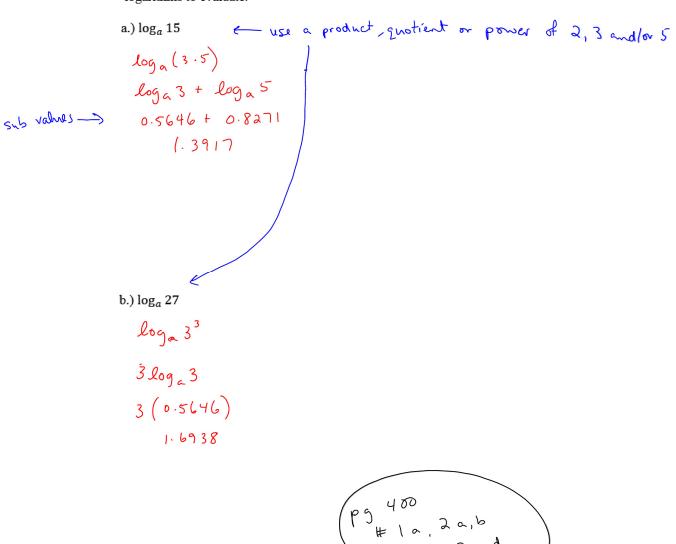
b)
$$2\log_4 6 - 3\log_4 3 + \log_4 12$$

$$\log_4\left(\frac{6^2 \cdot 12}{3^3}\right)$$

$$\log_4 16$$

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Ex. 5) Given $\log_a 2 = 0.3562$, $\log_a 3 = 0.5646$ and $\log_a 5 = 0.8271$, use the laws of logarithms to evaluate.





Assignment: Pg_392+#4c, 5b,d, 8n,b, 12b,c, 13b,d, 15, 16b,d, M.C. #1, 2