

Laws of Logarithms

1. Express as a single log.

a) $4\log x - \frac{\log y}{3} + 5\log z$

b) $6\log_c k - \log_c k^2 - \log_c \sqrt{k}$

c) $m\log_2 5 + \log_2 5 - \log_2 5^{m+3}$

d) $2 + \log_2 3x - 2\log_2 x$

2. If $\log_6 4 = m$, and $\log_6 5 = n$, then $\log_6 80$ expressed in terms of m and n can be written as

a) $m + n$

b) $2m + 2n$

c) $2m + n$

d) $m + 2n$

3. The simplification of $\left(4^{\log m}\right)\left(4^{\log m}\right)$ is

- a) $4^{\log m^2}$ b) $4^{\log 2m}$ c) $16^{\log m^2}$ d) $16^{\log 2m}$

4. Evaluate

a) $\left(6^{\log 20}\right)\left(6^{\log 5}\right)$

b) $-\log_3 9 - 3\log_3\left(\frac{1}{3}\right)$

b) $\frac{1}{2}\log_4 729 - \left(\log_4 2 + \frac{3\log_4 81}{4}\right)$

e) $\frac{\left(\sqrt{2}^{\log_6 27}\right)\left(\sqrt{2}^{\log_6 16}\right)}{\sqrt{2}^{\log_6 12}}$

f) $\log_n n + \log_m m^4 - \log_c 1 - 2\log_{0.5} 32$

Use the following information to answer the next question.

A Math 30-1 student was asked to horizontally stretch $y = \log_2 x$ by a factor of $\frac{1}{24}$ about the y-axis and then state an equivalent transformation. Analyze the following steps.

Step 1 $y = \log_2 24x$

Step 2 $y = \log_2 8 + \log_2 3x$

Step 3 $y = 3 + \log_2 3x$

Step 4 Compared to $y = \log_2 x$, $y = \log_2 24x$ has been horizontally stretched by a factor of $\frac{1}{3}$ about the y-axis and translated 3 units up.

5. Did the Math 30-1 student make an error in any step? If so, identify the step, the error and make any corrections.
6. If $\log_5 x$ is horizontally stretched by a factor of 125 about the y-axis, this would be the equivalent of $\log_5 x$ vertically translated ___ units _____ (up or down).

7. The sound of a car horn is about 110 dB. If another sound, which is just above normal conversation, is about 39 811 times less intense as the car horn, what is the decibel level of the other sound?
8. The logarithmic scale to express the pH of a solution is $\text{pH} = -\log[\text{H}^+]$, where $[\text{H}^+]$ is the hydrogen ion concentration, in moles per litre (mol/L). Lactic acidosis is a medical condition characterized by elevated lactates and a blood pH of less than 7.35. A patient is severely ill when his or her blood pH is 7.0. Find the hydrogen ion concentration in a patient with a blood pH of 7.0.
9. Evaluate $\log_2\left(\sin\frac{\pi}{4}\right) + \log_2\left(\cos\frac{\pi}{4}\right)$