Making Sense of Log Properties

Use What You've Learned
Answers and Explanations

After watching the video, *Making Sense of Logarithm Properties,* complete the following problems.

1. Find the decimal approximations for the following quantities, using a calculator **only** when needed.

   a.

$\log 2$	$\log 3$	$\log 6$	$\log 2 + \log 3$
0.30103	0.47712	0.77815 no calc	0.77815 no calc

   b.

$\log 6$	$\log 36$	$\log 6 + \log 6$
0.77815	1.55630 $\log(6^2) = 2\log 6$ no calc	1.55630 no calc

   c.

$\log 6$	$\log 2$	$\log 72$	$\log 6 + \log 6 + \log 2$
0.77815	0.30103	1.85733 $\log(2 \cdot 6^2) = \log 2 + 2\log 6$ no calc	1.85733 no calc

2. It is a fact that

$$\log 3 \approx 0.4771$$
$$\log 5 \approx 0.6990$$
$$\log 7 \approx 0.8451$$

   Without using a calculator, approximate the following quantities to four decimal places. (Hint: The properties proved in the video *Making Sense of Logarithm Properties* will be useful.)

   a. $\log 15$ — 1.1761; $\log 15 = \log 3 + \log 5$
   b. $\log 35$ — 1.5441; $\log 35 = \log 5 + \log 7$
   c. $\log 105$ — 2.0212; $\log 105 = \log 3 + \log 5 + \log 7$

3. Find decimal approximations for the following quantities, using a calculator when needed.

$\log 3$	$\log 3^2$	$2\log 3$
0.47712	0.95424 $\log 3 + \log 3$ no calc	0.95424 no calc

4. Using the facts given in #2, approximate:

   a. log 243 (Hint: $243 = 3^5$)

   2.3855; $\log 243 = \log 3^5$ or $5 \cdot \log 3$ (Note: The number in the ten-thousandths place is different than you would get using a calculator but it is what you would get by using the properties.)

   b. log 45

   1.6532; $\log 45 = \log(3^2 \cdot 5)$, or $\log 3^2 + \text{Log } 5 = 2 \cdot \log 3 + \log 5$

   c. log 5

   0.84510

   d. $\log 7^a$

   a(0.84510)

5. Fill in the blanks with the generalization used in the above problems.

   a. log ab = log a + log b

   b. $\log a^2 b$ = log a + log a + log b

6. Without a calculator, determine if the following are true or false. Explain your reasoning for any false solutions.

   a. log 5a = log 5 + log a

   True

   b. $(\log 2)^3 = \log 8$

   False; $\log 8 = \log 2^3$
   $(\log 2)^3 \neq \log 2^3$

   c. $\log 25 = 2\log 5$

   True

   d. log (a+9) = (log a) (log 9)

   False; there is no log property that allows us to split apart the log of a sum. Compare this to a true statement $\log a + \log 9 = \log(a \cdot 9)$

   e. $\log\left(\sqrt[3]{2+x}\right) = \dfrac{\log(2+x)}{3}$

   True