Making Sense of Log Properties

Extend Your Learning
Answers and Explanations

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

1. Find a number a such that $\log(1000a) = a + \log(a)$

   $\log(1000 \cdot a) = a + \log a$
   $\log(1000 \cdot a) = \log 10^3 + \log a$
   $\log(1000 \cdot a) = 3(\log 10) + \log a$
   $\log(1000 \cdot a) = 3 \cdot 1 + \log a$
   $\log(1000 \cdot a) = 3 + \log a$

   So, a must be 3.

2. Using a calculator, compute the following to four decimal places:

   a. log(1.357114) 0.1326
   b. log(13.57114) 1.1326
   c. log(135.7114) 2.1326
   d. log(1357.114) 3.1326
   e. log(13571.14) 4.1326
   f. log(135711.4) 5.1326
   g. log(1357114) 6.1326

   What pattern do you notice? Explain why this is true.
   Each time you move the decimal point one place to the right or multiply by 10, you add one to the result. This is because

   $\log(10^k a) = \log 10^k + \log a$
   $\log(10^k a) = k + \log a$

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

   a. $\log(3)$ $\qquad \log(\frac{1}{3})$

   0.47712 $\qquad$ -0.47712

   b. $\log(2)$ $\qquad \log(\frac{1}{2})$

   0.30103 $\qquad$ -0.30101

   c. Prove: $\log\left(\frac{1}{a}\right) = -\log a$

$$\log\left(\frac{1}{a}\right) = \log(a^{-1})$$

$$\log\left(\frac{1}{a}\right) = -\log a$$

4. Prove: $\log\left(\frac{a}{b}\right) = \log a - \log b$

$$\log(\frac{a}{b}) = \log(a \cdot \frac{1}{b})$$

$$\log(\frac{a}{b}) = \log(a) + \log(\frac{1}{b})$$

$$\log(\frac{a}{b}) = \log(a) - \log(b)$$