44. **MULTIPLE REASONING** Which of the following statements is *not* correct?

Ⓐ $\log_3 48 = \log_3 16 + \log_3 3$ Ⓑ $\log_3 48 = 3 \log_3 2 + \log_3 6$

Ⓒ $\log_3 48 = 2 \log_3 4 + \log_3 3$ Ⓓ $\log_3 48 = \log_3 8 + 2 \log_3 3$

EXAMPLE 4 on p. 509 for Exs. 45–61

CHANGE-OF-BASE FORMULA **Use the change-of-base formula to evaluate the logarithm.**

45. $\log_4 7$ **46.** $\log_5 13$ **47.** $\log_3 15$ **48.** $\log_8 22$

49. $\log_3 6$ **50.** $\log_5 14$ **51.** $\log_6 17$ **52.** $\log_2 28$

53. $\log_7 19$ **54.** $\log_4 48$ **55.** $\log_9 27$ **56.** $\log_8 32$

57. $\log_6 \frac{24}{5}$ **58.** $\log_2 \frac{15}{7}$ **59.** $\log_3 \frac{9}{40}$ **60.** $\log_7 \frac{3}{16}$

61. **ERROR ANALYSIS** *Describe* and correct the error in using the change-of-base formula.

$$\log_3 7 = \frac{\log 3}{\log 7}$$ ✗

EXAMPLE 5 on p. 509 for Exs. 62–63

SOUND INTENSITY **In Exercises 62 and 63, use the function in Example 5.**

62. Find the decibel level of the sound made by each object shown below.

a.

Barking dog: $I = 10^{-4}$ W/m^2

b.

Ambulance siren: $I = 10^{0}$ W/m^2

c.

Bee: $I = 10^{-6.5}$ W/m^2

63. The intensity of the sound of a trumpet is 10^3 watts per square meter. Find the decibel level of a trumpet.

64. **OPEN-ENDED MATH** For each statement, find positive numbers M, N, and b (with $b \neq 1$) that show the statement is false in general.

a. $\log_b (M + N) = \log_b M + \log_b N$ **b.** $\log_b (M - N) = \log_b M - \log_b N$

CHALLENGE **In Exercises 65–68, use the given hint and properties of exponents to prove the property of logarithms.**

65. **Product property** $\log_b mn = \log_b m + \log_b n$

(*Hint:* Let $x = \log_b m$ and let $y = \log_b n$. Then $m = b^x$ and $n = b^y$.)

66. **Quotient property** $\log_b \frac{m}{n} = \log_b m - \log_b n$

(*Hint:* Let $x = \log_b m$ and let $y = \log_b n$. Then $m = b^x$ and $n = b^y$.)

67. **Power property** $\log_b m^n = n \log_b m$

(*Hint:* Let $x = \log_b m$. Then $m = b^x$ and $m^n = b^{nx}$.)

68. **Change-of-base formula** $\log_c a = \frac{\log_b a}{\log_b c}$

(*Hint:* Let $x = \log_b a$, $y = \log_b c$, and $z = \log_c a$. Then $a = b^x$, $c = b^y$, and $a = c^z$, so that $b^x = c^z$.)