



6-5 Additional Practice

Properties of Logarithms

Use the properties of logarithms to expand each expression.

1. $\ln(a^4b^7)$

$$4 \ln a + 7 \ln b$$

2. $\ln(x^4)$

$$4 \ln x$$

3. $\log_7(a^2b^3c)$

$$2 \log_7 a + 3 \log_7 b + \log_7 c$$

4. $\log\left(\frac{7}{8}\right)^x$

$$x \log 7 - x \log 8$$

5. $\log_5\left(\frac{x}{7y}\right)$

$$\log_5 x - \log_5(7y)$$

6. $\log\left(\frac{a}{b^2}\right)$

$$\log a - 2 \log b$$

Use the properties of logarithms to write each expression as a single logarithm.

7. $3 \log 4 - 2 \log 7$

$$\log\left(\frac{4^3}{7^2}\right) = \log\left(\frac{64}{49}\right)$$

8. $2 \ln 4 + 2 \ln 5$

$$\ln 400$$

9. $2 \log_4 a + 5 \log_4 b$

$$\log_4(a^2b^5)$$

10. $\log 4 + \log 5 + \log 7$

$$\log 140$$

11. $2 \log 2 + 5 \log(2x)$

$$\log(4 \times (2x)^5) \\ = \log 128x^5$$

12. $4 \log_6 a - 7 \log_6 b$

$$\log_6\left(\frac{a^4}{b^7}\right)$$

13. Use the formula $\text{pH} = \log\left(\frac{1}{[H^+]}\right)$ to write an expression for the concentration of hydrogen ions in a liter of a sports drink that has a pH level of 2.5. What is the concentration of hydrogen ions?

$$\text{pH} = 2.5 = \log\left(\frac{1}{[H^+]}\right) \quad H^+ = 10^{-2.5}$$

The concentration of hydrogen ions in a liter of coca cola is $10^{-2.5}$ mole.

Use the Change of Base Formula to evaluate each logarithm. Round to the nearest thousandth.

14. $\log_2 10$ **3.322**

15. $\log_5 7$ **1.209**

16. $\ln e$ **1**

17. $\log_7 9$ **1.129**

18. $\log_5 13$ **1.594**

19. $\log_3 9$ **2**

Use the Change of Base Formula to solve each equation for x. Give an exact solution as a logarithm and an approximate solution rounded to the nearest thousandth.

20. $5^x = 7$ **1.209**

21. $4^x = 20$ **2.161**

22. $7^x = 42$ **1.921**

23. $4^x = 77$ **3.133**

24. $8^x = 50$ **1.881**

25. $3^x = 16$ **2.524**

26. Explain why $\frac{2}{3} \neq \frac{\ln 2}{\ln 3}$?

$$\frac{2}{3} = 0.667; \frac{\ln 2}{\ln 3} = 0.631; 0.667 \neq 0.631, \text{ therefore } \frac{2}{3} \neq \frac{\ln 2}{\ln 3}.$$