

Practice 8-4

Properties of Logarithms

For Exercises 1–2, use the formula $L = 10 \log \frac{I}{I_0}$.

- A sound has an intensity of $5.92 \times 10^{25} \text{W/m}^2$. What is the loudness of the sound in decibels? Use $I_0 = 10^{-12} \text{W/m}^2$.
- Suppose you decrease the intensity of a sound by 45%. By how many decibels would the loudness be decreased?

Assume that $\log 3 \approx 0.4771$, $\log 4 \approx 0.6021$, and $\log 5 \approx 0.6990$. Use the properties of logarithms to evaluate each expression. Do not use a calculator.

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|--------------|------------------------|------------------------|---------------|
| 3. $\log 12$ | 4. $\log 16$ | 5. $\log \frac{3}{5}$ | 6. $\log 0.8$ |
| 7. $\log 75$ | 8. $\log \frac{16}{5}$ | 9. $\log_6 1 - \log 1$ | 10. $\log 60$ |

Write each logarithmic expression as a single logarithm.

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| 11. $\log_5 4 + \log_5 3$ | 12. $\log_6 25 - \log_6 5$ | 13. $\log_2 4 + \log_2 2 - \log_2 8$ |
| 14. $5 \log_7 x - 2 \log_7 x$ | 15. $\log_4 60 - \log_4 4 + \log_4 x$ | 16. $\log 7 - \log 3 + \log 6$ |
| 17. $2 \log x - 3 \log y$ | 18. $\frac{1}{2} \log r + \frac{1}{3} \log s - \frac{1}{4} \log t$ | 19. $\log_3 4x + 2 \log_3 5y$ |
| 20. $5 \log 2 - 2 \log 2$ | 21. $\frac{1}{3} \log 3x + \frac{2}{3} \log 3x$ | 22. $2 \log 4 + \log 2 + \log 2$ |
| 23. $(\log 3 - \log 4) - \log 2$ | 24. $5 \log x + 3 \log x^2$ | 25. $\log_6 3 - \log_6 6$ |
| 26. $\log 2 + \log 4 - \log 7$ | 27. $\log_3 2x - 5 \log_3 y$ | 28. $\frac{1}{3}(\log_2 x - \log_2 y)$ |
| 29. $\frac{1}{2} \log x + \frac{1}{3} \log y - 2 \log z$ | 30. $3(4 \log t^2)$ | 31. $\log_5 y - 4(\log_5 r + 2 \log_5 t)$ |

Expand each logarithm.

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|------------------------|-----------------------------------|--------------------------|
| 32. $\log xyz$ | 33. $\log_2 \frac{x}{yz}$ | 34. $\log 6x^3y$ |
| 35. $\log 7(3x - 2)^2$ | 36. $\log \sqrt{\frac{2rst}{5w}}$ | 37. $\log \frac{5x}{4y}$ |
| 38. $\log_5 5x^{-5}$ | 39. $\log \frac{2x^2y}{3k^3}$ | 40. $\log_4 (3xyz)^2$ |

State the property or properties used to rewrite each expression.

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| 41. $\log 6 - \log 3 = \log 2$ | 42. $6 \log 2 = \log 64$ | 43. $\log 3x = \log 3 + \log x$ |
| 44. $\frac{1}{3} \log_2 x = \log_2 \sqrt[3]{x}$ | 45. $\frac{2}{3} \log 7 = \log \sqrt[3]{49}$ | 46. $\log_4 20 - 3 \log_4 x = \log_4 \frac{20}{x^3}$ |