In Problems 1–4, use the definition of a logarithmic function to rewrite each equation in exponential form.

1. $4 = \log_2 16$
2. $4 = \log_3 81$
3. $\dfrac{1}{2} = \log_4 2$
4. $-2 = \log_3 \left(\dfrac{1}{9}\right)$

In Problems 13–16, write the equation in logarithmic form.

13. $2^5 = 32$
14. $5^3 = 125$
15. $4^{-1} = \dfrac{1}{4}$
16. $9^{1/2} = 3$

Write each expression in Problems 33–36 as the sum or difference of two logarithmic functions containing no exponents.

33. $\log \left(\dfrac{x}{x + 1}\right)$
34. $\ln \left[(x + 1)(4x + 5)\right]$
35. $\log_7 (x\sqrt[3]{x + 4})$
36. $\log_5 \left(\dfrac{x^2}{\sqrt{x + 4}}\right)$

Use the properties of logarithms to write each expression in Problems 37–40 as a single logarithm.

37. $\ln x - \ln y$
38. $\log_3 (x + 1) + \log_3 (x - 1)$
39. $\log_5 (x + 1) + \dfrac{1}{2} \log_5 x$
40. $\log (2x + 1) - \dfrac{1}{3} \log (x + 1)$

In Problems 47 and 48, use a change-of-base formula to evaluate each logarithm.

47. (a) $\log_2 17$ (b) $\log_5 (0.78)$
48. (a) $\log_3 12$ (b) $\log_8 (0.15)$