Use (4.5) to change each of the equations in Exercises 1–8 to logarithmic form.

1 $4^2 = 16$

2 $3^4 = 81$

3 $2^4 = 16$

4 $3^2 = 9$

5 $10^{-4} = 0.0001$

6 $10^{-3} = 0.001$

7 $r^s = t$

8 $u^v = w$

Use (4.5) to change each of the equations in Exercises 9–16 to exponential form.

9 $\log_5 125 = 3$

10 $\log_4 64 = 3$

11 $\log_4 (\frac{1}{64}) = -3$

12 $\log_3 (1/27) = -3$

13 $\log_{10} 1 = 0$

14 $\log_a 1 = 0$

15 $\log_p s = t$

16 $\log_s p = t$

Find each of the numbers in Exercises 17–30.

17 $\log_3 (\frac{1}{9})$

18 $\log_2 (64)$

19 $\log_{10} (1000)$

20 $\log_9 (81)$

21 $10^{\log_{10} 7}$

22 $\log_{10} (0.001)$

23 $\log_8 \sqrt[5]{8}$

24 $10^{3 \log_{10} 2}$

25 $\log_{10} (\frac{1}{10})$

26 $\log_{10} (10{,}000)$

27 $\log_{1/2} 4$

28 $\log_2 (1/8)$

29 $10^{5 \log_{10} 2}$

30 $\log_4 \sqrt[3]{4}$

Given $\log_a 3 = .5$ and $\log_a 2 = .3$, change the expressions in Exercises 31–40 to decimal form.

31 $\log_a (2/3)$

32 $\log_a (3/2)$

33 $\log_a (3^2)$

34 $\log_a (2^3)$

35 $\log_a (1/2)$

36 $\log_a 18$

37 $\log_a (1/\sqrt[3]{2})$

38 $\log_a (3-2)$

39 $\log_2 a$

40 $(\log_2 a)(\log_a 2)$

Find the solution sets in Exercises 41–66.

41 $\log_4 (x-3) = 2$

42 $\log_6 x = \frac{1}{3}$

43 $\log_8 x = 2/3$

44 $\log_3 (x+5) = -1$

45 $\log_{10} x^2 = -2$

46 $\log_{10} (x^2) = -5$

47 $\log_2 (x^2+3x+4) = 1$

48 $\log_2 (x^2-x-2) = 2$

49 $\log_x 5 = 2$

50 $10^{\log_{10} x} = 2/13$

51 $\log_5 (x+1) < 2$

52 $\log_3 (2x-1) > 1$

53 $1 < \log_{10} x < 2$

54 $2 < \log_{10} x < 3$

55 $\log_3 2x = \log_3 3 + \log_3 5$

56 $\log_5 2x = \log_5 8 - \log_5 3$

57 $\log_6 (3x+1) = \log_6 10 - \log_6 2$

58 $3 \log_2 x = 2 \log_2 8$

59 $\log_4 x - \log_4 (x-1) = 2 \log_4 3$

60 $2 \log_5 \sqrt{x} = 3$

61 $\log_{10} x^2 - \log_{10} 5 = \log_{10} 7 + \log_{10} 2x$

62 $\log_{10} x^2 = \log_{10} x$

63 $\log_5 (x-1) + \log_5 (x-2) = 2 \log_5 \sqrt{6}$

64 $\frac{1}{3} \log_8 (x+1) = 2 \log_8 3 - \frac{2}{3} \log_8 (x+1)$

65 $\log_{10} |3x-1| < 2$

66 $\log_4 \sqrt{x} > 2$

In each of Exercises 67–74 express the logarithm in terms of logarithms of x, y, and z.

67 $\log_a \dfrac{xy^3}{z^2}$

68 $\log_a \dfrac{x^2y^3}{z^4}$

69 $\log_a \dfrac{\sqrt[3]{x}z^2}{y}$

70 $\log_a \dfrac{z^2\sqrt{x}}{y^3}$

71 $\log_a \sqrt[4]{\dfrac{x}{y^2z^5}}$

72 $\log_a \dfrac{\sqrt[3]{x}\sqrt{y}}{z}$

73 $\log_a \sqrt{x\sqrt{y}}$

74 $\log_a \sqrt{x\sqrt{yz}}$

In each of Exercises 75–78 write the expression as one logarithm.

75 $3 \log_a x + \frac{1}{2} \log_a (x+3) - 4 \log_a (x-2)$

76 $2 \log_a x + (1/5) \log_a (x+1) - 3 \log_a (x-1)$

1 $\log_4 16 = 2$. **3** $\log_2 16 = 4$. **5** $\log_{10} (0.0001) = -4$. **7** $\log_r t = s$.
9 $5^3 = 125$. **11** $4^{-3} = 1/64$. **13** $10^0 = 1$. **15** $p^t = s$.
17 -2. **19** 3. **21** 7. **23** 1/5. **25** -1. **27** -2.
29 32. **31** $-.2$. **33** 1. **35** $-.3$. **37** $-.1$. **39** 10/3.
41 $\{19\}$. **43** $\{4\}$. **45** $\{1/10, -1/10\}$. **47** $\{-1, -2\}$.
49 $\{\sqrt{5}\}$. **51** The interval $(-1, 24)$. **53** The interval $(10, 100)$.
55 $\{15/2\}$. **57** $\{4/3\}$. **59** $\{9/8\}$. **61** $\{70\}$. **63** $\{4\}$.
65 $(-33, 101/3)$. **67** $\log_a x + 3 \log_a y - 2 \log_a z$.
69 $(1/3) \log_a x + 2 \log_a z - \log_a y$. **71** $(1/4)(\log_a x - 2 \log_a y - 5 \log_a z)$.
73 $(1/2) \log_a x + (1/4) \log_a y$. **75** $\log_a [x^3\sqrt{x+3}/(x-2)^4]$. **77** $-\log_a x$.