

PRACTICE PROBLEMS

Evaluate:

1. $0.6^{\sqrt{3}}$ 2. $e^{3.2}$ 3. $(1.005)^{400}$ 4. $\log_4 64$ 5. $\ln 1$ 6. $\ln \sqrt{7}$

Rewrite into logarithms:

7. $2^4 = 16$ 8. $\sqrt{64} = 8$ 9. $e^4 = 54.60$

Evaluate without a calculator:

10. $\log_5 25$ 11. $\log_3 \frac{1}{81}$ 12. $\ln e^{-2}$

Use the change of base formula to evaluate the logarithms: (Round to 3 decimal places.)

13. $\log_7 3$ 14. $\log_2 \frac{1}{2}$ 15. $\log_{15} 42$

Use the properties of logarithms to rewrite each expression into lowest terms (i.e. expand the logarithms to a sum or a difference):

16. $\log 10x$ 19. $\log_4 4x^2$ 22. $\ln \frac{\sqrt{3x}}{7}$
17. $\ln \frac{xy}{z}$ 20. $\log_3 \sqrt{x-2}$
18. $\log_b \frac{x^4}{z^2}$ 21. $\ln \frac{x^5 z^2}{y^3}$

Write each expression as a single logarithmic quantity:

23. $\log 7 - \log x$ 26. $\log_2 5 + \log_2 x - \log_2 3$ 29. $\frac{1}{2} \log_5 7 - 2 \log_5 x$
24. $3 \ln x + 2 \ln y - 4 \ln z$ 27. $1 + 3 \log_4 x$
25. $\frac{3}{2} \ln x^6 - \frac{3}{4} \ln x^8$ 28. $2 \ln 8 + 5 \ln x$

Using properties of logarithms find the following values if:

$\log_b 3 = 0.562$ $\log_b 2 = 0.356$ $\log_b 7 = 0.872$
30. $\log_b 18$ 31. $\log_b \sqrt{28}$ 32. $\log_b \frac{1}{21}$ 33. $\log_b 3b^2$ 34. $\log_b 1$

Write the exponential equation in logarithmic form:

35. $4^3 = 64$ 36. $25^{3/2} = 125$

Write the logarithmic equation in exponential form:

37. $\ln e = 1$ 38. $\log_3 \frac{1}{9} = -2$

Evaluate the following logarithms without a calculator:

39. $\log 1000$ 42. $\log_4 \frac{1}{16}$ 45. $\ln 1$
40. $\log_9 3$ 43. $\ln e^7$ 46. $\ln e^{-3}$
41. $\log_3 \frac{1}{9}$ 44. $\log_a \frac{1}{a}$

Evaluate the following logarithms for the given values of x :

47. $f(x) = \log_3 x$

a. $x = 1$

b. $x = 27$

c. $x = 0.5$

48. $g(x) = \log x$

a. $x = 0.01$

b. $x = 0.1$

c. $x = 30$

49. $f(x) = \ln x$

a. $x = e$

b. $x = \frac{1}{3}$

c. $x = 10$

50. $h(x) = \ln x$

a. $x = e^2$

b. $x = \frac{5}{4}$

c. $x = 1200$

51. $g(x) = \ln e^{3x}$

a. $x = -2$

b. $x = 0$

c. $x = 7.5$

52. $f(x) = \log_2 \sqrt{x}$

a. $x = 4$

b. $x = 64$

c. $x = 5.2$

Use the change of base formula to evaluate the following logarithms: (Round to 3 decimal places.)

53. $\log_4 9$

54. $\log_{1/2} 5$

55. $\log_{12} 200$

56. $\log_3 0.28$

Approximate the following logarithms given that $\log_5 2 \approx 0.43068$ and $\log_5 3 \approx 0.68261$:

57. $\log_5 18$

60. $\log_5 \frac{2}{3}$

58. $\log_5 \sqrt{6}$

61. $\log_5 (12)^{2/3}$

59. $\log_5 \frac{1}{2}$

62. $\log_5 (5^2 \cdot 6)$

Use the properties of logarithms to expand the expression:

63. $\log_4 6x^4$

66. $\ln \sqrt[3]{\frac{x}{5}}$

69. $\ln[\sqrt{2x}(x+3)^5]$

64. $\log 2x^{-3}$

67. $\ln \frac{x+2}{x-2}$

70. $\log_3 \frac{a^2 \sqrt{b}}{cd^5}$

65. $\log_5 \sqrt{x+2}$

68. $\ln x(x-3)^2$

Use the properties of logarithms to condense the expression:

71. $-\frac{2}{3} \ln 3y$

75. $-2(\ln 2x - \ln 3)$

79. $3 \ln x + 4 \ln y + \ln z$

72. $5 \log_2 y$

76. $4(1 + \ln x + \ln x)$

80. $\ln(x+4) - 3 \ln x - \ln y$

73. $\log_8 16x + \log_8 2x^2$

77. $4[\log_2 k - \log_2(k-t)]$

74. $\log_4 6x - \log_4 10$

78. $\frac{1}{3}(\log_8 a + 2 \log_8 b)$

True or False? Use the properties of logarithms to determine whether the equation is true or false. If false, state why or give an example to show that it is false.

81. $\log_2 4x = 2 \log_2 x$

83. $\log 10^{2x} = 2x$

85. $\log_4 \frac{16}{x} = 2 - \log_4 x$

82. $\frac{\ln 5x}{\ln 10x} = \ln \frac{1}{2}$

84. $e^{\ln t} = t$

86. $6 \ln x + 6 \ln y = \ln(xy)^6$

Practice Problems Answers

Note: Remember that all variables that represent an argument of a logarithm must be greater than 0.

1. 0.413
2. 24.533
3. 7.352
4. 3
5. 0
6. 0.973
7. $\log_2 16 = 4$
8. $\log_{64} 8 = \frac{1}{2}$
9. $\ln 54.60 = 4$
10. 2
11. -4
12. -2
13. 0.565
14. -1
15. 1.380
16. $1 + \log x$
17. $\ln x + \ln y - \ln z$
18. $4 \log_b x - 2 \log_b z$
19. $1 + 2 \log_4 x$
20. $\frac{1}{2} \log_3 (x - 2)$
21. $(5 \ln x + 2 \ln z) - 3 \ln y$
22. $\frac{1}{2} (\ln 3 + \ln x) - \ln 7$
23. $\log \frac{7}{x}$
24. $\ln \frac{x^3 y^2}{z^4}$
25. $\ln x^3$
26. $\log_2 \frac{5x}{3}$
27. $\log_4 4x^3$
28. $\ln 64x^5$
29. $\log_5 \frac{\sqrt{7}}{x^2}$
30. 1.48
31. 0.792
32. -1.434
33. 2.562
34. 0
35. $\log_4 64 = 3$
36. $\log_{25} 125 = \frac{3}{2}$
37. $e^1 = e$
38. $3^{-2} = \frac{1}{9}$
39. 3
40. $\frac{1}{2}$
41. -2
42. -2
43. 7
44. -1
45. 0
46. -3
47. a. 0 b. 3 c. -0.631
48. a. -2 b. -1 c. 1.477
49. a. 1 b. -1.099 c. 2.303
50. a. 2 b. 0.223 c. 7.090
51. a. -6 b. 0 c. 22.5
52. a. 1 b. 3 c. 1.189
53. 1.585
54. -2.322
55. 2.132
56. -1.159
57. 1.7959
58. 0.556645
59. -0.43068
60. -0.25193
61. 1.02931
62. 3.11329
63. $\log_4 6 + 4 \log_4 x$
64. $\log 2 - 3 \log x$
65. $\frac{1}{2} \log_5 (x + 2)$
66. $\frac{1}{3} (\ln x - \ln 5)$
67. $\ln(x + 2) - \ln(x - 2)$
68. $\ln x + 2 \ln(x - 3)$
69. $\frac{1}{2} (\ln 2 + \ln x) + 5 \ln(x + 3)$
70. $2 \log_3 a + \frac{1}{2} \log_3 b - \log_3 c - 5 \log_3 d$
71. $\ln \left(\frac{1}{3y} \right)^{2/3}$
72. $\log_2 y^5$
73. $\log_8 32x^3$
74. $\log_4 \frac{3x}{5}$
75. $\ln \frac{9}{4x^2}$
76. $4 + \ln x^8$
77. $\log_2 \left(\frac{k}{k-t} \right)^4$
78. $\log_8 \sqrt[3]{ab^2}$
79. $\ln(x^3 y^4 z)$
80. $\ln \frac{x+4}{x^3 y}$
81. False. $\log_2 4x = 2 + \log_2 x$
82. False. $\ln \frac{5x}{10x} = \ln \frac{1}{2}$
83. True
84. True
85. True
86. True