

Name _____ Date _____ Period _____

1. $\log_a 1 =$ _____ 2. $\log_a a =$ _____ 3. $a^{\log_a M} =$ _____
4. $\log_a a^r =$ _____ 5. $\log_a (MN) =$ _____ 6. $\log_a \left(\frac{M}{N}\right) =$ _____
7. $\log_a M^r =$ _____ 8. If $\log_a x = \log_a 6$, then $x =$ _____.
9. If $\log_8 M = \frac{\log_5 7}{\log_5 8}$, then $M =$ _____.
10. True or False: $\frac{\ln 8}{\ln 2} = 3$
11. True or False: $\ln(x+3) - \ln(2x) = \frac{\ln(x+3)}{\ln(2x)}$
12. True or False: $\log_2(3x^4) = 4\log_2(3x)$

Use properties of logarithms to find the exact value of each expression. Do not use a calculator.

13. $\log_2 2^{-13}$ 14. $2^{\log_2 7}$ 15. $\log_4 4$ 16. $\ln \sqrt[4]{e}$
17. $e^{\ln 6}$ 18. $\log_6 1$ 19. $7^{\log_7 6}$ 20. $\log 10,000$
21. $10^{\log(0.5)}$ 22. $\log_5 \sqrt[3]{25}$ 23. $\log_6 \frac{1}{\sqrt[3]{36}}$ 24. $\ln \frac{1}{e}$
25. $\log 10^{-4}$ 26. $\log \sqrt[3]{10}$ 27. $e^{\ln(\frac{1}{5})}$ 28. $\ln e^3$
29. $10^{\log 14}$ 30. $\ln e$ 31. $10^{\log(5)}$ 32. $\log_2 32$
33. $\ln 1$ 34. $\log_7 1$ 35. $\ln \frac{1}{\sqrt{e^7}}$

Assuming x and y are positive, use properties of logarithms to write the expression as a sum and/or difference of logarithms or multiples of logarithms. Express exponents as factors using the power property. Simplify if possible.

36. $\ln 4x$

37. $\log \frac{5}{y}$

38. $\log y^4$

39. $\log_6 x^2 y^3$

40. $\ln \frac{x^3}{y^2}$

41. $\log_3 x^{-2}$

42. $\ln \frac{\sqrt[3]{y}}{\sqrt[3]{x}}$

43. $\ln(ex)$

44. $\ln\left(\frac{e}{x}\right)$

45. $\ln\left(\frac{x}{e^x}\right)$

46. $\log_a(u^2 v^3)$

47. $\ln(\sqrt{1-x})$

Assuming x , y and z are positive, use properties of logarithms to write the expression as a single logarithm. Simplify if possible.

48. $\log y + \log 7$

49. $\ln y - \ln x$

50. $\frac{1}{2} \ln y$

51. $3 \log(xy) - 2 \log(yz)$

52. $2 \ln(x^2 y) + 3 \ln(xy^3)$

53. $3 \log_5 u + 4 \log_5 v$

54. $2 \log_3 u - \log_3 v$

55. $\log(2x-3) + \log(7x+6)$

Suppose that $\ln 2 = a$ and $\ln 3 = b$, use the properties of logarithms to write each logarithm in terms of a and b .

56. $\ln \frac{2}{3}$

57. $\ln \frac{1}{2}$

58. $\ln 2^3$

Use the Change-of-Base Formula and a calculator to evaluate each logarithm. Round your answer to three decimal places. You must write the Change-of-Base expression.

59. $\log_3 21$

60. $\log_5 18$

Write the expression using only natural logarithms.

61. $\log_4 x$

62. $\log_3 (x + y)$

Write the expression using only common logarithms.

63. $\log_3 x$

64. $\log_{1/3} (x + y)$

Use properties of logarithms of find the exact value of each expression. Do not use a calculator.

65. $\log_8 2 + \log_8 4$

66. $\log_6 18 - \log_6 3$

67. $3^{\log_3 5 - \log_3 4}$