SM 3H 2023-2024

5.3 Properties of Logarithms

SCORE: /

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 of 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. $10^{\log(x+4)}$
20. $\log 10{,}000$
21. $e^{\ln(0.5)}$
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. $e^{\ln\left(\frac{1}{5}\right)}$
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. $\log_6 x^2y^3$

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. $\log_a\left(u^2v^3\right)$

47. $\ln\left(x^2\sqrt{1-x}\right)$

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

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

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

55. $\log\left(\frac{x^2+2x-3}{x^2-4}\right) - \log\left(\frac{x^2+7x+6}{x+2}\right)$

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. $\ln 0.5$

58. $\ln 8$

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. $\log_3 (x+y)$

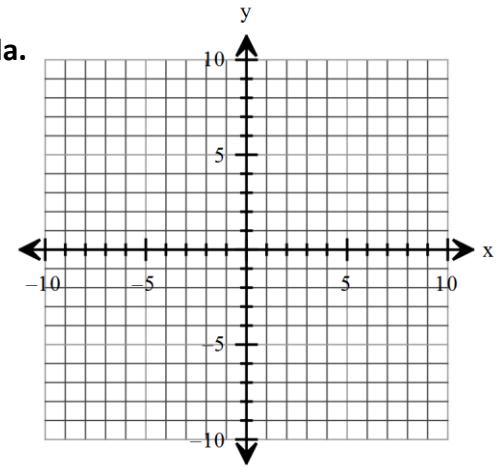
Write the expression using only common logarithms.

63. $\log_3 x$

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

Graph the function using a graphing calculator and the Change-of-Base Formula.

65. $f(x) = \log_5 x$



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

66. $\log_8 2 - \log_8 4$

67. $\log_6 18 - \log_6 3$

68. $\log_3 8 \cdot \log_8 9$

69. $3^{\log_3 5 - \log_3 4}$

Use the properties of logarithms to express *y* as a function of *x*. The constant C is a positive number.

70. $\ln y = \ln x + \ln C$

71. $\ln y = \ln x + \ln(x+1) + \ln C$