SM3 4.4 Log Properties

Rewrite the following using logarithmic properties. Simplify if appropriate.

1. $\log[(2)(3)]$

$\log 2 + \log 3$

2. $\log \frac{2}{3}$

$\log 2 - \log 3$

3. $\log 2^3$

$3 \log 2$

4. $\log_4 3^x$

$x \log_4 3$

5. $\log 2x$

$\log 2 + \log x$

6. $\log_2 \frac{x}{2}$

$\log_2 x - \log_2 2$
$\log_2 x - 1$

7. $\log_5 x^3$

$3 \log_5 x$

8. $\log_4[x(2-x)]$

$\log_4 x + \log_4(2-x)$

9. $\log_3 \frac{5}{x+3}$

$\log_3 5 - \log_3(x+3)$

10. $\log_2(x+1)^4$

$4 \log_2(x+1)$

11. $\log \sqrt{x}$

$\frac{1}{2} \log x$

12. $\log \sqrt[3]{x+3}$

$\frac{1}{3} \log(x+3)$

13. $\log_4[x(x-2)^4]$

$\log_4 x + 4 \log_4(x-2)$

14. $\log_3[x(x+1)]^5$

$5 \log_3 x + 5 \log_3(x+1)$

15. $\log \sqrt[4]{\frac{x+1}{x-1}}$

$\frac{1}{4} \log(x+1) - \frac{1}{4} \log(x-1)$

16. $\log_3 \frac{\sqrt{x}}{3+x^2}$

$\frac{1}{2} \log_3 x - \log_3(3+x^2)$

17. $\ln(2x)$

$\ln(2) + \ln(x)$

18. $\ln \frac{x}{3}$

$\ln(x) - \ln(3)$

19. $\ln x^3$

$3 \ln(x)$

20. $\ln[x(x-1)^4]$

$\ln(x)$
$+ 4 \ln(x-1)$

21. $\ln[(x-2)(x+3)]^2$

$2 \ln(x-2) + 2 \ln(x+3)$

22. $\ln(x^2 - 16)$

$\ln(x+4)(x-4)$
$\ln(x+4) + \ln(x-4)$

23. $\ln \frac{x^2 + 3x - 4}{x^2 - 25}$

$\ln \frac{(x+4)(x-1)}{(x+5)(x-5)}$

$\ln(x+4) + \ln(x-1) - \ln(x+5) - \ln(x-5)$

24. $\ln[3x^4(9-2x)]$

$\ln 3 + 4\ln x + \ln(9-2x)$

25. $\ln\dfrac{x^2-4}{x+2}$

$\ln\dfrac{(x+2)(x-2)}{x+2}$

$\ln(x-2)$

26. $\ln(x^4+3x^3+2x-1)^2$

$2\ln(x^4+3x^3+2x-1)$

Rewrite the following using one logarithm.

27. $\log_2 x + \log_2 y$

$\log_2 xy$

28. $3\log x$

$\log x^3$

29. $\log_2 x - \log_2 y$

$\log_2 \dfrac{x}{y}$

30. $\dfrac{1}{2}\log_3(x-3)$

$\log_3 \sqrt{x-3}$

31. $2\log_5 x + \log_5(4+x)$

$\log_5[x^2(4+x)]$

32. $\log(x-2)-\log(x+2)$

$\log\dfrac{x-2}{x+2}$

33. $3\log_2(x^2) + 3\log_2(x+10)$

$\log_2 x^6(x+10)^3$

34. $\log x + \log(x-2) + \log(x^3+3)$

$\log[x(x-2)(x^3+3)]$

35. $\log_4(x+3) + \log_4(x-3) - \log_4(x+7)$

$\log_4 \dfrac{x^2-9}{x+7}$

36. $\dfrac{2}{3}\log_7 x - \dfrac{1}{3}\log_7(4-x)$

$\log_7 \sqrt[3]{\dfrac{x^2}{4-x}}$

37. $\ln x + \ln 2$
    $\ln 2x$

38. $\ln x - \ln 2$
    $\ln\dfrac{x}{2}$

39. $4\ln x$
    $\ln x^4$

40. $\ln(x+1) + \ln 2$
    $\ln(2x+2)$

41. $3\ln x + 2\ln(x+3)$
    $\ln x^3 + \ln(x+3)^2$
    $\ln[x^3(x+3)^2]$

42. $\ln(x-5) + \ln(x+5)$
    $\ln(x-5)(x+5)$
    $\ln(x^2-25)$

43. $\dfrac{1}{2}\ln x - \ln(4-x)$
    $\ln\sqrt{x} - \ln(4-x)$
    $\ln\left(\dfrac{\sqrt{x}}{4-x}\right)$

44. $\ln e^0 + e^{\ln x}$
$0 + x$
x

45. $\ln x + \ln y - \ln z$
$\ln xy - \ln z$
$\ln\left(\dfrac{xy}{z}\right)$

46. $3[\ln(x - 2) + \ln(3 + x)]$
$3\ln(x - 2) + 3\ln(x + 3)$
$\ln(x - 2)^3 + \ln(x + 3)^3$
$\ln(x - 2)^3(x + 3)^3$

Rewrite the following in base 10.

47. $\log_2 3$

$\dfrac{\log 3}{\log 2}$

48. $\log_8 4$

$\dfrac{\log 4}{\log 8}$

49. $\log_3 x^2$

$\dfrac{\log x^2}{\log 3}$

50. $\log_3 (x - 2)$

$\dfrac{\log(x-2)}{\log 3}$

51. $\log_7 (x + 5)$

$\dfrac{\log(x+5)}{\log 7}$

52. $\log_3 \sqrt[3]{x - 4}$

$\dfrac{\log(x-4)}{3\log 3}$

53. $\log_5 12x$

$\dfrac{\log 12x}{\log 5}$

54. $\log_4 (x + 7)$

$\dfrac{\log(x+7)}{\log 4}$

Rewrite in Base e

55. $\log_4 10$

$\dfrac{\ln 10}{\ln 4}$

56. $\log_2 4$

$\dfrac{\ln 4}{\ln 2} = \dfrac{\ln 2^2}{\ln 2} =$

$\dfrac{2\ln 2}{\ln 2} = 2$

57. $\log_4 x^3$

$\dfrac{\ln x^3}{\ln 4} =$

$\dfrac{3\ln x}{\ln 4}$

58. $\log_7 (x + 10)$

$\dfrac{\ln(x + 10)}{\ln 7}$

59. $\log_3 (x - 5)$

$\dfrac{\ln(x - 5)}{\ln 3}$

60. $\log_3 \sqrt[4]{2x - 4}$

$\dfrac{\ln \sqrt[4]{2x - 4}}{\ln 3} =$

$\dfrac{\ln(2x - 4)}{4\ln 3} =$

$\dfrac{\ln 2 + \ln(x - 2)}{4\ln 3}$

61. $\log_2 3x$

$\dfrac{\ln 3x}{\ln 2} =$

$\dfrac{\ln 3 + \ln x}{\ln 2}$

62. $\log_5 (3x + 7y)$

$\dfrac{\ln(3x + 7y)}{\ln 5}$