Answers for Lesson 8-4 Exercises

1. Product Property

2. Quotient Property

3. Power Property

4. Power Property

5. Power Property, Quotient Property

6. Power Property

7. Power Property, Quotient Property

8. Power Property, Product Property

9. Power Property, Quotient Property

10. Power Property, Product Property

11. $\log 14$ **12.** $\log_2 3$ **13.** $\log 972$ **14.** $\log \frac{2}{3}$

15. $\log \frac{m^4}{n}$ **16.** $\log \frac{5}{2^k}$ **17.** $\log_6 5x$ **18.** $\log_7 \frac{xy}{z}$

19. $3 \log x + 5 \log y$

20. $\log_7 22 + \log_7 x + \log_7 y + \log_7 z$

21. $\log_4 5 + \frac{1}{2}\log_4 x$ **22.** $\log 3 + 4 \log m - 2 \log n$

23. $\log_5 r - \log_5 s$ **24.** $2 \log_3 2 + 2 \log_3 x$

25. $\log_3 7 + 2 \log (2x - 3)$ **26.** $2 \log a + 3 \log b - 4 \log c$

27. $\frac{1}{2} \log 2 + \frac{1}{2} \log x - \frac{1}{2} \log y$ **28.** $1 + \frac{1}{2} \log_8 3 + \frac{5}{2}\log_8 a$

29. $\log s + \frac{1}{2} \log 7 - 2 \log t$ **30.** $-\log_b x$

31. 9 dB **32.** 13 dB **33.** -2 **34.** 1

35. 6 **36.** 2 **37.** 2 **38.** 1

39. 1 **40.** -2 **41.** 1

42. The coefficient $\frac{1}{2}$ is missing in $\log_4 s$; $\log_4 \sqrt{\frac{t}{s}} = \frac{1}{2} \log_4 \frac{t}{s} = \frac{1}{2}(\log_4 t - \log_4 s) = \frac{1}{2} \log_4 t - \frac{1}{2} \log_4 s$.

43. Answers may vary. Sample: log 150 = log 15 + log 10

44. 1.3803 **45.** 1.4772 **46.** 1.2042

47. 2.097 **48.** 0.1761 **49.** -0.0969

50. -0.6021 **51.** -1.398 **52.** 1.398

53. -0.7782 **54.** 1.5564 **55.** 0.3495

56. 12 dB **57.** 0.00001

58. True; $\log_2 4 = 2$ and $\log_2 8 = 3$.

59. False; $\frac{1}{2} \log_3 3 = \log_3 3^{\frac{1}{2}}$, not $\log_3 \frac{3}{2}$.

60. True; it is an example of the Power Property since $8 = 2^3$.

61. False; the two logs have different bases.

62. False; this is not an example of the Quotient Property. $\log (x - 2) \neq \log x - \log 2$.

63. False; $\log_b \frac{x}{y} = \log_b x - \log_b y$.

64. False; the exponent on the left means the log x, quantity squared, not the log of x^2.

65. False; $\log_4 7 - \log_4 3 = \log_4 \frac{7}{3}$, not $\log_4 4$.

66. True; $\log x + \log (x^2 + 2) = \log x(x^2 + 2)$, which equals $\log (x^3 + 2x)$.

67. False; the three logs have different bases.

68. True; the power and quotient properties are used correctly.

69. True; the left side equals $\log_b\left(\frac{1}{8} \cdot 4^3\right)$, which equals $\log_b 8$.

70. 102 dB

71. No; the expression $(2x + 1)$ is a sum, so it is not covered by the Product, Quotient, or Power properties.

72. The log of a product is equal to the sum of the logs. $\log (MN) = \log M + \log N$. So $\log (5 \cdot 2) = \log 10 = 1$, $\log 5 \cdot \log 2 \approx (0.7)(0.3) = 0.21$, which is not equal to 1.

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

74. $\log_x \frac{2\sqrt{y}}{\sqrt[3]{}}$

75. $\log \frac{27}{2}$

76. $\log_4 \frac{m^x n^{1/y}}{p}$

77. $\log_b \frac{\sqrt[3]{x^2}\sqrt[4]{y^3}}{z^5}$

78. $\log \frac{\sqrt[4]{z}}{\sqrt[4]{3}\sqrt{x^5}}$

79. $3 \log 2 + \frac{3}{2}\log x - 3 \log 5$

80. $3 \log m - 4 \log n + 2 \log p$

81. $\log 2 + \frac{1}{2} \log 4 + \frac{1}{2} \log r - \log s$

82. $\frac{1}{2} \log_b x + \frac{2}{3}\log_b y - \frac{2}{5}\log_b z$

83. $\frac{5}{2}\log_4 x + \frac{7}{2}\log_4 y - \log_4 z - 4 \log_4 w$

84. $\frac{1}{2} \log (x^2 - 4) - 2 \log (x + 3)$

85. $\frac{1}{2} \log x + \frac{1}{4}\log 2 - \log y$

86. $\log_3 x + \log_3 y - 6 \log_3 z$

87. $\frac{1}{2} \log_7 (r + 9) - 2 \log_7 s - \frac{1}{3}\log_7 t$

88. $v = \log_b N$

$b^v = N$

$MN = b^u \cdot b^v = b^{u+v}$

$\log_b MN = u + v$

$\log_b MN = \log_b M + \log_b N$

89. **1.** $u = \log_b M$ (Given)

2. $b^u = M$ (Rewrite in exponential form.)

3. $(b^u)^x = M^x$ (Raise each side to x power.)

4. $b^{ux} = M^x$ (Power Property of exponents)

5. $\log_b b^{ux} = \log_b M^x$ (Take the log of each side.)

6. $ux = \log_b M^x$ (Simplify.)

7. $\log_b M^x = x \bullet \log_b M$ (Substitution)

90. **1.** $u = \log_b M$ (Given)

2. $b^u = M$ (Rewrite in exponential form.)

3. $v = \log_b N$ (Given)

4. $b^v = N$ (Rewrite in exponential form.)

5. $\frac{M}{N} = \frac{b^u}{b^v} = b^{u\text{-}v}$ (Quotient Property of Exponents)

6. $\log_b \frac{M}{N} = \log_b b^{u\text{-}v}$ (Take the log of each side.)

7. $\log_b \frac{M}{N} = u - v$ (Simplify.)

8. $\log_b \frac{M}{N} = \log_b M - \log_b N$ (Substitution)