5.3 pg. 405 7-19 EOO, 23-43 odd, 45-77 EOO

7. $\frac{\log 16}{\log 5}$; $\frac{\ln 16}{\ln 5}$ 11 $\frac{\log \frac{3}{10}}{\log x}$ $\frac{\ln \frac{3}{10}}{\ln x}$

15. $\frac{\log 7}{\log 3} = \boxed{1.771}$ 19. $\frac{\log .1}{\log 9} = \boxed{-1.048}$

23. $\log_4 8 = \frac{\log 8}{\log 4} = \frac{\log 2^3}{\log 2^2} = \frac{3\log 2}{2\log 2} = \boxed{\frac{3}{2}}$

24. $\log_2(4^2 \cdot 3^4) = \frac{\log(4^2) + \log 3^4}{\log 2} = \frac{2\log 4 + 4\log 3}{\log 2}$

$= \frac{2\log 2^2}{\log 2} + \frac{4\log 3}{\log 2} = \frac{4\log 2}{\log 2} - \frac{4\log 3}{\log 2}$

$\boxed{4 - \frac{4\log 3}{\log 2} = 4(1 - \log_2 3)}$

25. $\log_5 \frac{1}{250} = \frac{\log \frac{1}{250}}{\log 5} = \frac{\log(125 \cdot 2)^{-1}}{\log 5} = \frac{-(\log 125 + \log 2)}{\log 5}$

$\frac{-(\log 5^3 + \log 2)}{\log 5} = \frac{-3\log 5}{\log 5} - \frac{\log 2}{\log 5}$

$= \boxed{-3 - \log_5 2}$

27. $\ln(5e^6) = \ln 5 + 6\ln e = \boxed{\ln 5 + 6}$

29. $\log_3 9 = x$ $3^x = 9$

$3^x = 3^2$ $\boxed{2}$

$x = 2$

31. $\log_2 \sqrt[4]{8} = x$ $\quad 2^x = 8^{\frac{1}{4}}$

$2^x = (2^3)^{\frac{1}{4}}$

$2^x = 2^{3/4}$

$x = \frac{3}{4}$

$\boxed{\frac{3}{4}}$

33. $\log_4 16^2 = \log_4 (4^2)^2$

$= \log_4 4^4$

$= 4 \log_4 4$

$= \boxed{4}$

35 Undefined ; -2 is outside the domain of $\log x$

37. $\ln e^{4.5} = 4.5 \ln e$

$= \boxed{4.5}$

39. $\ln \sqrt{e}^{\frac{1}{2}} = \ln 1 - \ln (e)^{\frac{1}{2}}$

$= \ln 1 - \frac{1}{2} \ln e$

$= 0 - \frac{1}{2}$

$= \boxed{-\frac{1}{2}}$

41. $\ln e^2 + \ln e^5 = 2 \ln e + 5 \ln e$

$= 2 + 5$

$= \boxed{7}$

43. $\log_5 75 - \log_5 3 = \log_5 \frac{75}{3}$

$= \log_5 25$

$= \log_5 5^2$

$= 2 \log_5 5 = \boxed{2}$

5.3 cont'd 45-77 EOO

45. $\ln 4x = \boxed{\ln 4 + \ln x}$

49. $\log_5 \frac{5}{x} = \log_5 5 - \log_5 x$
$= \boxed{1 - \log_5 x}$

53. $\ln xyz^2 = \boxed{\ln x + \ln y + 2\ln z}$

57. $\log_2 \frac{\sqrt{a-1}}{9} = \log_2 \sqrt{a-1} - \log_2 9$
$= \log_2 (a-1)^{\frac{1}{2}} - \log_2 3^2$
$= \boxed{\frac{1}{2}\log_2 (a-1) - 2\log_2 3}$

61. $\ln x^2 \sqrt{\frac{y}{z}} = \ln x^2 \left(\frac{y}{z}\right)^{\frac{1}{2}}$
$= \ln x^2 + \ln y^{\frac{1}{2}} - \ln z^{\frac{1}{2}}$
$= 2\ln x + \frac{1}{2}\ln y - \frac{1}{2}\ln z$

65. $\ln \sqrt[4]{x^3(x^2+3)} = \ln \left(x^3(x^2+3)\right)^{\frac{1}{4}}$
$= \ln \left(x^{\frac{3}{4}}(x^2+3)^{\frac{1}{4}}\right)$
$= \ln x^{\frac{3}{4}} + \ln (x^2+3)^{\frac{1}{4}}$
$= \boxed{\frac{3}{4}\ln x + \frac{1}{4}\ln (x^2+3)}$

69. $\log_4 z - \log_4 y = \boxed{\log_4 \left(\frac{z}{y}\right)}$

73. $\frac{1}{4}\log_3 5x = \boxed{\log_3 \sqrt[4]{5x}}$

77. $\log x - 2\log y + 3\log z = \log x - \log y^2 + \log z^3$
$= \boxed{\log \frac{x z^3}{y^2}}$

81. $\frac{1}{3}[\log_8 y + 2\log_8(y+4)] - \log_8(y-1)$

$\frac{1}{3}(\log_8 y + \log_8(y+4)^2) - \log_8(y-1)$

$\frac{1}{3}(\log_8 y(y+4)^2) - \log_8(y-1)$

$(\log_8(y(y+4)^2)^{\frac{1}{3}} - \log_8(y-1)$

$$\boxed{\log_8 \frac{(y^{\frac{1}{3}}(y+4)^{\frac{2}{3}})}{y-1}}$$

87. (A) $B = 10\left(\log \frac{I}{10^{-12}}\right)$

$= 10(\log I \cdot 10^{12})$

$= 10\log I + 10\log 10^{12}$

$= 10\log I + 10(12)$

$= \boxed{10\log I + 120}$

(B) $I = 10^{-6}$

$10\log(10^{-6}) + 120$

$10(-6) + 120$

$-60 + 120$

$\boxed{60}$

88. Avg. office: 1.26×10^{-7}

$= 10\log(1.26 \times 10^{-7}) + 120$

$= 51.004$

Studio: 3.16×10^{-10}

$= 10\log(3.16 \times 10^{-10}) + 120$

$= 24.997$

$51.004 - 24.997 \approx \boxed{26\ dB}$

89. vacuum $= 10\log 10^{-4} + 120$

$= 80$

leaves $= 10\log 10^{-11} + 120$

$= 10$

$80 - 10 = 70\ dB$

(90) $10\log(2I) + 120$

$= 10\log 2 + \underbrace{10\log I + 120}_{\text{one stereo}}$

↓ w/ two stereos

$10\log 2 \approx 3\ dB$