3.3b p. 208 - 209 (69-83 odd, 89-101 odd, 107, 111-116 all)

69. $\ln x + \ln 4$

$= \boxed{\ln 4x}$

71. $\log_4 z - \log_4 y$

$= \boxed{\log_4 \frac{z}{y}}$

73. $4 \log_3 (x+2)$

$= \boxed{\log_3 (x+2)^4}$

75. $\frac{1}{2} \ln (x^2+4) + \ln x$

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

$= \ln (x^2+4)^{\frac{1}{2}} \cdot x$

$= \boxed{\ln \sqrt{x^2+4} \cdot x}$ or $\boxed{\ln x\sqrt{x^2+4}}$

77. $\ln x - 3 \ln (x+1)$

$= \ln x - \ln (x+1)^3$

$= \boxed{\ln \frac{x}{(x+1)^3}}$

79. $\ln(x-2) + \ln 2 - 3\ln y$

$= \ln (x-2)2 - 3 \ln y$

$= \boxed{\ln \frac{2(x-2)}{y^3}}$

81. $\ln x - 2[\ln(x+2) + \ln(x-2)]$

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

$= \ln x - \ln [(x+2)(x-2)]^2$

$= \ln \frac{x}{[(x+2)(x-2)]^2}$

$= \boxed{\ln \frac{x}{(x^2-4)^2}}$

83. $\frac{1}{2}[2\ln(x+3) + \ln x - \ln(x^2-1)]$

$= \frac{1}{2}[\ln(x+3)^2 + \ln x - \ln(x^2-1)]$

$= \frac{1}{2}\left[\ln \frac{x(x+3)^2}{x^2-1}\right]$

$= \boxed{\ln \sqrt{\frac{x(x+3)^2}{x^2-1}}}$

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(89) $\log_3 9$

$= \log_3 3\cdot3$

$= \log_3 3 + \log_3 3$

$= 1 + 1$

$= \boxed{2}$

(91) $\log_4 16^{3.4}$

$= 3.4(\log_4 4\cdot4)$

$= 3.4(\log_4 4 + \log_4 4)$

$= 3.4\ (1+1)$

$= 3.4(2)$

$= \boxed{6.8}$

(93) $\log_2(-4) = \square$

$2^{\square} = -4$

cannot do

$\boxed{\text{not possible}}$ or undefined

(95) $\log_5 375 - \log_5 3$

$= \log_5 \frac{375}{3}$

$= \log_5 125$

$= \log_5 5^3$

$= 3(\log_5 5)$

$= 3(1) = \boxed{3}$

(97) $\ln e^3 - \ln e^7 = \ln \frac{e^3}{e^7} = \ln \frac{1}{e^4}$

$= \ln e^{-4} = -4(\ln e)$

$= -4(1) = \boxed{-4}$

(99) $2 \ln e^4 = 4(2 \ln e)$

$= 4(2)(1) = \boxed{8}$

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

$= -\frac{1}{2}(\ln e) = -\frac{1}{2}(1) = \boxed{-\frac{1}{2}}$

(107.) $\beta = 10 \log_{10}\left(\frac{I}{10^{-12}}\right)$

(a) $\beta = 10 \log_{10}(I \cdot 10^{12})$

$= 10\left[\log_{10}(I) + \log_{10} 10^{12}\right]$

$= 10(\log_{10} I) + 12(10)\underbrace{\log_{10} 10}_{(1)})$

$\boxed{\beta = 10 \log_{10} I + 120}$

I	10^{-4}	10^{-6}	10^{-8}	10^{-10}	10^{-12}	10^{-14}
β	80	60	40	20	0	-20

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$f(x) = \ln x \quad x > 0$

T 111. $f(ax) = f(a) + f(x)$ product property ✓

F 112. $f(x-a) = f(x) - f(a)$, $x > a$
don't have difference property

F 113. $\sqrt{f(x)} = \frac{1}{2} f(x)$
to be true $f\sqrt{x} = \frac{1}{2} f(x)$

F 114. $[f(x)]^n = n\, f(x) \Rightarrow (\ln(x))^n \neq n \ln(x)$
$f(x)^n = n\, f(x) \Rightarrow \ln(x)^n = n \ln(x)$

T 115. If $f(x) < 0$, then $0 < x < 1$
$\ln(x) < 0$,

x	$\ln(x)$
0	undef
1	0

F 116. $f(x) > 0$, then $x > e$
$\ln(x) > 0$, then $x > e$
test
let $x = 2$ $\quad 2 > e$
False $\ln(2) > 0$
.6931

$\ln(3) > 0$
$1.09 > 0$
✓