p185 #11, 12, 19, 20, 23-28, 30

11 (a) $\log 1000 = 3$ (c) $\log(10^0) = 0$

(b) $\log\sqrt{1000} = \frac{3}{2}$ (d) $\log\sqrt{10} = \frac{1}{2}$

(e) $\log 10^5 = 5$ (f) $\log 10^2 = 2$ (g) $\log\left(\frac{1}{\sqrt{10}}\right) = -\frac{1}{2}$

(h) $10^{\log 100} = 100$ (i) $10^{\log 1} = 1$

(j) $10^{\log(0.01)} = 0.01$

12 (a) $\ln 1 = 0$ (b) $\ln e^0 = 0$ (c) $\ln e^5 = 5$

(d) $\ln(\sqrt{e}) = \frac{1}{2}$ (e) $e^{\ln 2} = 2$ (f) $\ln\left(\frac{1}{\sqrt{e}}\right) = -\frac{1}{2}$

19 (a) $\log 100^x = 2x$

(b) $1000^{\log x} = 10^{3\log x} = 10^{\log x^3} = x^3$

(c) $\log 0.001^x = x\log 10^{-3} = -3x$

20 (a) $\ln e^{2x} = 2x$

(b) $e^{\ln(3x+2)} = 3x+2$

(c) $\ln\left(\frac{1}{e^{5x}}\right) = \ln(e^{-5x}) = -5x$

(d) $\ln(\sqrt{e^x}) = \ln(e^{\frac{x}{2}}) = \frac{x}{2}$

23 (a) T (b) F (c) F (d) T (e) T
(f) F

(24) $\log(3 \cdot 2^x) = 8$

$\log 3 + \log 2^x = 8$

$x \log 2 = 8 - \log 3$

$x = \dfrac{8 - \log 3}{\log 2}$

25 $\ln(25(1.05)^x) = 6$

$\ln 25 + \ln(1.05)^x = 6$

$x \ln(1.05) = 6 - \ln 25$

$x = \dfrac{6 - \ln 25}{\ln(1.05)}$

26 $\ln(ab^x) = M$

$\ln a + \ln b^x = M$

$x \ln b = M - \ln a$

$x = \dfrac{M - \ln a}{\ln b}$

28 $\ln(3x^2) = 8$

$e^8 = 3x^2$

$\dfrac{e^8}{3} = x^2$

$\dfrac{e^4}{\sqrt{3}} = x$

30 $P = 25(1.075)^t$

a $P_0 = 25$ $r = 7.5\%$

c $100 = 25(1.075)^t$

$4 = 1.075^t$

$\log 4 = \log 1.075^t$

$\log 4 = t \log 1.075$

$\frac{\log 4}{\log 1.075} = t$