7.4 Pg 369

1. $P = 2000e^{1.3t}$

a) initial = 2000

b) $10000 = 2000e^{1.3t}$

$5 = e^{1.3t}$

$\ln 5 = \ln e^{1.3t}$

$\ln 5 = 1.3t$

$\frac{\ln 5}{1.3} = t$

$t = 1.24$ hrs

5. $N(0) = 1$ Find $N(60)$ $N(t) = P_0 e^{kt}$

$N(3) = 2$

$1 = P_0 e^{k(0)}$

$1 = P_0(1)$

$P_0 = 1$

$N(t) = 1e^{kt}$

$2 = 1e^{k(3)}$

$2 = e^{3k}$

$\ln 2 = \ln e^{3k}$

$\ln 2 = 3k$

$\frac{\ln 2}{3} = k$

$N(t) = e^{\frac{\ln 2}{3}t}$

$N(60) = e^{\frac{\ln 2}{3}(60)}$

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

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

$= 2^{20}$

$= 1048576$

7. $y' = -5y$ $y(0) = 3.4$

$P_0 = 3.4$

$y = P_0 e^{-5t}$

$y = 3.4e^{-5t}$

9. $y' = 3y$ $\quad y(2) = 1000$

$y = P_0 e^{3t}$ $\quad 1000 = P_0 e^{3(2)}$

$1000 = P_0 e^6$

$y = \frac{1000}{e^6} e^{3t}$ $\quad \frac{1000}{e^6} = P_0$

$y = 1000 e^{3t-6}$

$y = 1000 e^{3(t-2)}$

15. $P(t) = 2e^{0.06t}$

a) Population double $P(t) = 4$

$4 = 2e^{0.06t}$

$2 = e^{0.06t}$

$\ln 2 = \ln e^{0.06t}$

$\ln 2 = 0.06t$

$\frac{\ln 2}{0.06} = t$

$t = 11.55$

b) triple $P(t) = 6$

$6 = 2e^{.06t}$

$3 = e^{.06t}$

$\ln 3 = \ln e^{.06t}$

$\ln 3 = .06t$

$\frac{\ln 3}{.06} = t$

$t = 18.31$

c) $P(t) = 14$

$14 = 2e^{0.06t}$

$7 = e^{0.06t}$

$\ln 7 = \ln e^{0.06t}$

$\ln 7 = .06t$

$t = \frac{\ln 7}{.06} = 32.43$

20. $P' = -kP$

$P = P_0 e^{-kh}$

a) $P(0) = 101.3 \quad P_0 = 101.3$

$P(30900) = 1.013$

$P = 1011.3e^{-kh}$

$1.013 = 101.3\, e^{-k(30900)}$

$.01 = e^{-30900k}$

$\ln(.01) = -30900k$

$\frac{\ln(.01)}{-30900} = k$

$K = 1.49 \times 10^{-4}$

$K = 0.000149$

b) $h = 500 \quad P = 101.3e^{-0.000149(500)}$

$P = 101.3(.92819)$

$= 94.026$