DiffEq - Ch 3 - Required Practice **ANSWERS ONLY**

3.1

#1. $(a)\ 7.9\ years, \quad (b) 10.0\ \ years$

#2. $(a)\ 6598\ people, \quad (b) 26,392\ people,$
$(c)\ 3,658.7\ \frac{people}{year}$

#3. $88.53\ mg$

#4. $136.5\ \ hrs$

#5. $12.055\ yrs$

#6. $(a)\ 36.7\ ^\circ F, \quad (b) 3.064\ minutes$

#7. $(a)\ 82.13\ seconds, \quad (b) 145.7\ seconds$

#8. $(a)\ i(t) = \frac{3}{5} - \frac{3}{5}e^{-500t}, \quad (b) \frac{3}{5}\ Amp$

#9. $(a)\ q(t) = \frac{1}{100} - \frac{1}{100}e^{-50t}, \quad (b) i(t) = \frac{1}{2}e^{-50t}$

#10. $(a)\ v(t) = -32t + 300$
$(b)\ s(t) = -16t^2 + 300t$
$(c)\ s_{\max} = 1406.25\ ft$

#11. $(a)\ v(t) = -6400 + 6700e^{-0.005t},$
$(b)\ s(t) = -6400t - 1340000e^{-0.005t} + 1340000$
$(c)\ s_{\max} = 1363.8\ ft$

#12. $9.022\ minutes$

3.2

#1.
(a) A phase diagram with 3 curves (see extra problem for an example).
For $P_0 > 4$: population decreases to 4.
For $1 < P_0 < 4$: population increases to 4.
For $P_0 < 1$: population decreases to 0.

(b) $P(t) = \dfrac{4 - \left(\dfrac{P_0 - 4}{P_0 - 1}\right)e^{-3t}}{1 - \left(\dfrac{P_0 - 4}{P_0 - 1}\right)e^{-3t}}$

(See extra problems for similar graphs)
For $P_0 < 1,$ the population doesn't smoothly decrease to zero because it encounters a vertical asymptote.

(c) For any $P_0 < 1,$ the population becomes extinct at the time $t = \dfrac{\ln\left(4\dfrac{P_0 - 1}{P_0 - 4}\right)}{-3}$