Answers to WS 2

1. $\Delta P = -0.15P \quad P(t) = 20000(0.85)^t \quad P(10) = 3935.49$

2. a. $\Delta P = -10 \quad P(t) = 2500 - 10t$

b. $P(15) = 2350$ people

3. $\Delta N = 1 - \frac{1}{3}N$

b.

t	0	1	2	3	4	5	6	7
N	0	1	1.67	2.11	2.41	2.6	2.74	2.82

the values are rounded to two decimals.

c. in the long run the amount of drug will stabilize at 3 mg (stable equilibrium)

4. a. $\Delta P = 0.085P \quad P(t) = 600(1.085)^t$

b. $t_{dbl} = \dfrac{\ln(2)}{\ln(1.085)} = 8.5$ years

c. $t = \dfrac{\ln(20/6)}{\ln(1.085)} = 14.76$ years

5. a. $\dfrac{dP}{dt} = 0.085P \quad P(t) = 600e^{0.085t}$

b. $t_{dbl} = \dfrac{\ln(2)}{0.085} = 8.15$ years

c. $t = \dfrac{\ln(20/6)}{0.085} = 14.16$ years.

6. a. $\Delta P = 0.008P - 40$

b. $P(n+1) = 1.008P(n) - 40$

c. $P(2) = 936$, $P(10) = 668$ (the answers are rounded to the nearest integer). note that four weeks equals two units of time, thus the size of the population after four weeks is equal to $P(2)$ and the size of the population after twenty weeks is $P(10)$.

d. $P_{equil} = 5000$ unstable equilibrium

7. a. $\dfrac{dP}{dt} = 0.02P - 12$ (measure population in millions)

b. $P_{equil} = 600$ million – unstable equilibrium

c. becomes extinct after 20 years (from table of values on calculator)

d. unlimited growth in the long run; will reach 800 million after 35 years (from table of values on calculator)