

Homework assigned Friday, January 20.

(1) For the rate equation

$$\frac{dN}{dt} = .1N(20 - N)$$

- (a) If $N(0) = 10$ what is $N'(0)$? (Recall that N' is just another notation for $\frac{dN}{dt}$.) *Answer:* $N'(0) = 10$.
- (b) If $N(0) = 25$ what is $N'(0)$? *Answer:* $N'(0) = -12.5$.
- (c) What are the stationary solutions? *Answer:* $N = 0, 20$.
- (d) Make a graph showing some solutions to $N' = .1N(20 - N)$ including the solutions with $N(0) = 10$ and $N(0) = 25$.
- (e) If $N(0) = 25$ estimate $N(1,000)$. *Answer:* $N(1,000) \approx 20$.
- (f) If $N(0) = 10$ estimate $N(5,000)$. *Answer:* $N(5,000) \approx 20$.
- (g) If $N(5) = 6$ then what is $N'(5)$? *Answer:* $N'(5) = .1(6)(20 - 6) = 8.4$.

(2) For the rate equation

$$\frac{dP}{dt} = -.1P(P - 4)(P - 10)$$

- (a) What are the stationary solutions? *answer:* $P = 0, 4, 10$.
- (b) Make a graph showing the solutions with $P(0) = 1$, $P(0) = 5$, $P(0) = 8$, and $P(0) = 13$.
- (c) For the solution with $P(0) = 1$ estimate $P(5,532)$. *Answer:* $P(5,532) \approx 0$
- (d) For the solution with $P(0) = 5$ estimate $P(789)$. *Answer:* $P(789) \approx 10$.
- (e) For the solution with $P(0) = 13$ estimate $P(10,000)$. *Answer:* $P(10,000) \approx 10$.