

MATH 209 QUIZ 5 - Version A

March 11, 2014

Name: ANSWERS

Instructions: Write your answers in the space provided. Do not show calculations on this page.

1. A population N starts with 350 individuals and grows logistically with a growth constant $r = 0.04$ and a carrying capacity of $K = 400$.

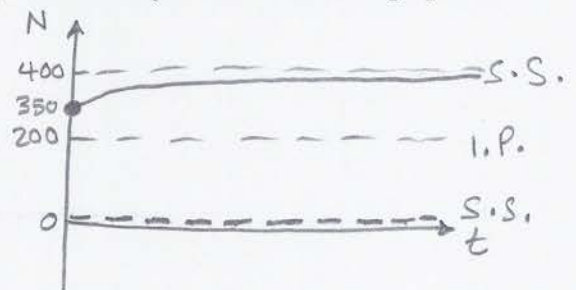
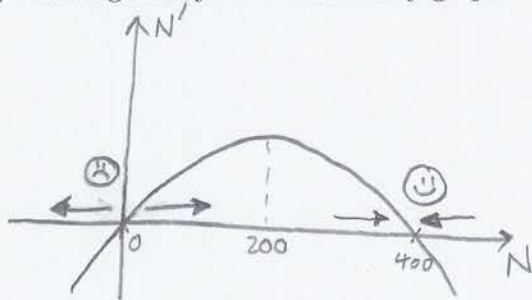
(a) Write down an ODE and initial condition for this population.

ODE: $\frac{dN}{dt} = 0.04N\left(1 - \frac{N}{400}\right)$ Initial condition: $N(0) = 350$

(b) Perform qualitative analysis on this population by:

(i) Finding its steady states: $N=0, N=400$ (ii) Its inflection points: $N=200$

(iii) Drawing a fully labeled Stability graph below. (iv) Draw a fully labeled Solution graph.



(c) Describe the long term behavior of the population: It will increase up to 400, the carrying capacity.

2. Solve the system for x and y :

$$\begin{aligned} x(50 - x - y) &= 0 \\ y(100 - 4y - 5x) &= 0 \end{aligned}$$

$\Rightarrow (x, y) = (0, 0), (0, 25), (50, 0), (-100, 150)$ (List all solutions)

3. Fill out the competition table for:

$$\frac{dN_1}{dt} = 0.23N_1 \left(1 - \frac{N_1}{300} - \frac{N_2}{100}\right)$$

$$\frac{dN_2}{dt} = 0.54N_2 \left(1 - \frac{N_2}{250} - \frac{N_1}{100}\right)$$

	1	2
1	$\frac{1}{300} = 0.003$	$\frac{1}{100} = 0.01$
2	$\frac{1}{100} = 0.01$	$\frac{1}{250} = 0.004$
Total	0.013	0.014

4. Is the system above competitive (Yes or No)? Yes