MATH 209 QUIZ 4 - Version B

March 4, 2014

Name: ANSWERS

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

1. Write down general formulas for the following models:

(a) The Malthus model: $\frac{dP}{dt} = rP$

(b) The Harvesting model: $\frac{dP}{dt} = rP - H$

(c) The Logistic model: $\frac{dP}{dt} = rP\left(1 - \frac{P}{K}\right)$

2. A fish population has initially 40,000 members. The population grows at a rate proportional to its current size and increases by 40% per year. Fishermen fish an average of 20,000 fish per year from this population.

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

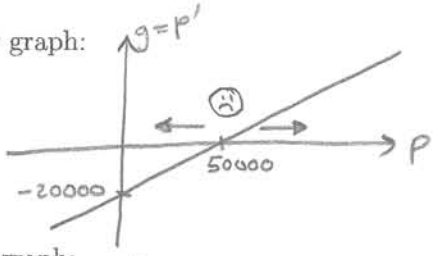
ODE: $\frac{dP}{dt} = 0.4P - 20000$ Initial condition: $P(0) = 40000$

(b) Perform qualitative analysis on this population by:

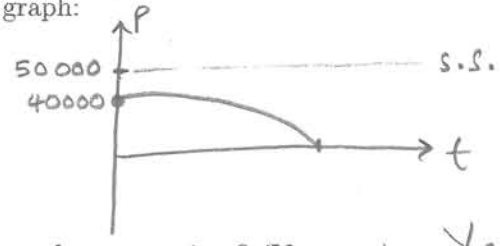
(i) Finding its steady states: $P = 50000$

(ii) Finding its inflection points: None

(iii) Drawing a fully labeled Stability graph:



(iv) Drawing a fully labeled solution graph:



(c) By the above, does the population ever become extinct? (Yes or no) Yes

(d) If it becomes extinct, use quantitative methods to find exactly when (2 decimal places). If not, write "NEVER!" 4.02

Bonus: Solve the system for x and y:

$$\begin{aligned} 2x - 4y &= 6 \\ x + 3y &= -2 \end{aligned}$$

$\Longrightarrow x =$ 1, $y =$ -1