Mathematics 172

Quiz #12 Name: Key

You must show your work to get full credit.

A population of yeast is growing logistically with an intrinsic growth rate of $r = .5$ grams/day and a carrying capacity of 100 grams. Let $A(t)$ be the number of grams of yeast after t days.

1. Write the rate equation for A.

$$\frac{dA}{dt} = .5A\left(1 - \frac{A}{100}\right)$$

2. A baker starts using the yeast at a constant rate of 10 grams/day. What is the new rate equation satisfied by A?

$$\frac{dA}{dt} = .5A\left(1 - \frac{A}{100}\right) - 10$$

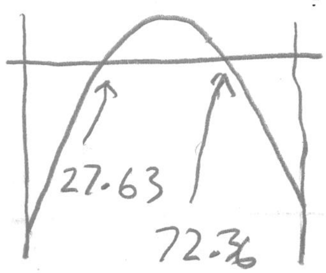
3. What are the equilibrium points for the equation of Problem 2?

$Y1 = .5X(1 - X/100) - 10$

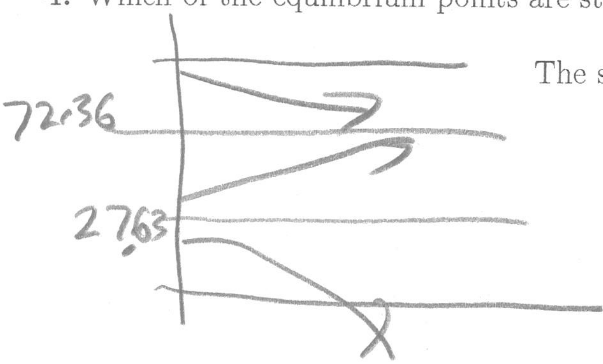
$X_{min} = 0$

$X_{max} = 100$

The equilibrium points are 27.63, 72.36



4. Which of the equilibrium points are stable?



The stable equilibrium points are 72.36

5. What is the greatest rate that the baker can harvest the yeast with out kill off the population of yeast?

The maximum of $\frac{dA}{dt} = .5A\left(1 - \frac{A}{100}\right)$ occurs when $A = 100/2 = 50$

Maximal rate is: 12.5

The maximum is $.5(50)\left(1 - \frac{50}{100}\right) = 12.5$