

Mathematics 172

Quiz #33

Name: _____

You must show your work to get full credit.

1. A population of bacteria grows in a mason jar full of salted chopped cabbage.¹ If $N(t)$ is the number of grams of the bacteria after t days assume that it grows by the logistic equation

$$\frac{dN}{dt} = .03N \left(1 - \frac{N}{2.5} \right).$$

(a) If $N(0) = .15$ find $N'(0)$. $N'(0) = \underline{.00423 \text{ grams/day}}$

$$N'(0) = .03(.15) \left(1 - \frac{.15}{2.5} \right) = .00423$$

(b) If $N(0) = .15$ estimate the number of grams of bacteria after 12 hours (= .5 days)

$$\begin{aligned} N(.5) &\approx N(0) + N'(0) \cdot .5 \\ &= .15 + (.00423)(.5) \\ &= .152115 \end{aligned} \quad N(.5) \approx \underline{.152115 \text{ grams}}$$

(c) If $N(0) = .15$ estimate the number of grams of bacteria after 30 days.

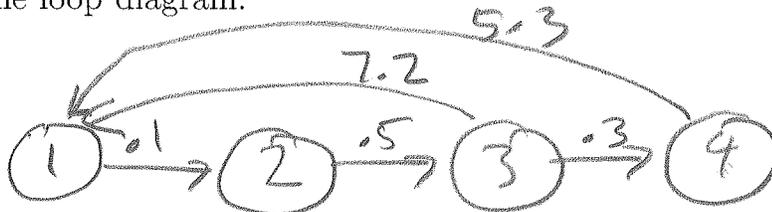
By $t=30$ it will have reached the carrying capacity so $N(30) \approx \underline{2.5 \text{ grams}}$
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2. For the Leslie matrix $L = \begin{bmatrix} 0 & 0 & 7.2 & 5.3 \\ .1 & 0 & 0 & 0 \\ 0 & .5 & 0 & 0 \\ 0 & 0 & 0 & .3 \end{bmatrix}$

(a) What does the number .1 mean?

.1 = proportion of stage one's that survive to stage 2

(b) Draw the loop diagram.



¹This is how both sauerkraut and kimchee are made. In this case the bacteria are benevolent and in fact kill off harmful bacteria.