

Mathematics 172

Quiz 3

Name: Key

You must show your work to get full credit.

A population of paramecium in a tank has an intrinsic growth rate of $r = -.02$ (paramecium/day)/paramecium.

- (1) If the tank is stocked at a constant rate of $S = 10$ paramecium/day, then what is the stable population size?

Population size = 500

Let $P(t)$ = number of paramecium after t days.
the rate eqn is

$$\frac{dP}{dt} = -.02P + 10$$

At the stable population size

$$\frac{dP}{dt} = -.02P + 10 = 0$$

$$\begin{aligned} \cdot 02P &= 10 \\ P &= \frac{10}{.02} = 500 \end{aligned}$$

- (2) If we wish to maintain a stable population size of 10,000 paramecium, then at what rate should the tank be stocked?

Stocking rate is $S =$ 200

This time the rate equation is

$$\frac{dP}{dt} = -.02P + S$$

where S = stocking rate.

solving

$$\frac{dP}{dt} = -.02P + S = 0$$

$$\text{since } P = \frac{S}{.02} = 50S$$

for the stable population size,
we want this to be

$$50S = 10,000$$

$$\text{i.e. } S = \frac{10,000}{50} = \frac{1000}{5} = 200$$