Mathematics 172

Quiz 19 Name: Key

You must show your work to get full credit.

A population of bacteria in a pore grows logistically with an intrinsic growth rate of .5 (bacteria/hour)/bacterium and a carrying capacity of $K = 1{,}000{,}000$ bacteria to form a pimple.

Let $N(t)$ be the number of bacteria in the pimple t hours after the first bacteria invade the pore.

1. What is the rate equation for N? Rate equation is: $\frac{dN}{dt} = .5N\left(1 - \frac{N}{1{,}000{,}000}\right)$

The owner of the face on which the pimple lives does not like the pimple. His first try at getting rid of it is to use Brand A anti-bacterial cream. This cream kills off 30% of the bacterial population each hour.

2. (a) What is the rate equation for N after Brand A is applied?

Brand A rate equation: $\frac{dN}{dt} = .5N\left(1 - \frac{N}{1{,}000{,}000}\right) - .3N$

(b) Did Brand A kill off the pimple **Yes** or (No) (circle one). If not, what is the new stable population size of the bacteria?.

we solve for N in

$\frac{dN}{dt} = 0 = .5N\left(1 - \frac{N}{1{,}000{,}000}\right) - .3N$

$Y1 = .5X(1 - X/1000000) - .3X$

$X_{min} = 0$

$X_{max} = 1000000$

Stable population size: 400,000

Zoom 0: ZoomFit
2nd calc 2: zero
Put in left bound
right bound and guess.
Get $X = 400000$, $Y = 0$

He next tries Band B which kills off 60% of the bacterial population each hour.

3. (a) What is the rate equation for N after Brand B is applied?

Brand B rate equation: $\frac{dN}{dt} = .5N\left(1 - \frac{N}{1000000}\right) - .6N$

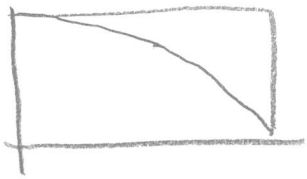
(b) Did Brand B kill off the pimple (Yes) or **No** (circle one). If not, what is the new stable population size of the bacteria?.

$Y1 = .5X(1 - X/1000000) - .6X$

$X_{min} = 0$

$X_{max} = 1000000$

Stable population size: 0



SO NO positive equilibrium point. Thus Pimple is killed