Mathematics 172

Quiz 25 Name: Key

You must show your work to get full credit.

Consider the system of rate equations:

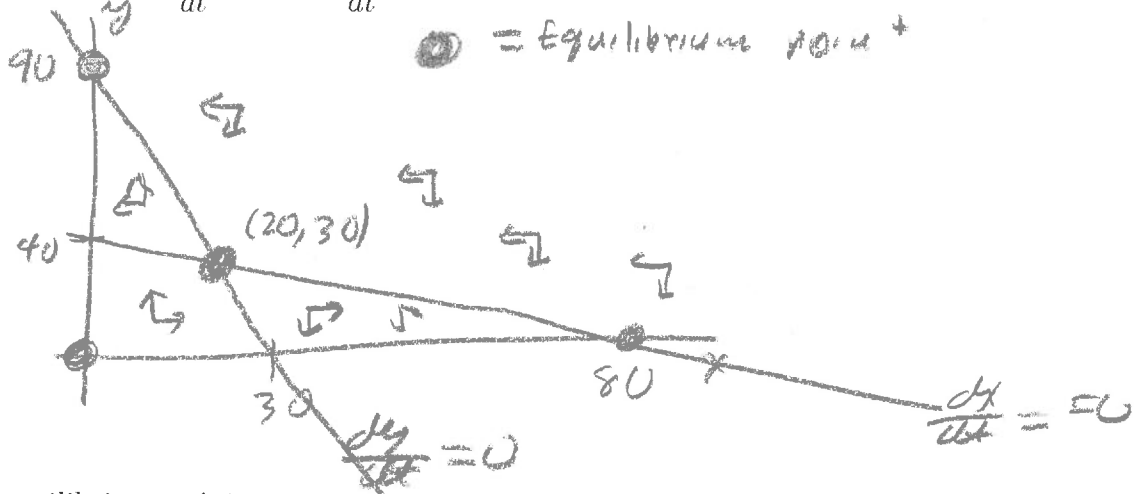
$$\frac{dx}{dt} = .2x\left(\frac{80 - x - 2y}{80}\right)$$
$$\frac{dy}{dt} = .3y\left(\frac{90 - 3x - y}{90}\right)$$

for two competing species.

$x=0$, $x+2y=80$
x-intercept $(80,0)$
y-intercept $(0,40)$

$y=0$ $3x+y=90$
x-intercept $(30,0)$
y-intercept $(0,90)$

1. Draw the lines where $\frac{dx}{dt} = 0$ and $\frac{dy}{dt} = 0$.



● = equilibrium point

2. Find the equilibrium points.

The equilibrium points are $(0,0)$, $(80,0)$, $(0,90)$, $(20,30)$

① $x+2y=80$
② $3x+y=90$

From ② $y=90-3x$
use this in ①

$x+2(90-3x)=80$
$x+180-6x=80$
$-5x=-100$
$x=\frac{100}{5}=20$

$y=90-3x=90-3(20)=30$

$(x,y)=(20,30)$ is equil. pt.

3. Which of the equilibrium points are stable.

The stable points are $(80,0)$, $(0,90)$