Mathematics 172

Quiz 29 Name: Key

You must show your work to get full credit.

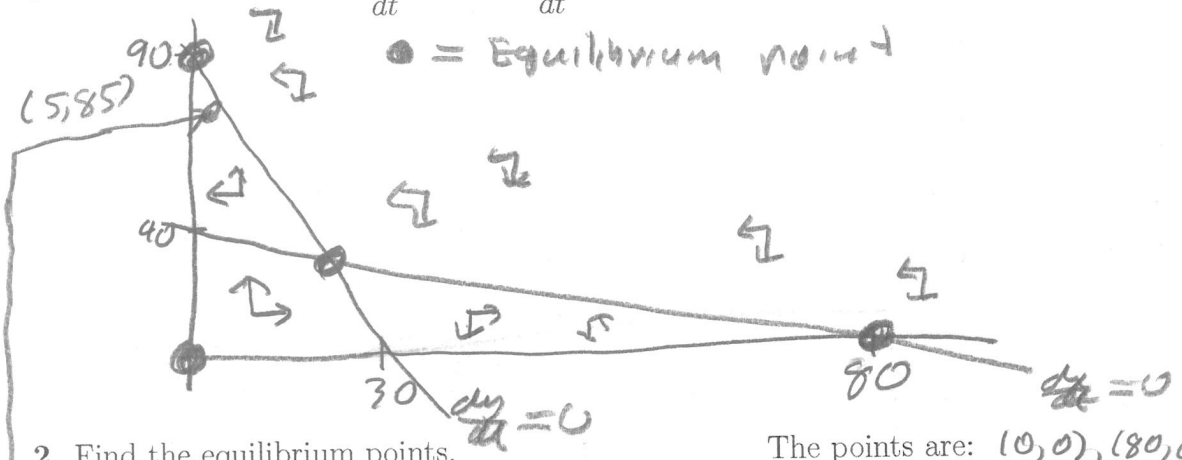
Consider the system for two competing species:

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

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

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

So $y = 90-3x = 90-3(20)$
$= 90-60$
$= 30$

3. Which of the equilibrium points are stable.

Stable Points: (0,80), (90,0)

4. If $x(0) = 5$ and $y(0) = 85$ estimate $x(100)$ and $y(100)$.

It starts near (0,90) and ends up there

$x(100) \approx$ 0 $y(100) \approx$ 90

5. Circle one: This is **competitive coexistence**, **competitive exclusion.**