System Applications
Differential Equations
Math 337
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Problem 2 (a): In your written HW, give a brief explanation of each species' ecological behavior. Describe each term on the right hand side of the differential equations.

$$\frac{dX}{dt} = 0.22X - 0.039X^2 - 0.0154XY$$

$$\frac{dY}{dt} = 0.41Y - 0.025Y^2 - 0.0846XY$$

The first term on the right side of each of the 2 equations represents the **Malthusian growth model** in which we see the growth of the each species without any factors to slow growth.

The second term represents the **intraspecies competition** in which we see that the rate of growth slows down as members within the species compete against each other.

The third term represents the **interspecies competition** in which we see that the rate of growth slows down as members of each species compete with each other.

Problem 3 (a): In your written HW, give a brief explanation of each species' ecological behavior. Describe each term on the right hand side of the differential equations.

$$\frac{dX}{dt} = 0.7X - 6.7X^2 + 5.9XY$$

$$\frac{dY}{dt} = 0.8Y - 5.1Y^2 + 3.9XY$$

The first term on the right side of each of the 2 equations represents the **Malthusian growth model** in which we see the growth of the each species without any factors to slow growth.

The second term represents the **intraspecies competition** in which we see that the rate of growth slows down as members within the species compete against each other.

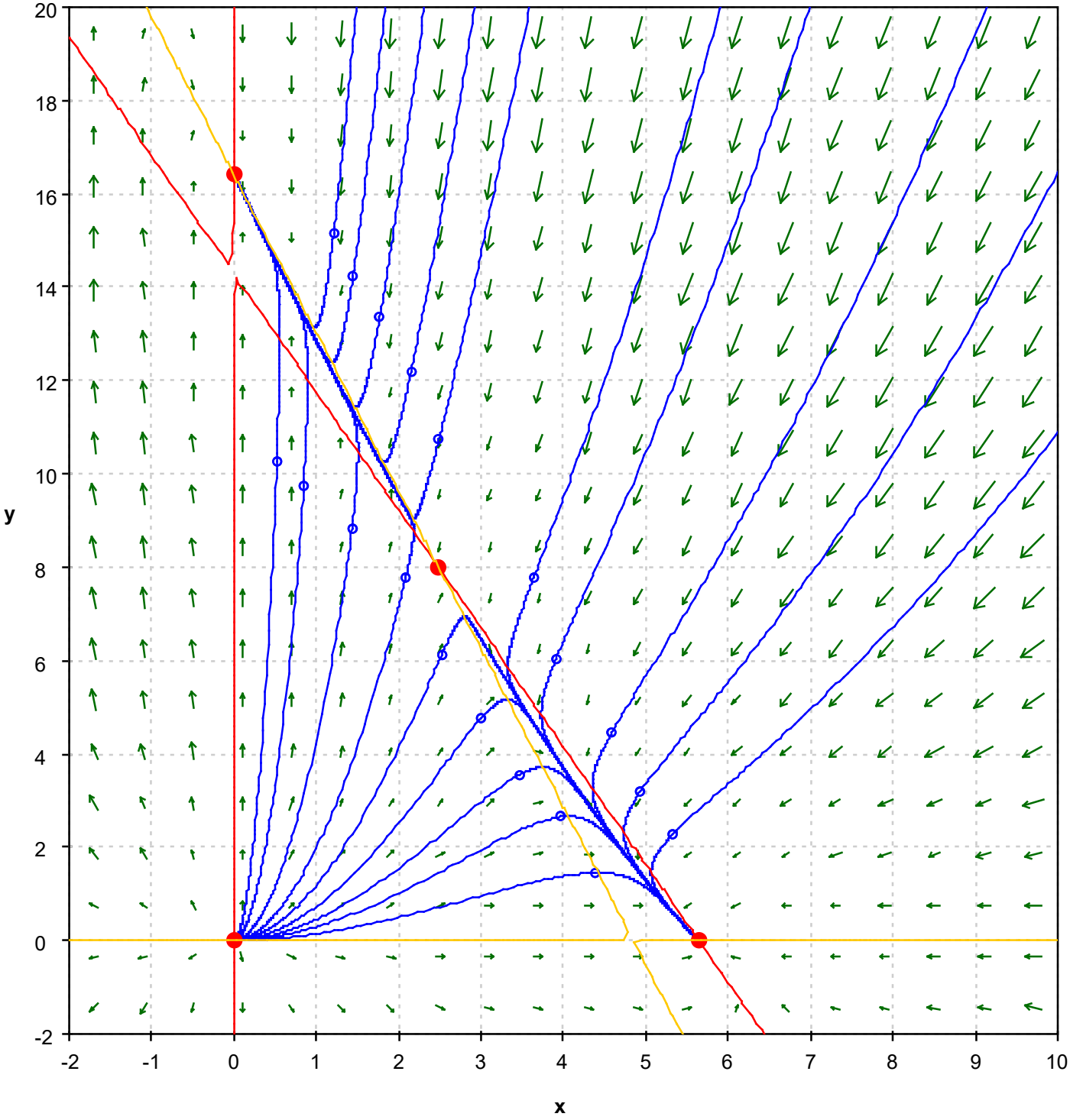
The third term represents the **interspecies cooperation** as we see that the rate of growth remains increases as members of each species cooperate with each other.

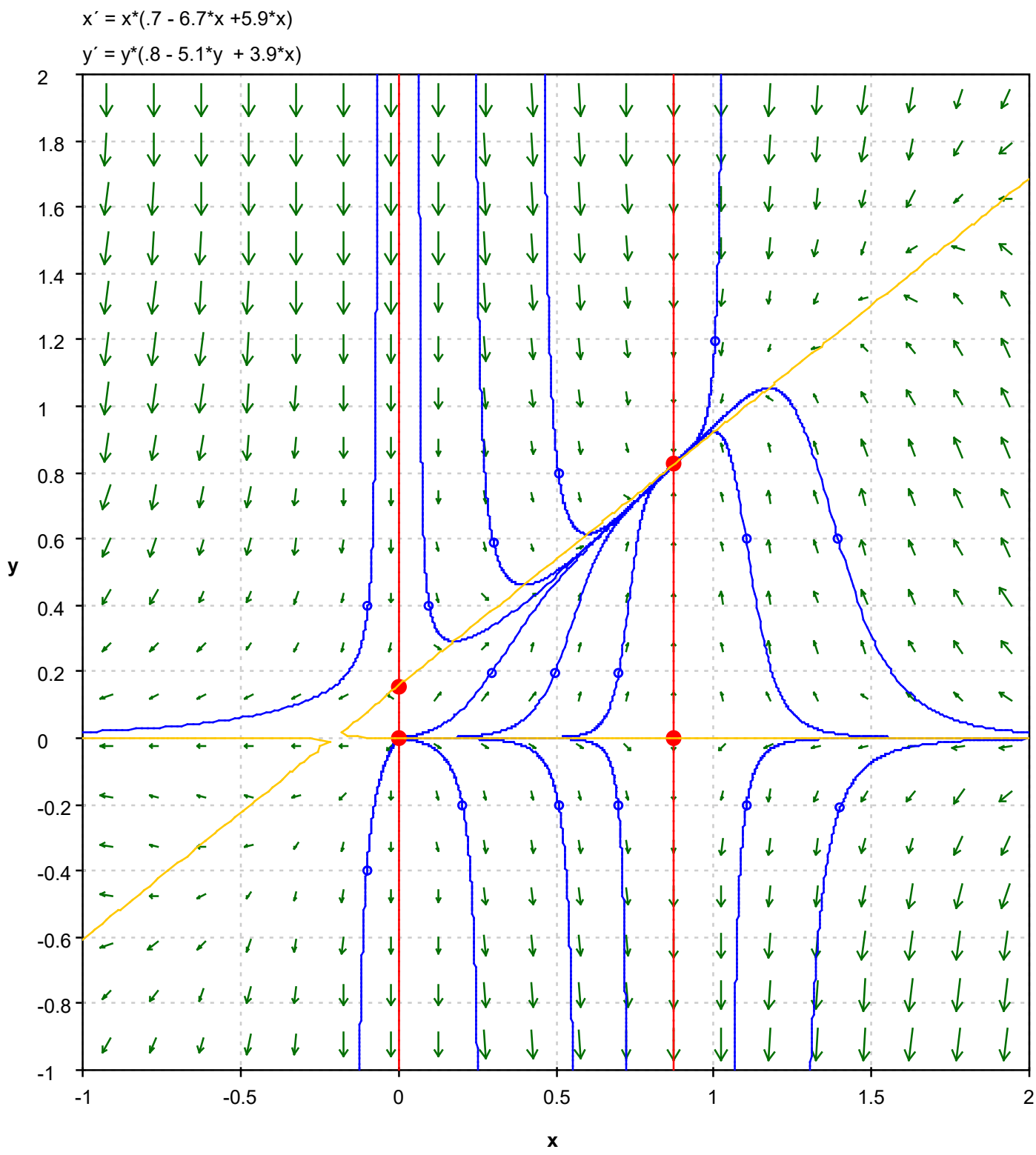
Problem 3 (e): In your written HW, discuss what happens ultimately for this biological system according to the mathematical model.

The model shows us that the population rate equations goes towards the equilibrium in which both species can live. The species show coexistence as for the population rates to come to equilibrium, not any one species has to go to 0.

x′ = x*(.22 - .039*x - .0154*y)

y′ = y*(.41 - .025*y - .0846*x)




x´ = x*(.7 - 6.7*x +5.9*x)
y´ = y*(.8 - 5.1*y + 3.9*x)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
y
-1
-0.5
0
0.5
1
1.5
2
x