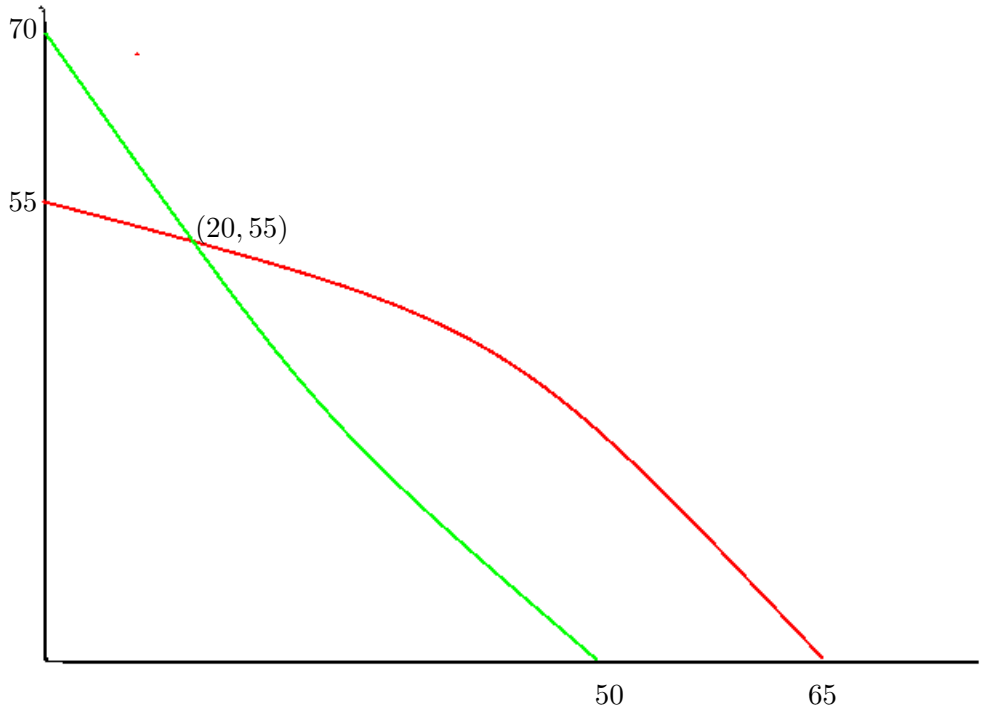
Mathematics 172 Homework



The figure above is the phase space for the rate equations

$$\frac{dx}{dt} = xf(x,y)$$
$$\frac{dy}{dt} = yg(x,y)$$

1. Assume that the red curve is where $f(x,y) = 0$ and the green curve is where $g(x,y) = 0$. Also assume $f(x,y) > 0$ for points below the red curve and $g(x,y) > 0$ for points below the green curve.

(a) Find all the rest points.

(b) Draw in the arrows in the different regions showing the direction that a point will move.

(c) Can you tell which of the rest points are stable or unstable? What about long term behavior?

2. This time assume that assume that the red curve is where $g(x,y) = 0$ and the green curve is where $f(x,y) = 0$. Assume that $f(x,y) > 0$ for point below the green curve and $g(x,y) > 0$ for points below the red curve.

(a) Find all the rest points.

(b) Draw in the arrows in the different regions showing the direction that a point will move.

(c) Can you tell which of the rest points are stable or unstable? What about long term behavior?

3. As a last variant we assume, as in Problem 1, that the red curve is where $f(x, y) = 0$ and the green curve is where $g(x, y) = 0$. Again, as on Problem 1, assume that assume that $f(x, y) > 0$ for points below the red curve, but this time assume that $g(x, y) > 0$ for points above the green curve.

(a) Find all the rest points.

(b) Draw in the arrows in the different regions showing the direction that a point will move.

(c) Can you tell which of the rest points are stable or unstable? What about long term behavior?