MTH 267, Quiz #8, Fall 2018 Name KEY

Instructions: Show all work. Use exact answers unless otherwise asked to round.

1. A system of differential equations is given by $\begin{cases} \frac{dx}{dt} = -0.9x + 0.6x^2 - xy \\ \frac{dy}{dt} = 0.2y - 0.4y^2 - xy \end{cases}$. Sketch the phase plane using nullclines. Identify all equilibria. Use technology to determine which, if any, of the equilibria are stable. Include both your hand-drawn graph and the technology-based graph. Explain your reasoning for categorizing the equilibria.

$0 = -0.9x + 0.6x^2 - xy$

$= x(-0.9 + 0.6x - y)$

$x = 0 \quad 0 = -0.9 + 0.6x - y$

$y = 0.6x - 0.9$

$\frac{dy}{dt} = 0 = 0.2y - 0.4y^2 - xy$

$= y(0.2 - 0.4y - x)$

$y = 0 \quad 0 = 0.2 - 0.4y - x$

$\frac{-x + 0.2}{0.4} = \frac{0.4y}{0.4}$

$-2.5x + 0.5 = y$

$0.6x - 0.9 = -2.5x + 0.5$

$3.1x = 1.4$

$x = \frac{1.4}{3.1} = \frac{14}{31} \approx 0.45$

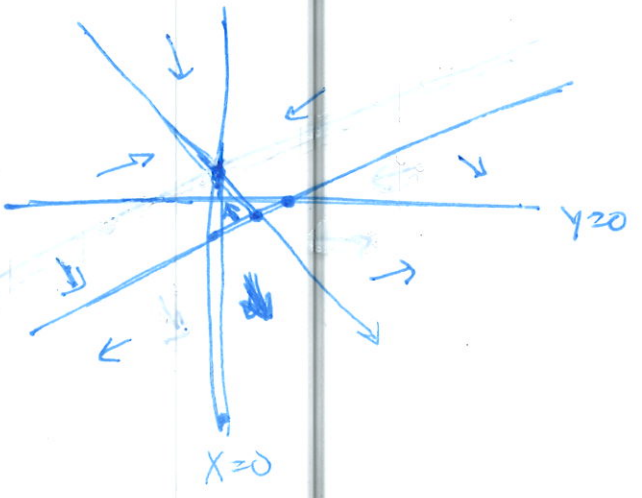
$y = 0.6\left(\frac{14}{31}\right) - .9 = \frac{-39}{62} \approx -.63$

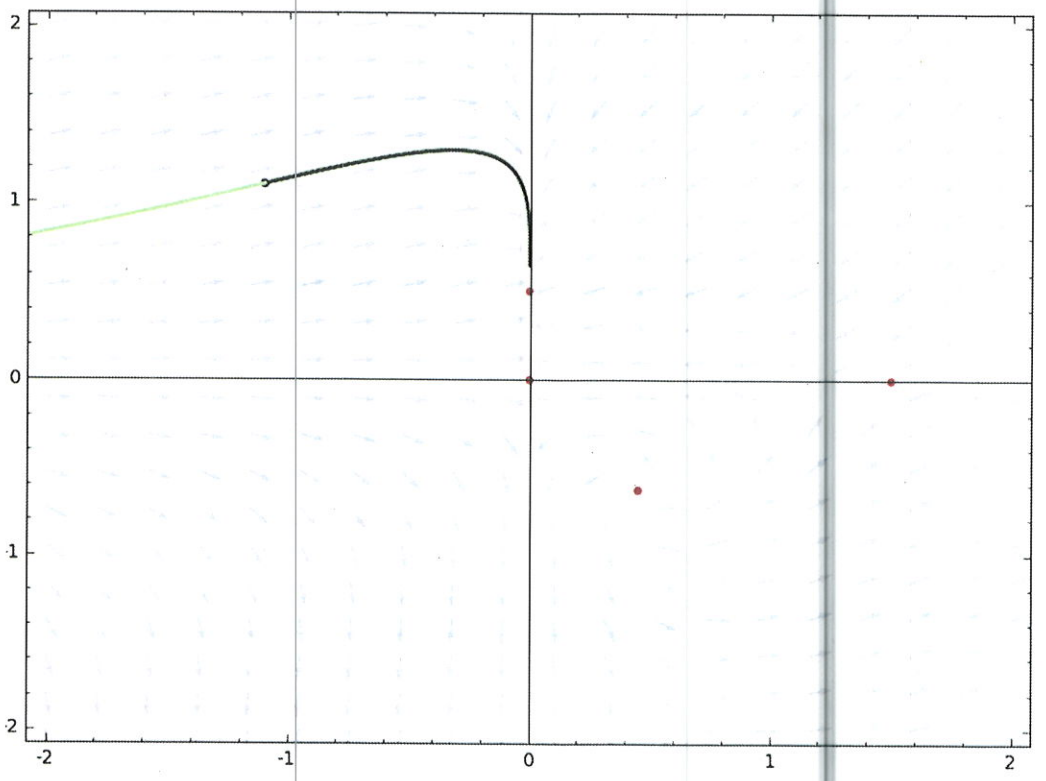
equilibria: (0,0) saddle

stable (0, 0.5)

(1.5, 0) saddle

$\left(\frac{14}{31}, \frac{-39}{62}\right)$ unstable




2
1
0
-1
-2
-2
-1
0
1
2