

Assignment #13

Due on Wednesday, March 25, 2015

Read Section 5.3 on *Analysis of General Systems* in the class lecture notes at <http://pages.pomona.edu/~ajr04747/>

Read Section 5.1, on *Equilibrium Point Analysis*, in Blanchard, Devaney and Hall.

Read Section 5.2, on *Qualitative Analysis*, in Blanchard, Devaney and Hall.

Do the following problems

In problems (1)–(5), given the two–dimensional system, (b) sketch the nullclines; (b) determine the critical points; (c) find the derivative of the vector field associated with the system; (d) determine the stability of the origin for each linearized system; (e) use the principle of linearized stability (when applicable) to determine the stability type of each equilibrium point of the non–linear system; and (f) sketch the phase portrait.

$$1. \begin{cases} \dot{x} = -3x + 2xy; \\ \dot{y} = -4y + 3xy. \end{cases}$$

$$2. \begin{cases} \dot{x} = x(1 - 2y); \\ \dot{y} = y(x - 1). \end{cases}$$

$$3. \begin{cases} \dot{x} = y; \\ \dot{y} = x - y - x^3. \end{cases}$$

$$4. \begin{cases} \dot{x} = y - x^3; \\ \dot{y} = y - 4x. \end{cases}$$

$$5. \begin{cases} \dot{x} = x(1 - 2x) - 3y; \\ \dot{y} = y(x - 1). \end{cases}$$