

This is a take home quiz. Please write complete solutions (your own paper) to the following and turn in on Friday before 3PM.

1. Give the solution to $\mathbf{x}' = A\mathbf{x}$ for each matrix below (using eigenvalues and eigenvectors).

(a) $A = \begin{bmatrix} 0 & -1 \\ -2 & 1 \end{bmatrix}$

(b) $A = \begin{bmatrix} -2 & -2 \\ 5 & 0 \end{bmatrix}$

(c) $A = \begin{bmatrix} 2 & 1 \\ -1 & 4 \end{bmatrix}$

2. For 1(a,b), provide a sketch of the phase plane (the (x_1, x_2) plane) with some sample solutions.
3. For the nonlinear system below, (i) Draw the nullclines, (ii) find the equilibrium solutions, (ii) linearize about each equilibrium (just find the Jacobian matrix), and (iii) classify the equilibrium using the Poincare Diagram.

$$\begin{aligned}x' &= 2x - x^2 - xy \\y' &= 3y - 2y^2 - 3xy\end{aligned}$$