Quiz 10, Math 246, Professor David Levermore
Tuesday, 26 November 2019

Your Name:

Discussion Instructor (circle one): Sam Potter Nathan Yu David Russell
Discussion Time (circle one): 9:00 11:00 12:00

No books, notes, calculators, or any electronic devices.
Show your reasoning for full credit. Good luck!

(1) [3] Consider the system $\mathbf{x}' = \mathbf{B}\mathbf{x}$ where $\mathbf{B} = \begin{pmatrix} -4 & 6 \\ -3 & 2 \end{pmatrix}$.

(a) [1] Classify its phase-plane portrait.
(b) [1] Determine the stability of the origin for this system.
(c) [1] Sketch its phase-plane portrait.

(2) [3] Consider the system $\mathbf{x}' = \mathbf{C}\mathbf{x}$ where the 2×2 matrix $\mathbf{C}$ has eigenpairs

$$\left(1\,,\,\begin{pmatrix} 1 \\ 3 \end{pmatrix}\right)\,, \qquad \left(2\,,\,\begin{pmatrix} 3 \\ -1 \end{pmatrix}\right)\,.$$

(a) [1] Classify its phase-plane portrait.
(b) [1] Determine the stability of the origin for this system.
(c) [1] Sketch its phase-plane portrait.

(3) [4] Consider the system

$$x' = 3x - y\,, \qquad y' = 5x - 3y + 2x^2\,.$$

(a) [2] This system has two stationary points. Find them.
(b) [2] Find a nonconstant function $H(x, y)$ such that every orbit of this system satisfies $H(x, y) = c$ for some constant c.