

Homework 2

MA 30300 (Fall 2025, §764)

September 7th, 2025

Instructions

- Due: Saturday, September 13th at 11 PM Eastern Time.
- Total Score: 20 points.
- Section numbers and problem numbers below are as in *Differential Equations and Boundary Value Problems* (6th Edition) by C. Henry Edwards, David E. Penney, and David Calvis.
- The three lowest homework scores will be dropped from the final grade.
- One late submission is permitted (over the course of the semester) with no questions asked.
- Submissions can be hand-written or typed in L^AT_EX and must be submitted on Gradescope.
- You are allowed to discuss and collaborate on problems. However, each student must work on the final submission on their own. **In particular, copying someone else's final submission will be considered cheating and will be reported to the Office of the Dean of Students.**

Problem 0. [0 points] Copy paste the following text in the beginning of your submission:

I have not made use of any unauthorized resources (including online resources) while working on this submission. Any collaboration with other students conforms with the policies of this course.

After that, list all students you collaborated with, clearly indicating which problems you worked with them on. If you did not collaborate with anyone, clearly state this instead.

Problem §5.5 #12. [5 points] Find the general solution of the following system:

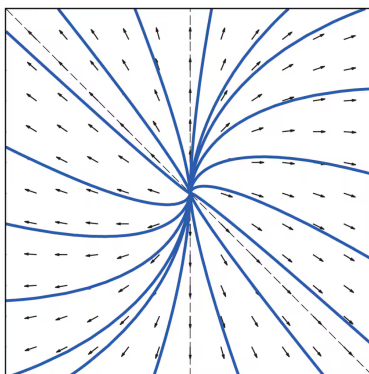
$$\mathbf{x}' = \begin{bmatrix} -1 & 0 & -1 \\ 0 & -1 & 1 \\ 1 & -1 & -1 \end{bmatrix} \mathbf{x}.$$

Problem §5.5 #26. [5 points] Find the general solution of the following system (which is given to have eigenvalue 3 with algebraic multiplicity equal to 3):

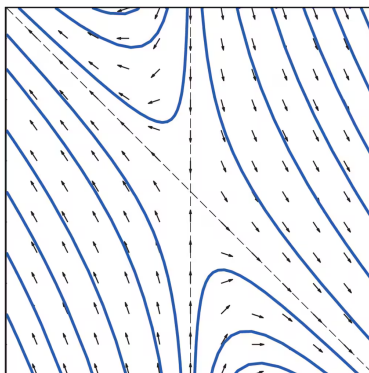
$$\mathbf{x}' = \begin{bmatrix} 5 & -1 & 1 \\ 1 & 3 & 0 \\ -3 & 2 & 1 \end{bmatrix} \mathbf{x}.$$

For the following problems, the phase portraits corresponding to linear systems with two dependent variables are provided. From these diagrams, determine the behaviour of $(0,0)$ (e.g. improper nodal sink, spiral source, center etc.), the nature of the eigenvalues (e.g. real or complex, sign of real part, distinct or equal etc.), and the nature of the eigenvectors (e.g. number of LI eigenvectors, their rough direction, which eigenvalue they correspond to). It may be the case that one or more of these cannot be determined from the phase portraits, so the answer may be “cannot be determined” for some parts.

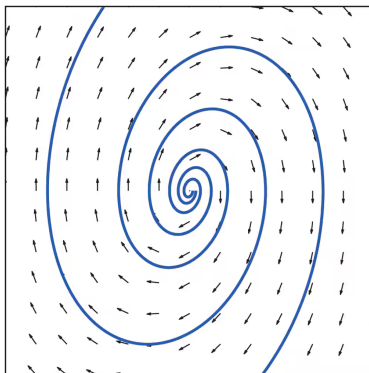
Problem §5.3 #18. [2 points]



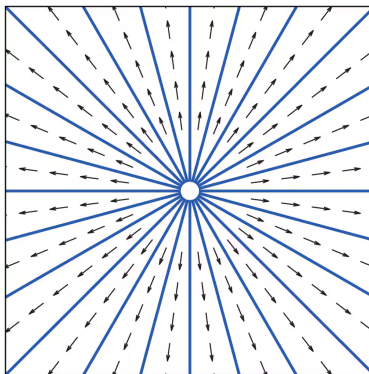
Problem §5.3 #19. [2 points]



Problem §5.3 #20. [2 points]



Problem §5.3 #21. [2 points]



Problem §5.3 #26. [2 points]

