HOMEWORK 20
DIFFERENTIAL EQUATIONS
DUE 10-24

Show your work!

(1) In each part below, you are given the eigenvectors and eigenvalues of a coefficient matrix for a constant-coefficient, linear, homogeneous system, but not the matrix itself. Draw the phase portrait, and answer the associated question.

(a) Eigenvector $\begin{pmatrix}1\\1\end{pmatrix}$ with eigenvalue 3, and eigenvector $\begin{pmatrix}1\\-1\end{pmatrix}$ with eigenvalue -2. Draw the phase portrait for the associated system. Almost all solution curves asymptotically approach a fixed line as $t \to +\infty$. Which line is it? Justify your answer.

(b) Eigenvector $\begin{pmatrix}1\\1\end{pmatrix}$ with eigenvalue -3, and eigenvector $\begin{pmatrix}1\\-1\end{pmatrix}$ with eigenvalue -2. Draw the phase portrait for the associated system. All solution curves are asymptotically tangent at the origin to a fixed line as $t \to +\infty$. Which line is it? Justify your answer.

(c) Eigenvector $\begin{pmatrix}1\\1\end{pmatrix}$ with eigenvalue 3, and eigenvector $\begin{pmatrix}1\\-1\end{pmatrix}$ with eigenvalue 2. Draw the phase portrait for the associated system. Almost all solution curves are asymptotically parallel to a fixed line as $t \to +\infty$. Which line is it? Justify your answer.

- **Four** book problems: #3.2.13, 14; #3.3.19, 21.
- **This problem *only* due 10-29.** It must be completed on a separate, new sheet of paper, *not* on the original exam.

  Re-do any **one** regular problem (#1–#5) on Midterm 2. Your grade on this one problem will replace the original grade. For example, if you earned 5/10 on #2 and submit a complete, correct solution, then your recorded midterm grade will increase by 5 points.

  These problems will be graded quite strictly, so be sure that your answer is absolutely correct! You may talk to anyone, including your classmates and the instructor, about your solution, but you **must** write it up yourself.