Homework 3

Due: Monday, April 19, at 11:00 PM Seattle time on Gradescope

1 Complex Diagonalization

Diagonalize each of the following matrices

A. $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$

B. $\begin{pmatrix} 3 & -2 \\ 2 & 3 \end{pmatrix}$

C. $\begin{pmatrix} 7 & -5 \\ 13 & -9 \end{pmatrix}$

2 Complex General Solutions

For each of the following ODEs, find the (complex) general solution.

A. $x' = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} x$

B. $x' = \begin{pmatrix} 3 & -2 \\ 2 & 3 \end{pmatrix} x$

C. $x' = \begin{pmatrix} 7 & -5 \\ 13 & -9 \end{pmatrix} x$

3 Real General Solutions

For each of the following ODEs, find the real general solution.

A. $x' = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} x$

B. $x' = \begin{pmatrix} 3 & -2 \\ 2 & 3 \end{pmatrix} x$

C. $x' = \begin{pmatrix} 7 & -5 \\ 13 & -9 \end{pmatrix} x$

4 Initial Value Problems

Find the solution to each of the following IVPs

A. $x' = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} x$, $x(0) = (1, 2)$

B. $x' = \begin{pmatrix} 3 & -2 \\ 2 & 3 \end{pmatrix} x$, $x(0) = (1, -1)$

C. $x' = \begin{pmatrix} 7 & -5 \\ 13 & -9 \end{pmatrix} x$, $x(0) = (3, 4)$

5 Limiting Behavior

For each of the following IVPs, compute the limit $\lim_{t \to \infty} |x(t)|$, for the solution x.

A. $x' = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} x$, $x(0) = (1, 2)$

B. $x' = \begin{pmatrix} 3 & -2 \\ 2 & 3 \end{pmatrix} x$, $x(0) = (1, -1)$

C. $x' = \begin{pmatrix} 7 & -5 \\ 13 & -9 \end{pmatrix} x$, $x(0) = (3, 4)$

6 Direction Fields

Draw the direciton field (approximately) for each of the following ODEs

A. $x' = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} x$

B. $x' = \begin{pmatrix} 3 & -2 \\ 2 & 3 \end{pmatrix} x$

C. $x' = \begin{pmatrix} 7 & -5 \\ 13 & -9 \end{pmatrix} x$