Homework Assignment 9

Due *Friday, November 22.*

1. Consider the system $\dfrac{d\vec{Y}}{dt} = A\vec{Y}$, where $A = \begin{bmatrix} -1 & 1/2 \\ -1/2 & 0 \end{bmatrix}$.

   (a) Find the general solution.

   (b) Sketch the phase portrait. Include the straight-line solutions, and a few other curves to illustrate the qualitative behavior. Use nullclines to help draw reasonably accurate solution curves.

   (c) Solve the initial value problem $\vec{Y}(0) = \begin{bmatrix} -2 \\ 0 \end{bmatrix}$, and sketch the corresponding x and y coordinates of this solution versus t (include positive and negative values of t).

2. Consider
$$\frac{d\vec{Y}}{dt} = A\vec{Y}, \quad \text{where} \quad A = \begin{bmatrix} p & 1 \\ 0 & p \end{bmatrix}.$$
Use a computer (either Maple or the "HPG System Solver" on the text's CD) to create phase portraits when $p = -1$, $p = -0.1$, $p = 0$, $p = 0.1$, $p = 1$. Include solution curves that go through the points $(2, 0)$, $(2, 2)$ and $(0, 2)$. Hand in copies of the cases $p = -1$, $p = 0$ and $p = 1$, and describe (with complete sentences) how the phase portrait changes as p changes from -1 through 0 to 1.

3. Now consider
$$\frac{d\vec{Y}}{dt} = A\vec{Y}, \quad \text{where} \quad A = \begin{bmatrix} -1 & p \\ 0 & -1 \end{bmatrix}.$$
and repeat the previous problem.

Text Problems

- Section 3.6/ 8, 10, 12 (Do these without converting to a system!)

Recommended Exercises - Do Not Hand In – Check the answers in the back of the book.

- Section 3.5/ 1–7 odds, 14
- Section 3.6/ 1–11 odds (Do these without converting to a system!), 33
- Section 3.7/ 3, 7