MATH 225 - Differential Equations May 29 , 2008

Homework 5, Field 2008 **Due Date**: June 3, 2008

LINEAR EQUATIONS - COMPLEX/REPEATED/ZERO EIGENVALUES - TRACE DETERMINANT PLANE

1. Given that $\dfrac{d\mathbf{Y}}{dt} = \mathbf{AY}$ where $\mathbf{A} = \begin{bmatrix} -2 & -3 \\ 3 & -2 \end{bmatrix}$.
   (a) Find the real valued general solution of this system.
   (b) Using HPGSystemSolver plot the phase portrait and classify the equilibrium solution.

2. Given that $\dfrac{d\mathbf{Y}}{dt} = \mathbf{AY}$ where $\mathbf{A} = \begin{bmatrix} -3 & 10 \\ -1 & 3 \end{bmatrix}$.
   (a) Find the real valued general solution of this system.
   (b) Using HPGSystemSolver plot the phase portrait and classify the equilibrium solution.

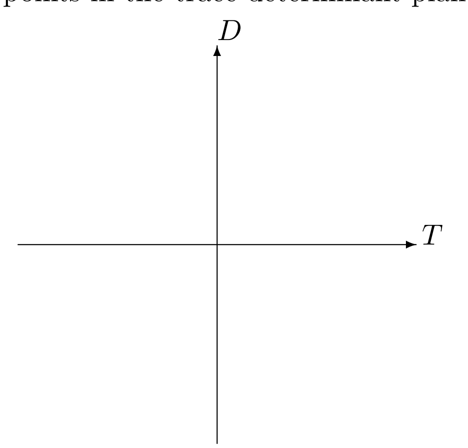
3. Given that $\dfrac{d\mathbf{Y}}{dt} = \mathbf{AY}$ where $\mathbf{A} = \begin{bmatrix} -3 & 1 \\ 3 & -1 \end{bmatrix}$.
   (a) Find the general solution of this system.
   (b) Using HPGSystemSolver plot the phase portrait and classify the equilibrium solutions.

4. Given that $\dfrac{d\mathbf{Y}}{dt} = \mathbf{AY}$ where $\mathbf{A} = \begin{bmatrix} -5 & 1 \\ -1 & -3 \end{bmatrix}$.
   (a) Find the solution of this system assuming that $\mathbf{Y} = \begin{bmatrix} x_0 \\ y_0 \end{bmatrix}$.
   (b) Using HPGSystemSolver plot the phase portrait and classify the equilibrium solution.

5. Given the general two-dimensional autonomous system of linear ODE's,

$$\begin{bmatrix} x'(t) \\ y'(t) \end{bmatrix} = \begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{bmatrix} x(t) \\ y(t) \end{bmatrix}, \tag{1}$$

draw and label all off-axis equilibrium points in the trace-determinant plane.



Using the program TDAnimation discuss the changes to both the number and classification of equilibrium points as the TD-plane is traversed by the program.