

HOMWORK 12, M 331  
DUE 5/7/09

**Problem 1.** Consider the matrix ODE

$$y' = \begin{pmatrix} -2 & 1 \\ 1 & -2 \end{pmatrix} y$$

- (i) Find the general solution.
- (ii) Draw a picture showing the eigen solutions and sketch the general behavior of the solutions.
- (iii) Characterize whether the origin is a source, sink, saddle or spiral point.

**Problem 2.** Consider the matrix ODE

$$y' = \begin{pmatrix} 2 & 3 \\ 0 & 2 \end{pmatrix} y$$

- (i) Find the general solution.
- (ii) Draw a picture showing the eigen solutions and sketch the general behavior of the solutions.
- (iii) Find the solution with initial data  $y(0) = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$

**Problem 3.** Consider the matrix ODE

$$y' = \begin{pmatrix} 0 & 2 \\ -2 & 0 \end{pmatrix} y$$

- (i) Find the general solution.
- (ii) Find the solution with initial condition  $y(0) = \begin{pmatrix} 0 \\ 4 \end{pmatrix}$ .
- (iii) Draw a picture showing the solution with the previous initial condition and sketch the general behavior of the solutions.
- (iv) Characterize whether the origin is a source, sink, saddle or spiral point.

**Problem 4.** Consider the matrix ODE

$$y' = \begin{pmatrix} 3 & -2 \\ 4 & -1 \end{pmatrix} y$$

- (i) Find the general solution.
- (ii) Find the solution with initial condition  $y(0) = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$ .
- (iii) Draw the solution with the previous initial condition and sketch the general behavior of the solutions.
- (iv) Characterize whether the origin is a source, sink, saddle or spiral point.