

MATH150 Introduction to Ordinary Differential Equations, Spring 2010-11
Week 11 Worksheet: Systems of ODEs I (Ver. T1A)

Name: _____ ID No.: _____ Tutorial Section: _____

Complete at least TWO questions from the following questions! The worksheet must be handed in at the end of the tutorial

(Solution of this worksheet will be available at the course website after all the Friday tutorials)

1. **(Demonstration)** (§7.5, p. 398, problem 1) Solve the following system and sketch a phase diagram

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

2. **(Demonstration)** (§7.5, p. 398, problem 2) Solve the following system and sketch a phase diagram

$$\mathbf{x}' = \begin{pmatrix} 1 & -2 \\ 3 & -4 \end{pmatrix} \mathbf{x}.$$

3. **(Class work)** (§7.5, p. 398, problem 4) Solve the following system and sketch a phase diagram

$$\mathbf{x}' = \begin{pmatrix} 1 & 1 \\ 4 & -2 \end{pmatrix} \mathbf{x}.$$

Answer _____

4. **(Class work)** (§7.5, p. 398, problem 6) Solve the following system and sketch a phase diagram

$$\mathbf{x}' = \begin{pmatrix} \frac{5}{4} & \frac{3}{4} \\ \frac{3}{4} & \frac{5}{4} \end{pmatrix} \mathbf{x}.$$

Answer _____

5. **(Class work)** (§7.5, p. 398, modified from problem 31) Solve the following system

$$\mathbf{x}' = \begin{pmatrix} -1 & -1 \\ -\alpha & -1 \end{pmatrix} \mathbf{x},$$

and determine the value of $\frac{1}{2} \leq \alpha \leq 2$ for which the nature of the equilibrium point changes.

Answer _____