

MATH150 Introduction to Ordinary Differential Equations, Spring 2010-11
Week 12 Worksheet: Systems of ODEs II (Ver. T1A)

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

Complete at least ONE question 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)** (§7.6, p. 410, problem 17) Solve the following system in terms of α , determine the *critical values* of α at which the qualitative nature of the the phase diagram changes, and sketch a phase diagram

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

2. **(Demonstration)** (§7.8, p. 428, Q. 3) Solve the following system and sketch a phase diagram

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

3. **(Class work)** (§7.6, p. 410, problem 14) Solve the following system in terms of α , determine the *critical values* of α at which the qualitative nature of the the phase diagram changes, and sketch a phase diagram

$$\mathbf{x}' = \begin{pmatrix} 0 & -5 \\ 1 & \alpha \end{pmatrix} \mathbf{x}.$$

Answer _____

4. **(Class work)** (§7.8, p. 428, Q. 4) Solve the following system and sketch a phase diagram

$$\mathbf{x}' = \begin{pmatrix} -3 & \frac{5}{2} \\ -\frac{5}{2} & 2 \end{pmatrix} \mathbf{x}.$$

Answer _____

5. **(Further work)** (§7.6, modified from Q. 31) Suppose the coupled mass-spring system as on pp. 75-76 of Prof. Chasnov's Notes has $k = 1 = k_{12}$, $m = 1$. Write down the equation in the form $\ddot{\mathbf{x}} = A\mathbf{x}$ and solve for the corresponding eigenvalues/eigenvectors and the general solution.

Answer _____