MTH 267, Homework #11, Fall 2022 Name _____

Instructions: Work problems on a separate sheet of paper and attach work to this page. You should show all work to receive full credit for problems. Checking your work with computer algebra systems is fine, but that doesn't count as "work" since you won't be able to use CAS programs on exams or quizzes. Graphs and longer answers that won't fit here, indicate which page of the work the answer can be found on and be sure to clearly indicate it on the attached pages.

1. For each of the systems below, find the general solution to the system. Graph the direction field and several sample trajectories.
   a. $\vec{x}' = \begin{bmatrix} 1 & -2 \\ 3 & -4 \end{bmatrix}\vec{x}$
   b. $t\vec{x}' = \begin{bmatrix} 4 & -3 \\ 8 & -6 \end{bmatrix}\vec{x}$
   c. $\vec{x}' = \begin{bmatrix} -2 & 1 \\ -8 & 2 \end{bmatrix}\vec{x}$
   d. $t\vec{x}' = \begin{bmatrix} 2 & -1 \\ 3 & -2 \end{bmatrix}\vec{x}$
   e. $\vec{x}' = \begin{bmatrix} 7 & -1 \\ 3 & 3 \end{bmatrix}\vec{x}$
   f. $\vec{x}' = \begin{bmatrix} 3 & -2 \\ 4 & -1 \end{bmatrix}\vec{x}$
   g. $\vec{x}' = \begin{bmatrix} -2 & 1 \\ 1 & -2 \end{bmatrix}\vec{x}$
   h. $\vec{x}' = \begin{bmatrix} 4 & -3 \\ 6 & -2 \end{bmatrix}\vec{x}$
   i. $\vec{x}' = \begin{bmatrix} 1 & -5 \\ 1 & -3 \end{bmatrix}\vec{x}$

2. Find the solution to the system and use the initial conditions to find any constants.
   a. $\vec{x}' = \begin{pmatrix} 5 & -1 \\ 3 & 1 \end{pmatrix}\vec{x}, \vec{x}(0) = \begin{pmatrix} 2 \\ -1 \end{pmatrix}$

3. Find the general solution to the system. Describe the behaviour of the system as $t \to \infty$. Draw a direction field and draw at least 4 trajectories.
   a. $\vec{x}' = \begin{pmatrix} 3 & -2 \\ 4 & -1 \end{pmatrix}\vec{x}$
   b. $\vec{x}' = \begin{pmatrix} 1 & 2 \\ -5 & -1 \end{pmatrix}\vec{x}$

4. Find the general solution to the system. Describe the behaviour of the system as $t \to \infty$. Draw a direction field and draw at least 4 trajectories. Find the fundamental matrix for the system.
   a. $\vec{x}' = \begin{pmatrix} 3 & -2 \\ 2 & -2 \end{pmatrix}\vec{x}$
   b. $\vec{x}' = \begin{pmatrix} 2 & 2+i \\ -1 & -1-i \end{pmatrix}\vec{x}$
   c. $\vec{x}' = \begin{pmatrix} -2 & 1 \\ 1 & -2 \end{pmatrix}\vec{x}$
   d. $t\vec{x}' = \begin{pmatrix} 2 & -1 \\ 3 & -2 \end{pmatrix}\vec{x}$