Homework 7 - Math 243 **Name:** ______________________

Find the eigenvalues for each of the following systems and then use them to classify the type of equilibrium at the origin.

1. $\dfrac{dx}{dt} = \begin{bmatrix} -1 & 6 \\ -2 & 6 \end{bmatrix} x$

2. $\dfrac{dy}{dt} = \begin{bmatrix} 1 & -2 \\ 2 & 1 \end{bmatrix} y$

3. $\dfrac{dx}{dt} = \begin{bmatrix} -1 & 6 \\ -2 & 6 \end{bmatrix} x$

4. $\dfrac{dy}{dt} = \begin{bmatrix} 1 & -2 \\ 2 & 1 \end{bmatrix} y$

Find the characteristic polynomial and eigenvalues for each of the following matrices.
Use a computer to find the eigenvectors and eigenvalues for the following matrices. Be clear about which eigenvalue corresponds to which eigenvector.

5. $\begin{bmatrix} 5 & 1 & 1 \\ -3 & 1 & -3 \\ 0 & 0 & 4 \end{bmatrix}$

6. $\begin{bmatrix} 3 & 4 \\ -4 & 3 \end{bmatrix}$

Find general solutions for the following linear systems. You can use a computer to find the relevant eigenvectors/eigenvalues.

7. $\begin{aligned} x' &= 4x + 2y \\ y' &= 1x + 3y \end{aligned}$

8. $\begin{aligned} x' &= -3x + 4y \\ y' &= 3x - 2y \end{aligned}$

Find solutions for the following initial value problems. You should start with the general solutions from the last two problems.

9. $\begin{aligned} x' &= 4x + 2y \\ y' &= 1x + 3y \end{aligned}$, $x(0) = 2$ and $y(0) = 7$.

10. $\begin{aligned} x' &= -3x + 4y \\ y' &= 3x - 2y \end{aligned}$, $x(0) = 8$ and $y(0) = -6$.