

# Homework 8

Due: 11/11/2019, in class

MTH 311 Sections C and F

Fall 2019

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Please write legibly and show all work. If the answer to a problem is written down correctly, but certain steps of solving it are not shown, points might be taken off.

1. Consider the following matrices.

$$A = \begin{bmatrix} 3 & -1 \\ 2 & 1 \\ 1 & 4 \end{bmatrix}, \quad B = \begin{bmatrix} -2 & 3 & 1 \\ 4 & -1 & 1 \end{bmatrix}, \quad C = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 2 & 3 & 0 \end{bmatrix}, \quad E = \begin{bmatrix} 1 \\ -1 \\ 0 \end{bmatrix}$$

Compute the following expressions.

- (a)  $AB + I$ . (Here  $I$  is the  $3 \times 3$  identity matrix.)  
(b)  $BC - 2B$ .  
(c)  $CE + 3E$ .
2. Find all eigenvalues and all eigenvectors for the following matrices.

$$(a) \begin{bmatrix} 6 & -7 \\ 1 & -2 \end{bmatrix} \quad (b) \begin{bmatrix} 4 & 1 & 4 \\ 1 & 7 & 1 \\ 4 & 1 & 4 \end{bmatrix} \quad (c) \begin{bmatrix} 3 & -1 \\ 1 & 1 \end{bmatrix}$$

For the next problems: (a) find the general solution to the given system of differential equations, and (b) draw the corresponding phase portrait.

3.  $x'_1 = 6x_1 - 7x_2$ ,  $x'_2 = x_1 - 2x_2$ .  
4.  $x' = -y$ ,  $y' = 4x$ .  
5.  $x'_1 = 9x_1 + 5x_2$ ,  $x'_2 = -6x_1 - 2x_2$ .  
6.  $x' = x - 2y$ ,  $y' = 2x + y$ .