

MATH 245: Differential Equations and Linear Algebra

SAMPLE MIDTERM II

Fall 2009

NAME :

NOTE: There are 5 problems on this midterm (total of 6 pages). Use of calculators to check your work is permitted; however, in order to receive full credit for any problem, you must show work leading to your answer. You have 50 minutes to complete this test.

Problem	Possible points	Score
1	20	
2	20	
3	20	
4	10	
5	30	
Total	100	

Problem 1. (20pts) Calculate whichever of the matrices \mathbf{AB} and \mathbf{BA} is defined.

$$\mathbf{A} = \begin{bmatrix} 1 & 0 & -3 \\ 3 & 2 & 4 \\ 2 & -3 & 5 \end{bmatrix}, \quad \mathbf{B} = \begin{bmatrix} 3 & 0 \\ -1 & 4 \\ 6 & 5 \end{bmatrix}.$$

Problem 2. (20pts) Find the inverse of the following matrix.

$$\begin{bmatrix} 1 & 1 & 5 \\ 1 & 4 & 13 \\ 3 & 2 & 12 \end{bmatrix}$$

Problem 3. (20pts) Find the eigenvalues and associated eigenvectors for the given matrix.

$$\mathbf{A} = \begin{bmatrix} 7 & -6 \\ 12 & -10 \end{bmatrix}$$

Problem 4. (10pts) Transform the system of differential equations into an equivalent system of first-order differential equations.

$$x'' - 5x + 4y = 0, \quad y'' + 4x - 5y = 0.$$

Problem 5. (30pts) Solve the following initial value problem.

$$x' = 9x + 5y, \quad y' = -6x - 2y, \quad x(0) = 1, y(0) = 0$$