University of New Brunswick **Department of Mathematics & Statistics**

Math 1503 **Midterm 2** **November 9, 2009**

Total points: 30 Name: ____________________

Instructions: Calculators are not permitted. Show your steps and calculations, so that your answers are justified.

1. (8 points) Carry out the indicated computation, if possible, using the matrices A and B. The matrix I is the 3 by 3 identity matrix.

$$A = \begin{bmatrix} 2 & 1 & 2 \\ 4 & 0 & 0 \\ -7 & 3 & 5 \end{bmatrix} \qquad B = \begin{bmatrix} 0 & 0 & 1/4 \\ -5 & 2 & 6 \\ 3 & -1 & -13/4 \end{bmatrix}$$

   (a) Compute AB.

   (b) Show that $AB \neq BA$. (You need not compute all of BA.)

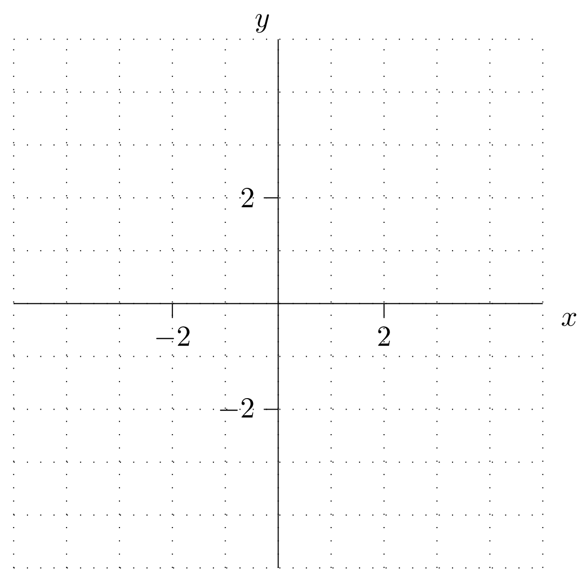
   (c) Compute $5(-A + 8B)$.

   (d) Compute $A(B - I)$.

2. (6 points)

(a) Draw a graph corresponding to the linear system

$$\begin{aligned} 3x - 6y &= 3 \\ -x + 2y &= 1. \end{aligned}$$



(b) Determine geometrically (that is, from your graph) whether the system has a unique solution, infinitely many solutions, or no solutions.

(c) Solve the system using Gaussian elimination or Gauss-Jordan elimination to confirm your answer to (b).

3. (8 points) Find the inverse of the matrix $A = \begin{bmatrix} 1 & 3 & 0 & 0 \\ 0 & -6 & 0 & 1 \\ 0 & 0 & 5 & 0 \\ 0 & 1 & 0 & 0 \end{bmatrix}$. Show your steps to demonstrate your knowledge of a method you learned in this course.

4. (8 points) Determine whether $\mathbf{b} = \begin{bmatrix} 5 \\ -8 \\ 5 \end{bmatrix}$ is in the span of vectors $\mathbf{a_1} = \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix}$ and $\mathbf{a_2} = \begin{bmatrix} 2 \\ 1 \\ 2 \end{bmatrix}$. In other words, find (if possible) scalars x_1 and x_2 such that

$$\mathbf{b} = x_1\mathbf{a_1} + x_2\mathbf{a_2} \ .$$

Show your steps to demonstrate your knowledge of a method you learned in this course.