Math 201
Fall 2019
Midterm1
10/04/2019
Time Limit: 50 minutes

Name (Print): ____________________

This exam contains 9 pages (including this cover page) and 4 problems. Check to see if any pages are missing.

Statement of Ethics

I agree to complete this exam without unauthorized assistance from any person, materials, or device.

Signature ____________________ Date ____________________

1 Fuentes T 1:30 - 2:20 Bloomberg 278
2 Quinan T 3:00 - 3:50 Hodson 301
3 Quinan T 4:30 - 5:20 Hodson 216
4 Luo Th 1:30 - 2:20 Bloomberg 278
5 Luo Th 3:00 - 3:50 Maryland 309

Your section number: ____________________

You are required to show your work on each problem on this exam. The following rules apply:

- **Organize your work**, in a reasonably neat and coherent way, in the space provided.
- **No partial credit for any 1 point problem**. A correct answer, unsupported by calculations, explanation, or algebraic work will receive no credit.
- If you need more space, use the back of the pages; clearly indicate when you have done this.
- **Any answer or solution on scratch paper will receive no credit**.

Do not write in the table to the right.

Problem	Points	Score
1	5	
2	5	
3	5	
4	5	
Total:	20	

1. (a) (1 point) For which values of a, b, c, d, e is the following matrix in reduced row-echelon form?

$$\begin{bmatrix} 1 & a & 2 & 1 & b \\ 0 & 1 & 0 & c & d \\ 0 & 0 & e & 0 & 0 \end{bmatrix}.$$

(b) (1 point) Let

$$A = \begin{bmatrix} 1 & a & b \\ a & 1 & b \\ a & b & 1 \end{bmatrix}, \ B = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix},$$

Compute AB.

(c) (3 points) Consider the equations

$$\left| \begin{array}{ll} x + 2y + 3z & = 4 \\ x + ky + 4z & = 6 \\ x + 2y + (k+2)z & = 6 \end{array} \right| ,$$

where k is an arbitrary constant. (1) For which values of the constant k does this system have a unique solution? (1pt) (2) When is there no solution? (1pt) (3) When are there infinitely many solutions? (1pt)

2. (a) (1 point) Find the matrix P of the orthogonal projection onto the line spanned by $\vec{\boldsymbol{w}} = (5, 12)$.

(b) (2 points) What's the matrix A of a counterclockwise rotation in $\mathbb{R}^2$ through the angle $\frac{\pi}{2}$? (1pt) Compute A^2. (1pt)

(c) (2 points) Let L be the line defined by $2x + y = 0$, let $\boldsymbol{x} = (1, 2)$, find the reflection of $\boldsymbol{x}$ about L.

3. (a) (2 points) Use Gauss-Jordan elimination to compute rref(A), where $A = \begin{bmatrix} 1 & 0 & 2 & 4 \\ 0 & 1 & -3 & -1 \\ 3 & 4 & -6 & 8 \\ 0 & -1 & 3 & 4 \end{bmatrix}$.

(b) (3 points) For which values of the constant k is the following matrix invertible?

$$\begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & k \\ 1 & 4 & k^2 \end{bmatrix}$$

4. (5 points) Find all the possible solutions of the equation $A \cdot A^T = I_2$, where A is a 2×3 matrix, A^T is the transpose matrix of A, I_2 is the 2×2 identity matrix.

Please estimate your score. You can also provide your suggestion for the course here.