Practice Midterm I, Math 312 will NOT be collected or graded

1. (20 points) For each of the following statements, mark whether they are true or false. No work needs to be shown for this problem. (5 problems, 4 points each)

   (a) To multiply (the matrices) AB, if A has n rows then B must have n columns.

   (T) **(F)**

   (b) For two matrices it holds that $AB = BA$.

   (T) **(F)**

   (c) The matrices A and $-A$ have different column and null spaces.

   (T) **(F)**

   (d) The symmetric 3×3 matricies (where $A^T = A$) form a subspace.

   (T) **(F)**

   (e) A and A^T have the same number of pivots.

   (T) **(F)**

2. (20 points) Calculate the value of each Ax below

$$(a) \quad \begin{pmatrix} 0 & 1 & 5 & 1 \\ 1 & 2 & -3 & 0 \\ 1 & -1 & 3 & -1 \\ 9 & 7 & 0 & 2 \end{pmatrix} \begin{pmatrix} 2 \\ 1 \\ 5 \\ 8 \end{pmatrix} = ?$$

and

$$(b) \quad \begin{pmatrix} 4 & 1 & 0 & 1 & 0 \\ 1 & 0 & 2 & 1 & 0 \\ 0 & 0 & 1 & 1 & 3 \end{pmatrix} \begin{pmatrix} 2 & 1 \\ 1 & 3 \\ 1 & 3 \\ 1 & 3 \\ 0 & 0 \end{pmatrix} = ?$$

3. (20 points) Invert the matrix A where

$$A = \begin{pmatrix} 1 & 1 & 1 \\ 1 & 2 & 2 \\ 1 & 2 & 3 \end{pmatrix}$$

by using the Gauss-Jordan approach starting with the matrix $[A\ I]$.

4. (20 points) Describe the column space and the null space of the matrix A:

$$A = \begin{pmatrix} 2 & 1 & 3 \\ 6 & 3 & 9 \\ 4 & 2 & 6 \end{pmatrix} \quad \text{where} \quad b = \begin{pmatrix} 1 \\ 3 \\ 2 \end{pmatrix}$$

Then determine the general (complete) solution to the problem $Ax = b$.

5. (20 points)

(a) Define the column, row and the null spaces of the matrix A.

(b) Find a basis for the column, row and the null spaces of A:

$$A = \begin{pmatrix} 0 & 1 & 2 & 3 & 4 \\ 0 & 1 & 2 & 4 & 6 \\ 0 & 0 & 0 & 1 & 2 \end{pmatrix}$$