Math 369 HW #8

Due 8:00 AM Friday, Apr. 7

1. Let $A = \begin{bmatrix} 1 & 2 & 4 & 0 \\ -3 & 1 & 5 & 2 \\ -2 & 3 & 9 & 2 \end{bmatrix}$.

   (a) What is rank(A)?

   (b) What is rank(A^T)?

2. Let $T : \mathbb{R}^2 \to \mathbb{R}^3$ be the linear transformation defined by

$$T\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = \begin{bmatrix} x + 3y \\ x - y \\ x \end{bmatrix}.$$

   (a) What is the rank of the standard matrix for T?

   (b) What is the nullity of the standard matrix for T?

3. (a) Give an example of a 3×3 matrix whose column space is a plane through the origin in $\mathbb{R}^3$.

   (b) Which geometric object is the nullspace of your matrix?

   (c) Which of geometric object is the row space of your matrix?

4. Let $A = \begin{bmatrix} 1 & 0 & -2 \\ 0 & 0 & 0 \\ -2 & 0 & 4 \end{bmatrix}$.

   (a) What is the characteristic equation for A?

   (b) What are the eigenvalues of A?

5. Let $B = \begin{bmatrix} -2 & 2 & 3 \\ -2 & 3 & 2 \\ -4 & 2 & 5 \end{bmatrix}$.

   (a) What are the eigenvalues of B?

   (b) Find bases for the eigenspaces of B.