

Instructor: Tatsunari Watanabe
TA: Carlos Salinas

Name: _____.

MA 26500 Quiz 5

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1. Consider the matrix

$$A = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 1 \\ 2 & 3 & 3 \\ 0 & -1 & -1 \end{bmatrix}. \quad (\star)$$

- (a) (12 points) Recall that the **nullspace** of an $m \times n$ matrix A is the set of vectors \mathbf{x} in \mathbb{R}^n such that $A\mathbf{x} = \mathbf{0}$. This subset spans a subspace of \mathbb{R}^n . Give a description of the nullspace of the matrix (\star) by writing down basis for the nullspace.

[HINT: You should begin by putting the matrix in rref.]

- (b) (8 points) The **range** or **columnspace** of an $m \times n$ matrix A is the set of vectors \mathbf{y} in \mathbb{R}^m that are, in some sense, “hit” by vectors \mathbf{x} in \mathbb{R}^n by the matrix A , i.e., $\mathbf{y} = A\mathbf{x}$ for some \mathbf{x} . Using your calculations from above (the hint), write down a basis for the range of (\star) .