This quiz has six problems worth 10 points.

1. (8 points) Let $A = \begin{bmatrix} 1 & 0 & 2 & -1 & 0 \\ 2 & 1 & 3 & 1 & 2 \\ 2 & 3 & 1 & 7 & 5 \\ 1 & -1 & 3 & -4 & -5 \end{bmatrix}$ and rref$(A) = R = \begin{bmatrix} 1 & 0 & 2 & -1 & 0 \\ 0 & 1 & -1 & 3 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$

   (a) Find a basis for $C(A)$.

   (b) Find a basis for $N(A)$.

   (c) Find a basis for $C(A^T)$.

   (d) Could the vector $\mathbf{v} = (-15, 10, -3, 1)$ be a basis for the left null space of A? Explain your reasoning.

2. (2 points) [Fill in the blank.] The vectors $\mathbf{a}_1, \mathbf{a}_2, \mathbf{a}_3, \cdots \mathbf{a}_k$ form a basis for the vector space S if