Section 1: Definitions

1. A linear system $A \cdot x = b$ is **inconsistent** if...

2. An $n \times n$ matrix $A$ is **invertible/nonsingular** if...

3. The **determinant** of a $2 \times 2$ matrix $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ is...

4. A set $W$ is a **subspace** of $\mathbb{R}^n$ if...

5. Consider a set of vectors $S = \{v_1, \ldots, v_m\}$ where $v_i \in \mathbb{R}^n$. Then:
   
   (a) A vector $v \in \mathbb{R}^n$ is a **linear combination** of the vectors in $S$ if...
   
   (b) The **span** of $S$ is...
   
   (c) The set $S$ is **linearly independent** if...
   
   (d) The set $S$ is a **basis** for the subspace $W \subseteq \mathbb{R}^n$ if...

6. The **row space** of an $m \times n$ matrix $A$ is...

7. The **column space** of an $m \times n$ matrix $A$ is...

8. The **null space** of an $m \times n$ matrix $A$ is...

9. The value $\lambda \in \mathbb{C}$ and vector $v \in \mathbb{C}^n$ are an **eigenvalue/eigenvector** pair of the $n \times n$ matrix $A$ if...

Section 2: Proofs

1. Consider three vectors $v_1, v_2, v_3 \in \mathbb{R}^3$. Prove that, if $v_3 \in \text{span}\{v_1, v_2\}$, then $\text{span}\{v_1, v_2\} = \text{span}\{v_1, v_2, v_3\}$. 
2. Prove that, for any $m \times n$ matrix $A$, $\text{null}(A)$ is a subspace of $\mathbb{R}^n$.

3. Consider a $2 \times 2$ matrix $A$ which has two real and distinct eigenvalues $\lambda_1$ and $\lambda_2$. Show that the corresponding eigenvectors $v_1$ and $v_2$ are linearly independent.

4. Show that $\lambda$ is an eigenvalue of an invertible matrix $A$ if and only if $\lambda^{-1}$ is an eigenvalue of $A^{-1}$.