1. Prove the following: If $S$ and $T$ are vector spaces in $\mathbb{R}^n$ with $\text{dim}(S) < \text{dim}(T)$, then there always exists a nonzero vector $x \in T$ such that $x \in S^\perp$.

2. Suppose $A$ is an $m \times n$ matrix.
   
   (a) Prove that there exists a matrix $G$ such that $A'AG = A'$.
   
   (b) Suppose $G$ satisfies $A'AG = A'$. Complete the following statement and prove that your answer is correct.
   
   $AG = I \iff \underline{________}.$

3. Complete exercises 3.22, 3.26, 4.1, 4.2, 4.11, 4.12 from the text.