1. Let $T : C^\infty(\mathbb{R}) \to \mathbb{R}$ be defined by $T(g(x)) = \int_0^1 e^{2x} g(x) \, dx$. Is $T$ a linear transformation? What is $T(x)$?


4. If $A$ is a $3 \times 3$ matrix and $(A^T)^{-1} = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 3 \\ 1 & 1 & -1 \end{bmatrix}$, solve the system $AX = \begin{bmatrix} 0 \\ -1 \\ 2 \end{bmatrix}$.

5. Let $A$ and $B$ be $n \times n$ invertible matrices. Prove the following:
   (a) $(ABA^{-1})^2 = AB^2A^{-1}$.
   (b) $(ABA^{-1})^{-1} = AB^{-1}A^{-1}$.

6. If $A$ is invertible, is $A^2$ invertible? Why or why not? If $A^2$ is invertible, what is its inverse?


8. Page 233: # 4(c), 5(a), 6(b).