1. By using Gram-Schmidt, find an orthonormal basis for the subspace of $L^2[0,1]$ spanned by $1, x, x^2, x^3$.

2. Find the $L^2[0,1]$-orthogonal projection of the function $\cos x$ onto the span of $1, x, x^2, x^3$.

3. Suppose $u_0$ and $u_1$ are vectors in an inner product space $V$ such that $\langle u_0, v \rangle = \langle u_1, v \rangle$ for all $v \in V$. Show that $u_0 = u_1$.

4. Suppose $A$ is an $n \times n$ matrix with complex entries. Show that the following are equivalent.
   (a) The rows of $A$ form an orthonormal basis in $\mathbb{C}^n$.
   (b) $AA^* = I$ (the identity matrix).
   (c) $\|Ax\| = \|x\|$ for all $x \in \mathbb{C}^n$. 