Problem 1
Find the eigenvalues and the eigenvectors of $A$

$$A = \begin{bmatrix} a & b \\ b & a \end{bmatrix}$$

Problem 2. Find all values of $k$ such that $v = (1 - k, 3k, k + 1)$ has a $||v|| = 2$.

Problem 3. Find the $proj_a(u)$ if $u = (2, 1, 2, 1)$ and $a = (1, 1, 0, 1)$.

Problem 4. Let $u \in \mathbb{R}^n$ and $v \in \mathbb{R}^n$. Further let $v_k \in \mathbb{R}^n$ such that $||v_k|| = \frac{1}{2^k} \sqrt{||v||}$ for $k = 1, 2, \ldots$. Prove the following identity

$$|| \sum_{k=1}^{\infty} (u \cdot v_k)v_k || \leq ||u|| \cdot ||v||$$

Hint: Use triangular inequality, then, SCB inequality and at the end the formula for a sum of geometric series.