1. Find the eigenvalues and eigenvectors of the matrix $\begin{pmatrix} 3 & -4 & 4 \\ 1 & -2 & 4 \\ 1 & -1 & 3 \end{pmatrix}$.

2. Verify Cayley Hamilton theorem and find A^{-1} and A^4 if $A = \begin{pmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{pmatrix}$.

3. Use Cayley Hamilton theorem to find the value of the matrix given by

   $A^6 - 5A^5 + 8A^4 - 2A^3 - 9A^2 + 31A + 36I$ if the matrix $A = \begin{pmatrix} 1 & 0 & 3 \\ 2 & 1 & -1 \\ 1 & -1 & 1 \end{pmatrix}$.

4. Diagonalise the matrix $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ by orthogonal transformation.

5. Reduce the quadratic form by an orthogonal reduction $Q = 6x^2 + 3y^2 + 3z^2 - 4xy - 2yz + 4xz$ to canonical form and hence find its nature, rank, index and signature.