(1) Let \( \mathbf{A} = \begin{pmatrix} -1 & 2 & -2 \\ 2 & -1 & 2 \\ -2 & 2 & -1 \end{pmatrix} \).

(a) Verify that eigenvalues of \( \mathbf{A} \) are \( \lambda_1 = -5 \) and \( \lambda_2 = \lambda_3 = 1 \).

(b) Find an orthogonal matrix \( \mathbf{P} \) that diagonalizes \( \mathbf{A} \) and find the diagonal matrix \( \mathbf{D} = \mathbf{P}^T \mathbf{A} \mathbf{P} \).