1. (8 points) Let \( A = \begin{bmatrix} 2 & 1 & z \\ 0 & 3 & 1 \\ 1 & z & 4 \end{bmatrix} \).

a) Compute \( \det A \).

b) Using the result of a) find all values of \( z \) for which \( A \) is invertible.

2. (4 points) Suppose that a matrix \( U \) has the property that \( U^T = U^{-1} \) (such a matrix is said to be orthogonal). Show that \( \det U = \pm 1 \).
3. (8 points) Let

\[ A = \begin{bmatrix} 1 & -2 & 2 \\ 0 & 5 & 0 \\ 2 & 1 & 4 \end{bmatrix} \]

Find the eigenvalues and their algebraic multiplicities.