Math 218D  
Quiz 7

1. Find the followings for the matrix

\[ A = \begin{pmatrix} -1 & 1 & 0 \\ 1 & 2 & 1 \\ 0 & 3 & -1 \end{pmatrix} \]

a) Characteristic polynomial \( p(\lambda) =? \)

b) Eigenvalues (one of the eigenvalues is \( \lambda_1 = -1 \)).

c) Eigenvectors.

2. Let \( A \) be a matrix with orthonormal columns \( \{v_1, ..., v_n\} \), and \( P_V \) be the projection matrix associated with the subspace \( V = \text{Col}(A) \). Determine if the following statements are True or False?

a) \( \boxed{\text{True}} \) : \( P_V = AA^T = I \).

b) \( \boxed{\text{False}} \) : \( A^T A = I \).

c) \( \boxed{\text{True}} \) : \( P_V^T P_V = I \).

d) \( \boxed{\text{False}} \) : The null space of \( P_V \) equals to \( V \).

e) \( \boxed{\text{False}} \) : \( P_V P_{V^\perp} = 0 \).