

LAHORE UNIVERSITY OF MANAGEMENT SCIENCES
Department of Electrical Engineering

AI 501 Mathematics for Artificial Intelligence
Quiz 3

Name: _____

Campus ID: _____

Total Marks: 10

Time Duration: 15 minutes

Question 1 (3 marks)

Given the vectors

$$v_1 = \begin{pmatrix} 1 \\ 3 \end{pmatrix} \quad \text{and} \quad v_2 = \begin{pmatrix} 2 \\ 6 \end{pmatrix},$$

use the Gram-Schmidt process to find an **orthonormal** basis for the subspace spanned by these two vectors in \mathbb{R}^2 .

Question 2 (2 marks)

Determine if the following set forms a subspace of \mathbb{R}^3 :

$$W = \{(x, y, z) \in \mathbb{R}^3 \mid x + y = z\}$$

Question 3 (5 marks)

Consider the block matrix

$$K = \begin{pmatrix} I & A^T \\ A & 0 \end{pmatrix}$$

where I is an identity matrix and 0 is a zero matrix. Which of the following statements **must** be true? For each statement, provide reasoning for your choice.

- (a) K is square.
- (b) A is square or wide.
- (c) K is symmetric, i.e., $K^T = K$.
- (d) The identity and zero submatrices in K have the same dimensions.
- (e) The zero submatrix is square.