الاسم: الرقم الجامعي: رقم الشعبة:

King Saud University/College of Sciences/Department of Mathematics
Semester 442 / MATH-244 / Quiz-2

Max. Marks: 10 **Max. Time: 35 Min.**

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Note: Choose the correct answers to all the 6 questions. Calculators are not allowed!

Question 1 [Marks: 1.5**]:** Let B = {(2, 1, 0), (-3, 0, 1)} be a given basis for the null space $N(A)$, where $A = \begin{bmatrix} 1 & -2 & 3 \\ -2 & 4 & -6 \end{bmatrix}$. Find the vector $u \in N(A)$ that has the coordinate vector $[u]_B = \begin{bmatrix} -3 \\ 1 \end{bmatrix}$.

(a) u = (-3, 0, 1) (b) u = (-9, -3, 1) (c) u = (-3, 1, 0) (d) $u = (-6, -3, 0)$.

Question 2 [Marks: 2**]:** Let $B = \{b_1, b_2, b_3\}$ and $C = \{c_1, c_2, c_3\}$ be two ordered bases for the Euclidean space $\mathbb{R}^3$. If ${}_CP_B = \begin{bmatrix} 1 & 2 & 1 \\ -1 & 1 & 1 \\ 2 & 1 & 1 \end{bmatrix}$ is the transition matrix from B to C, then find the coordinate vector $[b_1 - b_3 + b_2]_C$.

(a) $\begin{bmatrix} 1 \\ -1 \\ 1 \end{bmatrix}$ (b) $\begin{bmatrix} 1 \\ -1 \\ -1 \end{bmatrix}$ (c) $\begin{bmatrix} -1 \\ -1 \\ 1 \end{bmatrix}$ (d) $\begin{bmatrix} 2 \\ -1 \\ 2 \end{bmatrix}$.

Question 3 [Marks: 1.5]**:** If $nullity(A^T) = 3$ where A is a matrix of size 9×5, then find $rank(A)$.

(a) 1 (b) 2 (c) 3 (d) 6.

Question 4 [Marks: 1.5]**:** Let $M_{2\times2}(\mathbb{R})$ be the vector space of all 2×2 real matrices with the standard inner product. Which of the following statements is correct if $A = \begin{bmatrix} -3 & 1 \\ 4 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 4 \\ -1 & 3 \end{bmatrix}$?

(a) Angle between A and B is 60^o (b) A and B are linearly dependent

(c) $A\ and\ B$ are orthogonal (d) $\{A, B\}$ is a basis for $M_{2\times2}(\mathbb{R})$.

Question 5 [Marks: 2]**:** If $\boldsymbol{E} = \{a, b, c\}$ is an orthogonal set of non-zero vectors in the Euclidean space $\mathbb{R}^4$, then which of the following statements is true?

(a) $\boldsymbol{E}$ is an orthonormal basis for $\mathbb{R}^3$.

(b) $span(\boldsymbol{E})$ is a proper subspace of $\mathbb{R}^3$.

(c) $\boldsymbol{E}$ is an orthogonal basis of $span(\boldsymbol{E})$.

(d) $\boldsymbol{E}$ is linearly dependent in $\mathbb{R}^4$.

Question 6 [Marks: 1.5]**:** Let $\boldsymbol{V} \neq \{\boldsymbol{0}\}$ be a finite-dimensional inner product space. Which of the following statements is correct?

(a) $\boldsymbol{V}$ is a basis of itself**.** (b) $\boldsymbol{V}$ may not have any basis.

(c) $\boldsymbol{V}$ is a finite set. (d) $\boldsymbol{V}$ must have an orthonormal basis.