**King Saud University** **MATH 240 (Linear Algebra)**

**Department of Mathematics** **2nd Midterm**

**First Semester 1445 H** **Duration:90 Minutes**

Student Name: Serial Number:

| Question Number | I | II | III | IV | Total |
|---|---|---|---|---|---|
| Mark | | | | | |

| Question Number | 1 | 2 | 3 | 4 | 5 | 6 | Total |
|---|---|---|---|---|---|---|---|
| Answer | | | | | | | |

## <u>Question I</u>:

**Choose the correct answer, then fill in the table above:**

**(1) If** $A = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$ **and** $B = \begin{bmatrix} 2a_{31} & 2a_{32} & 2a_{33} \\ a_{21} & a_{22} & a_{23} \\ a_{11} & a_{12} & a_{31} \end{bmatrix}$**, then they have the same**

**(a) row vectors (b) row space (c) column vectors (d) None of the previous**

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**(2) Let** $S = \{\ x^3, 4x^2, x-1, 3x, -2\}$ **be a subset of** $P_3$ **then** $S$ **is**

**(a) Linearly independent but does not span** $P_3$ **(b) Spans** $P_3$ **but is not linearly independent**

**(c) a basis for** $P_3$ **(d) None of the previous**

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**(3) Which of the following are subspace of** $R^3$

**(a)all vectors of the form** $(2a, a+c, c)$ **(b)all vectors of the form** $(a, 1, 1)$

**(c)all vectors of the form** $(a, b, a-1)$ **(d) None of the previous**

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**(4) The coordinate vector of** $u = (1, 4)$ **relative to the basis** $v_1 = (1, 1)$ **and**

$v_2 = (1, 0)$ **is**

**(a)** $(4, -2)$ **(b)** $(4, -3)$ **(c)** $(1, -3)$ **(d) None of the previous**

(5) Let $B = \begin{bmatrix} 1 & 1 & -3 & 0 & 1 \\ 0 & 1 & 2 & 4 & 1 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$ then rank of $B$ =

(a)2 (b)3 (c)4 (d) None of the previous

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(6) Let $M_{5\times 6}$ be the space of all $5 \times 6$ matrices then the number of vectors in any basis of $M_{5\times 6}$ is

(a)11 (b)30 (c)1 (d) None of the previous

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**<u>Question II</u>:**

**Find a basis and the dimension of the solution space of the homogeneous system**

$$\begin{cases} x + y + 2z + w = 0 \\ -x - 2y + 3z + 2w = 0 \end{cases}$$

**<u>Question III</u>: If $\boldsymbol{B} = \{(\mathbf{2}, \mathbf{1}, \mathbf{1}), (\mathbf{2}, -\mathbf{1}, \mathbf{1}), (\mathbf{1}, \mathbf{2}, \mathbf{1})\}$ and $\boldsymbol{B}' = \{(\mathbf{3}, \mathbf{1}, -\mathbf{5}), (\mathbf{1}, \mathbf{1}, -\mathbf{3}), (-\mathbf{1}, \mathbf{0}, \mathbf{2})\}$are bases for $\boldsymbol{R}^{\mathbf{3}}$, then find the transition matrix $\boldsymbol{B}$ to $\boldsymbol{B}'$.**

**<u>Question IV</u>:**

**Find a basis for the row space of the matrix** $A = \begin{bmatrix} 1 & 2 & 0 & 2 & 5 \\ -2 & -5 & 1 & -1 & -8 \\ 0 & -3 & 3 & 4 & 1 \\ 3 & 6 & 0 & -7 & 2 \end{bmatrix}$ **consisting entirely of row vectors from** $A$**.**

**Question V:**

**(a) Show that** $S = \{(1, 2, 1), (3, 3, 4), (2, 9, 0)\}$ **is a basis for** $R^3$

**(b) If** $v = (4, -1, 2) \in R^3$. **Then find** $(v)_S$.

**(c) If** $(u)_S = (2, 0, 5)$ **then find** $u$ .