King Saud University
Department of Mathematics
Second Semester 1435-1436 H

MATH 244 (Linear Algebra)
First Midterm (Make-up) Exam
Duration: 105 Minutes

Student's Name	Student's ID	Group No.	Lecturer's Name

Question No.	I	II	III	IV	Total
Mark					

[**I**] Determine whether the following is **True** or **False**. [3 *Points*]

(1) The following system of equations is linear. ( )

$$\begin{aligned} x + 2^4 y - z &= 0 \\ \sqrt{3}\, x - y + z &= 1 \end{aligned}$$

(2) For any $n \times n$ matrix A, the matrix AA^T is symmetric. ( )

(3) The matrix $\begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ is in the Reduced Row Echelon Form. ( )

(4) Every elementary matrix is invertible. ( )

(5) If A and B are $n \times n$ matrices, then $(A - B)(A + B) = A^2 - B^2$. ( )

(6) If $D^3 = \begin{bmatrix} -8 & 0 \\ 0 & 27 \end{bmatrix}$, then $D^2 = \begin{bmatrix} 4 & 0 \\ 0 & 9 \end{bmatrix}$. ( )

OVER

[II] Choose the correct answer. [5 *Points*]

(1) The values of c, if any, for which the matrix $A = \begin{bmatrix} c & -c & c \\ 1 & c & 1 \\ 0 & 0 & c \end{bmatrix}$ is invertible are

(a) $c \neq 0, 1$ **(b)** $c \neq 0, -1$ **(c)** $c = 0, -1$ **(d)** None of the previous

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(2) If $A^T = \begin{bmatrix} 1 & 2 \\ 1 & 3 \end{bmatrix}$ and $p(x) = x^2 + 3$, then $p(A)$ equals

(a) $\begin{bmatrix} 6 & 8 \\ 4 & 14 \end{bmatrix}$ **(b)** $\begin{bmatrix} 9 & 4 \\ 8 & 14 \end{bmatrix}$ **(c)** $\begin{bmatrix} 8 & 4 \\ 9 & 14 \end{bmatrix}$ **(d)** None of the previous

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(3) The values of x and y for which the matrix $\begin{bmatrix} x^2 & -1 & x^2 - 3 \\ -1 & 3 & 2y^2 + 5 \\ 1 & 7 & 2x - 5y \end{bmatrix}$ is symmetric are

(a) $x = \pm 1, y = \pm 2$ **(b)** $x = y = 0$ **(c)** $x = \pm 2, y = \pm 1$ **(d)** None of the previous

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(4) For $\begin{bmatrix} 3 & 1 & 0 \\ -2 & -4 & 3 \\ 5 & 4 & -2 \end{bmatrix}$, the cofactor C_{32} equals

(a) -36 **(b)** 9 **(c)** -9 **(d)** None of the previous

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(5) For any $\mathbf{b} = \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}$, the system

$$\begin{aligned} 2x + y &= b_1 \\ 3x + 6y &= b_2 \end{aligned}$$

has

(a) No solution **(b)** a unique solution **(c)** Infinitely many solutions **(d)** None of the previous

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OVER

[III] Let $A = \begin{bmatrix} 1 & 3 & 1 & 1 \\ 2 & 5 & 2 & 2 \\ 1 & 3 & 8 & 9 \\ 1 & 3 & 2 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 & 0 \\ -2 & 3 & 0 \\ 2 & 4 & 1 \end{bmatrix}$. **Find** the following [7 *Points*]

(a) $\det(A)$ using **Row Reduction**;

(b) $(3B)^{-1}$;

(c) The matrix X for which $BX = \begin{bmatrix} 1 & 0 \\ -3 & 3 \\ 3 & 3 \end{bmatrix}$

OVER

[IV] [5 *Points*]

(a) **Solve** the following system

$$\begin{aligned} x + 2y - 3z &= 6 \\ 2x - y + 4z &= 1 \\ x - y + z &= 3 \end{aligned}$$

(b) **Can** the coefficient matrix of the previous system be written as a product of elementary matrices? **Justify** your answer.

Good Luck