2^{st} midterm examination **King Saud university**

First semester, 1431H **Math 244**

Time: 90 Minutes

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Question No.1

Choose the correct answer:

(a) If $A = \begin{pmatrix} 0 & 0 & 1 \\ 1 & 0 & 2 \\ 0 & 1 & 0 \end{pmatrix}$, then $\det(A)$ equals:

$(i)0$ $(ii)1$ $(iii)-1$ $(v)2$

(b) If $u = (-3, 2, 1, 0)$, then the scalars k which satisfy $\|ku\| = 28$ are:

$(i) \pm 1$ $(ii) \pm 2$ $(iii) \pm \sqrt{2}$ (v) None of these

(c) The standard matrix of the reflection principle about XY- plane is

$(i) \begin{pmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ $(ii) \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{pmatrix}$ $(iii) \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & -1 \end{pmatrix}$

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Question No.2

Consider the following system:

$$4x + 2y + 2z = 1,$$

$$3x + 4y = 2,$$

$$2x + y + 2z = 3$$

(a) Write the system in the form $Ax = b$.

(b) Is A invertible ? if so, find its inverse.

(c) Use Cramer's rule to solve for z without solving for x and y.

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Question No.3

(a) If $u = (-3, 2, 1, 0)$ and $v = (4, 7, -3, 2)$, find the following:

$$(i)2u - v \qquad (ii)u.v \qquad (iii)\|u + v\|.$$

(b) Find the standard matrix for the linear transformation $T : \mathbb{R}^3 \to \mathbb{R}^3$ given by

$$T(x_1, x_2, x_3) = (2x_1 - x_2 + x_3, x_2 + x_3, 0),$$

and calculate $T(2, 1, -3)$.

(c) Find the standard matrix of $T_1 \circ T_2$, where $T_1 : \mathbb{R}^2 \to \mathbb{R}^2$ is the reflection about X-axis, and $T_2 : \mathbb{R}^2 \to \mathbb{R}^2$ is the orthogonal projection on the Y-axis.

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Good luck