بسم الله الرّحمن الرّحيم

Kingdom of Saudi Arabia
Ministry of Higher Education
Al-Imam Mohammed Bin
Saud Islamic University

College: Science
Department: Mathematics & Statistics
Course Name: Linear Agebra & ODEs.

المملكة العربية السعودية
وزارة التّعليم العالي
جامعة الإمام محمّد بن
سعود الإسلامية

Duration: 75 Minutes
Course Code: MATH 227
Semester/Year: First / 1434-35

Final Examination

Q 1. [**8 Marks**]
Solve the following system of linear equations using Gauss-Jordan Elimination Method

$$\begin{array}{rcrcrcr} x_1 & - & 2x_2 & - & 6x_3 & = & 7 \\ 2x_1 & - & 6x_2 & - & 16x_3 & = & -46 \\ x_1 & - & 2x_2 & - & x_3 & = & -5 \end{array}$$

Q 2. [**2+2+2+2 Marks**]
Determine whether the following statements are True or False. Justify your answer

(a) **If** P, Q, R **are matrices and Size**$(P) = 3 \times 1,$ **Size**$(Q) = 2 \times 1,$ **Size**$(R) = 1 \times 3$**. Then, Size**$(3PQ + 4RPQ) = 3 \times 2$**.**

(b) **If** A, B **are square matrices of same size. Then** $(A-B)(A+B)-(A^2-B^2) = O$**.**

(c) **If** A **is a square matrix and** c **is a scalar. Then** $(cA)^{-1} = cA^{-1}$**.**

(d) **If** A **is a square matrix and** c **is a scalar. Then** $(cA)^t = \frac{1}{c}A^t$**.**

Q 3. [**8 Marks**]
Show that the following system of linear equations has unique solution. Find this solution by using Cramer's rule

$$\begin{array}{rcrcrcr} x_1 & + & 3x_2 & + & x_3 & = & -2 \\ 2x_1 & + & 5x_2 & + & x_3 & = & -5 \\ x_1 & + & 2x_2 & + & 3x_3 & = & 6 \end{array}$$

Q 4. [**2+3+3 Marks**]

(a) **Determine whether or not the vectors** $\underline{u} = (1, -1, 2, -5, 9)$ **and** $\underline{v} = (4, 7, 4, 1, 0)$ **are orthogonal?**

(b) **Show that the set** $W = \left\{ \begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix} : a, b \in R \right\}$ **of all** 2×2 **diagonal matrices is a subspace of the vector space** M_{22} **of all** 2×2 **matrices of real numbers.**

(c) **Find whether or not the set** $B = \{(0, 0, 1), (2, 3, 1), (4, 1, 2)\}$ **is a basis of the vector space** R^3**?**

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Q 5. **[2+3+3 Marks]**

Solve the following differential equations:

(a) $(x+1)\frac{dy}{dx} - y = 0,\ \ y(0) = 1,$ **Use Separation of variables.**

(b) $4y^{''} + 9y = 15,$ **Non-homogeneous equation.**

(c) $y^{''} + y^{'} - 6y = 2x,$ **Non-homogeneous equation.**

GOOD LUCK