

22I2505 10

National University of Computer and Emerging Sciences, Lahore Campus



Course: Linear Algebra  
Program: BSSE  
Duration: 15 Minutes  
Paper Date: 18-3-24  
Name & Section: Tayyab Kamran  
BS SE 4A  
Exam: Quiz 2

Course Code: MT1005  
Semester: Spring 2024  
Total Marks: 10  
Weight: 3.3%

Page(s):  
Roll No: 22I-2505

Instruction/Notes: No fractional marks will be awarded. Only brief and most suitable / appropriate answers will be accepted.

Q1) Determine whether the indicated set of matrices is a subspace of  $M_{22}$ .

The set  $W$  consisting of all matrices of the form  $\begin{bmatrix} x & 0 \\ 2x & y \end{bmatrix}$ .

We have to prove only property 1 and 6 i.e. closure property under multiplication, closure property under addition

$$\text{let } u_1 = \begin{bmatrix} x_1 & 0 \\ 2x_1 & y_1 \end{bmatrix} \in W \quad v_1 = \begin{bmatrix} x_2 & 0 \\ 2x_2 & y_2 \end{bmatrix} \in W$$

$$u_1 + v_1 = \begin{bmatrix} x_1 + x_2 & 0 \\ 2x_1 + 2x_2 & y_1 + y_2 \end{bmatrix} \in W. \text{ It is closed under addition}$$

$$\text{let } v = \begin{bmatrix} x & 0 \\ 2x & y \end{bmatrix} \in W \quad \text{let } k \text{ be any scalar } kv = \begin{bmatrix} kx & 0 \\ 2kx & ky \end{bmatrix} \in W$$

Q2) Compute the scalar triple product  $u \cdot (v \times w)$ .

$$u = (-2, 0, 6), v = (1, -3, 1), w = (-5, -1, 1)$$

It is closed under multiplication.

As  $u + v \in W$  and  $kv \in W$ , Hence we can say the indicated matrix is a subspace of  $M_{22}$ .

$$\vec{u} \cdot (\vec{v} \times \vec{w}) = \begin{vmatrix} u_1 & u_2 & u_3 \\ v_1 & v_2 & v_3 \\ w_1 & w_2 & w_3 \end{vmatrix}$$

$$\begin{array}{r} 3 \\ -16 \\ \times 6 \\ \hline 96 \end{array}$$

$$\begin{vmatrix} -2 & 0 & 6 \\ 1 & -3 & 1 \\ -5 & -1 & 1 \end{vmatrix}$$

$$= -2(-3+1) - 0 + 6 \begin{vmatrix} 1 & -3 \\ -5 & -1 \end{vmatrix}$$

$$= -2(-2) - 0 + 6(-1-15)$$

$$= 4 + 6(-16)$$

$$= 4 - 96$$

$$\boxed{= -92}$$

$$\boxed{\vec{U} \cdot (\vec{V} \times \vec{W}) = -92}$$