

Weekly Mock - Week 1 and 2
Time: 1 Hour: Full marks: 25
Mathematics for Data Science - 2

1. Match the systems of linear equations in Column A with their number of solutions in column B and their geometric representation in Column C.

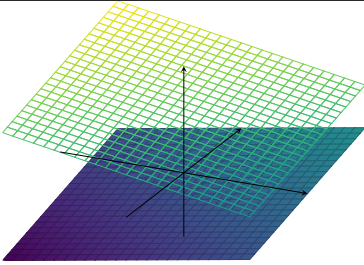
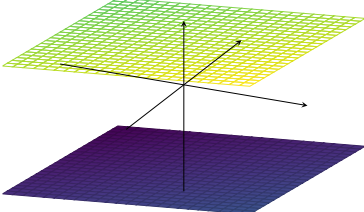
	System of linear equations (Column A)		Number of solutions (Column B)		Geometric representations (Column C)
i)	$x - y - z = 8, -x + y + z = 4$	a)	No solution	1)	
ii)	$x + y - z = 3, x - y + z = 3$	b)	Infinitely many solutions	2)	

Table: M2Q1:1

Choose the correct option from the following:

Marks: 2

- ☐ Option 1: i) \rightarrow b \rightarrow 1, ii) \rightarrow a \rightarrow 2.
 - ☐ Option 2: i) \rightarrow a \rightarrow 1, ii) \rightarrow b \rightarrow 2.
 - ☐ Option 3: i) \rightarrow b \rightarrow 2, ii) \rightarrow a \rightarrow 1.
 - ☒ **Option 4:** i) \rightarrow a \rightarrow 2, ii) \rightarrow b \rightarrow 1.
2. If $A + 3I = 0$, where A is a 2×2 matrix and I is the identity matrix of order 2, then find out the $\det(A)$. [Answer:9]**Marks: 2**
3. If matrix $A = \begin{bmatrix} 3 & -3 \\ -3 & 3 \end{bmatrix}$ and $A^2 = \lambda A$, then find the value of λ . [Answer:6]**Marks: 1**

4. If $\begin{bmatrix} a+4 & 3b \\ 8 & -6 \end{bmatrix} = \begin{bmatrix} 2a+2 & b+2 \\ 8 & a-8b \end{bmatrix}$, then find the value of $a+2b$. [Answer:4] **Marks: 2**

5. Consider a system of linear equations:

$$0x_1 + x_2 + x_3 + 0x_4 = 1$$

$$0x_1 + 0x_2 + x_3 + x_4 = 1$$

Find out the number of independent variable.

[Answer: 2] **Marks: 1**

6. Consider the matrix

$$A = \begin{bmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ -\frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \end{bmatrix}$$

Which of the following options are true?

Marks: 2

☐ **Option 1:** $\det(A) \neq 0$.

☐ **Option 2:** A is invertible.

☐ **Option 3:** The columns of the matrix A are linearly independent.

☐ **Option 4:** $A^{-1} = A^T$.

7. If determinant of the matrix $\begin{bmatrix} 1 & a \\ -1 & b \end{bmatrix}$ is $2k$, where $0 < 2k < 10$ for some integer k and $a+b$ is multiple of 3, then what is the value of k ? [Answer: 3] **Marks: 1**

8. Let A be a matrix given by $\begin{bmatrix} 1 & 0 & 2 \\ -1 & 2 & 1 \\ -1 & 6 & 7 \end{bmatrix}$.

(a) If $R_2 + R_1$ is applied on the matrix A and a new matrix R' is obtained, then what will be the sum of elements of the second row of R' ? [Answer: 5] **Marks: 1**

(b) If $R_3 + R_1$ is applied on the matrix A and a new matrix R' is obtained, then what will be the sum of elements of the second row of R' ? [Answer: 15] **Marks: 1**

(c) If R be the reduced row echelon form of A , then find the number of non-zero rows of R . [Answer: 2] **Marks: 2**

9. Consider the system of linear equations:

$$x + y = 2$$

$$y - z = 3$$

$$x + z = 1$$

Find out the number of solutions of this system of linear equations.

[Answer: 0] **Marks: 1**

10. Consider the matrix $A = \begin{bmatrix} 0 & 0 & -a \\ 1 & 0 & -b \\ 0 & 1 & -c \end{bmatrix}$. Which of the following options are true?

Marks: 2

- ☐ Option 1: If b and c both are zero and a is non-zero, then the matrix A is not invertible.
☐ Option 2: If b is 0 but both a and c are non-zero, then the matrix A is not invertible.
☐ **Option 3:** If a is 0 but both b and c are non-zero, then the matrix A is not invertible.
☐ **Option 4:** If a , b and c all are non-zero, then the matrix is invertible.
11. Shubham bought 2 kg of potatoes and c kg of dal and 1 kg of wheat from a shop, and paid ₹80 to the shopkeeper. Sushmitha bought 4 kg of potatoes and 1 kg of dal and 2 kg of wheat, and paid ₹ d to the shopkeeper. Subhasis bought 2 kg of potatoes, 1 kg of dal and 2 kg of wheat, and paid ₹80 to the shopkeeper. If $x_1 (\neq 0)$ represents the price of 1 kg of potato and $x_2 (\neq 0)$ represents the price of 1 kg of dal, and $x_3 (\neq 0)$ represents the price of 1 kg of wheat, then answer the following questions.

- (a) The matrix representation to find x_1 , x_2 , and x_3 is

Marks: 1

- ☐ Option 1:

$$\begin{bmatrix} 2 & c & 1 \\ 2 & 1 & 2 \\ 4 & 1 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 80 \\ d \\ 80 \end{bmatrix}$$

- ☐ Option 2:

$$\begin{bmatrix} 2 & c & 1 \\ 4 & 1 & 2 \\ 2 & 1 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 80 \\ 80 \\ d \end{bmatrix}$$

- ☐ **Option 3:**

$$\begin{bmatrix} 2 & c & 1 \\ 4 & 1 & 2 \\ 2 & 1 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 80 \\ d \\ 80 \end{bmatrix}$$

- ☐ Option 4:

$$\begin{bmatrix} 4 & 1 & 2 \\ 2 & c & 1 \\ 2 & 1 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 80 \\ d \\ 80 \end{bmatrix}$$

- (b) If we try to find x_1 , x_2 , and x_3 using appropriate matrix representation by taking $c = 0.5$ and $d = 100$, then

Marks: 2

- ☐ Option 1: We will find that the price of 1 kg potato is unique.
☐ **Option 2:** We will fail to find the price (as a numerical value) of 1 kg potato.

- ☐ Option 3: We will find that the price of 1 kg potato is ₹20.
☐ Option 4: We will find infinitely many values as the price of 1 kg potato.
- (c) If we try to find x_1 , x_2 , and x_3 using appropriate matrix representation by taking $c = 2$ and $d \neq 160$, then which of the following options is always true? **Marks: 2**
- ☐ Option 1: $x_1 = x_3$
☐ Option 2: $x_1 = x_2$
☒ **Option 3:** $x_2 = x_3$
☐ Option 4: $x_1 = x_2 = x_3$
- (d) If we try to find x_1 , x_2 , and x_3 using appropriate matrix representation by taking $c = 3$ and $d = 100$, then which of the following options is always true? **Marks: 2**
- ☐ Option 1: $x_1 = 12$, $x_2 = 20$ and $x_3 = 10$
☐ Option 2: $x_1 = x_2 = 24$ and $x_3 = 10$
☒ **Option 3:** $x_1 = 10$, $x_2 = 12$ and $x_3 = 24$
☐ Option 4: $x_1 = x_2 = x_3 = 10$