

Subject (Mathematics 041)
PT1 Examination
April-May, 2025



Name:		Max Marks: 40
Date:	02-05-2025	Grade: 12 Duration: 90 min

General Instructions

1. Please check that this question paper contains 4 printed pages.
2. This Question paper contains 19 questions. All questions are compulsory.
3. This Question paper is divided into 5 Sections - A, B, C, D, and E.
4. In Section A, Questions 1 - 10 are multiple choice questions (MCQs), and Question 10 is an Assertion-Reason based question of 1 mark each.
5. In Section B, Questions 11 - 13 are Very Short Answer (VSA)-type questions, carrying 2 marks each.
6. In Section C, Questions 14 - 15 are Short Answer (SA)-type questions, carrying 3 marks each.
7. In Section D, Questions 16 - 17 are Long-answer type questions carrying 5 marks each.
8. In Section E, Questions 18 - 19 are Case study-based questions, carrying 4 marks each.
9. There is no overall choice. However, an internal choice has been provided in some sections for some questions.
10. Use of calculators is not allowed.
11. Please write down the serial number of the question in the answer book before attempting it.

Section A

Questions 1 to 10 carry 1 mark each

1.	If $A = \begin{bmatrix} 7 & 0 & x \\ 0 & 7 & 0 \\ 0 & 0 & y \end{bmatrix}$ is a scalar matrix, then y^x is equal to	1
	(a) 0 (b) 7 (c) 1 (d) ± 7	
2.	If a square matrix of order 3 such that $\det(A) = 9$, then $\det(9A^{-1})$ is equal to	1
	(a) 9 (b) 9^2 (c) 9^3 (d) 9^4	
3.	Let A be a matrix of order $m \times n$ and B is a matrix such that $A^T B$ and BA^T are defined. Then, the order of B is:	1
	(a) $m \times m$ (b) $n \times n$ (c) $m \times n$ (d) $n \times m$	

4.	If A is a square matrix and $A^2 = A$, then $(I + A)^2 - 3A$ is equal to a) I (b) A (c) $2A$ (d) $3I$	1
5.	If $A = \begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix}$, $B = \begin{bmatrix} x & 0 \\ 1 & 1 \end{bmatrix}$ and $A = B^2$, then x equal to a) ± 1 (b) -1 (c) 1 (d) 2	1
6.	If $\begin{bmatrix} 2a+b & a-2b \\ 5c-d & 4c+3d \end{bmatrix} = \begin{bmatrix} 4 & -3 \\ 11 & 24 \end{bmatrix}$ then the value of $a+b-c+2d$ is a) 8 (b) 10 (c) 4 (d) -8	1 $5c-d=11$ $-d=11-5c$
7.	Given that matrices A and B are of order $3 \times n$ and $m \times 5$ respectively, then the order of the matrix $C = 5A + 3B$ is a) 3×5 and $m = n$ (b) 3×5 (c) 3×3 (d) 5×5	1 $d=5c+11$ $-15c+33+4c=24$ $-11c=-9$ $c=\frac{9}{11}$
8.	If $\begin{vmatrix} \alpha & 3 & 4 \\ 1 & 2 & 1 \\ 1 & 4 & 1 \end{vmatrix} = 0$, then the value of α is a) 1 (b) 2 (c) 3 (d) 4	1 $4c+3d=24$ $c=\frac{24-4d}{3}$
9.	If $A = \begin{bmatrix} 200 & 50 \\ 10 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 50 & 40 \\ 2 & 3 \end{bmatrix}$ then $ AB $ is equal to a) 460 (b) 2000 (c) 3000 (d) -7000	1 $-11c+33=24$ $c=1$
10.	Assertion-Reason Based Question Two statements are given, one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer from the options (A), (B), (C) and (D) as given below. (A) Both Assertion (A) and Reason (R) are true, and the Reason (R) is the correct explanation of the Assertion (A). (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A). (C) Assertion (A) is true, but Reason (R) is false. (D) Assertion (A) is false, but Reason (R) is true. Assertion (A): Scalar matrix $A = [a_{ij}] = (k \text{ if } i = j) \text{ or } (0 \text{ if } i \neq j)$, where k is a scalar, is an identity matrix when $k = 1$. Reason (R): Every identity matrix is not a scalar matrix.	1 $d=-6$ $a-2b=3$ $a=3+2b$ $3+4b+2b=4$ $6b=-1$ $b=-\frac{1}{6}$ $a=3-\frac{1}{3}$ $a=\frac{8}{3}$ $c=$

$$\begin{aligned}
 8a + 4b &= 16 \\
 2a - 4b &= -6 \\
 \hline
 6a &= 10 \\
 a &= \frac{10}{6} = \frac{5}{3} \\
 3a - b &= 3
 \end{aligned}$$

$$\begin{aligned}
 5c - d &= 11 \\
 5c &= 11 - d \\
 c &= \frac{11-d}{5}
 \end{aligned}$$

Section B
Questions 11 to 13 carry 2 marks each.

11.	Find x , if $\begin{bmatrix} x & -5 & -1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix} \begin{bmatrix} x \\ 4 \\ 1 \end{bmatrix} = 0$ ✓	2
12.	Find the equation of the line joining (3,1) and (9,3) using determinants.	2
OR		
	If the area of triangle is 35 units ² with the vertices (2,-6), (5,4) and (k,4), then find the value of k . ✓	
13.	If $A = \begin{bmatrix} p & 2 \\ 2 & p \end{bmatrix}$ and $ A^3 = 125$, then find the value of p . ✓	2

Section C
Questions 14 to 15 carry 3 marks each.

14.	If $A = \begin{bmatrix} 0 & -\tan(\frac{\alpha}{2}) \\ \tan(\frac{\alpha}{2}) & 0 \end{bmatrix}$ and I is the identity matrix of order 2, then show that $I + A = (I - A) \begin{bmatrix} \cos \alpha & -\sin \alpha \\ \sin \alpha & \cos \alpha \end{bmatrix}$. ✓	3
OR		
	Express the matrix $B = \begin{bmatrix} 2 & -2 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{bmatrix}$ as the sum of a symmetric and a skew symmetric matrix.	
15.	If $A = \begin{bmatrix} 2 & 3 \\ 1 & -4 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -2 \\ -1 & 3 \end{bmatrix}$, verify that $(AB)^{-1} = B^{-1}A^{-1}$. ✓	3

Section D
Questions 16 to 17 carry 5 marks each

16.	If $A = \begin{bmatrix} 1 & 0 & -2 \\ -2 & -1 & 2 \\ 3 & 4 & 1 \end{bmatrix}$, then show that $A^3 - A^2 - 3A - I = 0$. Also find A^{-1} using this equation. ✓	5
17.	If $A = \begin{bmatrix} 1 & -2 & 0 \\ 2 & -1 & -1 \\ 0 & -2 & 1 \end{bmatrix}$, then find A^{-1} and use it to solve the following system of linear equations: $x - 2y = 10$ $2x - y - z = 8$ $-2y + z = 7$ ✓	5

$$\begin{aligned}
 50 - 10k &= 70 \\
 -10k &= 20 \\
 \frac{1}{2}(30 - 6k + 20 - 4k) &= 35 & \frac{1}{2}(2(4-4) + \frac{3}{4} \frac{2}{1} \frac{1}{1} \quad \begin{matrix} 3 & -4 & -3 \\ & -1 & 2 \end{matrix} \\
 \frac{1}{2}(30 - 10k + 20) &= 35 & \frac{1}{2}(2(4-4) + (5-k) + 1(20-4k)) = 35
 \end{aligned}$$

	OR	
	Find the product of matrices AB, $A = \begin{bmatrix} 1 & 3 & -2 \\ -3 & 0 & -1 \\ 2 & 1 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 1 & -2 & -3 \\ -2 & 4 & 7 \\ -3 & 5 & 9 \end{bmatrix}$ and use the result to solve the following system of linear equations: $x - 2y - 3z = 1$ $-2x + 4y + 5z = -1$ $-3x + 7y + 9z = -4$	

Section E

Questions 18 to 19 carry 4 marks each

18.	Gautam buys 5 pens, 3 bags and 1 instrument box and pays a sum of Rs 160. From the same shop. Vikram buys 2 pens, 1 bag and 3 instrument boxes and pays a sum of Rs 190. Also, Ankur buys 1 pen, 2 bags and 4 instrument boxes and pays a sum of Rs 250. (i) Convert the situation given above into a matrix equation of the form $AX = B$. (ii) Find A. (iii) Find A^{-1}. Or (iii) Determine $P = A^2 - 5A$.	1 1 2																
19.	A manufacture produces three stationery products Pencil, Eraser and Sharpener which he sells in two markets. Annual sales are indicated below: <table border="1" style="margin: 10px auto; width: 60%;"><thead><tr><th>Market</th><th colspan="3">Products (in numbers)</th></tr><tr><th></th><th>Pencil</th><th>Eraser</th><th>Sharpener</th></tr></thead><tbody><tr><td>A</td><td>10,000</td><td>2000</td><td>18,000</td></tr><tr><td>B</td><td>600</td><td>20,000</td><td>8,00</td></tr></tbody></table> If the unit Sale price of Pencil, Eraser and Sharpener are Rs. 2.50, Rs. 1.50 and Rs. 1.00 respectively, and unit cost of the above three commodities are Rs. 2.00, Rs. 1.00 and Rs. 0.50 respectively, then, based on the above information answer the following: (a) Find the total Revenue of both the markets. (b) Find the total Profit for both the markets.	Market	Products (in numbers)				Pencil	Eraser	Sharpener	A	10,000	2000	18,000	B	600	20,000	8,00	2 2
Market	Products (in numbers)																	
	Pencil	Eraser	Sharpener															
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