



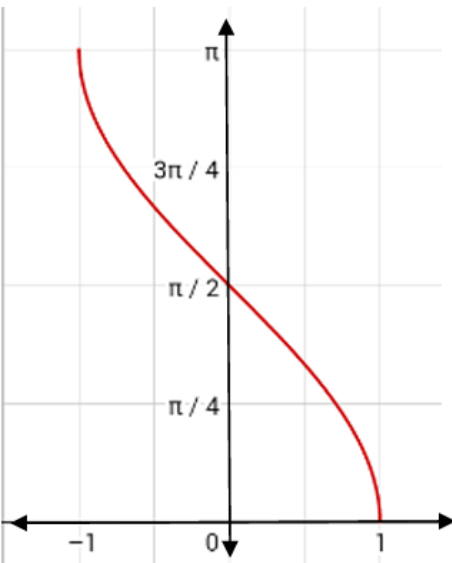
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INDIAN SCHOOL SALALAH**FIRST TERM EXAMINATION – SEPTEMBER 2025****Class: XII****MATHEMATICS (041)****Date: 22/09/2025****Time: 3 hours****Maximum Marks: 80****General Instructions:**

- This Question paper contains 38 questions. All questions are compulsory.
- This Question paper is divided into five Sections - A, B, C, D and E.
- In Section A, Questions no. 1 to 18 are multiple choice questions (MCQs) with only one correct option and Questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.
- In Section B, Questions no. 21 to 25 are Very Short Answer (VSA)-type questions, carrying 2 marks each.
- In Section C, Questions no. 26 to 31 are Short Answer (SA)-type questions, carrying 3 marks each.
- In Section D, Questions no. 32 to 35 are Long Answer (LA)-type questions, carrying 5 marks each.
- In Section E, Questions no. 36 to 38 are Case study-based questions, carrying 4 marks each.
- There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 3 questions in Section C, 2 questions in Section D and one subpart each in 2 questions of Section E.
- Use of calculator is not allowed.

NO	SECTION A	MARKS
1	A relation R in set $A = \{1, 2, 3\}$ is defined as $R = \{(1, 1), (1, 2), (2, 2), (3, 3)\}$. Which of the following ordered pair in R shall be removed to make it an equivalence relation in A? (A) (1, 1) (B) (1, 2) (C) (2, 2) (D) (3, 3)	1
2	The function $f: R \rightarrow R$ defined as $f(x) = x^3$ is: (A) One-one but not onto (B) Not one-one but onto (C) Neither one-one nor onto (D) One-one and onto	1
3	If R is the relation defined in the set $\{1, 2, 3, 4, 5, 6\}$ as $R = \{(a, b): b = a + 1\}$ then R is (A) reflexive (B) symmetric (C) transitive (D) None of these	1

4	$\sin \left[\frac{\pi}{3} - \sin^{-1} \left(\frac{-1}{2} \right) \right]$ is equal to: (A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) 1 (D) -1	1
5	The graph drawn below depicts  (A) $y = \sin^{-1}x$ (B) $y = \cos^{-1}x$ (C) $y = \operatorname{cosec}^{-1}x$ (D) $y = \cot^{-1}x$	1
6	If $A = [a_{ij}]$ is an identity matrix, then which of the following is true? (A) $a_{ij} = \begin{cases} 0, & \text{if } i = j \\ 1, & \text{if } i \neq j \end{cases}$ (B) $a_{ij} = 1, \forall i, j$ (C) $a_{ij} = 0, \forall i, j$ (D) $a_{ij} = \begin{cases} 0, & \text{if } i \neq j \\ 1, & \text{if } i = j \end{cases}$	1
7	The matrix $A = \begin{bmatrix} 0 & 0 & 5 \\ 0 & 5 & 0 \\ 5 & 0 & 0 \end{bmatrix}$ (A) scalar matrix (B) diagonal matrix (C) unit matrix (D) square matrix	1
8	If $A = \begin{bmatrix} 1 & 12 & 4y \\ 6x & 5 & 2x \\ 8x & 4 & 6 \end{bmatrix}$ is a symmetric matrix, then $(2x + y)$ is (A) -8 (B) 8 (C) 6 (D) 0	1
9	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 (B) 5×3 (C) 3×3 (D) 5×5	1

10	If $A. (\text{adj } A) = \begin{bmatrix} 3 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 3 \end{bmatrix}$, then the value of $A + \text{adj } A$ is equal to: (A) 12 (B) 9 (C) 3 (D) 27	1
11	If $\begin{vmatrix} 2x & 5 \\ 8 & x \end{vmatrix} = \begin{vmatrix} 6 & -2 \\ 7 & 3 \end{vmatrix}$, then the value of x is: (A) 3 (B) ± 3 (C) ± 6 (D) 6	1
12	The value of k for which the function $f(x) = \begin{cases} x^2, & x \geq 0 \\ kx, & x < 0 \end{cases}$ is differentiable at $x = 0$ is (A) 1 (B) 2 (C) Any real number (D) 0	1
13	The radius of the circle is increasing at the rate of 0.7 cm/sec. What is the rate of increase of its circumference? (A) 0.7 cm/sec (B) π cm/sec (C) 1.4π cm/sec (D) 2π cm/sec	1
14	The values of λ so that $f(x) = \sin x - \cos x - \lambda x + C$ decreases for all real values x are: (A) $1 < \lambda < \sqrt{2}$ (B) $\lambda \geq 1$ (C) $\lambda \geq \sqrt{2}$ (D) $\lambda < 1$	1
15	Two positive numbers whose sum is 16 and the sum of whose cubes is minimum are (A) 8 & 8 (B) 6 & 10 (C) 4 & 12 (D) 2 & 14	1
16	$\int \frac{1+\tan x}{1-\tan x} dx$ is equal to: (A) $\sec^2\left(\frac{\pi}{4} + x\right) + C$ (B) $\sec^2\left(\frac{\pi}{4} - x\right) + C$ (C) $\log\left \sec\left(\frac{\pi}{4} + x\right)\right + C$ (D) $\log\left \sec\left(\frac{\pi}{4} - x\right)\right + C$	1
17	$\int e^x \sec x (1 + \tan x) dx$ equals (A) $e^x \cos x + C$ (B) $e^x \sec x + C$ (C) $e^x \tan x + C$ (D) $e^x \operatorname{cosec} x + C$	1
18	$\int \frac{dx}{x^3(1+x^4)^{\frac{1}{2}}}$ equals (A) $\frac{-1}{2x^2} \sqrt{1+x^4} + c$ (B) $\frac{1}{2x} \sqrt{1+x^4} + c$ (C) $\frac{-1}{4x} \sqrt{1+x^4} + c$ (D) $\frac{1}{4x^2} \sqrt{1+x^4} + c$	1

	Question number 19 and 20 are Assertion and Reason based question. Two statements are given, one labelled Assertion (A) and the other labelled Reason (R). Select the correct answers from the codes A, B C and D as given below. (A) Both A and R are true and R is the correct explanation of A. (B) Both A and R are true but R is not the correct explanation of A. (C) A is true and R is false. (D) A is false and R is true.	
19	Assertion(A): Range of $f(x) = \sin^{-1}x + 2\cos^{-1}x$ is $[0, \pi]$ Reasoning(R): Principal value branch of $\sin^{-1}x$ has range $\left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$.	1
20	Assertion(A): The function $f(x) = (x + 2)e^{-x}$ is strictly increasing on $(-1, \infty)$. Reasoning(R): A function $f(x)$ is strictly increasing if $f'(x) > 0$.	1
	SECTION B	
21	Find the domain of the function $y = \cos^{-1}(x - 1)$. OR Find the value of $\tan^{-1}(\sqrt{3}) - \sec^{-1}(-2)$.	2
22	If $A = \begin{bmatrix} 1 & 0 \\ -1 & 5 \end{bmatrix}$, then find the value of K if $A^2 = 6A + KI_2$ where I_2 is an identity matrix.	2
23	If $P = \begin{bmatrix} 1 & k & 3 \\ 1 & 3 & 3 \\ 2 & 4 & 4 \end{bmatrix}$ is the adjoint of a 3×3 matrix A and $A = 4$, then find the value of k.	2
24	Find the value of k for which the function f given as $f(x) = \begin{cases} \frac{1-\cos x}{2x^2} & , \text{ if } x \neq 0 \\ k & , \text{ if } x = 0 \end{cases}$ is continuous at $x = 0$. OR Show that the function $f(x) = x ^3$ is differentiable at all points of its domain.	2
25	Evaluate : $\int \sqrt{1 - \sin 2x} \, dx, \frac{\pi}{4} < x < \frac{\pi}{2}$.	2

	SECTION C	
26	Let $\mathbb{N}$ be the set of natural numbers and R be the relation on $\mathbb{N} \times \mathbb{N}$ defined by $(a, b) R (c, d)$ iff $ad = bc$ for all $a, b, c, d \in \mathbb{N}$. Show that R is an equivalence relation. OR Show that the function $f: \mathbb{N} \rightarrow \mathbb{N}$ defined by $f(x) = x^2 + x + 1$ is one-one but not onto.	3
27	Find the simplest form of $\tan^{-1} \left(\frac{\sqrt{1+\cos x} + \sqrt{1-\cos x}}{\sqrt{1+\cos x} - \sqrt{1-\cos x}} \right), \pi < x < \frac{3\pi}{2}$.	3
28	Using determinants, find the area of triangle PQR with vertices P(3, 1), Q(9, 3) and R(5, 7). Also, find the equation of line PQ using determinants. OR If $A = \begin{bmatrix} 1 & \tan x \\ -\tan x & 1 \end{bmatrix}$, show that $A^T A^{-1} = \begin{bmatrix} \cos 2x & -\sin 2x \\ \sin 2x & \cos 2x \end{bmatrix}$.	3
29	If $(\cos y)^x = (\sin x)^y$, then find $\frac{dy}{dx}$.	3
30	Find the intervals in which the function $f(x) = 3x^4 - 4x^3 - 12x^2 + 5$ is (a) strictly increasing (b) strictly decreasing	3
31	Evaluate $\int x \tan^{-1} x \, dx$ OR Evaluate $\int \frac{x^2 + x + 1}{(x + 2)(x^2 + 1)} \, dx$	3
	SECTION D	
32	If $A = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 3 \\ 1 & -2 & 1 \end{bmatrix}$, then find A^{-1} and hence solve the system of system of linear equations: $x + y + z = 6, y + 3z = 7$ and $x - 2y + z = 0$. OR A boy visits a restaurant with his friends and orders 1 pizza, 2 burgers and 2 packs of fries which cost ₹520. On another day, he orders 2 pizzas, 1 burger and 2 packs of fries for ₹780. Additionally, the cost of a meal that includes a pizza, a burger, and a pack of fries is ₹410. Using the matrix method, find the cost of one pizza, one burger and one pack of fries.	5
33	(a) If $y = \cos(m \cos^{-1} x)$ then show that $(1 - x^2) \frac{d^2 y}{dx^2} - x \frac{dy}{dx} + m^2 y = 0$. (b) If $x = 3 \sin t - \sin 3t, y = 3 \cos t - \cos 3t$, find $\frac{dy}{dx}$ at $t = \frac{\pi}{3}$.	5

34	Show that the volume of the largest cone that can be inscribed in a sphere of radius R is $\frac{8}{27}$ of the volume of the sphere. OR The perimeter of a rectangular metallic sheet is 300 cm. It is rolled along one of its sides to form a cylinder. Find the dimensions of the rectangular sheet so that volume of cylinder so formed is maximum.	5
35	Evaluate $\int \frac{5x + 3}{\sqrt{x^2 + 4x + 10}} dx$	5
	SECTION E	
36	Case Study.1 A school conducted a Mathematics quiz competition under two categories – Category A (Junior) and Category B (Senior). In total, there were 200 participants. Finally, three students from Category A and two students from Category B were selected for the final round.  Priya forms two sets A and B with these participants for her mathematics project: $A = \{a_1, a_2, a_3\}$, $B = \{b_1, b_2\}$ where A represents the set of Category A students selected and B represents the set of Category B students selected. a) Priya wishes to form all possible relations from A to B. How many such relations are possible? b) Write the smallest equivalence relation on B. c) Priya defines a relation from A to A as: $R_1 = \{(a_1, a_2), (a_2, a_1)\}$. Write the minimum ordered pairs to be added in R_1 so that it becomes: (i) Reflexive but not symmetric (ii) Reflexive and symmetric but not transitive OR c) Show that the function $f: \mathbb{N} \rightarrow \mathbb{N}$, given by $f(x) = 2x$, is one-one but not onto.	1 1 2

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Case Study.2

A trust fund has ₹35000 that must be invested in two different types of bonds, say X and Y. The first bond pays 10% interest p.a. which will be given to an old age home and second one pays 8% interest p.a. which will be given to WWA (Women Welfare Association)

Let A be a 1×2 matrix and B be a 2×1 matrix, representing the investment and interest rate on each bond respectively.



Based on the above information, answer the following questions:

- Write the matrix which represent the total amount of interest received on both bonds.
- What is the total amount of interest received on both the bonds if ₹15,000 is invested in bond X?
- What amount should be invested in bond X and Y to get an annual total interest of ₹3200?

OR

- c) Calculate the amount of investment in bond Y if the amount of interest given to old age home is ₹500.

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Case Study.3

A factory manufactures boxes and almirah from metal sheets. A rectangular sheet of tin 45 cm by 24 cm is to be made into a box without top by cutting off squares of side length x cm from each corner and folding up the flaps.



Based on the given information, answer the following questions:

- What will be the maximum volume of the box?
- What is the outer surface area of the box of maximum volume?