

HIGHER SECONDARY FIRST TERMINAL EXAMINATION - 2025

Max. Score : 60

PART – III

Time : 2 Hrs

Second Year

MATHEMATICS (SC 60)

Cool-off Time : 15 Mts

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Answer any 6 questions from 1 to 8. Each carries 3 scores.

1. Let $A = \{a, b, c, d\}$ and $R = \{(a, a), (b, b), (c, c), (c, d)\}$ be a relation on A

(i) The relation R is

(A) Reflexive and Symmetric

(B) Symmetric and Transitive

(C) Reflexive and Transitive

(D) Transitive only

[1]

(ii) Make the relation R equivalence by adding exactly two elements

[1]

(iii) Find the number of elements in the largest equivalence relation on A

[1]

2. Find the value of $\cot^{-1}(-1) + \operatorname{cosec}^{-1}(-\sqrt{2}) + \sec^{-1}(2)$

[3]

3. (i) The number of all possible 2×2 matrices with entries 0 or 1 is

(A) 8

(B) 9

(C) 16

(D) 25

[1]

(ii) Find the value of x and y if $2 \begin{bmatrix} 1 & 3 \\ 0 & x \end{bmatrix} + \begin{bmatrix} y & 0 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} 5 & 6 \\ 1 & 8 \end{bmatrix}$

[2]

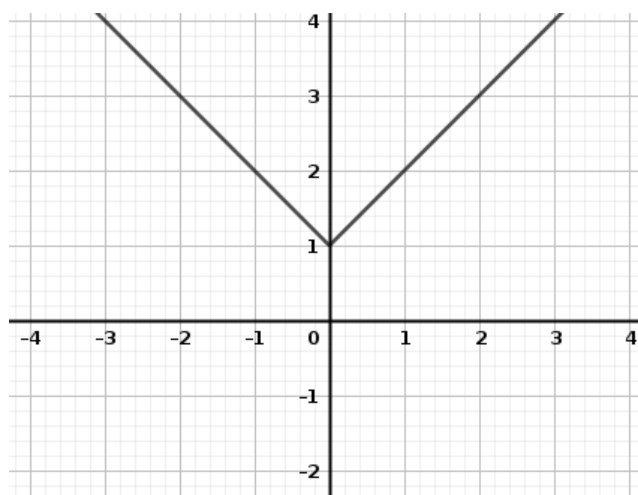
4. (i) If $\begin{vmatrix} x & 3 \\ 5 & 2 \end{vmatrix} = 5$, then $x = \dots\dots\dots$

[1]

(ii) If the area of a triangle with vertices $(k, 0)$, $(4, 0)$, $(0, 2)$ is 4 square units, find k

5. (i) Identify the following function

[2]



(A) $|x|$

(B) $|x| + 1$

(C) $|x - 1|$

(D) $|x + 1|$

[1]

(ii) Discuss the continuity of the function

[1]

(iii) Examine the differentiability of the function

[1]

(1)

P.T.O

6. (i) Identify the function which is one – one but not onto among the following

(A) $f : \mathbb{R} \rightarrow \mathbb{R}, f(x) = 3 - 4x$

(B) $f : \mathbb{R} \rightarrow \mathbb{R}, f(x) = x^2$

(C) $f : \mathbb{Z} \rightarrow \mathbb{Z}, f(x) = (x - 2)^2$

(D) $f : \mathbb{N} \rightarrow \mathbb{N}, f(x) = x^3$ [1]

(ii) Let $f : \mathbb{R} \rightarrow \mathbb{R}$ and $g : \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = \cos x$ and $g(x) = 3x^2$

Show that $f \circ g \neq g \circ f$ [2]

7. Write the simplest form of $\tan^{-1} \left(\frac{\sqrt{1+x^2}-1}{x} \right), x \neq 0$ [3]

8. Find $\frac{dy}{dx}$ (i) $y = \sqrt{\tan x}$ [1]

(ii) $x^2 + xy + y^2 = 100$ [2]

Answer any 6 questions from 9 to 16. Each carries 4 scores.

9. (i) Let $R = \{(a, b) : |a - b| \text{ is even}\}$ be a relation on $A = \{1, 2, 3, 4, 5\}$

Show that R is an equivalence relation [3]

(ii) Write the set of all elements related to 5 in A under the relation R [1]

10. Match the following : [1 x 4 = 4]

Functions

Principal Value Branch

(a) $\cos^{-1} x$

(i) $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

(b) $\sec^{-1} x$

(ii) $(0, \pi)$

(c) $\tan^{-1} x$

(iii) $[0, \pi]$

(d) $\cot^{-1} x$

(iv) $[0, \pi] - \left\{\frac{\pi}{2}\right\}$

(v) $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right] - \{0\}$

11. If $A = \begin{bmatrix} -2 \\ 4 \\ 5 \end{bmatrix}$ and $B = [1 \ 3 \ 6]$

(i) What is the order of AB [1]

(ii) Verify that $(AB)' = B'.A'$ [3]

12.(i) Given that $\begin{bmatrix} 2+x & 3 & 4 \\ 1 & -1 & 2 \\ x & 1 & 5 \end{bmatrix}$ is a singular matrix. Find the value of x [2]

(ii) If $A = \begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix}$, prove that $A(\text{Adj } A) = |A|I$ [2]

13.(i) If $A = \begin{bmatrix} 0 & 2b & -2 \\ 3 & 1 & 3 \\ 3a & 3 & -1 \end{bmatrix}$ is a symmetric matrix, find the values of a and b [1]

(ii) If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$, show that $A^2 - 5A + 7I = 0$ [3]

14.(i) If $y = \sin^{-1} x$, show that $(1 - x^2) \frac{d^2 y}{dx^2} = x \frac{dy}{dx}$ [2]

(ii) Find $\frac{dy}{dx}$, where $y = \cos^{-1} \left(\frac{1-x^2}{1+x^2} \right)$, $0 < x < 1$ [2]

15.(i) $\sin^{-1} \left(\sin \frac{2\pi}{3} \right) = \dots\dots\dots$ [1]

(ii) Prove that $\sin^{-1} \frac{8}{17} + \sin^{-1} \frac{3}{5} = \tan^{-1} \frac{77}{36}$ [3]

16. (i) Show that the function $f(x) = \cos(x^2)$ is a continuous function [2]

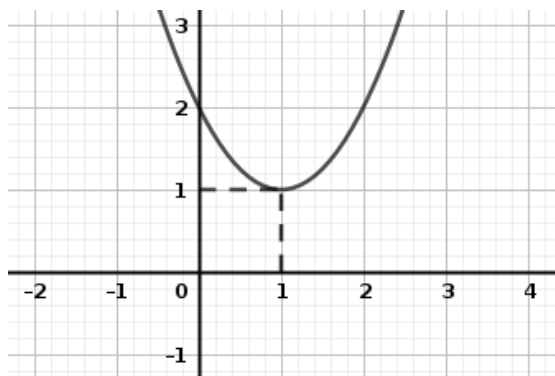
(ii) Find the value of k so that the function $f(x) = \begin{cases} kx + 1, & \text{if } x \leq 5 \\ 3x - 5, & \text{if } x > 5 \end{cases}$ is continuous at $x = 5$ [2]

Answer any 3 questions from 17 to 20. Each carries 6 scores.

17.(i) Number of onto functions that can be defined from $\{1, 2, 3\}$ to $\{4, 5, 6, 7\}$ is

(A) 0 (B) 3 (C) 81 (D) 64 [1]

(ii) Consider the graph of function $f : \mathbb{R} \rightarrow \mathbb{R}$ by $f(x) = (x - 1)^2 + 1$



Make $f(x)$ bijective by redefining its domain and co domain [2]

(iii) Show that the function $f : \mathbb{R} - \{3\} \rightarrow \mathbb{R} - \{1\}$ defined by $f(x) = \frac{x-2}{x-3}$ is both one - one and onto. [3]

18.(i) Construct a 3 X 3 matrix A whose $(i, j)^{th}$ element $a_{ij} = 2i - j$ [2]

(ii) Express A as the sum of a symmetric and skew symmetric matrices [4]

19. Solve the following system of linear equations using matrix method

$x - y + z = 4$; $2x + y - 3z = 0$; $x + y + z = 2$ [6]

20.(i) $\frac{d}{dx}(a^x) = \dots\dots\dots$ [1]

(ii) Find $\frac{dy}{dx}$ of the following

(a) $x = a \cos \theta$, $y = a(\theta + \sin \theta)$ [2]

(b) $y = x^x + x^{\sin x}$ [3]

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