HIGHER SECONDARY FIRST TERMINAL EXAMINATION - 2025

Max. Score : 60

PART – III Time : 2 Hrs

Second Year MATHEMATICS (SC 60) Cool-off Time : 15 Mts

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 x 2 matrices with entries 0 or 1 is

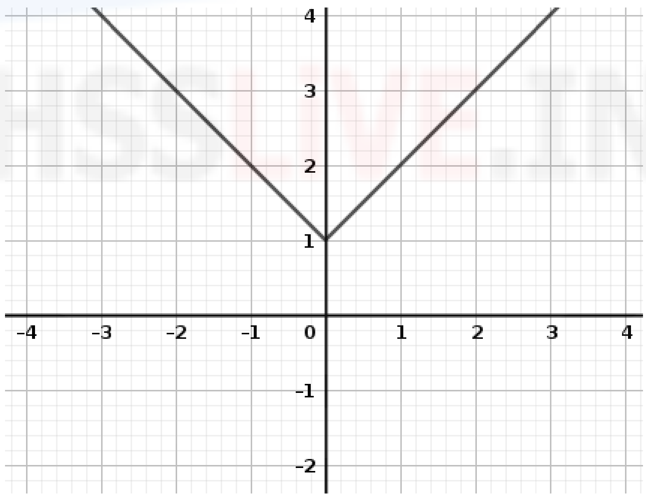
(A) 8 (B) 9 (C) 16 (D) 25 **[1]**

(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 = ... **[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]**

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

(A) $f : \mathbb{R} \to \mathbb{R}$, $f(x) = 3 - 4x$ (B) $f : \mathbb{R} \to \mathbb{R}$, $f(x) = x^2$

(C) $f : \mathbb{Z} \to \mathbb{Z}$, $f(x) = (x-2)^2$ (D) $f : \mathbb{N} \to \mathbb{N}$, $f(x) = x^3$ **[1]**

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

Show that fog $\neq$ gof **[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 $B = \begin{bmatrix} 1 & 3 & 6 \end{bmatrix}$

(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(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 $(1-x^2)\frac{d^2y}{dx^2} = x\frac{dy}{dx}$ **[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) $\sin^{-1}\left(\sin\frac{2\pi}{3}\right) =$ ……………………….. **[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]**

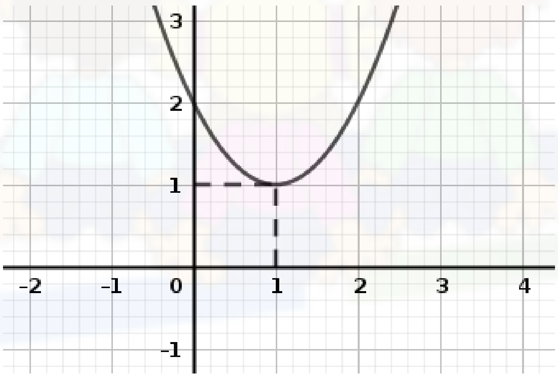
(ii) Find the value of k so that the function $f(x) = \begin{cases} kx+1, if\ x \le 5 \\ 3x-5, if\ x > 5 \end{cases}$ is continuous at x = 5 **[2]**

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 $f : \mathbb{R} \to \mathbb{R}$ by $f(x) = (x-1)^2 + 1$



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

(iii) Show that the function $f : \mathbb{R} - \{3\} \to \mathbb{R} - \{1\}$ 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) $\frac{d}{dx}(a^x) =$ ………………… **[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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