Name _____ **Section**_____ **Roll No.**_____

CRPF PUBLIC SCHOOL, ROHINI, DELHI
PRE-BOARD - 1 EXAMINATION (2025-26)
CLASS XII
MATHEMATICS (SET-A)

Time Allowed: 3 hours **Maximum Marks: 80**

General Instructions:

1. This Question paper contains - **five sections** A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.

2. Section A has **18 MCQ's and 02 Assertion Reasoning based questions** of 1 mark each.

3. Section B has **5 Very Short Answer (VSA)-type questions** of 2 marks each.

4. Section C has **6 Short Answer (SA)-type questions** of 3 marks each.

5. Section D has **4 Long Answer (LA)-type questions** of 5 marks each.

6. Section E has **3 source based/case based/passage based/integrated units of assessment** (4 marks each) with sub parts.

SECTION – A (MCQ) 1 Mark Questions	
Q1	If $y = \sin^{-1}x, -1 \le x \le 0$, then the range of y is (A) $\left(\frac{-\pi}{2}, 0\right)$ (B) $\left[\frac{-\pi}{2}, 0\right]$ (C) $\left[\frac{-\pi}{2}, 0\right)$ (D) $\left(\frac{-\pi}{2}, 0\right]$
Q2	If $\begin{bmatrix} x & 2 & 0 \end{bmatrix} \begin{bmatrix} 5 \\ -1 \\ x \end{bmatrix} = \begin{bmatrix} 3 & 1 \end{bmatrix} \begin{bmatrix} -2 \\ x \end{bmatrix}$, then value of x is : (A) –1 (B) 0 (C) 1 (D) 2
Q3	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) 0 (C) 6 (D) 8
Q4	If $A = \begin{bmatrix} x & 3 \\ 3 & x \end{bmatrix}$ and $\lvert A^3 \rvert = 343$, then x is (A) ± 7 (B) ± 4 (C) ± 3 (D) ± 5

Q5

If $\begin{vmatrix} x+1 & x-1 \\ x-3 & x+2 \end{vmatrix} = \begin{vmatrix} 5 & 5 \\ 3 & 7 \end{vmatrix}$, then the value of x is :

(A) 4 (B) 3

(C) 6 (D) 2

Q6

If A is a square matrix of order 3 such that A(adj A) = 7 I, then $|\text{adj } A|$ is equal to :

(A) 1 (B) 343

(C) 7 (D) 49

Q7

$\frac{d}{dx}[\cos(\log x + e^x)]$ at x = 1 is :

(A) $-\sin e$ (B) $\sin e$

(C) $-(1+e)\sin e$ (D) $(1+e)\sin e$

Q8

$f(x) = x^x$ has a critical point at :

(A) $x = e$ (B) $x = e^{-1}$

(C) $x = 0$ (D) $x = 1$

Q9

$\int \frac{\cos 2x - \cos 2\alpha}{\cos x - \cos \alpha} dx$ is equal to :

(A) $2(\sin x + x\cos\alpha) + C$ (B) $2(\sin x - x\cos\alpha) + C$

(C) $2(\sin x + 2x\cos\alpha) + C$ (D) $2(\sin x + \sin\alpha) + C$

Q10

$\int \frac{e^x}{\sqrt{4 - e^{2x}}} dx$ is equal to :

(A) $\frac{1}{2}\cos^{-1}(e^x) + C$ (B) $\frac{1}{2}\sin^{-1}(e^x) + C$

(C) $\frac{e^x}{2} + C$ (D) $\sin^{-1}\left(\frac{e^x}{2}\right) + C$

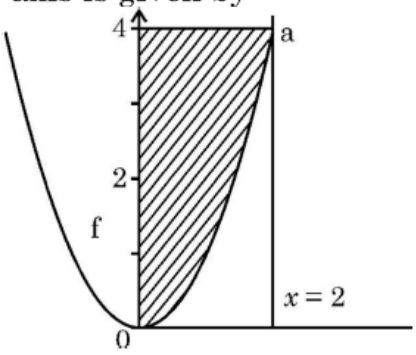
Q11

The value of $\int_{-1}^{1} |x| \, dx$ is :

(A) -2 (B) -1

(C) 1 (D) 2

Q12 The area of the shaded region (figure) represented by the curves $y = x^2$, $0 \le x \le 2$ and y-axis is given by



(A) $\int_0^2 x^2\,dx$ (B) $\int_0^2 \sqrt{y}\,dy$

(C) $\int_0^4 x^2\,dx$ (D) $\int_0^4 \sqrt{y}\,dy$

Q13 The order and degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^2 + \left(\frac{dy}{dx}\right)^2 = x \sin\left(\frac{dy}{dx}\right)$ are :

(A) order 2, degree 2 (B) order 2, degree 1

(C) order 2, degree not defined (D) order 1, degree not defined

Q14 If $\vec{\alpha} = \hat{i} - 4\hat{j} + 9\hat{k}$ and $\vec{\beta} = 2\hat{i} - 8\hat{j} + \lambda\hat{k}$ are two mutually parallel vectors, then λ is equal to :

(A) -18 (B) 18

(C) $\frac{-34}{9}$ (D) $\frac{34}{9}$

Q15 If a line makes an angle of 30° with the positive direction of x-axis, 120° with the positive direction of y-axis, then the angle which it makes with the positive direction of z-axis is :

(A) 90° (B) 120°

(C) 60° (D) 0°

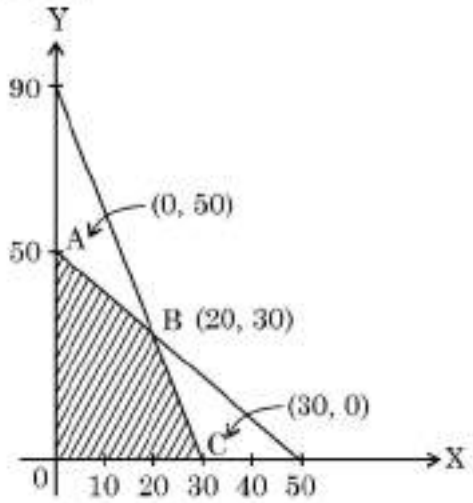
Q16 In an LPP, corner points of the feasible region determined by the system of linear constraints are (1, 1), (3, 0) and (0, 3). If $Z = ax + by$, where $a, b > 0$ is to be minimized, the condition on a and b, so that the minimum of Z occurs at (3, 0) and (1, 1), will be :

(A) $a = 2b$ (B) $a = \frac{b}{2}$

(C) $a = 3b$ (D) $a = b$

Q17

The maximum value of $Z = 4x + y$ for a L.P.P. whose feasible region is given below is :



(A) 50 (B) 110

(C) 120 (D) 170

Q18

If $P(A) = \frac{1}{7}$, $P(B) = \frac{5}{7}$ and $P(A \cap B) = \frac{4}{7}$, then $P(\overline{A} \mid B)$ is :

(A) $\frac{6}{7}$ (B) $\frac{3}{4}$

(C) $\frac{4}{5}$ (D) $\frac{1}{5}$

Assertion Reasoning Based Questions

Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R.**

In the light of the above statements, choose the ***most appropriate*** answer from the options given below

(A) Both **A** and **R** are correct and **R** is the correct explanation of **A**

(B) Both **A** and **R** are correct but **R** is **NOT** the correct explanation of **A**

(C) **A** is correct but **R** is not correct

(D) **A** is not correct but **R** is correct

Q19

Assertion (A) : $\cos^{-1}\left(\cos\frac{13\pi}{6}\right)$ is equal to $\frac{\pi}{6}$.

Reason (R) : The range of the principal value branch of the function $y = \cos^{-1} x$ is $[0, \pi]$.

Q20

Assertion (A) : $f(x) = \begin{cases} x \sin\frac{1}{x} & , x \neq 0 \\ 0 & , x = 0 \end{cases}$ is continuous at $x = 0$.

Reason (R) : When $x \to 0$, $\sin\frac{1}{x}$ is a finite value between -1 and 1.

SECTION – B (Very Short Answer (VSA)-type questions) 2 Marks Each	
Q21	Prove that : $\tan^{-1}\sqrt{x} = \frac{1}{2}\cos^{-1}\left(\frac{1-x}{1+x}\right), x \in [0, 1]$ **OR** Evaluate : $\sec^2\left(\tan^{-1}\frac{1}{2}\right) + \text{cosec}^2\left(\cot^{-1}\frac{1}{3}\right)$
Q22	If $\tan^{-1}(x^2 + y^2) = a^2$, then find $\frac{dy}{dx}$. **OR** If $x^y = e^{x-y}$, prove that $\frac{dy}{dx} = \frac{\log x}{\{\log(xe)\}^2}$.
Q23	A ladder 13 m long is leaning against the wall. The bottom of the ladder is pulled along the ground away from the wall at the rate of 2 m/s. How fast is the height on the wall decreasing when the foot of the ladder is 12 m away from the wall ?
Q24	Find a vector of magnitude 21 units in the direction opposite to that of $\overrightarrow{AB}$ where A and B are the points A(2, 1, 3) and B(8, –1, 0) respectively.
Q25	The diagonals of a parallelogram are given by $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + 3\hat{j} - \hat{k}$. Find the area of the parallelogram. **OR** The scalar product of the vector $\vec{a} = \hat{i} - \hat{j} + 2\hat{k}$ with a unit vector along sum of vectors $\vec{b} = 2\hat{i} - 4\hat{j} + 5\hat{k}$ and $\vec{c} = \lambda\hat{i} - 2\hat{j} - 3\hat{k}$ is equal to 1. Find the value of λ.
SECTION – C (Short Answer (SA)-type questions) 3 Marks Each	
Q26	Find the intervals in which the function $f(x) = \frac{3}{2}x^4 - 4x^3 - 45x^2 + 51$ is : (a) strictly increasing (b) strictly decreasing. **OR** If M and m denote the local maximum and local minimum values of the function $f(x) = x + \frac{1}{x}$ $(x \neq 0)$ respectively, find the value of (M – m).

Q27	Using integration, find the area of the region bounded between the lines $x = -2$, $x = 2$ and the circle $x^2 + y^2 = 16$.
Q28	Solve the differential equation $(1 + x^2)\frac{dy}{dx} + 2xy - 4x^2 = 0$ subject to initial condition $y(0) = 0$. **OR** For the differential equation $\frac{dy}{dx} - \frac{y}{x} + \text{cosec}\left(\frac{y}{x}\right) = 0$, find the particular solution, given that $y = 0$ when $x = 1$.
Q29	Find a point P on the line $\frac{x+5}{1} = \frac{y+3}{4} = \frac{z-6}{-9}$ such that its distance from point Q(2, 4, –1) is 7 units. Also, find the equation of line joining P and Q.
Q30	Solve the following L.P.P. graphically : Maximise $Z = x + 3y$ subject to the constraints : $x + 2y \leq 200$ $x + y \leq 150$ $y \leq 75$ $x, y \geq 0$
Q31	Four students of class XII are given a problem to solve independently. Their chances of solving the problem respectively are $\frac{1}{2}, \frac{1}{3}, \frac{2}{3}$ and $\frac{1}{5}$. Find the probability that at most one of them will solve the problem. **OR** A black and a red die are rolled together. Find the conditional probability of obtaining the sum 8, given that the red die resulted in a number less than 4.
SECTION – D (Long Answer (LA)-type questions) 5 Marks Each	
Q32	If matrix $A = \begin{bmatrix} 3 & 2 & 1 \\ 4 & 1 & 3 \\ 1 & 1 & 1 \end{bmatrix}$, find A^{-1} and hence solve the following system of linear equations : $3x + 2y + z = 2000$ $4x + y + 3z = 2500$ $x + y + z = 900$

Q33

If $\sqrt{1-x^2} + \sqrt{1-y^2} = a(x-y)$, then prove that $\frac{dy}{dx} = \sqrt{\frac{1-y^2}{1-x^2}}$.

OR

If $x = a\left(\cos\theta + \log\tan\frac{\theta}{2}\right)$ and $y = \sin\theta$, then find $\frac{d^2y}{dx^2}$ at $\theta = \frac{\pi}{4}$.

Q34

Find :

$$\int \frac{dx}{\sin x + \sin 2x}$$

OR

Evaluate :

$$\int_0^{\pi/4} \frac{\sin x \cos x}{\cos^4 x + \sin^4 x}\, dx$$

Q35

Write the nature of the lines $\frac{x-1}{4} = \frac{y-2}{6} = \frac{z-3}{8}$ and $\frac{x-2}{2} = \frac{y-4}{3} = \frac{z-5}{4}$. Also, find the shortest distance between them.

OR

Find the foot of the perpendicular drawn from the point (2, 3, −8) to the line $\frac{x-4}{2} = \frac{y}{-6} = \frac{z-1}{3}$. Also, find the perpendicular distance of the given line from the given point.

SECTION – E (Case Study Based Questions) 4 Marks Each

Q36

A school is organizing a debate competition with participants as speakers $S = \{S_1, S_2, S_3, S_4\}$ and these are judged by judges $J = \{J_1, J_2, J_3\}$. Each speaker can be assigned one judge. Let R be a relation from set S to J defined as $R = \{(x, y) : \text{speaker } x \text{ is judged by judge } y, x \in S, y \in J\}$.

Based on the above, answer the following :

(i) How many relations can be there from S to J ? **1**

(ii) A student identifies a function from S to J as $f = \{(S_1, J_1), (S_2, J_2), (S_3, J_2), (S_4, J_3)\}$ Check if it is bijective. **1**

(iii) (a) How many one-one functions can be there from set S to set J ? **2**

OR

(iii) (b) Another student considers a relation $R_1 = \{(S_1, S_2), \{S_2, S_4)\}$ in set S. Write minimum ordered pairs to be included in R_1 so that R_1 is reflexive but not symmetric. **2**

Q37

Engine displacement is the measure of the cylinder volume swept by all the pistons of a piston engine. The piston moves inside the cylinder bore The cylinder bore in the form of circular cylinder open at the top is to be made from a metal sheet of area 75π cm^2.

Based on the above information, answer the following questions :

(i) If the radius of cylinder is r cm and height is h cm, then write the volume V of cylinder in terms of radius r. **1**

(ii) Find $\frac{dV}{dr}$. **1**

(iii) (a) Find the radius of cylinder when its volume is maximum. **2**

OR

(b) For maximum volume, h > r. State true or false and justify. **2**

Q38

A bank offers loan to its customers on different types of interest namely, fixed rate, floating rate and variable rate. From the past data with the bank, it is known that a customer avails loan on fixed rate, floating rate or variable rate with probabilities 10%, 20% and 70% respectively. A customer after availing loan can pay the loan or default on loan repayment. The bank data suggests that the probability that a person defaults on loan after availing it at fixed rate, floating rate and variable rate is 5%, 3% and 1% respectively.

Based on the above information, answer the following :

(i) What is the probability that a customer after availing the loan will default on the loan repayment ? **2**

(ii) A customer after availing the loan, defaults on loan repayment. What is the probability that he availed the loan at a variable rate of interest ? **2**