BUDHA DAL PUBLIC SCHOOL PATIALA
PRE BOARD EXAMINATION (16 December 2025)
Class – XII
Paper- Mathematics (Set-B)

Time: 3hrs. **M.M. 80**

General Instructions:

(i) *This Question paper contains 38 questions. All questions are compulsory.*

(ii) *This Question paper is divided into five Sections – A, B, C, D and E.*

(iii) *In Section A, Questions no. 1 to 18 are multiple choice questions (MCQs) and Questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.*

(iv) *In Section B, Questions no. 21 to 25 are Very Short Answer (VSA)-type questions, carrying 2 marks each.*

(v) *In Section C, Questions no. 26 to 31 are Short Answer (SA)-type questions, carrying 3 marks each.*

(vi) *In Section D, Questions no. 32 to 35 are Long Answer (LA)-type questions, carrying 5 marks each.*

(vii) *In Section E, Questions no. 36 to 38 are Case study-based questions, carrying 4 marks each.*

(viii) *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.*

(ix) *Use of calculators is not allowed.*

SECTION – A

(This section comprises of multiple choice questions (MCQs) of 1 mark each)

Select the correct option (Question 1 - Question 18):

1. Total number of possible matrices of order 3×2 with each entry 5 or 7 are

(a) 6 (b) 12 (c) 64 (d) 32

2. Given a matrix $A = [a_{ij}]$ of order 3×3, where $a_{ij} = \begin{cases} i+3j, & i<j \\ 5, & i=j \\ i-3j, & i>j \end{cases}$

The number of elements in matrix A which are more than 3 are

(a) 6 (b) 3 (c) 5 (d) 9

3. Vectors $\hat{i}, \hat{j}, \hat{k}$ are unit vectors along x, y and z-axes respectively, then the value of $\hat{i}\cdot(\hat{j}\times\hat{k}) - 2\hat{k}\cdot(\hat{i}\times\hat{j}) + \hat{j}\cdot(\hat{i}\times\hat{k})$ is

(a) –4 (b) 0 (c) –1 (d) –2

4. The function $f(x) = [x], -3 < x < 4, x \in R$, where $[x]$ represents greatest integer $\le x$ is discontinuous for one of the values of x equal to

(a) 8 (b) 1 (c) 4 (d) 2.5

5. If $\int f(x)dx = \frac{2^x}{\log_e 2} + C$, then $f(x)$ is

(a) 2^x (b) $\frac{2^x}{\log_e 2}$ (c) $2^x \cdot \log_e 2$ (d) 2^{x-1}

6. If p and q are degree and order of differential equation $\frac{dy}{dx} + \frac{1}{dy/dx} = x$, then value of $p - 3q$ is

(a) –5 (b) –3 (c) –1 (d) not defined

7. The solution set of the inequation $x + 2y \ge 5$ is

(a) an open half plane not containing origin.

(b) an open half plane containing origin.

(c) plane XY excluding the line $x + 2y = 5$.

(d) closed half plane not containing the origin.

8. If vectors $3\hat{i} - 2\hat{j} + \hat{k}$ and $2\hat{i} + p\hat{j} + \frac{2}{3}\hat{k}$ are parallel vectors then the value of p is

(a) $\frac{2}{3}$ (b) $\frac{3}{2}$ (c) $-\frac{3}{4}$ (d) $-\frac{4}{3}$

B-1

9. The value of $\int_1^4 \frac{x}{\sqrt{x^2-1}}dx$ is

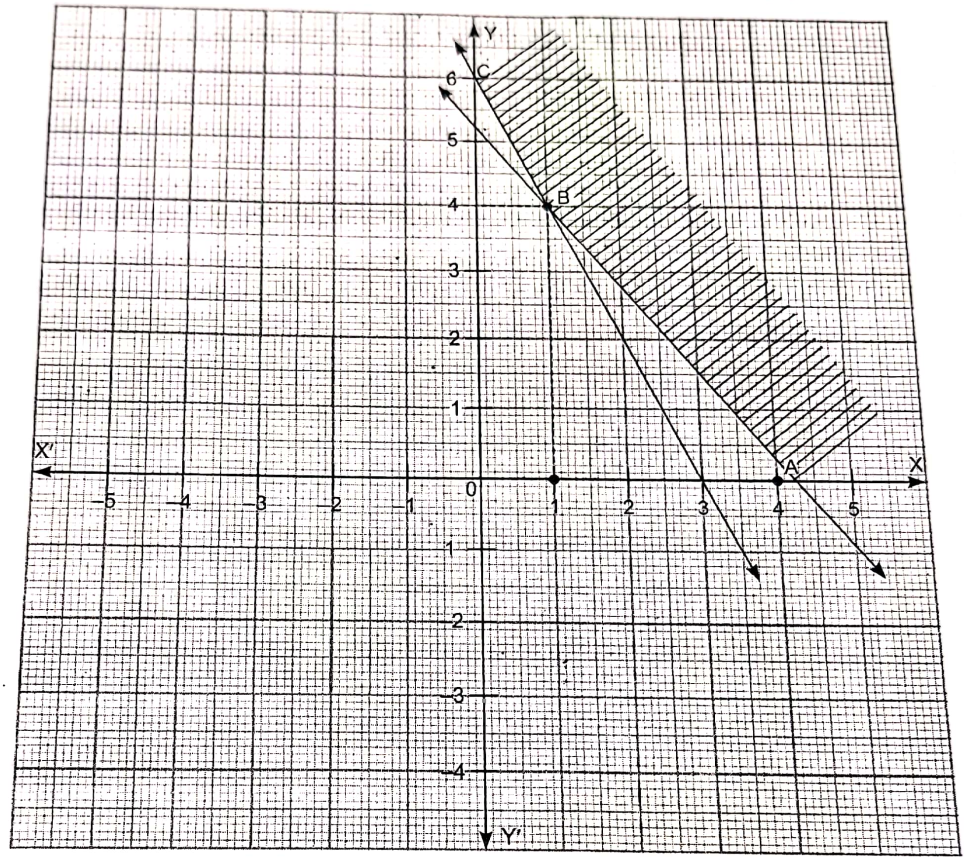
(a) $\frac{1}{2}\sqrt{15}$ (b) $\sqrt{15}$ (c) $2\sqrt{15}$ (d) $\sqrt{15}-1$

10. If A is a square matrix such that $|A| = 7$, then $|A^{-1}|$ is

(a) 49 (b) $\frac{1}{7}$ (c) -7 (d) 14

11. For the given unbounded feasible region, minimum of $Z = 3x + 5y$ occurs at

(a) A only (b) B only (c) B and C (d) A and C



12. The value of p such that the points $(3, -2)$, $(p, 2)$ and $(8, 8)$ are collinear is

(a) 0 (b) 4 (c) 5 (d) 3

13. For two given square matrices A and B, $BA = 9I$, then $A^{-1}B^{-1}$ is

(a) $\frac{1}{9}I$ (b) $9B^{-1}$ (c) $9A^{-1}$ (d) $9I$

14. If A and B are events such that $P(A/B) = P(B/A)$, then

(a) $A \subset B$ (b) $A = B$ (c) $A \cap B = \phi$ (d) $P(A) = P(B)$

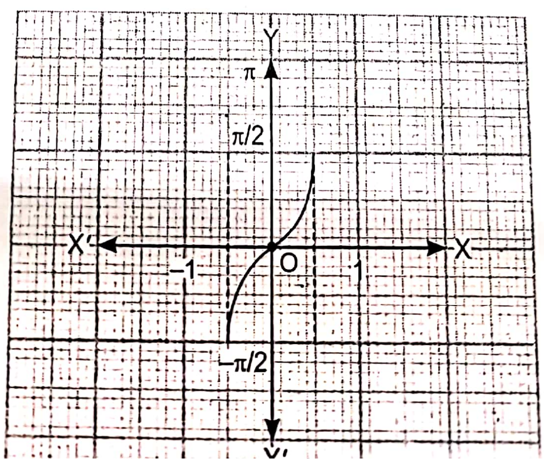
15. Identify the function shown in the graph

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

(b) $\sin^{-1}(2x)$

(c) $\sin^{-1}\left(\frac{x}{2}\right)$

(d) $2\sin^{-1}x$



If $y = e^{\sin^{-1}x}$, then $(1-x^2){y_1}^2$ is equal to

(a) $\sqrt{1-x^2}$ (b) $\sin^{-1}x$ (c) y^2 (d) y

17. If θ is acute angle between any two non-zero vectors $\vec{a}$ and $\vec{b}$ such that $|\vec{a}\cdot\vec{b}| = |\vec{a}\times\vec{b}|$, then value of θ is

(a) $\frac{3\pi}{4}$ (b) 0 (c) $\frac{\pi}{2}$ (d) $\frac{\pi}{4}$

18. Which triplet can represent direction cosines of a line?

(a) 1, 2, 3 (b) –1, 1, 1 (c) $\frac{1}{3}, \frac{1}{3}, \frac{1}{3}$ (d) $\frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$

ASSERTION-REASON BASED QUESTIONS

(Question numbers 19 and 20 are Assertion-Reason based questions carrying 1 mark each. 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 (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 but (R) is false.
(d) (A) is false but (R) is true.

19. **Assertion (A):** Value of the expression $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right) + \tan^{-1}1 - \sec^{-1}(\sqrt{2})$ is $\frac{\pi}{4}$.

Reason (R): Principal value branch of $\sin^{-1}x$ is $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ and that of $\sec^{-1}x$ is $[0, \pi] - \left\{\frac{\pi}{2}\right\}$.

20. **Assertion (A):** Given two non-zero vectors $\vec{a}$ and $\vec{b}$. If $\vec{r}$ is another non-zero vector such that $\vec{r}\times(\vec{a}+\vec{b}) = \vec{0}$. Then $\vec{r}$ is perpendicular to $\vec{a}\times\vec{b}$.

Reason (R): The vector $(\vec{a}+\vec{b})$ is perpendicular to the plane of $\vec{a}$ and $\vec{b}$

SECTION – B

(This section comprises of 5 very short answer (VSA) type questions of 2 marks each.)

21. (a) Evaluate $\tan\left(\tan^{-1}(-1)+\frac{\pi}{3}\right)$

OR

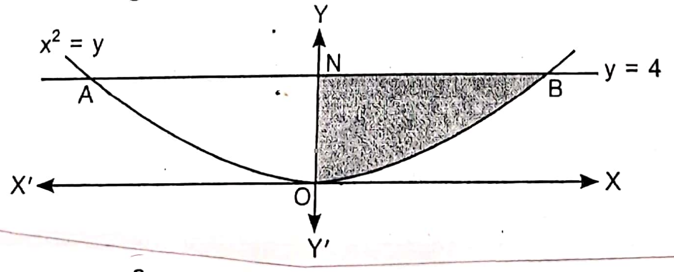
(b) Find the domain of $\cos^{-1}(3x-2)$

22. If $y = \log\tan\left(\frac{\pi}{4}+\frac{x}{2}\right)$, then prove that $\frac{dy}{dx} - \sec x = 0$

23. (a) Find: $\int \frac{(x-3)}{(x-1)^3}e^x dx$

OR

(b) Find out the area of shaded region in the enclosed figure.



24. Differentiate $2^{\cos^2 x}$ w.r.t. $\cos^2 x$

OR

If $\tan^{-1}(x^2+y^2) = a^2$, then find $\frac{dy}{dx}$

25. The two vectors $\hat{i}+\hat{j}+\hat{k}$ and $3\hat{i}-\hat{j}+3\hat{k}$ represent the two sides OA and OB, respectively of a ΔOAB, wher O is the origin. The point P lies on AB such that OP is a median. Find the area of the parallelogram formed b the two adjacent sides as OA and OP.

SECTION – C

(This section comprises of 6 short answer (SA) type questions of 3 marks each.)

26 If $y = \sin(\log x)$, then prove that $x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = 0$

OR

If $x^{13}y^7 = (x+y)^{20}$, then prove that $\frac{dy}{dx} = \frac{y}{x}$

27. The volume of a cube is increasing at the rate of 9 cm^3/s. How fast is its surface area increasing when the length of an edge is 10 cm.

28. Sketch the region $\{(x,0): y = \sqrt{4-x^2}\}$ and x *axis*. Find the area of the region. using integration.

OR

Sketch the graph of $y = |x+3|$ and find the area of the region enclosed by the curve, $x - axis$, between $x = -6$ *and* $x = 0$, using integration.

29. Find the shortest distance between the following lines.

$\vec{r} = 3\hat{i} + 5\hat{j} + 7k + \lambda(i - 2\hat{j} + \hat{k})$
$\vec{r} = -\hat{i} - \hat{j} - k + \mu(7i - 6\hat{j} + \hat{k})$

OR

Find the equation of the line which intersect the lines $\frac{x+2}{1} = \frac{y-3}{2} = \frac{z+1}{4}$ and $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and passes through the point $(1,1,1)$

30. Solve the following LPP graphically:

Maximise $Z = 2x - y + 5$,
Subject to constraints $3x + 4y \leq 60, x + 3y \leq 30, x \geq 0, y \geq 0$.

31. Find the probability of getting a total of 9 in a throw of two dice, if it is known that number 5 occurs on the first dice.

OR

A bag contains 5 red and 3 blue balls. If two balls are drawn at random with replacement, find the probability of getting (*a*) one red ball (*b*) a least one red ball

SECTION – D

(This section comprises of 4 long answer (LA) type questions of 5 marks each)

32. For two matrices $A = \begin{bmatrix} 3 & -6 & -1 \\ 2 & -5 & -1 \\ -2 & 4 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -2 & -1 \\ 0 & -1 & -1 \\ 2 & 0 & 3 \end{bmatrix}$, find the product AB and hence solve the system of equations:

$$3x - 6y - z = 3$$
$$2x - 5y - z + 2 = 0$$
$$-2x + 4y + z = 5$$

33. $\int_0^{\pi} \frac{x\tan x}{\sec x + \tan x} \, dx$

OR

$\int \sqrt{\frac{1-\sqrt{x}}{1+\sqrt{x}}} \, dx$

34. Solve the differential equation

$$\left\{x\cos\left(\frac{y}{x}\right) + y\sin\left(\frac{y}{x}\right)\right\} y\,dx = \left\{y\sin\left(\frac{y}{x}\right) - x\cos\left(\frac{y}{x}\right)\right\} x\,dy$$

OR

$$(1+x^2)\frac{dy}{dx} + 2xy = \frac{1}{1+x^2}\ ; y = 0 \text{ when } x = 1$$

B-

$= 3\hat{i} + \hat{j}$ and $\vec{b} = 2\hat{i} - \hat{j} + 3\hat{k}$, then represent $\vec{b}$ as $\vec{b_1} + \vec{b_2}$, where $\vec{b_1}$ is parallel to $\vec{a}$ and $\vec{b_2}$ is perpendicular to

SECTION – E

(This section comprises of 3 case-study/passage-based questions of 4 marks each with subparts. The first two case study questions have three subparts (i), (ii), (iii) of marks 1, 1, 2 respectively. The third case study question has two subparts of 2 marks each)

36. Sherlin and Danju are playing Ludo at home during Covid-19. While rolling the dice, Sherlin's sister Raji observed and noted the possible outcomes of the throw every time belongs to set {1, 2, 3, 4, 5, 6}. Let A be the set of players while B be the set of all possible outcomes.

A = {S, D}, B = {1, 2, 3, 4, 5, 6}

Based on the above information, answer the following questions.

1. Let R : B → B be defined by R = {(x, y): y is divisible by x }. Show that the relation R is reflexive and transitive but not symmetric.
2. Let R be a relation on B defined by R = {(1,2), (2,2), (1,3), (3,4), (3,1), (4,3), (5,5)}. Then check whether R is an equivalence rlation.
3. (a) Raji wants to know the number of functions from A to B. How many number of functions are possible?

OR

(b) Raji wants to know the number of relations possible from A to B. How many numbers of relations are possible?

37. $P(x) = -5x^2 + 125x + 37500$ is the total profit function of a company, where x is the production of the company.

Based on the above information, answer the following questions.

1. What will be the production when the profit is maximum?
2. What will be the maximum profit?
3. (a) When the production is 2 units what will be the profit of the company?

OR

(b) What will be the production of the company when the profit is Rs. 8250?

A building contractor undertakes a job to construct 4 flats on a plot along with parking area. Due to strike the probability of many construction workers not being present for the job is 0.65. The probability that many are not present and still the work gets completed on time is 0.35. The probability that work will be completed on time when all workers are present is 0.80.

Let E_1 : represent the event when many workers were not present for the job.

E_2 : represent the event when all workers were present ; and

E_3 : represent completing the construction work on time.

Based on the above information, answer the following questions.

1. What is the probability that construction will be completed on time?
2. What is the probability that many workers are not present given that the construction work is completed on time?