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

M.M. 80

Time: 3hrs.

General Instructions:

Read the following instructions very carefully and strictly follow them:

(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. A matrix having n elements, where n is prime can be

   (a) a square matrix (b) a row matrix

   (c) a column matrix (d) a row or a column matrix

2. If A is a square matrix of order 3 and $|A| = -5$, then $|3A|$ is

   (a) –45 (b) 135 (c) –135 (d) –15

3. If $\vec{a}$ and $\vec{b}$ are position vectors of points A and B, when $\overrightarrow{AB} = \vec{r}$, then

   (a) $\vec{a} + \vec{b} = \vec{r}$ (b) $\vec{a} - \vec{b} = \vec{r}$ (c) $|\vec{a} + \vec{b}| = |\vec{r}|$ (d) $\vec{b} = \vec{a} + \vec{r}$

4. For what value(s) of k, the function $f(x) = \begin{cases} \frac{\sin 2x}{\tan 5x}, & x \neq 0 \\ 3k, & x = 0 \end{cases}$ is continuous at $x = 0$?

   (a) $\frac{2}{5}$ (b) $\frac{5}{2}$ (c) $\frac{2}{15}$ (d) $\frac{6}{5}$

5. $\int \frac{1}{x^2+1} dx$ is equal to

   (a) $\log|x^2 + 1| + C$ (b) $\frac{\log|x^2+1|}{2x} + C$ (c) $\frac{1}{(x^2+1)^2} + C$ (d) $\tan^{-1}x + C$

6. If m and n are degree and order of differential equation $\frac{d^3y}{dx^3} - \left(\frac{dy}{dx}\right)^2 + \left(\frac{d^4y}{dx^4}\right)^3 = 5$, then the value of $4m - 3n$ is

   (a) 7 (b) 4 (c) 0 (d) 3

7. The point which lies in the half plane of $x + 2y > 5$ is

   (a) (0, 0) (b) (–1, 1) (c) (0, 3) (d) (4, –5)

8. If $\vec{a}$ and $\vec{b}$ are along one side and diagonal of a parallelogram then area of parallelogram is

   (a) $\vec{a} \times \vec{b}$ (b) $\frac{1}{2}|\vec{a} \times \vec{b}|$ (c) $|2\vec{a} \times \vec{b}|$ (d) $|\vec{a} \times \vec{b}|$

9. The value of $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sin^3 x \, dx$ is

(a) $\frac{\pi}{2}$ (b) $\frac{\pi^3}{8}$ (c) $-\frac{\pi}{2}$ (d) 0

10. If $\begin{vmatrix} x & -5 \\ 2 & 6 \end{vmatrix} = \begin{vmatrix} 4 & -5 \\ 2 & 3 \end{vmatrix}$, then x is equal to

(a) 2 (b) 4 (c) –2 (d) –4

11. The corner points of the feasible region of an LPP whose objective function is $Z = 2x + 3y$ are $A(0, 6), B(1, 2), C(4, 3), D(6, 2)$. Then function attain maximum value at

(a) A (b) D

(c) C (d) any point on line segment joining A and D.

12. If points $(2, 3), (3, k), (1, 0)$ are collinear, then value of k is

(a) –6 (b) 6 (c) 2 (d) –2

13. The value of k, for which the matrix $\begin{bmatrix} 0 & 2 & -1 \\ -2 & k & 5 \\ 1 & -5 & 2k \end{bmatrix}$ is skew symmetric is

(a) –1 (b) 0 (c) 2 (d) 3

14. If A and B are independent events then $P(A/B)$ is equal to

(a) $P(A)$ (b) $P(B)$ (c) $P(A \cap B)$ (d) $\frac{P(A \cap B)}{P(A)}$

15. The principal value of $cos^{-1}\left(\cos\frac{7\pi}{4}\right)$ is

a) $\frac{7\pi}{4}$ b) $\frac{-\pi}{4}$ c) $\frac{\pi}{4}$ d) none of these

16. If $y = \log x$, then y_2 is equal to

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

17. If $\vec{a}$ and $\vec{b}$ are along adjacent sides of a rectangle then

(a) $\vec{a} \times \vec{b} = \vec{0}$ (b) $\vec{a} \cdot \vec{b} = 0$ (c) $|\vec{a}| = |\vec{b}|$ (d) $\vec{a} = \vec{b}$

18. A function $f(x) = 10 - x - 2x^2$ is increasing on the internal

a) $(-\infty, \frac{1}{4}]$ b) $(-\infty, \frac{1}{4})$ c) $[-\frac{1}{14}, \infty]$ d) $[-\frac{1}{4}, \frac{1}{4}]$

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):** $(\sin^{-1}x)^2 \neq \sin^{-2}x$.

Reason (R): $\sin^{-1}x$ represents inverse of sine function, we can't use exponent laws.

20. **Assertion (A):** Line $\vec{r} = (\hat{i} - \hat{j} - \hat{k}) + \lambda(2\hat{i} + \hat{j} + 2\hat{k})$ passes through a fixed point $(1, -1, -1)$.

Reason (R): In vector equation of a line $\vec{r} = \vec{a} + \lambda\vec{b}$, $\vec{a}$ represents position vector of fixed point, through which line passes.

SECTION – B

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

21. Evaluate $2\tan^{-1}(\sqrt{3}) - \text{cosec}^{-1}\left(\frac{2}{\sqrt{3}}\right)$.

OR

Find the domain of $y = \sin^{-1}(x^2 - 4)$.

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

23. Find the angle between the vectors $\vec{a} = \hat{i} - 2\hat{j}$ and $\vec{b} = \hat{j} + 3\hat{k}$ using cross product of vectors.

OR

Find a vector whose magnitude is 5 units and is along the vector $2\hat{i} - \hat{j} + 2\hat{k}$.

24. $\int \frac{\cos 2x - cos2\alpha}{\cos x - \cos\alpha}\, dx$

25. If $y = cosec\,(\cot\sqrt{x})$, then find $\frac{dy}{dx}$

SECTION – C

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

26. (*a*) If $x^y = e^{x-y}$ prove that $\frac{dy}{dx} = \frac{\log x}{(\log(xe))^2}$ and hence find its value at $x = e$.

OR

(*b*) If $x = a(\theta - \sin\theta), y = a(1 - \cos\theta)$ find $\frac{d^2y}{dx^2}$.

27. A spherical ball of ice melts in such a way that the rate at which its volume decreases at any instant is directly proportional to its surface area. Prove that the radius of the ice ball decreases at a constant rate.

28. Sketch the graph $y = |x + 1|$. Evaluate $\int_{-4}^{2} |x+1|\,dx$. What does the value of this integral represent on the graph?

OR

Using integration find the area of the region $\{(x, y) : x^2 - 4y \leq 0, y - x \leq 0\}$

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 point of intersection of the line $\vec{r} = (3\hat{i} + \hat{k}) + \mu(\hat{i} + \hat{j} + \hat{k})$ and the line through $(2, -1, 1)$ parallel to the z-axis. How far is this point from the z-axis?

30. Solve graphically:

Maximise $Z = 2x + y$ subject to

$$x + y \leq 1200$$
$$x + y \geq 600$$
$$y \leq \frac{x}{2}$$
$$x \geq 0, y \geq 0.$$

31. Two students Mehul and Rashi are seeking admission in a college. The probability that Mehul is selected is 0.4 and the probability of selection of exactly one of them is 0.5. Chances of selection of them is independent of each other. Find the chances of selection of Rashi. Also find the probability of selection of at least one of them.

SECTION – D

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

32. (*a*) Evaluate: $\int_0^1 \frac{\log(1+x)}{1+x^2}dx$

OR

(*b*) Find $\int \frac{(3\sin\theta - 2)\cos\theta}{5 - \cos^2\theta - 4\sin\theta}d\theta$

33. (*a*) Solve the differential equation: $y + \frac{d}{dx}(xy) = x(\sin x + x)$

OR

(*b*) Find the particular solution of the differential equation:
$2ye^{x/y}dx + (y - 2xe^{x/y})dy = 0$ given that $y(0) = 1$

34. Show that the lines $\vec{r} = (\hat{i} + \hat{j} - \hat{k}) + \lambda(3\hat{i} - \hat{j})$ and $\vec{r} = (4\hat{i} - \hat{k}) + \mu(2\hat{i} + 3\hat{k})$ intersect. Also, find their point of intersection.

35. Given $A = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}$ verify that $BA = 6I$ and hence solve the system of equations $x = y + 3, 2x + 3y + 4z = 17, y + 2z = 7$.

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. A class-room teacher is keen to assess the learning of her students the concept of "relations" taught to them. She writes the following five relations each defined on the set $A = \{1, 2, 3\}$:

$R_1 = \{(2, 3), (3, 2)\}$

$R_2 = \{(1, 2), (1, 3), (3, 2)\}$

$R_3 = \{(1, 2), (2, 1), (1, 1)\}$

$R_4 = \{(1, 1), (1, 2), (3, 3), (2, 2)\}$

$R_5 = \{(1, 1), (1, 2), (3, 3), (2, 2), (2, 1), (2, 3), (3, 2)\}$

The students are asked to answer the following questions about the above relations:

(*i*) Identify the relation which is reflexive, transitive but not symmetric.

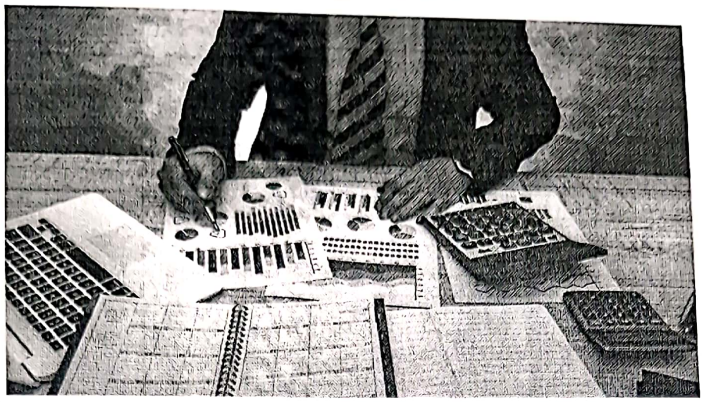
(*ii*) Identify the relation which is reflexive and symmetric but not transitive.

(*iii*) (*a*) Identify the relations which are symmetric but neither reflexive nor transitive.

OR

(*iii*) (*b*) What pairs should be added to the relation R_2 to make it an equivalence relation?

...ead the following passage and answer the questions given below:



Companies are very alert regarding expenditure, profit, loss and other issues related to the company and at equal interval they keep on evaluating the performance. In one such case the profit of the company is $p(x) = -10x^2 + 4000x + 37000$, where x represents the number of units.

(*i*) What is critical point of profit function?

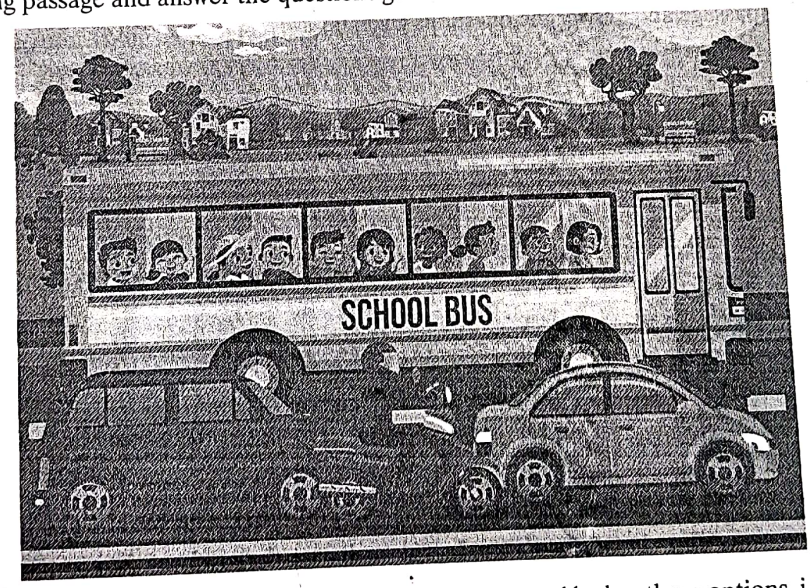
(*ii*) What is maximum profit?

(*iii*) For what units, profit function is increasing?

OR

(*iii*) What is marginal profit when $x = 75$?

38. Read the following passage and answer the questions given below.



During examinations a candidate has to reach examination centre and he has three options, i.e. going by bus or scooter or by car. The probability of his going by bus or scooter or by car are $\frac{3}{10}, \frac{1}{10}, \frac{3}{5}$ respectively. The probabilities that he will be late are $\frac{1}{4}$ and $\frac{1}{3}$ if he travels by bus and scooter respectively but if he travels by car he is not late.

(*i*) What is the probability of reaching late if he travels by car?

(*ii*) What is the probability that candidate reaches late?