

KENDRIYA VIDYALAYA SANGATHAN DELHI REGION

Pre-Board-II Examination 2025-26

Class: XII

Subject: (041) Mathematics

MM: 80

Time: 3:00 Hours

General Instructions:

Read the following instructions very carefully and strictly follow them:

- (i) This Question paper contains 38 questions. All questions are compulsory.
- (ii) Question paper is divided into FIVE Section A, B, C, D and E.
- (iii) In **Section A**: Question 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**: Question no. 21 to 25 are very short answer (VSA) type questions carrying 2 marks each.
- (v) In **Section C**: Question no. 26 to 31 are short answer (SA) type question carrying 3 marks each.
- (vi) In **Section D**: Question no. 32 to 35 are long answer (LA) type question carrying 5 marks each.
- (vii) In **Section E**: Question no.36 to 38 are case study based question 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.

SECTION- A

This section comprises of 20 multiple choice questions (MCQs) of 1 mark each.

1. Let $f: [2, \infty) \rightarrow \mathbb{R}$ be the function defined by $f(x) = x^2 - 4x + 5$, Then the range of f is
(A) $\mathbb{R}$ (B) $[1, \infty)$ (C) $[4, \infty)$ (D) $[5, \infty)$
2. The principal value of $\tan^{-1} \sqrt{3} - \cot^{-1}(-\sqrt{3})$ is
(A) $-\frac{\pi}{2}$ (B) π (C) 0 (D) $2\sqrt{3}$
3. If $\begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$ then $A^3 - 2A^2$ is
(A) a null matrix (B) an identity matrix (C) A (D) $-A$
4. If $\begin{bmatrix} 2 & 0 \\ 8 & 5 \end{bmatrix} = P+Q$, where P is a symmetric matrix and Q is a skew-symmetric matrix, then

(A) $Q = \begin{bmatrix} 2 & -4 \\ 4 & 4 \end{bmatrix}$ (B) $Q = \begin{bmatrix} 0 & -4 \\ 4 & 0 \end{bmatrix}$ (C) $Q = \begin{bmatrix} 1 & 4 \\ -4 & 2 \end{bmatrix}$ (D) $Q = \begin{bmatrix} 0 & 4 \\ -4 & 0 \end{bmatrix}$

5. If $A = \begin{bmatrix} 2 & -3 \\ 3 & 4 \end{bmatrix}$, then A^{-1} will be

(A) $\frac{1}{17} \begin{bmatrix} 4 & 3 \\ -3 & 2 \end{bmatrix}$ (B) $\frac{1}{17} \begin{bmatrix} 2 & 3 \\ -3 & 4 \end{bmatrix}$ (C) $\frac{-1}{17} \begin{bmatrix} 4 & 3 \\ -3 & 2 \end{bmatrix}$ (D) $\frac{1}{17} \begin{bmatrix} 4 & 3 \\ -3 & -2 \end{bmatrix}$

6. The number of points at which the function $f(x) = \frac{1}{x - [x]}$ is not continuous is

(A) 4 (B) -2 (C) 1 (D) None of these

7. The derivative of $f(x) = |x-5| + |x-8|$ at $x = 7$ is

(A) 0 (B) -2 (C) 2 (D) Does not exist

8. If $V = \frac{4}{3}\pi r^3$, at what rate in cubic units is V increasing, when $r=10$ and $\frac{dr}{dt}=0.01$?

(A) π (B) $\frac{4\pi}{3}$ (C) 4π (D) 40π

9. The function $f(x) = 1 - x^3 - x^5$ is strictly decreasing

(A) $1 \leq x \leq 5$ (B) $x \leq 1$ (C) $x \geq 1$ (D) all values of $x \neq 0$

10. $\int \frac{x^9}{(4x^2 + 1)^6} dx$ is equal to

(A) $\frac{1}{5x} \left(4 + \frac{1}{x^2}\right)^{-5} + C$ (B) $\frac{1}{5} \left(4 + \frac{1}{x^2}\right)^{-5} + C$
(C) $\frac{1}{10} \left(\frac{1}{x} + 4\right)^{-5}$ (D) $\frac{1}{10} \left(\frac{1}{x^2} + 4\right)^{-5} + C$

11. The order and degree of the differential equation $\frac{d^2 y}{dx^2} + \left(\frac{dy}{dx}\right)^{\frac{1}{4}} + x^{\frac{1}{5}} = 0$, respectively are

(A) 2 and 4 (B) 2 and 2 (C) 2 and 3 (D) 3 and 3

12. Which of the following is a homogeneous differential equation

(A) $(4x+6y+5)dy - (3y+2x+4)dx = 0$ (B) $xydx - (x^3 + y^3) dy = 0$
(C) $(x^3 + 2y^2) dx + 2xydy = 0$ (D) $y^2 dx + (x^2 - xy - y^2) dy = 0$

13. In a $\triangle ABC$, if D is the mid-point of BC and $\vec{AB} = \vec{a}$, $\vec{AD} = \vec{b}$ then $\vec{AC}$ is equal to

(A) $\vec{b} - \vec{a}$ (B) $\vec{b} - 2\vec{a}$ (C) $2\vec{b} - \vec{a}$ (D) $2\vec{b} + \vec{a}$

14. Let $\vec{a}$ and $\vec{b}$ are two vectors inclined at an angle of 60° . If $|\vec{a}| = |\vec{b}| = 2$, then the angle between $\vec{a}$ and $\vec{a} + \vec{b}$ is

- (A) 30° (B) 60° (C) 45° (D) None of these

15. If a line makes angle α , β and γ with the coordinates axes respectively then $\cos 2\alpha + \cos 2\beta + \cos 2\gamma =$

- (A) 2 (B) -1 (C) 1 (D) 2

16. Corner points of the feasible region for an LPP are: (0,2), (3,0), (6,0), (6,8), and (0,5) Let $z = 4x + 6y$ be the objective function. Then $\max z - \min z =$

- (A) 60 (B) 48 (C) 42 (D) 18

17. The objective function of an LPP is

- (A) a constant (B) a linear function to be optimized
(C) an inequality (D) a quadratic expression

18. Two event E and F are independent. If $P(E)=0.3$, $P(E \cup F)=0.5$, Then $P(E/F) - P(F/E)$ is

- (A) $\frac{2}{7}$ (B) $\frac{3}{35}$ (C) $\frac{1}{70}$ (D) $\frac{1}{7}$

ASSERTION – REASON BASED PROBLEMS

Direction: In the following questions, a statement of assertion (A) is followed by a statement of reason (R), mark the correct choice as:

- A. Both assertion (A) and reason (R) are true and reason (R) is the correct explanation for assertion (A)
B. Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation for assertion (A)
C. Assertion (A) is true but reason (R) is false
D. Assertion (A) is false but reason (R) is true

19. Statement – 1 (Assertion): The function $f(x) = \begin{cases} x^2 & , x \geq 1 \\ x + 2 & , x < 1 \end{cases}$ is not differentiable at $x = 1$ as $\lim_{x \rightarrow 1^-} f(x) \neq \lim_{x \rightarrow 1^+} f(x)$.

Statement – 2 (Reason): If a function f is not continuous at a point ' a ', then it is not differentiable at ' a '.

20. Statement – 1 (Assertion): If a homogeneous differential equation is of the form $\frac{dy}{dx} = f(x, y)$ then the substitution $y = vx$ reduces it to a differential equation in variable separable form

Statement – 2 (Reason): A homogeneous differential equation $\frac{dx}{dy} = g(x, y)$ reduces to the variable separable form by making the substitution $x = vy$

SECTION- B

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

22. Find the value of $x^2 + y^2 + z^2$ if $\begin{bmatrix} x + y + z \\ x + z \\ y + z \end{bmatrix} = \begin{bmatrix} 9 \\ 5 \\ 7 \end{bmatrix}$

OR

For what values of x and y are the following matrices are equal

$$A = \begin{bmatrix} 2x + 2 & y^2 + 2 \\ 5 & y^2 - 5y \end{bmatrix} \quad B = \begin{bmatrix} x + 4 & 3y \\ 5 & -6 \end{bmatrix}$$

23. If $x = e^{\frac{x}{y}}$, then prove that $\frac{dy}{dx} = \frac{x - y}{x \log x}$

24. Find the values of “a” for which $f(x) = \sin x - ax + b$ is increasing on R

OR

Find the intervals in which real valued function $f(x) = 5x^{\frac{3}{2}} - 3x^{\frac{5}{2}}$ is

(i) Increasing (ii) decreasing

25. Evaluate: $\int \frac{dx}{\sqrt{6-4x-x^2}}$

SECTION- C

26. If $x\sqrt{1+y} + y\sqrt{1+x} = 0, -1 < x < 1, x \neq y$ then prove that $\frac{dy}{dx} = \frac{-1}{(1+x)^2}$

OR

If $y = \log\left(\sqrt{x} + \frac{1}{\sqrt{x}}\right)^2$ then show that $x(x+1)^2 y_2 + (x+1)^2 y_1 = 2$

27. Solve the differential equation $2(y+3) - xy \frac{dy}{dx} = 0$ given $y(1) = -2$

OR

Solve the differential equation $(1 + x^2) \frac{dy}{dx} + 2xy = 4x^2$

28. If vectors $\vec{a}, \vec{b}$ and $2\vec{a} + 3\vec{b}$ are unit vectors, then find the angle between $\vec{a}$ and $\vec{b}$.

OR

If $\vec{a}$ and $\vec{b}$ are two vectors such that $\left| \frac{\vec{a} + \vec{b}}{2} \right| = \left| \frac{\vec{a} - \vec{b}}{2} \right|$ then prove that $(\vec{a} + 2\vec{b})$ is perpendicular to $\vec{a}$.

29. Find the angle between the lines $2x = 3y = -z$ and $6x = -y = -4z$

30. Solve the following linear programming problem graphically, Maximise $Z = 6x + 4y$,

Subject to constraints: $x + 2y \leq 12$;

$$2x + y \leq 12;$$

$$4x + 5y \geq 20;$$

$$x, y \geq 0$$

31. Two cards are drawn successively with replacement from a well-shuffled pack of 52 playing cards. Find the probability distribution of number of kings and hence find the mean of the distribution.

SECTION- D

32. Solve the following system of equations by Matrix Method:

$$x - y + z = 0,$$

$$4x + 2y + z = 12,$$

$$9x + 3y + z = 20$$

33. Evaluate $\int (\sqrt{\tan x} + \sqrt{\cot x}) dx$

OR

Evaluate $\int_1^4 [|x - 1| + |x - 2| + |x - 3|] dx$

34. Using integration find the area of the region bounded by the line $y = 5x + 2$, the x-axis and the ordinates $x = -2$ and $x = 2$

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

OR

Find the shortest distance between the following pair of lines:

$$\frac{x-1}{2} = \frac{y+1}{3} = z ; \quad \frac{x+1}{5} = \frac{y-2}{1}, z = 2$$

SECTION- E

This section comprises of 3 case study based questions of 4 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. $A = \{S, D\}$, $B = \{1,2,3,4,5,6\}$



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

(II) Raji wants to know the number of functions from A to B. How many number of functions are possible?

(III) Let $R: B \rightarrow B$ be defined by $R = \{(x,y): y \text{ is divisible } x\}$. Check Reflexivity, Symmetricity and Transitivity of R.

OR

Find number of symmetric relation on Set A.

37. In a survey, it was found that of the people having COVID, 90% of the test detect the disease but 10% go undetected, of people, free of COVID, 99% of the test are judged COVID negative but 1 % are diagnosed as showing COVID positive. From a large population of which only 0.1% have COVID, one person is selected at random given the COVID test, and

the pathologist reports him/her as COVID positive. Based on this information answer the following questions.

(I) Find the probability that the person tested as COVID positive given that he/she actually has COVID.

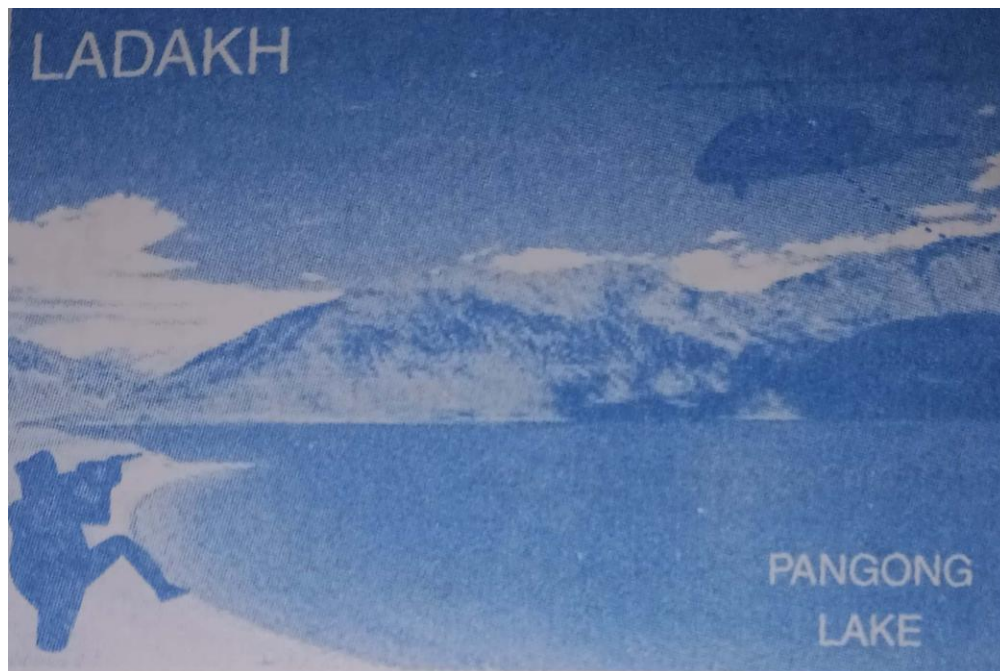
(II) Find the probability that the person tested as COVID positive given that he/she actually is not COVID infected.

(III) Find the probability that the person's COVID test is positive.

OR

Find the probability that person actually has COVID when reported positive.

38. Chinese and Indian troops are engaged in aggressive melee face – offs skirmishes at locations near the disputed pangong lake in Ladakh. One day a helicopter of enemy is flying along the curve represented by $y = x^2 + 7$. A soldier placed at (3,7) wants to shoot down the helicopter when it is nearest to him.



(I) If P is the position of helicopter on the curve $y = x^2 + 7$ and the distance PS from soldier placed at S (3,7) is minimum then express distance PS as a function of x.

(II) Find the nearest position of helicopter from soldier to shoot down the target.