SET - 1

Roll No. | | | | | | | |

Candidates must write the Set No on the title page of the answer book.

SAHODAYA PRE BOARD EXAMINATION: 2025-26

- Please check that this question paper contains 07 printed pages.
- Set number given on the right-hand side of the question paper should be written on the title page of the answer book by the candidate.
- Check that this question paper contains 38 questions.
- Write down the Serial Number of the question in the left side of the margin before attempting it.
- 15 minutes time has been allotted to read this question paper. The question paper will be distributed 15 minutes prior to the commencement of the examination. The students will read the question paper only and will not write any answer on the answer script during the period. Students should not write anything in the question paper.

CLASS-XII
SUBJECT: MATHEMATICS (041)

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

General Instructions:

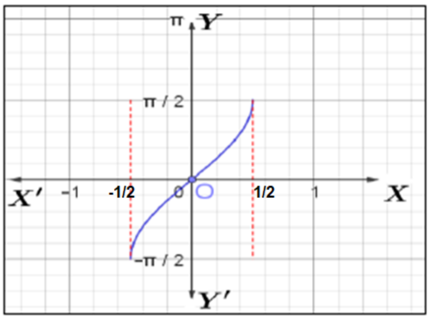
Read the following instructions very carefully and strictly follow them.

1. This question paper contains 38 questions. All questions are compulsory.
2. This question paper is divided into 5 sections.(A,B,C,D and E)
3. In section A, Question no. 1 to 18 are multiple choice questions (MCQs) and Question no.19 and 20 are Assertion-Reason based questions of 1 mark each.
4. In section B, Question no. 21 to 25 are very short answer (VSA) type questions, carrying 2 marks each.
5. In section C, Question no. 26 to 31 are short answer (SA) type questions, carrying 3 marks each.
6. In section D, Question no. 32 to 35 are Long Answer (LA) type questions, carrying 5 marks each.
7. In section E, Question no. 36 to 38 are case- based questions , carrying 4 marks each.
8. There is no overall choice. However, 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.
9. Use of calculators is not allowed.

SECTION-A $[1 \times 20 = 20]$

(This section comprises of multiple-choice questions (MCQs) of 1 mark each. Select the correct option.)

1. The graph drawn below depicts



a) $y = sin^{-1}x$ b) $y = sin^{-1}2x$ c) $y = sin^{-1}\left(\frac{x}{2}\right)$ d) $y = 2sin^{-1}x$

2. If A is a matrix of order $m \times n$ and B is a matrix such that AB^T and $B^T A$ both are defined. Then order of the matrix B is

a) $n \times m$ b) $n \times n$ c) $m \times n$ d) $m \times m$

3. If A=$\begin{bmatrix} 2x-y & 0 & 0 \\ 0 & 8 & 0 \\ 0 & 0 & y \end{bmatrix}$ is a scalar matrix, then the value of x and y are

a) $x = 8, y = 4$ b) $x = 0, y = 0$ c) $x = 8, y = 8$ d) $x = 4, y = 8$

4. If $A.(adj\ A) = \begin{bmatrix} 3 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 3 \end{bmatrix}$, then the value of $|A| + |adj\ A|$ is equal to

a) 12 b) 9 c) 3 d) 27

5. If A is a square matrix of order 2 such that $\det(A) = 4,$ then det (4 adj A) is equal to

a) 16 b) 64 c) 256 d) 512

6. If the matrix A = $\begin{bmatrix} 0 & a & 3 \\ 2 & b & -1 \\ c & 1 & 0 \end{bmatrix}$ is a skew symmetric matrix, then $a + b + c$ is equal to

a) -5 b) 0 c) 5 d) 10

7. If f(x) = |sinx|, then

a) f is everywhere differentiable

b) f is everywhere continuous but not differentiable $at\ x = n\pi, n \in Z$

c) f is everywhere continuous but not differentiable at $x = (2n+1)\frac{\pi}{2}, n \in Z$

d) None of these

8. The function f(x) = [x], (*where [x] denotes the greatest integer less than or equal to x*), is continuous when x is equal to

a) 1 b) 1.5 c) -2 d) 4

9. The function $f(x) = x^2e^{-x}$ is strictly increasing on the interval

a) $(-\infty, \infty)$ b) $(0,2)$ c) $(2, \infty)$ d) $(-\infty, 0)$

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

a) 4 and2 b) 2 and 4 c) 2 and 3 d) 2 and 5

11. If $f(a+b-x) = f(x)$ *then* $\int_a^b xf(x)dx$ *is*

a) $\frac{a+b}{2}\int_a^b f(b-x)dx$

b) $\frac{a+b}{2}\int_a^b f(b+x)dx$

c) $\frac{b-a}{2}\int_a^b f(x)dx$

d) $\frac{a+b}{2}\int_a^b f(x)dx$

12. $\int \frac{x-1}{e^x\left(\sin^2\left(xe^{-x}\right)\right)}dx$ is

a) $\cot(xe^{-x}) + c$ b) $\operatorname{cosec}^2\left(xe^x\right) + c$ c) $\tan(xe^{-x}) + c$ d) $\log\left|\sin(xe^{-x})\right| + c$

13. The position vectors of points P and Q are $\vec{p}$ *and* $\vec{q}$ respectively. The point R divides line segment PQ in the ratio 3:1 and S is the mid-point of line segment PR. The position vector of S is

a) $\frac{\vec{p}+3\vec{q}}{4}$ b) $\frac{\vec{p}+3\vec{q}}{8}$ c) $\frac{5\vec{p}+3\vec{q}}{4}$ d) $\frac{5\vec{p}+3\vec{q}}{8}$

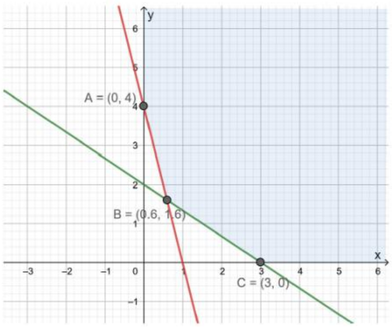
14. If $|\vec{a}| = 4, -5 \le k \le 3$ then $|k\vec{a}|$ lies on

a) $[0,20]$ b) $[-20,12]$ c) $[0,12]$ d) $[12,20]$

15. If the lines $\frac{x-3}{1} = \frac{y-2}{5} = \frac{z+1}{\lambda}$ and $\frac{x-1}{6} = \frac{y+1}{-2} = \frac{z+6}{4}$ are perpendicular then λ is equal to

a) 1 b) 2 c) 3 d) 4

16. The corner points of the shaded unbounded feasible region of an LPP are (0, 4),(0.6, 1.6) and (3, 0) as shown in the figure. The minimum value of the objective function Z = 4x + 6y occurs at



a) (0.6, 1.6) *only*

b) (3, 0) only

c) (0.6, 1.6) and (3, 0) only

d) every point on the line segment joining the points (0.6, 1.6) and (3, 0)

17. For a given LPP, the objective function is $Z = ax + by,\ \ a,b > 0$ and corner points of feasible region are A (2, 1), B (3, 5) and C (0, 7). If the value of the objective function at B is 2 less than sum of its values at A and C, then the relation between a and b is

a) $a - 3b + 2 = 0$ b) $a - 3b - 2 = 0$ c) $3a - b + 2 = 0$ d) $a + 3b - 2 = 0$

18. If $P(A) = \frac{3}{8}, P(B) = \frac{5}{8}$ and $P(A \cup B) = \frac{3}{4}$, then $P\left(\bar{B}/A\right)$ is equal to

a) $\frac{2}{3}$ b) $\frac{2}{5}$ c) $\frac{1}{4}$ d) $\frac{1}{3}$

ASSERTION-REASON BASED QUESTIONS

(In Question numbers 19 and 20, a statement of Assertion (A) is followed by a statement of Reason(R). Select the correct answer out of the following choices.)

(a) Both A and R are true and R is correct explanation of A

(b) Both A and R are true and R is not correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

19. **Assertion (A):** Range of $f(x) = \sin^{-1}x + \tan^{-1}x + \sec^{-1}x$ is $\left\{\frac{\pi}{4}, \frac{3\pi}{4}\right\}$

Reason (R): $f(x) = \sin^{-1}x + \tan^{-1}x + \sec^{-1}x$ is defined for all $x \in [-1,1]$

20. **Assertion (A):** The projection of the vector $\hat{i} - 2\hat{j} + \hat{k}$ on the vector $4\hat{i} - 4\hat{j} + 7\hat{k}$ is $\frac{19}{\sqrt{6}}$

Reason (R): The projection of vector $\vec{a}$ on $\vec{b}$ is $\vec{a}.\hat{b}$.

SECTION-B **[2 × 5 = 10]**

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

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

OR

Find the value of $\tan^2(\sec^{-1}2) + \cot^2(co\sec^{-1}3)$

22. Find the value of k if $f(x) = \begin{cases} \frac{1 - coskx}{xsinx}, & x \neq 0 \\ \frac{1}{2}, & x = 0 \end{cases}$ is continuous at $x = 0$.

23. Differentiate $\cos^{-1}(2x^2 - 1)$ with respect to $\cos^{-1}x$.

24. Evaluate: $\int_0^{\pi/6} e^{2x} \left(\frac{1+\sin 2x}{1+\cos 2x}\right) dx$

OR

Evaluate: $\int \frac{dx}{\sqrt{x}\left(\sqrt{x}+1\right)\left(\sqrt{x}+2\right)}$

25. Find the unit vector perpendicular to each of the vectors $(\vec{a}+\vec{b})$ and $(\vec{a}-\vec{b})$, where $\vec{a}=(4\hat{i}+3\hat{j}+\hat{k})$ and $\vec{b}=(2\hat{i}-\hat{j}+2\hat{k})$

SECTION-C **[$3 \times 6 = 18$]**

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

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

OR

Find 'a' and 'b', if the function given by $f(x)=\begin{cases} ax^2+b, \text{if } x<1 \\ 2x+1, \text{if } x\geq 1 \end{cases}$ is differentiable at $x=1$.

27. Minimize and maximize $Z=5x+2y$ subject to the following constraints :

$x-2y\leq 2,\ 3x+2y\leq 12,\ -3x+2y\leq 3, x\geq 0, y\geq 0$

28. Find the shortest distance between the lines whose vector equations are

$\vec{r}=(1-t)\hat{i}+(t-2)\hat{j}+(3-2t)\hat{k}$ and $\vec{r}=(s+1)\hat{i}+(2s-1)\hat{j}-(2s+1)\hat{k}$.

OR

Find the value of 'k' for which the lines $\frac{x+1}{3}=\frac{y+3}{5}=\frac{z+5}{k}$ and $\frac{x-2}{1}=\frac{y-4}{3}=\frac{z-6}{5}$ will intersect each other.

29. A card from a pack of 52 cards is lost. From the remaining cards of the pack, two cards are drawn and are found to be hearts. Find the probability of the missing card to be a heart.

30. By using integration find the area enclosed by the parabola $4y=3x^2$ and the straight line $3x-2y+12=0$.

OR

By using integration find the area of the triangular region whose sides have equations

$y=2x+1, y=3x+1$ and $x=4$.

31. A car starts from a point P at time $t=0$ seconds and stops at point Q. The distance x in metres covered by it, in t seconds is given by $x=t^2\left(2-\frac{t}{3}\right)$. Find the time taken by it to reach Q and also find distance between P and Q.

SECTION-D **[$5 \times 4 = 20$]**

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

32. The equation of the path traversed by the ball headed by a footballer is $y=ax^2+bx+c$; (where $0\leq x\leq 14$ and $a,b,c\in R$ and $a\neq 0$) with respect to a XY coordinate system in the vertical

plane. The ball passes through the points $(2,15),(4,25)$ and $(14,15)$. By using matrices, determine the values a, b and c. Also find the equation of the path traversed by the ball.

33. Evaluate $\int_0^{\pi} \frac{x\,dx}{a^2\cos^2 x+b^2\sin^2 x}$

OR

Evaluate $\int \frac{\sqrt{x^2+1}\left(\log(x^2+1)-2\log x\right)}{x^4}dx$

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

OR

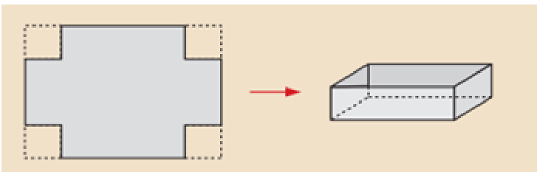
Solve the differential equation: $x^2y\,dx - \left(x^3+y^3\right)dy = 0$

35. A line passes through point $(-1,3,-2)$ and is perpendicular to both the lines $\frac{x}{1}=\frac{y}{2}=\frac{z}{3}$ and $\frac{x+2}{-3}=\frac{y-1}{2}=\frac{z+1}{5}$. Find the vector equation of the line. Also find the equation of the line parallel to the obtained line and passing through $(0,-3,4)$.

SECTION-E $[4 \times 3 = 12]$

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

36. A rectangular cake dish is made by cutting out squares from the corners of a 25 cm by 40 cm rectangle of tin plate, and then folding the metal to form the container.

Based on the given information, answer the following questions.

i) If x cm from each corner is cut out, then find length, breadth and height of the dish.

ii) Express the volume $V(x)$ in terms of x.

iii) Find the value of x for which the capacity of dish is maximum. Also find maximum volume.

OR

Find the interval in which the volume function $V(x)$ is strictly increasing or strictly decreasing.

37. In two different societies, there are some school going students – including girls as well as boys. Satish forms two sets with these students, as his college project. Let A= $\{a_1, a_2, a_3, a_4, a_5\}$ and

B ={b_1, b_2, b_3, b_4} where a_i 's and b_i 's are the school going students of first and second society respectively. Satish decides to explore these sets for various types of relations and functions. Using the information given above, answer the following:

i) Satish and his friend Rajat are interested to know the number of reflexive relations defined on both the sets A and B separately. What is difference between their results?

ii) To help Satish in his project, Rajat decides to form injective functions from set B to A. How many such functions are possible.

iii) Find the total number of relations from set A to set B.

OR

Find the total number of functions from set A to set B.

38. Ram bought two cages of birds: Cage-I contains 5 parrots and 1 owl and cage-II contains 6 parrots. One day Ram forgot to lock both cages. Two birds flew from cage-I to cage-II simultaneously. Then two birds flew back from cage-II to cage-I simultaneously. Assume that all the birds have equal chances of flying.

Based on the above information, answer the following questions.

i) When two birds flew from cage-I to cage-II and two birds flew back from cage-II to cage-I , then find the probability that the owl is still in cage-I.

ii) When two birds flew from cage-I to cage-II and two birds flew back from cage-II to cage-I , the owl is still seen in cage-I. What is the probability that one parrot and the owl flew from cage-I to cage-II?

BEST OF LUCK