CENTRAL KERALA SAHODAYA

MODEL EXAMINATION 2025-26

MATHEMATICS (041) – SET 1

Class: XII **Time: 3 hours**

Max. Marks: 80

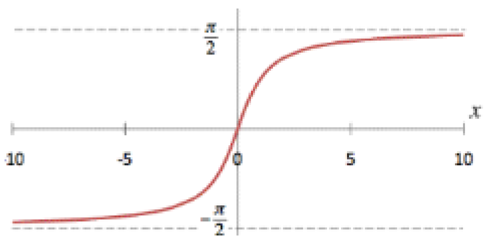
General Instructions :

1. This Question paper contains 38 questions. All questions are compulsory.
2. This question paper contains five sections **A, B, C, D** and **E.** Each section is compulsory. However there are internal choices in some questions.
3. **Section A** has **18 MCQ's** and **2** assertion reason based questions of 1 mark each.
4. **Section B** has **5Very Short Answer (VSA)-type** questions of 2 marks each.
5. **Section C** has 6 **Short Answer (SA) – type** questions of 3 marks each.
6. **Section D** has **4 Long Answer (LA) – type** questions of 5 marks each.
7. **Section E has 3 source based/case based/passage based /integrated units of assessment (**4 marks each) with sub parts.
8. Use of calculator is not allowed.

SECTION A

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

1. The given graph illustrates



a) $y = \tan^{-1} x$ b) $y = cosec^{-1}x$ c) $y = \cot^{-1} x$ d) $y = \sec^{-1} x$

2. If $\begin{bmatrix} 2x-1 & 3x \\ 0 & y^2-1 \end{bmatrix} = \begin{bmatrix} x+3 & 12 \\ 0 & 35 \end{bmatrix}$, then the value of $x - y$ is

a) $2 \text{ or } 10$ b) $-2 \text{ or } 10$ c) $2 \text{ or } -10$ d) $-2 \text{ or } -10$

3. If the matrix $A = \begin{bmatrix} 0 & r & -2 \\ 3 & p & t \\ q & -4 & 0 \end{bmatrix}$ is a skew symmetric matrix, then the value of $\frac{q+t}{p+r}$is

a) -2 b) 0 c) 1 d) 2

4. If A is a square matrix of order 4 and $|adjA| = 27, then\ A(adjA)$ is equal to

a) 3 b) 9 c) $3I$ d) 4

5. If inverse of matrix $\begin{bmatrix} 7 & -3 & -3 \\ -1 & 1 & 0 \\ -1 & 0 & 1 \end{bmatrix}$ is the matrix $\begin{bmatrix} 1 & 3 & 3 \\ 1 & \propto & 3 \\ 1 & 3 & 4 \end{bmatrix}$, then the value of $\propto$ is equal to

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

6. Let A be a matrix of order $m \times n$ and B is a matrix such that $A^T B$ & BA^T are defined. Then the order of B is

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

7. If $f(x) = \begin{cases} \frac{\sin^2 ax}{x^2}, x \neq 0 \\ 1, x \neq 0 \end{cases}$ is continuous at $x = 0$, then the value of a is

a) 1 b) -1 c) 0 d) ± 1

8. If $y = \log(\sin(x^2)), 0 < x < \frac{\pi}{2}$. Then the value of $\frac{dy}{dx}$at $x = \frac{\sqrt{\pi}}{2}$ is

a) 0 b) 1 c) $\frac{\pi}{4}$ d) $\sqrt{\pi}$

9. The function $f(x) = kx - sinx$ is strictly increasing for

a) $k > 1$ b) $k < 1$ c) $k > -1$ d) $k < -1$

10. If $\int \frac{x^3}{\sqrt{1+x^2}} dx = Q(1+x^2)^{\frac{3}{2}} + b\sqrt{1+x^2} + C$, then

a) $a = \frac{1}{3}, b = 1$ b) $a = -\frac{1}{3}, b = 1$ c) $a = -\frac{1}{3}, b = -1$ c) $a = \frac{1}{3}, b = -1$

11. $\int_0^1 \sqrt{\frac{1-x}{1+x}} dx$equals

a) $\frac{\pi}{2}$ b) $\frac{\pi}{2} - 1$ c) $\frac{\pi}{2} + 1$ d) *None of these*

12. If $\vec{a} + \vec{b} + \vec{c} = \vec{0}, |\vec{a}| = \sqrt{37}, |\vec{b}| = 3, |\vec{c}| = 4$, then the angle between $b\ and\ c$ is

a) $\frac{\pi}{6}$ b) $\frac{\pi}{4}$ c) $\frac{\pi}{3}$ d) $\frac{\pi}{2}$

13. Let $\vec{a}$ be a position vector whose tip is the point $(2, -3)$. If $\overrightarrow{AB} = \vec{a}$, where coordinates of A are $(-4,5)$ then the coordinates of B are

a) $(-2, -2)$ b) $(2, -2)$ c) $(-2,2)$ d) $(2,2)$

14. If $|\vec{a}+\vec{b}| = |\vec{a}-\vec{b}|$, for any two vectors ,then vectors $\vec{a}$ and $\vec{b}$ are

a) Orthogonal vectors c) Parallel vectors

b) Unit vectors d) Collinear vectors

15. The two lines $x = ay + b, z = cy + d$ and $x = a'y + b', z = c'y + d'$ will be perpendicular if and only if

a) $aa' + cc' + 1 = 0$ c) $aa' + bb' + cc' + 1 = 0$

b) $aa' + bb' + cc' = 0$ d) $(a' + a') + (b' + b') + (c' + c') = 0$

16. The corner points of the feasible region in the graphical representation of a Linear Programming Problem are $(2,72), (15,20)$ and $(40,15)$. If $Z = 18x + 9y$ be the objective function , then

a) Z is maximum at $(2,72)$, minimum at $(15,20)$.

b) Z is maximum at $(15,20)$, minimum at $(40,15)$

c) Z is maximum at $(40,15)$, minimum at $(15,20)$.

d) Z is maximum at $(40,15)$, minimum at $(2,72)$.

17. Two events A and B are independent if

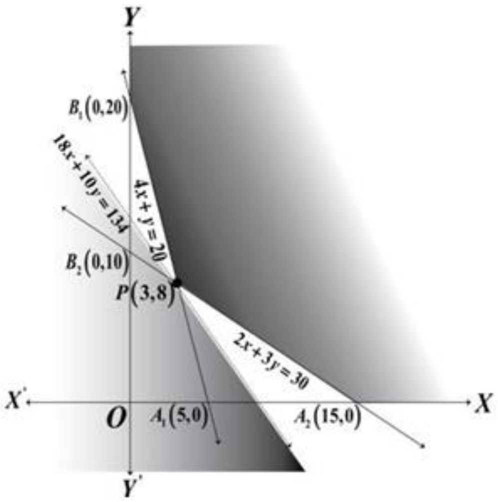
a) A and B are mutually exclusive.

b) $P(A' \cap B') = (1 - P(A))(1 - P(B)$

c) $P(A) = P(B)$

d) $P(A) + P(B) = 1$

18. A Linear Programming Problem along with graph of its constraints is shown below. The corresponding objective function is $Z = 18x + 10y$ which has to be minimized. The smallest value of the objective function Z is 134 and is obtained at the corner point (3,8).



The optimal solution of the above linear programming problem

a) does not exist as the feasible region is unbounded.

b) does not exist as the inequality $18x + 10y < 134$ does not have any point in common with the feasible region.

c) exists as the inequality $18x + 10y > 134$ has infinitely many points in common with the feasible region.

d) exists as the inequality $18x + 10y < 134$ does not have any point in common with the feasible region.

ASSERTION-REASON BASED QUESTIONS

In the following questions, a statement of assertion(A) is followed by a statement of Reason(R). Choose the correct answer out of the following choices.

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:** The range of the function $f(x) = 2\sin^{-1}x + \frac{3\pi}{2}$, where $x \in [-1,1]$ is $[\frac{\pi}{2}, \frac{5\pi}{2}]$

    REASON: The range of principal value branch of $\sin^{-1}x \ is \ [0, \pi]$.

20. **ASSERTION:** If $|\vec{a} \times \vec{b}| = 1 \ and \ |\vec{a}.\vec{b}| = \sqrt{3}$, then the angle between $\vec{a} \ and \ \vec{b}$is $\frac{\pi}{6}$.

    REASON: $|\vec{a} \times \vec{b}| = |\vec{a}||\vec{b}|sin\theta$ and $|\vec{a}.\vec{b}| = |\vec{a}||\vec{b}|cos\theta$

SECTION B

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

21. Evaluate $-\tan^{-1}\left(-\frac{1}{\sqrt{3}}\right) + \cot^{-1}\left(\frac{1}{\sqrt{3}}\right) + \tan^{-1}\left(\sin\left(-\frac{\pi}{2}\right)\right)$

    OR

    Find the domain of the function $y = \sin^{-1}\sqrt{x-1}$.

22. Find a vector of magnitude 5 which is perpendicular to both the vectors

$$3\hat{\imath} - 2\hat{\jmath} + \hat{k} \ and \ 4\hat{\imath} + 3\hat{\jmath} - 2\hat{k}$$

23. If $y = (x + \sqrt{x^2 - 1})^2$, then show that $(x^2 - 1)\left(\frac{dy}{dx}\right)^2 = 4y^2$.

OR

Find the derivative of $\cos^{-1}(2x^2 - 1)$ with respect to $\cos^{-1} x$..

24. If the function $f(x)$ defined by

$$f(x) = \begin{cases} -2sinx, x \leq -\pi/2 \\ Asinx + B, -\frac{\pi}{2} < x \leq \frac{\pi}{2} \\ cosx, \quad x > \frac{\pi}{2} \end{cases}$$ is continuous everywhere, then find the values

of A & B.

25. Find $\int e^x (\frac{\sqrt{1+sin2x}}{1+cos2x} dx$.

SECTION C

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

26. Surface area of a balloon (spherical), when air is blown into it, increases at a rate of $5mm^2/s$. When the radius of the balloon is 8 mm, find the rate at which the volume of the balloon is increasing.

27. Define the function $y = |x + 1|$. Evaluate $\int_{-4}^{2} |x + 1| dx$. What does the value of this integral represent?

OR

Find the area of the region bounded by the parabola $y = x^2$ and $y = x$.

28. For the vacancy advertised in the newspaper, 3000 candidates submitted their applications. From the date it was revealed that two third of the total applicants were females and other were males. The section for the job was done through a written test. The performance of the applicants indicates that the probability of a male getting a distinction in written test is 0.4 and that of a female getting distinction is 0.35. Find the probability that the candidate chosen at random will have a distinction in the written test.

29. Find the points on the line $\frac{x+2}{3} = \frac{y+1}{2} = \frac{z-3}{2}$ at a distance of 5 units from the point $P(1,3,3)$.

OR

Find the equation of a line passing through $(2,-1,3)$ and perpendicular to the lines $\vec{r} = (\hat{\imath} + \hat{\jmath} - \hat{k}) + \boldsymbol{\lambda}(2\hat{\imath} - 2\hat{\jmath} + \hat{k})$ and $\hat{r} = (2\hat{\imath} - \hat{\jmath} - 3\hat{k}) + \mu(\hat{\imath} + 2\hat{\jmath} + 2\hat{k})$

30. Solve the following L.P.P graphically:

Minimize $Z = 6x + 3y$

Subject to constraints

$4x + y \geq 80$

$x + 5y \geq 115$

$3x + 2y \leq 150$

$x, y \geq 0$

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

OR

If $e^y(x + 1) = 1$, then show that $\frac{d^2y}{dx^2} = \left(\frac{dy}{dx}\right)^2$.

SECTION D

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

32. If $A = \begin{bmatrix} 1 & 2 & -3 \\ 2 & 0 & -3 \\ 1 & 2 & 0 \end{bmatrix}$, then find A^{-1} and hence solve the following system of equations:

$x + 2y - 3z = 1$

$2x - 3z = 2$

$x + 2y = 3$

33. Evaluate: $\int_0^{\pi} \frac{4x\sin x}{1+\cos^2 x}\, dx$.

OR

Integrate the following function:

$$\int \frac{1}{x[(\log x) - 3\log x - 4]} dx$$

34. Solve the following differential equation

$$(1 + x^2)\frac{dy}{dx} + y = e^{\tan^{-1} x}, given\ that\ y(0) = 1$$

OR

Solve the differential equation $2xydy = (x^2 + y^2)dx$.

35. Find the shortest distance between the lines $L_1 \& L_2$ given below.

L_1: $The\ line\ passing\ through\ (2, -1, 1) and\ parallel\ to \frac{x}{1} = \frac{y}{1} = \frac{z}{3}$

$L_2: \vec{r} = \hat{\imath} + (2\mu + 1)\hat{\jmath} - (\mu + 2)\hat{k}$

OR

Find the image P' of the point $P(1,6,3)$ in the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$. Also find the equation of the line joining $P \& P'$.

SECTION E

(This section comprises of 3 case-study/passage-based questions of 4 marks each with subparts).

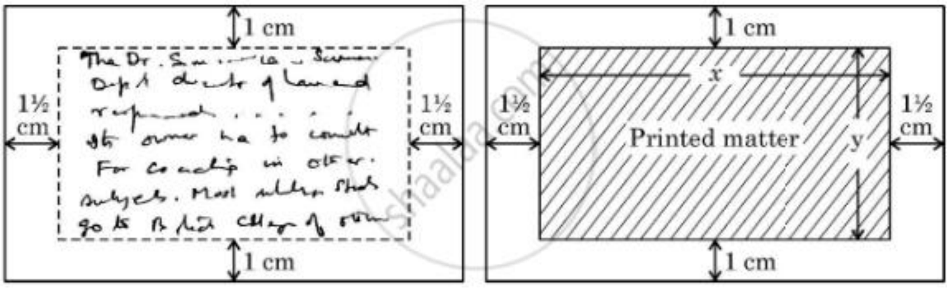
36. Read the following passage and answer the following:

For diagnosis of Tuberculosis(TB) testing is very important. On testing the probability that a person is diagnosed correctly when the person is actually suffering from TB is 0.99.The probability that doctor diagnoses incorrectly that a person is suffering from TB is 0.001. In a certain city it was detected that there is 0.001 chance that a person suffers from TB.

a) If the population of city is 200,000, then how many persons are expected to suffer from TB?
b) What is the probability that a person is diagnosed correctly for TB?
c) What is the probability that a person actually has a TB when he is diagnosed to have TB?

d) Find the probability that error occurred in diagnosing the TB?

37. A rectangular visiting card is to contain $24\ cm^2$ of printed matter. The margins at the top and bottom of the card are to be 1 cm and the margins on the left and right are to be $1\frac{1}{2}$ cm as shown below.



On the basis of the above information answer the following questions:

a) Write the expression for the area of the visiting card in terms of x.

b) Obtain the dimensions of the card of minimum area.

38. Nitya and Rohit are playing Ludo at home. While rolling a die Nitya's sister Ananya observed and noted the possible outcomes of the throw every time belongs to a set $\{1,2,3,4,5,6\}$. Let A be the set of players and B be the set of all possible outcomes.

Based on the above information answer the following questions.

a) How many relations are possible?

b) How many reflexive relations are there on B?

c) I) If R be a relation on B defined by $R = \{(a, b): a, b \in B, a\ divides\ b\}$, then find whether R is an equivalence relation or not.

OR

II) I f P be a relation on B defined by $xPy \Leftrightarrow x^2 + y^2 \leq 0$, then find whether P is an equivalence relation or not.