INFINITY THINK BEYOND.....

AN EDUCATIONAL INSTITUTE

XII MIND CURVE Mid Term Maths Test Series 2026-27

Test 06

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S no	Syllabus Covered	Chapters(In Half Yearly)	Marking Scheme
1	Unit 1 Relation & Function	Relation & Functions Inverse Trigonometric Function	15
2	Unit 2 Algebra	Matrices Determinants	20
3	Unit 3 Calculus	Continuity & Differentiability Application Of Derivates Integrals Application Of Integrals Differential Equations	40
4	Unit 4 Linear Programming	LPP	5

Note: Students/Teachers can refer to this Sample Paper for practice purpose. However, students may find or experience different exam pattern as syllabus or marking scheme may vary school to school.

MM:80 | **GENERAL INSTRUCTIONS** | **Time : 3Hrs**

READ CAREFULLY ALL INSTRUCTIONS

1. **This Question Paper has 5 Sections A, B, C, D and E.**
2. **Section A has 20 MCQs carrying 1 mark each**
3. **Section B has 5 questions carrying 02 marks each.**
4. **Section C has 6 questions carrying 03 marks each.**
5. **Section D has 4 questions carrying 05 marks each.**
6. **Section E has 3 case based integrated units of assessment (04 marks each) with sub parts of the values of 1, 1 and 2 marks each respectively.**
7. **All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2marks questions of Section E.**
8. **Draw neat figures wherever required. Take π =22/7 wherever required if not stated.**
9. **This paper consists of 38 questions.**
   a. **Write your answers neatly and legibly.**
   b. **Ensure you have not left any question unanswered**

SECTION – A

Questions 1 to 20 carry 1 mark each.

1. If $(2 \quad -8 \quad 3)\begin{pmatrix} 2023 & 2025 & 1 \\ 2022 & 2024 & 0 \\ 2021 & 2022 & 1 \end{pmatrix}\begin{pmatrix} 2021 \\ 2022 \\ 2023 \end{pmatrix} = A$,then the order of matrix A is

(a) 3 x 3 (b) 1 x 1 (c) 3 x 1 (d) 1 x 3

2. Let A = { 1,2,3 } . Then total number of reflexive relations on set A is

(a)8 (b)64 (c)16 (d) 32

3. If $\left|\frac{A^{-1}}{2}\right| = \frac{1}{K|A|}$ where A is a 3 x 3 matrix, then the value of k is

(a) $\frac{1}{8}$ (b) 8 (c) 2 (d) $\frac{1}{2}$

4. The corner points of the feasible region determined by the system of linear constraints are $(0,3), (1,1)$ and $(3,0)$. Let $Z = px + qy$, where $p, q > 0$. Conditions on p and q so that the minimum of z occurs at $(3,0)$ and $(1,1)$.

(a) $p = 3q$ (b) p = 4q (c) $2p = q$ (d) p = q

5. If A is a symmetric matrix, then which of the following is not Symmetric matrix,

(a) $A + A^T$ (b) $A.A^T$ (c) $A - A^T$ (d) A^T

6. If $x = \sin^3 t$, $y = \cos^3 t$ then $\frac{dy}{dx}$

(a) tan t (b) cot t (c) – tan t (d) – cot t

7. The sum of order & degree of the differential equation $\frac{d}{dx}\left(\left(\frac{d^2y}{dx^2}\right)^3\right) = 0$ is

(a) 5 (b) 4 (c) 2 (d) 3

8. The general solution of the differential equation $\frac{dy}{dx} = \frac{y}{x}$ is

(a) x = y + c (b)x – y = c (c) xy = c (d) $\frac{x}{y} = c$

9. Principal value of $\tan^{-1}\left(\tan\frac{7\pi}{6}\right)$ is

(a) $\frac{7\pi}{6}$ (b) $-\frac{\pi}{6}$ (c) $\frac{\pi}{6}$ (d) $-\frac{7\pi}{6}$

10. If f(x) = a (x – cos x) is strictly decreasing in R,then 'a' belongs to :

(a){0} (b)(0,∞) (c)(- ∞ , 0) (d)(- ∞, ∞)

11. If $y = 5e^{7x} + 6e^{-7x}$, such that $\frac{d^2y}{dx^2} - ky = 0$ then, the value of k will be

(a)-49 (b) 1 (c) 49 (d) 0

12. If A is a 3 x 3 matrix and $|A| = -2$ then value of $|A\ (adj\ A)|$ is

(a) -2 (b) 2 (c) -8 (d) 8

13. Value of $\int \frac{\cos\sqrt{x}\,dx}{\sqrt{x}}$ is

(a) $-2\sin\sqrt{x} + C$ (b) $\sin\sqrt{x} + C$

(c) $2\cos\sqrt{x} + C$ (d) $2\sin\sqrt{x} + C$

14. Which of the following is correct?

(a) LPP always has a unique solution.

(b)every LPP has a unique solution.

(c)LPP admits two optimal solution.

(d) If an LPP admits two optimal solution, then it has infinitely many optimal solution.

15. If $\cos(\tan^{-1}x + \cot^{-1}\sqrt{3}) = 0$,then value of x is :

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

16. If $\int \frac{2\cos 2x-1}{1+2\sin x}$ dx is equal to

(a) $x - 2\cos x + c$ (b) $x + 2\cos x + c$

(c) $-x - 2\cos x + c$ (d) $-x + 2\cos x + c$

17. Let $\sin^{-1}(2x) + \cos^{-1}\left(\frac{1}{2}\right) = \frac{\pi}{2}$. Then the value of x is

(a) $\frac{1}{8}$ (b) $\frac{1}{2}$ (c) 8 (d) $\frac{1}{4}$

18. If A = $\begin{pmatrix}3 & 5\\ 7 & 9\end{pmatrix}$ is written as A = P +Q , where P is a symmetric matrix and Q is skew symmetric matrix, then the matrix P will be given by

(a) $\begin{pmatrix}3 & 3\\ 6 & 9\end{pmatrix}$ (b) $\begin{pmatrix}3 & 6\\ 6 & 9\end{pmatrix}$

(c) $\begin{pmatrix}3 & 7\\ 5 & 9\end{pmatrix}$ (d) $\begin{pmatrix}0 & -2\\ 2 & 0\end{pmatrix}$

19. Assertion: Range of [$\sin^{-1}x + 2\cos^{-1}x$] is $[0,\pi]$

Reason: Principle value branch of $\sin^{-1}x$ has range $[-\frac{\pi}{2},\frac{\pi}{2}]$

(a) Both Assertion and Reason are correct and Reason is the correct explanation for Assertion

(b) Both Assertion and Reason are correct and Reason is not the correct explanation for Assertion.

(c) assertion is true but the reason is false.

(d)assertion is false and reason are true.

20. Assertion: If a man with height 2m is walking away from a lamp post of height 6 m at a uniform speed of 10m/minute, then the length of his shadow increases at the rate of 5m/minute .

Reason: The rate of change of the length of the shadow is half of the rate at which the man walks away from the lamp post.

(a)both Assertion and reason are correct and reason is correct explanation for Assertion

(b) both Assertion and reason are correct but reason is not correct explanation for Assertion

(c) Assertion is true but reason is false.

(d) Assertion is false and reason are true

SECTION – B

Questions 21 to 25 carry 2 mark each.

21. (A) Find whether the function f(x) = $\cos\left(2x + \frac{\pi}{4}\right)$, is increasing or decreasing in x ϵ $\left(\frac{3\pi}{8},\frac{5\pi}{8}\right)$.

OR

(B)A spherical ice-ball melts uniformly. When its radius is 10 cm, determine the rate of change of its volume with respect to the radius.

22. Find the matrix X and Y, if X + Y = $\begin{pmatrix}7 & 0\\ 2 & 5\end{pmatrix}$ and X - Y = $\begin{pmatrix}3 & 0\\ 0 & 3\end{pmatrix}$.

23. Find $\int e^x \frac{\sqrt{1+\sin 2x}}{1+\cos 2x}$ dx

24. If x = cos t + log tan $\left(\frac{t}{2}\right)$, y = sin t ,then find the value of $\frac{d^2y}{dx^2}$ at t = $\frac{\pi}{4}$.

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

OR

(B) If y = 5cosx – 3 sinx , prove that $\frac{d^2y}{dx^2}$ + y = 0 .

SECTION – C
Questions 26 to 31 carry 3 mark each

26. Determine the value of a such that following function is continuous at x = 0

$$f(x) = \begin{cases} \frac{x+\sin x}{\sin(a+1)x}, & \text{if } -\pi < x < 0 \\ 2, & \text{if } x = 0 \\ \frac{2(e^{\sin bx}-1)}{x}, & \text{if } x > 0 \end{cases}$$

27. Minimize $Z = 3x + 2y$ subject to the constraints

$$x + y \geq 8, 3x + 5y \leq 15, x \geq 0, y \geq 0$$

28. Evaluate : $\int_1^5 (|x-1| + |x-2| + |x-4|)dx$

29.(A) Solve : $x\frac{dy}{dx} + y - x + xy \cot x = 0$ $(x \neq 0)$.

OR

(B) Find the particular solution of the differential equation : $(1+e^{2x})dy + (1 + y^2)\, e^x dx = 0$ given that y = 1 when x = 0 .

30. (A) Let f : N→N, be defined by $f(n) = \begin{cases} \frac{n+1}{2}, & if\ n\ is\ odd \\ \frac{n}{2}, & if\ n\ is\ even \end{cases}$ $for\ all\ n \in N$

State whether the function f is bijective . Justify your answer

OR

(B) Let N denote the set of all natural numbers and R be the relation on N×N defined by (a,b)R(c,d)⇔ad(b+c)=bc(a+d). Prove that R is an equivalence relation.

31. Find the value of x,y,z if $A = \begin{pmatrix} 0 & 2y & z \\ x & y & -z \\ x & -y & z \end{pmatrix}$ statisfies $A' = A^{-1}$

SECTION – D
Questions 32 & 35 carry 5 mark each.

32. (A) Evaluate : $\int_0^{\frac{\pi}{4}} (\sqrt{\tan x} + \sqrt{\cot x})\, dx$

OR

(B) Evaluate: $\int_{-a}^{a} \frac{x^2}{1+e^x} dx$

33. (A) Solve the following system of equations by using matrix method .

x + 2y + 3z = 6 , 2x – y + z = 2 ,3x + 2y – 2z = 3 .

OR

(B) If $A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$ then show that $A^3 - 6A^2 + 7A + 2I = O$.

34. (A) Find the area of the region bounded between the parabola $4y=3x^2$ and the line 3x -2y +12= 0

OR

(B) If the area bounded by the parabola $y^2 = 16ax$ and the line y = 4mx is $\frac{a^2}{12}$ sq. Units, then using integration ,find the value of m .

35. (A) A wire of length 28 m is to be cut into two pieces. One of the pieces is to be made into a square and the other into a circle. What should be the length of the two pieces so that the combined area of the square and the circle is minimum?

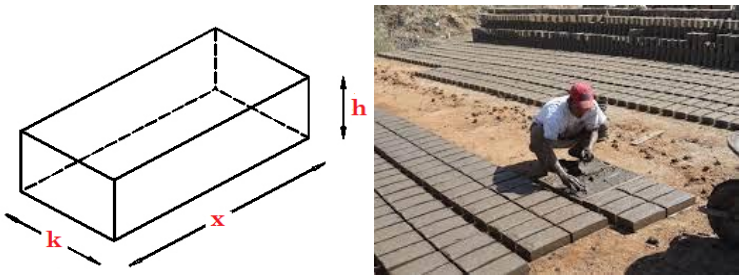
OR

(B)A particle is moving along the curve represented by the polynomial $f(x) = (x-2)^2(x-1)$. Find the rate at which the particle is moving. What are the critical points of polynomial f(x)? Find the interval(s) where f(x) is strictly increasing/decreasing.

SECTION – E

Questions 36 & 38 carry 4 mark each

36. Read the following passage and then answer the questions given below.



A foreign client approaches ISHA BRICKS COMPANY for a special type of bricks.

The client requests for few samples of bricks as per their requirement.

The solid rectangular brick is to be made from 1 cubic feet of clay of special type.

The brick must be 3 times as long as it is wide

(i)According to the figure shown, the length of brick is 'x', width is 'k' and height is 'h'. Obtain an expression in terms of 'h' and 'k'.

(ii) Express the surface area (S) of the brick, as a function of 'k'.

(iii)(a) Find $\frac{dS}{dK}$ At what value of k, $\frac{dS}{dK} = 0$?

or

(b)Show that $\frac{d^2S}{dk^2}$ is positive, at this obtained value of k. What does it signify?

37. Three shopkeepers P, Q and R go to a store to buy stationary, P purchases 12 dozen notebooks, 5 dozen pens and 6 dozen pencils. Q purchases 10 dozen notebooks, 6 dozen pens and 7 dozen pencils. R purchases 11 dozen notebooks, 13 dozen pens and 8 dozen pencils. A notebook costs Rs.40, a pen costs Rs.12 and a pencil costs Rs. 3.

Based on above information, answer the following:

(i) Represent in matrix form the number of items purchased by shopkeepers P,Q and R .

(ii) What amount P has to pay?

(iii) (a)Find XY if Y represents the matrix formed by the cost of each item and X represents the matrix formed by the number of items.

OR

(b)Find determinant of the matrix formed in (1) part

38. In a classroom, a teacher teaches a topic 'Relation on a set', which is defined below :

A relation R on a set A is said to be an equivalence relation on A if it is

I. **Reflexive** i.e. xRx or $(x,x) \in R, \forall\, x \in A$

II. **Symmetric** i.e. $xRy \implies yRx$ or if $(x,y) \in R$ then $(y,x) \in R, \forall\, x,y \in A$

III. **Transitive** i.e. xRy and yRz then xRz or$(x, y) \in R$ and $(y, z) \in R$, then $(x, z) \in R \forall x, y, z \in A$
Based on the above information, answer the following questions :

(i) If the relation R on the set on the set N of all natural numbers defined as R = {(x,y) : y = x +5 and x < 4} then check whether R is Reflexive, Symmetric or Transitive.

(ii) The relation R in the set Z of integers given by R = {(a,b) : 2 divides (a-b)}, show that R is an equivalence relation.