

CLASS XII
PRE MID TERM EXAM (2026 - 27)
MATHEMATICS (041)
SET A2

Time Allowed: 2 hrs.
General Instructions:

Max Marks: 50

1. This Question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
2. Section A has 9 MCQ's and 01 Assertion-Reason based questions of 1 mark each.
3. Section B has 3 Very Short Answer (VSA)-type questions of 2 marks each.
4. Section C has 5 Short Answer (SA)-type questions of 3 marks each.
5. Section D has 3 Long Answer (LA)-type questions of 5 marks each.
6. Section E has 1 source based/case based/passage based/integrated units of assessment (4 marks) with sub parts (1+1+2).

SECTION A**(Multiple Choice Questions) Each question carries 1 mark.**

1. If $y = 2 \sin(3 \cos 4x)$ then $\frac{dy}{dx}$ is equal to

- (a) $-12 \sin 4x \cos(3 \cos 4x)$ (b) $-36 \sin 4x \cos(3 \cos 4x)$
 (c) $-48 \sin 4x \cos(3 \cos 4x)$ (d) $-24 \sin 4x \cos(3 \cos 4x)$

2. If $f(x) = [x]$, $x \in \mathbb{R}$ is the greatest integer function, then the correct statement is:

- (a) f is continuous but not differentiable at $x = 2$.
 (b) f is neither continuous nor differentiable at $x = 2$
 (c) f is continuous as well as differentiable at $x = 2$
 (d) f is not continuous but differentiable at $x = 2$

3. The value of $|A|$, where $A = \begin{bmatrix} 0 & 2x-1 & \sqrt{x} \\ 1-2x & 0 & 2\sqrt{x} \\ -\sqrt{x} & -2\sqrt{x} & 0 \end{bmatrix}$, $x \in \mathbb{R}^+$, is

- (a) $(2x+1)^2$ (b) 0 (c) $(2x+1)^3$ (d) $(2x-1)^2$

4. If matrices A and B are of order 1×3 and 3×1 respectively, then the order of $A'B'$ is

- (a) 1×3 (b) 3×1 (c) 1×1 (d) 3×3

5. If $A = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$, then A^{2023} is equal to

- (a) $\begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$ (b) $\begin{bmatrix} 0 & 2023 \\ 0 & 0 \end{bmatrix}$ (c) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ (d) $\begin{bmatrix} 2023 & 1 \\ 0 & 2023 \end{bmatrix}$

6. The principal value of $\sin^{-1}(\cos \frac{43\pi}{5})$ is

- (a) $-\frac{7\pi}{5}$ (b) $-\frac{\pi}{10}$ (c) $\frac{\pi}{10}$ (d) $\frac{3\pi}{5}$

7. The value of $\cos\left(\frac{\pi}{6} + \cot^{-1}(-\sqrt{3})\right)$ is:

(a) -1

~~(b) 0~~

(c) 1

(d) $\frac{1}{2}$

8. If R be a relation defined as aRb iff $|a - b| > 0, a, b \in \mathbb{R}$ then R is

(a) reflexive

(b) symmetric

~~(c) transitive~~

(d) symmetric and transitive

9. Let $A = \{a, b\}$, then the number of reflexive relations defined on A is

~~(a) 16~~

(b) 8

(c) 4

(d) 2

10. Given below is a statement of **Assertion (A)** which is followed by a statement of **Reason**

(R). Of the following options, choose the correct one.

(a) Both A and R are true and R is the 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.

Assertion (A): $f(x) = \begin{cases} x \sin \frac{1}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases}$ is continuous at $x = 0$.

Reason (R): When $x \rightarrow 0$, $\sin \frac{1}{x}$ is a finite value between -1 and 1.

SECTION B

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

11(a). If $x = a \sin^3 t, y = b \cos^3 t$, then find $\frac{dy}{dx}$ at $t = \frac{\pi}{4}$

OR

11(b). If $y = \sqrt{\cos x + y}$, prove that $\frac{dy}{dx} = \frac{\sin x}{1-2y}$.

12. Find the domain of $g(x) = \cos^{-1}(x^2 - 1)$.

Hence, find the value of x for which $g(x) = \frac{\pi}{3}$.

$$y = x^2 - 1$$

13. Check whether $f: \mathbb{R} - \{3\} \rightarrow \mathbb{R}$ defined as $f(x) = \frac{x-2}{x-3}$ is onto or not.

SECTION C

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

14. If $f(x) = \begin{cases} \frac{1-\cos 4x}{x^2}, & \text{when } x < 0 \\ a, & \text{when } x = 0 \text{ and } f(x) \text{ is continuous at } x = 0, \text{ then find the value} \\ \frac{\sqrt{x}}{\sqrt{16+\sqrt{x}}-4}, & \text{when } x > 0 \end{cases}$

of a . = 8

15. Given a square matrix A of order 3 such that $A^2 = \begin{bmatrix} 3 & -4 & 4 \\ 0 & -1 & 0 \\ -2 & 2 & -3 \end{bmatrix}$, show $A^3 = A^{-1}$

$$A^3 = A^{-1}$$

16. Obtain the value of $\Delta = \begin{vmatrix} 1+x & 1 & 1 \\ 1 & 1+y & 1 \\ 1 & 1 & 1+z \end{vmatrix}$ in terms of x, y and z . Further, if $\Delta = 0$ and x, y, z are non-zero real numbers, prove that $x^{-1} + y^{-1} + z^{-1} = -1$.

17. If A is a symmetric matrix and B is a skew symmetric matrix such that $A - B = \begin{bmatrix} 2 & 3 \\ 5 & -1 \end{bmatrix}$, then find $\text{adj}(AB)$.

18(a). Prove that the relation R in the set $A = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$ given by $R = \{(a, b) : |a - b| \text{ is divisible by } 4, a, b \in A\}$ is an equivalence relation.

OR

18(b). Show that the relation S in the set $\mathbf{R}$ real numbers, defined as $S = \{(a, b) : a, b \in \mathbf{R} \text{ and } a \leq b^3\}$ is neither reflexive nor symmetric nor transitive.

SECTION D

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

19(a). The equation of the path traced by a roller coaster is given by $y = ax^3 + bx^2 + cx - 27$ where $a, b, c \in \mathbf{R}$ & $a \neq 0$.

If the roller coaster passes through the points $(-1, 0), (-2, 35)$ & $(1, -40)$, then find the values of a, b & c by solving the system of linear equations in a, b & c using matrix method.

OR

19(b). If $A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix}$, find A^{-1} . Hence solve the system of equation

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

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

$$x - 3y + z = 2$$

20. Differentiate with respect to x : $(\sin x)^x + \sin^{-1} \sqrt{x}$

21. Let R be a relation on $A = \mathbf{N} \times \mathbf{N}$ defined by $(a, b) R (c, d) \Leftrightarrow ad(b+c) = bc(a+d)$. Show that R is an equivalence relation on set A .

SECTION E

(This section comprises of one case-based question of 4 marks with three sub-parts (i), (ii) and (iii) of 1, 1, 2 marks respectively.)

22. A professional typist having his shop in a busy market, charges ₹ 200 for typing 8 English and 4 Hindi pages, while he charges ₹ 275 for typing 5 English and 10 Hindi pages.

Based on the above information, answer the following questions:

(1+1+2)

- If he charges ₹ x for one page of English and ₹ y for one page of Hindi, express the information in terms of matrix equation $AX = B$.
- Show that the matrix A is non-singular.
- (a) Using the matrix method, find the charges per page of English and Hindi

OR

- (b) For any two square matrices A and B of the same order, show that $(B'AB)$ is symmetric or skew symmetric according as A is symmetric or skew symmetric.