



AMBER INTERNATIONAL SCHOOL, THANE.
ACADEMIC YEAR (2025-26)
UNIT TEST- I
SUBJECT: MATHEMATICS
CODE: 041

GRADE: XII
MARKS: 40

DATE: 09.07.2025
DURATION: 1 ½ Hours

General Instructions:

1. This question paper contains three sections – A, B, C, D and E. Each section is compulsory.
2. Section - A has eight MCQ type questions and two Assertion and reason type questions of 1 Mark each.
3. Section – B has 3 small answer questions (SA-1) of 2 marks each.
4. Section - C has 2 small answer questions (SA-2) of 3 marks each.
5. Section - D has 2 long answer questions of 5 marks each.
6. Section - E has 2 Case study type questions of 4 marks each with two questions of 1 mark each and a question of 2 Marks.
7. All questions are compulsory. Internal choices in one question of 2, 3 and 5 marks questions have been provided and an internal choice had been provided in the 2 marks question of section E.
8. Use graph papers and Draw a well labelled diagram wherever required.

SECTION A

(Question carries one mark each)

1. If $f(x) = \left\{ \frac{\sin^2(ax)}{ax^2} \right\}$, $x \neq 0$, and $f(x) = 1$, If $x \neq 0$, then the value of a is
(a) 1 (b) 0 (c) -1 (d) None of these.
2. If $\begin{bmatrix} a & c & 0 \\ b & d & 0 \\ 0 & 0 & 5 \end{bmatrix}$ is a scalar matrix, then the value of $a + 2b + 3c + 4d$ is ;
(a) 0 (b) 5 (c) 10 (d) 25
3. If A and B are two square matrices of order 2 and $|A| = 2$ and $|B| = 5$, then $|-3AB|$ is:
(a) -90 (b) -30 (c) 30 (d) 90
4. Given that $A^{-1} = \frac{1}{7} \begin{bmatrix} 2 & 1 \\ -3 & 2 \end{bmatrix}$, matrix A is;
(a) $7 \begin{bmatrix} 2 & -1 \\ 3 & 2 \end{bmatrix}$ (b) $\begin{bmatrix} 2 & -1 \\ 3 & 2 \end{bmatrix}$ (c) $\frac{1}{7} \begin{bmatrix} 2 & -1 \\ 3 & 2 \end{bmatrix}$ (d) $\frac{1}{49} \begin{bmatrix} 2 & -1 \\ 3 & 2 \end{bmatrix}$

5. A function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined as $f(x) = x^2 - 4x + 5$ is:
 (a) Bijective (b) only injective (c) only surjective (d) None of these
6. The domain of $\sin^{-1}(3x)$ is equal to:
 (a) $[-1, 1]$ (b) $[-1/3, 1/3]$ (c) $[3, -3]$ (d) $[-3\pi, 3\pi]$
7. Derivative of $e^{\sin^2 x}$ with respect to $\cos(x)$ is:
 (a) $\sin(x) e^{\sin^2 x}$ (b) $\cos(x) e^{\sin^2 x}$ (c) $-2 \cos(x) e^{\sin^2 x}$ (d) $-2 \sin^2 x \cos x e^{\sin^2 x}$
8. If $|A| = |kA|$, where A is a square matrix of order 2, then sum of all possible values of k is
 (a) -1 (b) 1 (c) 0 (d) 2

DIRECTION: In the question number 9 and 10, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct option.

9. **ASSERTION** :- For an inverse trigonometry function $\sin^{-1}(\sin(2\pi/3)) = 2\pi/3$
REASON :- The principal value branch of $\sin^{-1}(x)$ is $[-\pi/2, \pi/2]$
 (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)
 (b) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of assertion (A)
 (c) Assertion (A) is true but reason (R) is false.
 (d) Assertion (A) is false but reason (R) is true.
10. **ASSERTION** :- If R is a relation defined on the set of natural numbers $\mathbb{N}$ such that $R = \{(x, y) : x, y \in \mathbb{N} \text{ and } 2x + y = 24\}$, then R is an equivalence relation.
REASON :- The relation is said to equivalence relation if it's reflexive, symmetric and transitive.
 (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)
 (b) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of assertion (A)
 (c) Assertion (A) is true but reason (R) is false.
 (d) Assertion (A) is false but reason (R) is true.

SECTION B

(Each question carries 2 marks)

11. (a) Find the function $f(x) = (1-x)^{1/3}$ is injective or surjective or bijective?
 OR

(b) If $f(x) = \frac{x-3}{|x-3|}$ then find the range of the function.

12. If $\begin{bmatrix} 3 & 2 \\ 4 & 3 \end{bmatrix}^{2022} + \begin{bmatrix} 3 & -2 \\ -4 & 3 \end{bmatrix}^{2022} = (a^{2022} + b^{2022}) I$, where $a, b \in \mathbb{R}$, then find the value of $a^2b + ab^2$.

13. Find a matrix A such that $A \begin{bmatrix} 4 & 0 \\ -1 & -2 \end{bmatrix} = \begin{bmatrix} 17 & 10 \\ 0 & -16 \end{bmatrix}$

SECTION C

(Each question carries 3 marks)

14. (a) If $y = \cos^{-1} \left(\frac{1-x^2}{1+x^2} \right)$, $0 < x < 1$, find $\frac{dy}{dx}$.

OR

- (b) If $x^y = e^{x-y}$, prove that $\frac{dy}{dx} = \frac{\log x}{[\log(xe)]^2}$

15. A function f is defined from $\mathbb{R} \rightarrow \mathbb{R}$ as $f(x) = ax + b$, such that $f(1) = 1$ and $f(2) = 3$. Find function $f(x)$. Hence, check whether function $f(x)$ is one to one and onto or not.

SECTION D

(Each question carries 5 marks)

16. (a) Evaluate: $\tan^{-1} \left[2 \sin \left(2 \cos^{-1} \left(\frac{\sqrt{3}}{2} \right) \right) \right]$ (2 marks)

- (b) Find the value of $\cos^{-1} \left(\frac{1}{2} \right) - \tan^{-1} \left(-\frac{1}{\sqrt{3}} \right) + \operatorname{cosec}^{-1}(-2)$. (3 Marks)

17. If $A = \begin{bmatrix} -1 & -2 & 0 \\ 2 & -1 & -1 \\ 0 & -2 & 1 \end{bmatrix}$ Find A^{-1} and use it to solve the following system of equation:
 $-x - 2y = 10$, $2x - y - z = 8$, $-2y + z = 7$.

OR

- (b) If $A = \begin{bmatrix} -1 & a & 2 \\ 1 & 2 & x \\ 3 & 1 & 1 \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} 1 & -1 & 1 \\ -8 & 7 & -5 \\ b & y & 3 \end{bmatrix}$, find the value of $(a+x) - (b+y)$.

SECTION E

(Section E consist of two activity based questions of 4 mark each.)

CASE STUDY 1:

18. A scholarship is a sum of money provided to a student to help him or her pay for education.

Some students are granted scholarships based on their academic achievements, while others are rewarded based on their financial needs. Every year a school offers scholarships to girl children and meritorious achievers based on certain criteria. In the session 2022 – 23, the school offered monthly scholarship of Rs.3,000 each to some girl students and Rs. 4,000 each to meritorious achievers in academics as well as sports. In all, 50 students were given the scholarships and monthly expenditure incurred by the school on scholarships was Rs1, 80,000.



Based on the above information, answer the following questions:

- (a) Express the given information algebraically using matrices. (1 Mark)
(b) Check whether the system of matrix equations so obtained is consistent or not. (1 Marks)
(c) Find the number of scholarships of each kind given by the school, using matrices.

(2 Marks)

OR

- (d) Had the amount of scholarship given to each girl child and meritorious student been interchanged, what would be the monthly expenditure incurred by the school?

CASE STUDY 2:

19. A volleyball player serves the ball which takes a parabolic path given by the equation

$$h(t) = -\frac{7}{2}t^2 + \frac{13}{2}t + 1, \text{ where } h(t)$$

is the height of ball at any time t (in seconds),
($t \geq 0$).

Based on the above given information, answer the following questions:

- (a) Is $h(t)$ a continuous function? Justify. (2 Marks)
(b) Find the time at which the height of the ball is maximum. (Given if $dh/dt = 0$) (2 Marks)


