



श्री Venkateshwar International School

Sector-18, Dwarka, New Delhi-75

MID-TERM EXAMINATION (2024-2025)

MATHEMATICS (041)

CLASS- XI

Time: 3 Hours

Max. Marks: 80

GENERAL INSTRUCTIONS:

1. This question paper consists of 7 pages with 38 questions in 5 Sections A-E.
2. Section A has 18 MCQs and 02 Assertion – Reason based questions carrying 1 mark each.
3. Section B has 5 Very Short Answer (VSA) type questions carrying 02 marks each.
4. Section C has 6 Short Answer (SA) type questions carrying 03 marks each.
5. Section D has 4 Long Answer (LA) type questions carrying 05 marks each.
6. Section E has 3 source based/ case based/passage based/ integrated units of assessment (04 marks each) with sub-parts.
7. All questions are compulsory. However, an internal choice in 2 questions of 5 marks, 2 questions of 3 marks and 2 questions of 2 marks has been provided. An internal choice has been provided in the 2 marks questions of Section E.
8. Draw neat figures wherever required.

SECTION – A

(20 questions of 1 mark each)

- Q1. If set A is a finite set having 3 elements, then the number of proper subsets on A is (1)
- (a) 7 (b) 8 (c) 5 (d) 6
- Q2. The value of $\tan \frac{13\pi}{12}$ is (1)
- (a) 1 (b) $\sqrt{3}$ (c) $\sqrt{3} - 2$ (d) $2 - \sqrt{3}$
- Q3. The greatest value of $\sin x \cdot \cos x$ (1)
- (a) 0 (b) 1 (c) 2 (d) $\frac{1}{2}$
- Q4. If $x = 1 + i$, then the value of $x^6 + x^4 + x^2 + 1$ is (1)
- (a) $6i - 3$ (b) $-6i + 3$ (c) $-6i - 3$ (d) $6i + 3$
- Q5. If $(1 + 2i)(2 + 3i)(3 + 4i) = x + iy$; $x, y \in \mathbb{R}$ then $x^2 + y^2$ is (1)
- (a) 1450 (b) 1625 (c) 1575 (d) 1725
- Q6. The number of 4 digit numbers, with no digit repeated is (1)
- (a) 4536 (b) 4360 (c) 4000 (d) 4420
- Q7. For any two sets A and B, $(A - B) \cup (B - A)$ is (1)
- (a) $(A - B) \cup A$ (b) $(B - A) \cup B$
(c) $(A \cup B) - (A \cap B)$ (d) $(A \cup B) \cap (A \cap B)$

- Q8.** The number of ways in which a student choose a programme of 5 courses if 9 courses available and 2 specific courses are compulsory for every students is (1)
- (a) 35 (b) 10 (c) 25 (d) 120
- Q9.** Two finite sets A and B are such that $A \subset B$, then which of the following is not correct? (1)
- (a) $A \cup B = B$ (b) $A \cap B = A$ (c) $A - B = \emptyset$ (d) $B - A = \emptyset$
- Q10.** The number of terms in the expansion of $(x + a)^{53} + (x - a)^{53}$ after simplification is (1)
- (a) 106 (b) 27 (c) 26 (d) 53
- Q11.** If $A = \{ x : x \text{ is a multiple of } 3 \}$ and $B = \{ x : x \text{ is a multiple of } 5 \}$ then $A - B$ is (1)
- (a) $A \cap B$ (b) $A \cap B'$ (c) $A' \cap B'$ (d) $(A \cap B)'$
- Q12.** If $\sin x = \frac{2}{3}$, then value of $\sin 3x$ is equal to (1)
- (a) $\frac{22}{27}$ (b) $\frac{24}{39}$ (c) $\frac{12}{27}$ (d) $\frac{21}{20}$
- Q13.** The domain function f defined by $f(x) = \sqrt{a-x} + \frac{1}{\sqrt{x^2-a^2}}$ is (1)
- (a) $(-\infty, a)$ (b) $(-\infty, -a)$ (c) $(-\infty, -a)$ (d) (a, ∞)
- Q14.** Let sets A and B are defined as $A = \{(x, y) : y = e^x, x \in R\}$, $B = \{(x, y) : y = x, x \in R\}$ then (1)
- (a) $B \subset A$ (b) $A \subset B$ (c) $A \cap B = \emptyset$ (d) $A \cup B = A$
- Q15.** The value of $1 + i + i^2 + \dots + i^n$ is (1)
- (a) positive (b) negative (c) 0 (d) cannot be determined
- Q16.** If $|x| < -3$, $x \in R$, then (1)
- (a) $3 < x < -3$ (b) $-3 < x < 3$ (c) $-3 < x \leq 3$ (d) $x \in \emptyset$
- Q17.** The solution set of $2y - 3 < y + 2 \leq 3y + 5$, $y \in R$ is (1)
- (a) $(-\frac{3}{2}, 5]$ (b) $[-\frac{3}{2}, 5)$ (c) $(0, 5)$ (d) $[0, 5]$
- Q18.** The number of words which can be formed out of the letters of the word "ORDINATE", so that vowels occupy odd places is (1)
- (a) 576 (b) 435 (c) 675 (d) 360

ASSERTION-REASONING QUESTIONS

In the following questions, a statement of Assertion (A) is followed by a statement of Reasons (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.

Q19. **Assertion (A)** : If $\sin x = \frac{3}{5}$ and $\cos x = -\frac{4}{5}$, then x lies in third quadrant. (1)

Reason (R) : In third quadrant, $\sin x < 0$, $\cos x < 0$

Q20. **Assertion(A)** : Relation from a finite set A to a finite set B given by $R = \{ (1,2), (2,3), (3,4), (2,5) \}$ is a function. (1)
Given that $A = \{1,2,3\}$ and $B = \{2,3,4,5\}$

Reason(R) : All functions are relations.

SECTION – B

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

Q21. Find the domain and range of the real function $f(x) = \frac{x}{1+x^2}$. (2)

OR

Let $f = \{ (1,1), (2,3), (0,-1), (-1,-3) \}$ be a linear function from Z to Z . Find $f(x)$.

Q22. For any two complex numbers Z_1 and Z_2 , prove that $\operatorname{Re}(Z_1 Z_2) = \operatorname{Re} Z_1 \operatorname{Re} Z_2 - \operatorname{Im} Z_1 \operatorname{Im} Z_2$. (2)

Q23. How many words, with or without meaning, each of 3 vowels and 2 consonants can be formed using all the letters of the word INVOLUTE ? (2)

Q24. Solve the inequality and graph the solution on the number line:

$$\frac{x-2}{x+5} > 5 \quad (2)$$

OR

$$|3 - 4x| \geq 9$$

Q25. Expand using binomial expansion: $(1 - x - x^2)^4$ (2)

SECTION – C

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

Q26. Prove : $\cos \theta \cos \frac{\theta}{2} - \cos 3\theta \cos \frac{9\theta}{2} = \sin \frac{7\theta}{2} \sin 4\theta$ (3)

OR

$$\text{Prove : } \tan 4x = \frac{4 \tan x (1 - \tan^2 x)}{1 - 6 \tan^2 x + \tan^4 x}$$

Q27. A solution of 9% boric acid is to be diluted by adding a 3% boric acid solution to it. The resulting mixture is to be more than 5% but less than 7% boric acid. If we have 460 litres of the 9% solution, how many litres of the 3% solution will have to be added? (3)

Q28. Draw the graph of the function f defined by $f(x) = |x - 2| + |x - 3|$. Hence find its range.

Q29. If $a + ib = \frac{c+i}{c-i}$, where a, b and c are real, prove that $a^2 + b^2 = 1$ and $\frac{b}{a} = \frac{2c}{c^2-1}$ (3)

OR

If $Z = x + iy$ and $|\frac{Z-2}{Z-3}| = 2$, show that $3(x^2 + y^2) - 20x + 32 = 0$.

Q30. A committee of 7 has to be formed from 9 boys and 4 girls. In how many ways can this be done when the committee consists of (i) exactly 3 girls ? (ii) atleast 3 girls ? (iii) atleast 3 girls? (3)

OR

How many different words can be formed by jumbling the letters in the word MISSISSIPPI in which no 2 S are together.

Q31. Using binomial theorem, show that $6^n - 5n$ always leaves the remainder 1 when divided by 25 for all natural number n . (3)

SECTION - D

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

Q32. If $z = x + iy$ and imaginary part of $\frac{2z+1}{iz+1}$ is -2 then show that $x + 2y - 2 = 0$ (5)

Q33. Prove : $\tan 20^\circ \tan 40^\circ \tan 80^\circ = \sqrt{3}$. (5)

OR

Prove : $\tan x + \tan(\frac{\pi}{3} + x) - \tan(\frac{\pi}{3} - x) = 3 \tan 3x$

✓ **Q34.** (a) How many numbers greater than 1000000 can be formed by using the digits 1, 2, 0, 2, 4, 2, 4 ? (3)

✶ (b) A polygon has 44 diagonals. Find the number of its sides. (2)

OR

Everybody in a room shakes hands with everybody else. The total number of hand shakes is 66. How many people are there in the room?

✓ **Q35.** (a) If $f(x) = y = \frac{6x-5}{5x-6}$, then prove that if $f(y) = x$ (3)

(b) If A and B are two sets such that $A \cap X = B \cap X = \emptyset$ and $A \cup X = B \cup X$ for some set X show that $A = B$ (2)

SECTION - E

CASE BASED QUESTIONS

Q36. A child during free time was reading a novel, during reading she came across the word **DAUGHTER** suddenly, she started thinking of forming different words from letters of the word **DAUGHTER** the words may or may not have a dictionary meaning. Many questions came to her mind help her in answering the following questions:

(i) Find the number of words so that all the vowels are always together (1)

- (ii) Find the number of words so that the letters G and H are together and in the middle (1)
- (iii) Find the number of words which can be formed starting with consonants only. (2)

OR

Find the number of words so that all vowels and consonants come together.

Q37. Given $\tan(45^\circ + x) = \frac{1 + \tan x}{1 - \tan x} = \frac{\cos x + \sin x}{\cos x - \sin x}$

and $\tan(45^\circ - x) = \frac{1 - \tan x}{1 + \tan x} = \frac{\cos x - \sin x}{\cos x + \sin x}$

Based on above information, answer the following questions;

- (i) Find the value of $\frac{\cos 11^\circ + \sin 11^\circ}{\cos 11^\circ - \sin 11^\circ}$ (1)
- (ii) Find the value of $\frac{\cos 9^\circ + \sin 9^\circ}{\cos 9^\circ - \sin 9^\circ}$ (1)

- (iii) Find the value of $\frac{1 - \tan 15^\circ}{1 + \tan 15^\circ}$ (2)

OR

Find the value of $\frac{1 + \tan 15^\circ}{1 - \tan 15^\circ}$

- **Q38.** Let $f : \mathbb{R} \rightarrow [0, \infty]$ be a function defined by $f(x) = |x|$ and $g(x) = f(x + 1) + f(x - 1)$, for all $x \in \mathbb{R}$.

Based on above information, answer the following questions:

- (i) Find $g(x)$. (1)
- (ii) Find the range of $g(x)$. (1)
- (iii) Draw the graph of $g(x)$. (2)

OR

Draw the graph of $f(x)$.