



SHAPING FUTURES. BUILDING LEGACIES

**ST KABIR
PUBLIC SCHOOL**

SECTOR 26, CHANDIGARH. 160019



TERM I EXAMINATION (2025 - 26)

Class - XI

Subject - Mathematics (041)

Duration - 3 Hours

Max. Marks - 80

General Instructions

Read the following instructions very carefully and strictly follow them:

- (i) This Question paper contains 38 questions. All questions are compulsory.
- (ii) This Question paper is divided into FIVE Sections: A, B, C, D, and E.
- (iii) In Section A - Questions Numbers 1 to 18 are Multiple Choice Questions (MCQ) type and Questions Numbers 19 and 20 are Assertion-Reason based questions of 1 mark each.
- (iv) In Section B - Questions Numbers 21 to 25 are Very Short Answer (VSA) type questions of 2 marks each.
- (v) In Section C - Questions Numbers 26 to 31 are Short Answer (SA) type questions carrying 3 marks each.
- (vi) In Section D - Question Numbers 32 to 35 are Long Answer (LA) type questions carrying 5 marks each.
- (vii) In Section E - Questions Number 36 to 38 are Case study-based questions carrying 4 marks each.
- (viii) There will be no overall choice. However, an internal choice has been provided in 2 questions in Section B, 3 questions in Section C, and 2 questions in Section D.
- (ix) Use of calculators is not allowed.

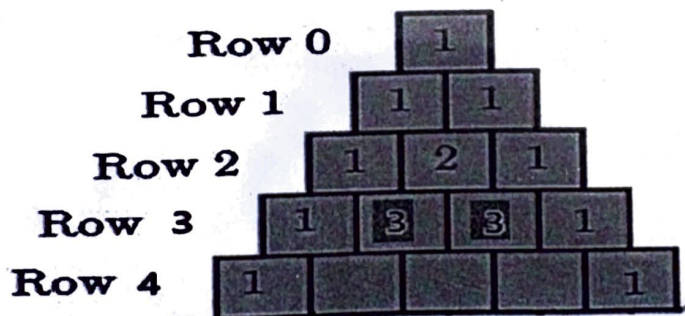
SECTION-A

[1 x 20 = 20]

*(This section comprises multiple-choice questions (MCQs) of 1 mark each)
Select the correct option (Question 1 - Question 18):*

- Q 1. Let A and B be two sets, then $A \cap (A \cup B)$ equal to (1)
(A) A (B) B (C) ϕ (D) $A \cap B$
- Q 2. If $X = \{8^n - 7n - 1 : n \in \mathbb{N}\}$ and $Y = \{49n - 49 : n \in \mathbb{N}\}$. Then (1)
(A) $X \subset Y$ (B) $Y \subset X$ (C) $X = Y$ (D) $X \cap Y = \emptyset$
- Q 3. Let $n(A) = m$ and $n(B) = n$, then the total number of non-empty relations that can be defined from A to B is (1)
(A) m^n (B) n^m (C) $mn - 1$ (D) $2^{mn} - 1$
- Q 4. If $f(x) = ax + b$, where a and b are integers, $f(-1) = -5$ and $f(3) = 3$, then a and b are equal to (1)
(A) $a = -3, b = -1$ (B) $a = 2, b = -3$ (C) $a = 0, b = 2$ (D) $a = 2, b = 2$
- Q 5. The range of the function $f(x) = 2 - |x - 5|$ is (1)
(A) $(-\infty, 1]$ (B) $(-\infty, 2]$ (C) $(-\infty, 2)$ (D) $(-\infty, 5]$

- Q 6. If $Z_1 = 2 - i$ and $Z_2 = 4 + 3i$, then the quadrant in which $\frac{Z_1}{Z_2}$ lies is (1)
- (A) First (B) Second (C) Third (D) Fourth
- Q 7. If $(-i)(3i)\left(\frac{-1}{6}i\right)^3 = a + ib$, then a is equal to (1)
- (A) 1 (B) 0 (C) -i (D) 2
- Q 8. The smallest positive integer n for which $(1 + i)^{2n} = (1 - i)^{2n}$, is (1)
- (A) 2 (B) 3 (C) 8 (D) 1
- Q 9. An inequality which have only $<$ or $>$ is called _____ (1)
- (A) strict inequality (B) inequality (C) equality (D) slack inequality
- Q 10. Let x and b are real numbers. If $b > 0$ and $|x| < b$, then (1)
- (A) $x \in (-b, \infty)$ (B) $x \in [-b, \infty)$ (C) $x \in (-b, b)$ (D) $x \in [-b, b]$
- Q 11. The number of chords that can be drawn through 16 points on a circle is (1)
- (A) 100 (B) 90 (C) 120 (D) 130
- Q 12. If ${}^nC_{12} = {}^nC_8$, then n is equal to (1)
- (A) 20 (B) 12 (C) 6 (D) 30
- Q 13. A bag contains 5 black and 6 red balls. The number of ways in which 2 black and 3 red balls can be selected is (1)
- (A) 200 (B) 300 (C) 100 (D) 400
- Q 14. If ${}^nP_r = 840$ and ${}^nC_r = 35$, then r is equal to (1)
- (A) 3 (B) 4 (C) 6 (D) 7
- Q 15. Complete Pascal's triangle: (1)



- (A) 4, 4, 6 (B) 6, 4, 4 (C) 4, 6, 4 (D) 4, 4, 4
- Q 16. The total number of terms in the expansion of $(x + a)^{100} + (x - a)^{100}$ is (1)
- (A) 50 (B) 202 (C) 51 (D) 200
- Q 17. L is the foot of the perpendicular drawn from the Point P (3, 4, 5) on the XY plane. The coordinates of the point L are (1)
- (A) (3, 0, 0) (B) (0, 4, 0) (C) (0, 0, 5) (D) (3, 4, 0)

- Q 18. The point $(-2, -3, -4)$ lies in the (1)
 (A) first octant (B) seventh octant (C) second octant (D) eighth octant

ASSERTION-REASON BASED QUESTIONS

(Question numbers 19 and 20 are Assertion-Reason based questions carrying 1 mark each. Two statements are given, one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer from the options (A), (B), (C), and (D) as given below.

- (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
- Q 19. Assertion (A): The number of ways the letters of the word 'PERMUTATIONS' can be arranged if the words start with P and end with S is 1814 400. (1)
 Reason (R): The number of permutations of n objects of which p_1 are of one kind, p_2 are of the second kind... p_k are of the k th kind such that $p_1 + p_2 + p_3 + \dots + p_k = n$ is $\frac{n!}{p_1! p_2! p_3! \dots p_k!}$.
- Q 20. Assertion (A): If $A = B = \{1, 2, 3, 4\}$, then $f = \{(x, y) : x + y > 4, x \in A, y \in B\}$ is a function from A to B. (1)
 Reason (R): A relation from a set A to set B is set to be function if every element of a set has one and only one image in set B. [2 x 5 = 10]

SECTION-B

(This section comprises 5 very short answers (VSA) type questions of 2 marks each.)

- Q 21. If $A = \{4n + 2 : n \text{ is a natural number}\}$ and $B = \{3n : n \text{ is a natural number}\}$, then write $A \cap B$ in roster form. (2)
- Q 22. Find all pairs of consecutive odd natural numbers, both of which are larger than 10, such that their sum is less than 40.

OR

Solve $|x + 2| \leq 9$ and represent the solution on the number line.

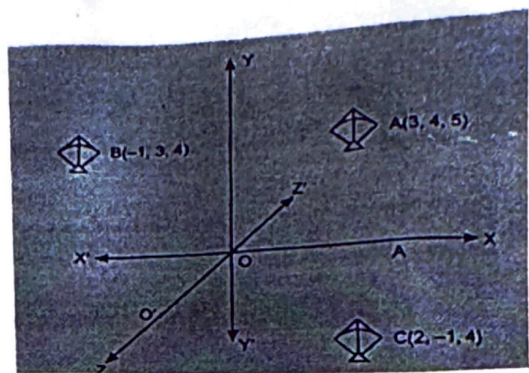
- Q 23. If $x = 1 + i$, then find the value of $x^4 - 4x^3 + 7x^2 - 6x + 3$.

OR

Find the values of x and y if $4x + i(3x - y)$ is conjugate of $3 + 6i$ for $x, y \in R$

- Q 24. Determine n if ${}^{2n}C_3 : {}^nC_3 = 11 : 1$

- Q 25 A boy stands at point O and observes three kites A, B, and C in space. Taking O as the origin if the coordinates of three kites A, B, and C are (3, 4, 5), (-1, 3, 4), and (2, -1, 4) respectively, then



(2)

- (i) Find the coordinates of a point on the y-axis which is at a distance of $\sqrt{35}$ units from kite A.
 (ii) Find the coordinates of point D so that ABCD is a parallelogram.

SECTION-C

[3 x 6 = 18]

(This section comprises 6 short-answer (SA) type questions of 3 marks each.)

- Q 26. (i) Write down all the subsets of the set $A = \{1, 2, 3\}$ (3)
 (ii) Write the $\{x: x \in R, -5 < x \leq 6\}$ as an interval.
 (iii) If a set is denoted by $A = \Phi$, then write the number of elements in A.
 Q 27. Let $A = \{1, 2, 3, 4, 5, 6\}$. Define a relation R from A to A by $R = \{(x, y): y = x + 1\}$ (3)
 (i) Depict this relation using an arrow diagram.
 (ii) Write down the domain, codomain, and range of R.

OR

Draw the graph of the function $f(x) = [x]$ for $x \in (-3, 3]$

- Q 28. The water acidity in a pool is considered normal when the average pH reading of three daily measurements is between 8.2 and 8.5. If the first two pH readings are 8.48 and 8.35, find the range of pH value for the third reading that will result in the acidity level being normal. (3)
 Q 29. A group consists of 4 girls and 7 boys. In how many ways can a team of 5 members be selected if the team has at least one boy and one girl? (3)

OR

In how many of the distinct permutations of the letters in MISSISSIPPI do the four I's not come together?

- Q 30. Evaluate $(x + 1)^6 + (x - 1)^6$ by using the binomial theorem. (3)

OR

Compute $(98)^5$ by using the binomial theorem.

- Q 31. If the origin is the centroid of the triangle ABC having the vertices $A(a, 1, 3)$, $B(-2, b, -5)$, and $C(4, 7, c)$, find the values of a, b, and c. (3)

SECTION-D

[5 x 4 = 20]

(This section comprises 4 long-answer (LA) type questions of 5 marks each)

Q 32. (i) If $U = \{x: x \in \mathbb{Z}, -1 \leq x \leq 5\}$, $A = \{x: x \in \mathbb{Z}, x^2 - 3x + 2 = 0\}$ and $B = \{x: x \in \mathbb{W}, x \leq 4\}$ (5)
Evaluate $((A \cup B) - A) \times B^c$

(ii) Find the range of the function $f(x) = \frac{x^2}{1+x^2} \forall x \in \mathbb{R}$.

Q 33. A manufacturer has 600 litres of a 12 % solution of acid. How many litres of a 30 % acid solution (5)
must be added to it so that the acid content in the resulting mixture will be more than 15 % but less than 18 %?

Q 34. Using the binomial theorem, prove that $6^n - 5n$ always leaves a remainder of 1 when divided by 25. (5)

OR

(i) Prove that $\sum_{r=0}^n 3^r {}^n C_r = 4^n$

(ii) Prove that ${}^n C_r + {}^n C_{r-1} = {}^{n+1} C_r$

Q 35. If $(x + iy)^3 = u + iv$, then show that $\frac{u}{x} + \frac{v}{y} = 4(x^2 - y^2)$. (5)

OR

If α and β are different complex numbers with $|\beta| = 1$, then find $\left| \frac{\beta - \alpha}{1 - \bar{\alpha}\beta} \right|$.

SECTION-E

[4 x 3 = 12]

This section comprises 3 case-study/passage-based questions of 4 marks each with subparts. The first two case study questions have three subparts (i), (ii), and (iii) of marks 1, 1, and 2, respectively. The third case study question has two subparts of 2 marks each)

Q 36. Case Study – 1 (4)

Consider $z = a + ib$ and $\bar{z} = a - ib$, where a and b are real numbers, are conjugates of each other.

A complex number Z is purely real if and only if $\bar{z} = z$ and is pure imaginary if and only if

$\bar{z} = -z$. Based on the above information, answer the following questions:

(i) Find $|z| + |\bar{z}|$.

(ii) Write the complex number $\frac{i^2 + i^4 + i^6 + i^7}{1 + i^2 + i^3}$ in the form of $a - ib$.

(iii) If x and y are real numbers and the complex number $\frac{(2+i)x-i}{4+i} + \frac{(1-i)y+2i}{4i}$ is pure real, then find the relationship between x and y .

400

Q 37. Case Study – 2

(4)

A relation R from a non-empty set A to a non-empty set B is a subset of the Cartesian product $A \times B$. The subset is derived by describing a relationship between the first element and the second element of the ordered pairs in $A \times B$. The second element is called the image of the first element.

A relation f from a set A to a set B is said to be a function if every element of set A has one and only one image in set B .

Let $A = \{1, 2, 3, 4\}$, $B = \{1, 5, 9, 11, 15, 16\}$, and $f = \{(1, 5), (2, 9), (3, 1), (4, 5), (2, 11)\}$. Based on the above information, answer the following questions:

- (i) Depict f using an arrow diagram.
- (ii) Is f a relation from A to B ? Justify your answer.
- (iii) Is f a function from A to B ? Justify your answer.

Q 38. Case Study – 3

(4)

A child was reading a novel during her free time. While reading, she came across the word "DAUGHTER." Suddenly, she started thinking of forming different words from the letters of the word "DAUGHTER." The word may or may not have a dictionary meaning. Many questions came to her mind. Based on the above information, answer the following questions:

- (i) Find the number of words that can be formed, starting with the letter D
- (ii) Find the number of words so that all the vowels are never together.