



RAN PUBLIC SCHOOL

HALF YEARLY EXAMINATION (2025 – 2026) (SET 1)

SUBJECT: MATHEMATICS (041)

CLASS : XI (SCIENCE)

MAX. MARKS : 80

DURATION : 3 hrs

General Instructions:

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 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.
3. Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.
4. Section C has 6 Short Answer (SA)-type questions of 3 marks each.
5. Section D has 4 Long Answer (LA)-type questions of 5 marks each.
6. Section E has 3 source based/case based/passage based/integrated units of assessment (4 marks each) with sub parts.

SECTION – A

Questions 1 to 5 carry 1 mark each.

1. The number of subsets of a set containing n elements is:-

- (a) 2^n (b) $2^n - 1$ (c) n^n (d) None of these

2. Conjugate of complex number $i^3 - 4$ is:-

- (a) $i^3 + 4$ (b) $4 - i$ (c) $-4 + i$ (d) none of these

3. For what value of k , coefficients of x^2 and x^3 will be equal in the expansion of $(3 + kx)^9$?

- (a) $\frac{4}{7}$ (b) $\frac{5}{7}$ (c) $\frac{9}{7}$ (d) $\frac{11}{7}$

4. Given set $A = \{1, 2, 3, \dots, 10\}$. Relation R is defined in set A as $R = \{(a, b) \in A \times A : a = 2b\}$. Then range of relation R is:-

- (a) $\{2, 4, 6, 8, 10\}$ (b) $\{1, 3, 5, 7, 9\}$
(c) $\{(2, 1), (4, 2), (6, 3), (8, 4), (10, 5)\}$ (d) $\{1, 2, 3, 4, 5\}$

5. The value of $\sin(45^\circ + \theta) - \cos(45^\circ - \theta)$ is:-

- (a) $2 \cos \theta$ (b) $2 \sin \theta$ (c) 1 (d) 0

6. The minimum value of $4^x + 4^{x-1}$, $x \in \mathbb{R}$ is:

- (a) 1 (b) 2 (c) 0 (d) 4

7. If $\tan A = \frac{1}{2}$ and $\tan B = \frac{1}{3}$, then $\tan(2A + B)$ is equal to:-

- (a) 1 (b) 2 (c) 3 (d) 4

8. $1 + i^2 + i^4 + i^6 + \dots + i^{2n}$ is:

- (a) positive (b) negative (c) 0 (d) cannot be determined

9. The coefficient of x^n in the expansion of $(1+x)^{2n}$ and $(1+x)^{2n-1}$ are in the ratio :

- (a) 1:2 (b) 1:3 (c) 3:1 (d) none of these

10. The minimum value of $3 \cos x + 4 \sin x + 8$ is:-

- (a) 5 (b) 9 (c) 7 (d) 3

11. Two finite sets have m and n elements. The number of subsets of the first set is 112 more than that of second set. The values of m and n are respectively:

- (a) 4, 7 (b) 7, 4 (c) 4, 4 (d) 7, 7

12. If ${}^{15}P_r = 2730$, then 5P_r .

- (a) 3 (b) 30 (c) 60 (d) 20

13. All the letters of the word "EAMCOT" are arranged in different possible ways. The number of such arrangements in which no two vowels are adjacent to each other is

- (a) 360 (b) 144 (c) 72 (d) 54

14. If $-3x + 17 < -13$, then

- (a) $x \in (10, \infty)$ (b) $x \in [10, \infty)$ (c) $x \in (-\infty, 10]$ (d) $x \in [-10, 10)$

15. If $|3 - 6x| \geq 9$, then $x \in$

- (a) $(-\infty, -1) \cup (3, \infty)$ (b) $(-\infty, 1] \cup (2, \infty)$
(c) $(-\infty, -1) \cup (0, \infty)$ (d) $(-\infty, -1) \cup (2, \infty)$

16. If $3x - 1 < 5 + x$, $6 - 5x \leq 1$, then $x \in$

- (a) $[1, 3]$ (b) $[-1, 3]$ (c) $[1, 3)$ (d) $(1, 3)$

17. If $[x]^2 - 5[x] + 6 = 0$, where $[\cdot]$ denotes the greatest integer function, then

- (a) $x \in [3, 4]$ (b) $x \in (2, 3]$ (c) $x \in [2, 3]$ (d) $x \in [2, 4)$

18. Find the modulus of $\frac{1+i}{1-i}$:-

- (a) 1 (b) 4 (c) 2 (d) 3

For Q19 and Q20, a statement of assertion (A) is followed by a statement of reason (R). Choose the correct answer out of the following choices.

- (a) Both Assertion (A) and Reason (R) are true & Reason (R) is the correct explanation of Assertion (A)
(b) Both Assertion (A) and Reason (R) are true & 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

19. Assertion (A): If the letters W, I, F, E are arranged in a row in all possible ways and the words (with or without meaning) so formed are written as in a dictionary, then the word WIFE occurs in the 24th position.

Reason (R): The number of ways of arranging four distinct objects taken all at a time is $C(4,4)$

20. Assertion (A): The sum of first 6 terms of the GP 4, 16, 64, ... is equal to 5460.

Reason (R): Sum of first n terms of the G. P is given by $S_n = \frac{a(r^n - 1)}{r - 1}$, where a = first term, r = common ratio and $|r| > 1$

SECTION - B

Questions 21 to 25 carry 2 marks each.

21. If $U = \{x : x \leq 10, x \in \mathbb{N}\}$, $A = \{x : x \in \mathbb{N}, x \text{ is prime}\}$, $B = \{x : x \in \mathbb{N}, x \text{ is even}\}$, write $A \cap B'$ in roster form.

22. Find n , if : ${}^{2n-1}P_n : {}^{2n+1}P_{n-1} = 22:7$

23. Solve for x : $|x + 1| + |x| > 3$.

24. Find the conjugate of $\frac{(3-2i)(2+3i)}{(1+2i)(2-i)}$.

25. How many words can be formed using all the letters of the word EQUATION so that (i) all the vowels are together, (ii) consonants occupy the odd places?

SECTION - C

Question 26 to 31 carry 3 marks.

26. Find the domain and range of the function $\left\{ \left(x, \frac{1}{1-x^2} \right) : x \in \mathbb{R}, x \neq \pm 1 \right\}$

27. Prove that: $\sin^3 x + \sin^3 \left(\frac{2\pi}{3} + x \right) + \sin^3 \left(\frac{4\pi}{3} + x \right) = -\frac{3}{4} \sin 3x$

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

29. Find $(a + b)^4 - (a - b)^4$. Hence, evaluate $(\sqrt{3} + \sqrt{2})^4 - (\sqrt{3} - \sqrt{2})^4$.

30. The number of arrangements of the letters of the word INDEPENDENCE. In how many of these arrangements,

(i) do all the vowels always occur together (ii) do all the vowels never occur together

(iii) do the words begin with I and end in P.

31. If $f(x) = x^3 - \frac{1}{x^3}$, then find $f(x) + f\left(\frac{1}{x}\right)$.

SECTION - D [Case Study Based Questions]

Questions 32 to 35 carry 5 marks each.

32. If a and b are the roots of $x^2 - 3x + p = 0$ and c, d are roots of $x^2 - 12x + q = 0$, where a, b, c, d form a G.P. Prove that $(q + p) : (q - p) = 17:15$.

OR

Let S be the sum, P the product and R the reciprocals of n terms in a G.P. Prove that $P^2 R^n = S^n$

33. If $|z + 1| = z + 2(1+i)$, then find the value of z .

34. Find the value of $\cos^4 \frac{\pi}{8} + \cos^4 \frac{3\pi}{8} + \cos^4 \frac{5\pi}{8} + \cos^4 \frac{7\pi}{8}$.

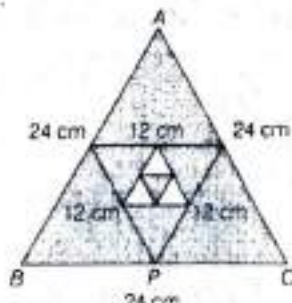
35. Find n , if the ratio of the 7th term from the beginning to the 7th term from the end in the expansion of $(\sqrt[3]{2} + \frac{1}{\sqrt[3]{3}})^n$ is $1 : 6$.

SECTION - E

Questions 36 to 38 carry 4 marks each.

36. Case-Study 1:

In Rangoli competition in school, Preeti made Rangoli in the equilateral shape. Each side of an equilateral triangle is 24 cm. The mid-point of its sides are joined to form another triangle. This process is going continuously infinite.



Based on above information, answer the following questions.

- Find the side of the 5th triangle is (in cm) (1)
- Find the sum of perimeter of first 6 triangle is (in cm) (2)

OR

- Find the area of all the triangle is (in sq cm). (2)
- Find the sum of perimeter of all triangle is (in cm). (1)

37. In a city of 56,000 people, following is the number of fans of players Rohit (R), Virat (V) and Dhoni (D):



Players	Number of Fans
Rohit	23,000
Virat	25,000
Dhoni	18,000
Rohit and Virat	12,000
Rohit and Dhoni	10,000
Virat and Dhoni	8,000
Rohit, Virat and Dhoni	3,000

Based on the above information, answer the following:

- (i) How many people are fans of at least 2 players?
- (ii) How many people are fans of exactly 1 player?
- (iii) How many people are fans of exactly 2 players?
- (iv) How many people follow R or V but not D?

38. An intelligence quotient (IQ) is a total score derived from a set of standardised tests or subtests designed to assess human intelligence. The abbreviation "IQ" was coined by the psychologist William Stern for the German term Intelligence quotient, his term for a scoring method for intelligence tests at University of Breslau he advocated in a 1912 book.



IQ Intelligence Quotient

Manjula is a Psychology student and nowadays she is learning about Intelligence Quotient (IQ). She calculates the result as follows:

$$\text{Intelligence Quotient} = \frac{\text{Mental age}}{\text{Chronological Age}} \times 100$$

- a) What could be the range of mental age if a group of children with chronological age of 15 years have the IQ range as $90 \leq IQ \leq 150$?
- (b) What could be the range of IQ if a group of children with age of 12 years have the mental age range as $9 \leq MA \leq 15$?

OR

- (b) What could be the range of IQ if a group of children with mental age of 18 years have the mental age range as $12 \leq CA \leq 15$?