



40-50

K R MANGALAM WORLD SCHOOL, GK II
HALF YEARLY EXAMINATION 2026 -27
CLASS XI MATHEMATICS
SET 1

Time allowed: 3 Hours

Maximum Marks: 80

General instructions

- 1) This question paper contains 38 questions. All questions are compulsory.
- 2) This question paper is divided into five Sections A, B, C, D and E.
- 3) In Section A, Questions no. 1 to 18 are multiple choice questions (MCQs) and questions number 19 and 20 are Assertion-Reason based questions of 1 mark each.
- 4) In Section B, Questions no. 21 to 25 are very short answer (VSA) type questions, carrying 2 marks each.
- 5) In Section C, Questions no. 26 to 31 are short answer (SA) type questions, carrying 3 marks each.
- 6) In Section D, Questions no. 32 to 35 are long answer (LA) type questions carrying 5 marks each.
- 7) In Section E, Questions no. 36 to 38 are case study based questions carrying 4 marks each.

SECTION-A

This section comprises multiple choice questions (MCQs) of 1 mark each.

- 1) If A and B are two given sets, then $A \cap (A \cap B)'$ is equal to

- a) A
- b) B'
- c) ϕ
- d) $A - B$

$$A \cap (1, 2, 4, 5)$$

$$(1, 2)$$

$$A \cap (5)$$

- 2) For any two sets A and B, $A \cap (A \cup B)'$ is equal to

- a) A
- b) B
- c) ϕ
- d) $A \cap B$

- 3) $n[P\{P(\phi)\}] =$

- a) 2
- b) 4
- c) 8
- d) 0

- 4) If $A = \{1, 2, 3, 4, 5\}$, then the number of proper subsets of A is

- a) 120
- b) 30
- c) 31
- d) 32

$$2^n - 1$$

$$2^5 - 1$$

$$\begin{array}{l} 4 \times 4 \times 2 \\ 2 \times 2 \times 2 \times 2 \times 2 \\ \hline 4 \times 8 \quad 32 \end{array}$$

- 5) Let $n(A) = x$, and $n(B) = y$. Then the total number of non-empty relations that can be defined from A to B is

$$\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$$

$$\begin{pmatrix} 4 \\ 5 \\ 6 \end{pmatrix}$$

$$\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$$

$$x + 5 \geq 2$$

$$\begin{pmatrix} 0 & 8 \end{pmatrix}^2 \cdot i$$

$$\begin{matrix} -1 & i \\ -i & \end{matrix}$$

$$i = \sqrt{-1}$$

$$i^2 = -1$$

$$i^{17}$$

$$\sin(2\sin 30 \cos 20)$$

- $$\left\{ \begin{array}{l} \text{a) } x^y \\ \text{b) } y^x - 1 \\ \text{c) } xy - 1 \\ \text{d) } 2^{xy} - 1 \end{array} \right.$$

6) Range of $f(x) = \frac{1}{2x+3}$

a) $\{-\frac{3}{2}\}$

b) $R - \{\frac{3}{2}\}$

c) $R - \{0\}$

d) $R - \{-\frac{3}{2}\}$

7) If $f(x) = \frac{x-1}{x+1}$, then $f(\frac{1}{x}) =$

a) $f(x)$

b) $-f(x)$

c) $\frac{1}{f(x)}$

d) $-\frac{1}{f(x)}$

8) What is the value of $\tan 75^\circ$?

a) $\frac{\sqrt{3}-1}{\sqrt{3}+1}$

b) $\frac{\sqrt{3}+1}{\sqrt{3}-1}$

c) $\frac{\sqrt{3}}{\sqrt{3}+1}$

d) $\frac{\sqrt{3}}{\sqrt{3}-1}$

9) The greatest value of $\sin x \cdot \cos x$ is

a) 1

b) 2

c) $\sqrt{2}$

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

10) The value of $\frac{1-\tan^2 15^\circ}{1+\tan^2 15^\circ}$ is

a) 1

b) $\sqrt{3}$

c) $\frac{\sqrt{3}}{2}$

d) 2

11) The value of $\sin 50^\circ - \sin 70^\circ + \sin 10^\circ$ is equal to

a) 1

b) 0

c) $\frac{1}{2}$

d) 2

12) The sum of series $1 + i^2 + i^3 + \dots$ up to 17 terms is

a) 0

b) i

$$2x + 3 \neq 0$$

$$x = -\frac{3}{2}$$

$$= \frac{\frac{1}{x} - \frac{1}{1}}{\frac{1}{x} + \frac{1}{1}} = \frac{\frac{1-x}{x}}{\frac{1+x}{x}} = \frac{1-x}{1+x}$$

$$\frac{1-x}{1+x}$$

$$-(x-1)$$

$$x+10$$

$$\tan 75^\circ$$

$$= \tan(30+45)^\circ$$

$$\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

$$2 \sin 60 \cos 10$$

$$= \frac{\sqrt{3}}{2}$$

$$\sin C - \sin D$$

$$2 \cos 60 \sin 10 + \sin 10$$

$$\sin 10 (2 \cos 60)$$

$$\cot(A+B) = \frac{\cot A \cot B - 1}{\cot A + \cot B}$$

$$= \frac{1}{\cot A + \cot B}$$

$$\sin 10 - 2\sqrt{3}$$

$$2 + \sqrt{3}$$

$$4\sqrt{3}$$

$$4\sqrt{3}$$

$$4\sqrt{3}$$

$$(\sqrt{3}+1)^2 = 3 + 1 + 2\sqrt{3}$$

$$4 + 2\sqrt{3}$$

$$2(2\sqrt{3})$$

$$2(2 + \sqrt{3})$$

$$-8 \leq 5x - 3 < 7 + 3$$

$$-8 + 3 \leq 5x < 10$$

$$-5 \leq 5x < 10$$

$$-1 \leq x < 2$$

13) The value of $\frac{i^{4n+1} - i^{4n-1}}{2}$ is

- a) $2i$
- b) -2
- c) i
- d) $-i$

14) If $\frac{c+i}{c-i} = a + ib$ where a, b, c are real, then $a^2 + b^2 =$

- a) 1
- b) -1
- c) c^2
- d) $-c^2$

15) If the conjugate of $(x + iy)(1 - 2i)$ be $1 + i$, then

- a) $x = \frac{1}{5}$
- b) $y = \frac{3}{5}$
- c) $x + iy = \frac{1-i}{1-2i}$
- d) $x - iy = \frac{1-i}{1+2i}$

16) If $-4x > 20$ and $x \in \mathbb{Z}^+$ then x belongs to -

- a) $\{-6, -7, -8, \dots\}$
- b) $\emptyset$
- c) $\{-4, -3, -2, -1\}$
- d) $\{1, 2, 3, 4, \dots\}$

17) Solution set for inequality $-8 \leq 5x - 3 < 7$ is

- a) $(-1, 2)$
- b) $(2, 3)$
- c) $[-1, 2)$
- d) $[2, 3]$

18) There are 10 true-false questions in an examination. These questions can be answered in

- a) 20 ways
- b) 100 ways
- c) 512 ways
- d) 1024 ways

Questions number 19 and 20 are Assertion and 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 codes (a), (b), (c) and (d) as given below.

- a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
- b) Both Assertion (A) and Reason (R) are true and Reason (R) is not the correct explanation of the Assertion (A).
- c) Assertion (A) is true, but Reason (R) is false.

$$\frac{c+i}{c-i} \times \frac{c+i}{c+i} = \frac{c^2 + i^2 + 2ic}{c^2 - (i)^2} = \frac{c^2 + 1 + 2ic}{c^2 - 1}$$

$$a < b \quad c < 0$$

$$1 < 2$$

$$1 \times 2 \times 3 \times 4 \times 5$$

$$6 \times 7 \times 8 \times 9 \times 10$$

$$4 \times 3 \times 2 \times 1$$

$$\frac{a}{c} < \frac{b}{c}$$

d) Assertion (A) is false, but Reason (R) is true.

$$\frac{1}{-1} < \frac{2}{-1}$$

Assertion (A): Product of five consecutive natural numbers is divisible by 4!

Reason (R): Product of n consecutive natural number is divisible by $(n+1)!$

20) Assertion (A): If $a < b, c < 0$, then $\frac{a}{c} < \frac{b}{c}$.

Reason (R): If both sides are divided by the same negative quantity, then the inequality is reversed.

$$-1 < -2$$

$$-1 < \frac{10}{-5}$$

$$a = 5, b = 10$$

$$c = -5$$

SECTION-B

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

21) Let $A = \{1, 2, 4, 5\}, B = \{2, 3, 5, 6\}, C = \{4, 5, 6, 7\}$. Verify the following identity $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

22) Prove that $\tan 3x = \frac{3 \tan x - \tan^3 x}{1 - 3 \tan^2 x}$

23) If $x + iy = \sqrt{\frac{1+i}{1-i}}$ prove that $x^2 + y^2 = 1$

24) Solve the inequalities for real x : $\frac{2x-3}{4} + 9 \geq 3 + \frac{4x}{3}, x \in R$

25) If ${}^n P_4 : {}^n P_2 = 12$, find n .

$$4 + 2 = n$$

$$4 + 2 = 2$$

SECTION-C

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

26) For any sets A and B show that

a) $(A \cap B) \cup (A - B) = A$

b) $A \cup (B - A) = A \cup B$

27) If $U = \{x: x \in N \text{ and } x \leq 30\}, A = \{x: x \text{ is prime and } x \leq 30\}, B = \{x: x \text{ is a factor of } 24\}$ Verify the following results using properties

a) $A - B = A \cap B'$

b) $(A \cup B)' = A' \cap B'$

28) If $\tan A - \tan B = x, \cot B - \cot A = y$ prove that $\cot(A - B) = \frac{1}{x} + \frac{1}{y}$

29) If $\left(\frac{1+i}{1-i}\right)^3 - \left(\frac{1-i}{1+i}\right)^3 = a + ib$, find a and b .

30) If $\left|\frac{z-5i}{z+5i}\right| = 1$, show that z is a real number.

31) A group consists of 4 girls and 7 boys. In how many ways can a team of 5 members be selected if a team has:

a) no girl

b) at least 3 girls

c) at least one girl and one boy?

$$\cot(A - B) = \frac{\cot A \cot B - 1}{\cot B - \cot A}$$

$${}^n C_r = \frac{n!}{(n-r)! r!}$$

$${}^4 C_3 = \frac{4!}{1! 3!} = 4$$

SECTION-D

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

- 32) Find the domain and range of $f(x) = 3 + \sqrt{16 - x^2}$
- 33) Prove that $\sin 10^\circ \sin 30^\circ \sin 50^\circ \sin 70^\circ = \frac{1}{16}$
- 34) How many litres of water will have to be added to 1125 litres of the 45% solution of acid so that the resulting mixture will contain more than 25% but less than 30% acid content?
- 35) Find the rank of the word JIGNESH.

SECTION-E

This section comprises 3 case study based questions of 4 marks each.

- 36) Case study 1: A company conducted interview under 2 different categories-male and Female. Totally there were 100 participants. Among all of them finally three from Category 1 and two from Category 2 were selected for the final race. Ravi forms two sets M and F with these participants for his college project. Let $M = \{m_1, m_2, m_3\}$, $F = \{f_1, f_2\}$ where M represents the set of males selected and F the set of females who were selected for the final. Ravi decides to explore these sets for various types of relations and functions. Based on above information answer the following:
- Ravi wishes to form all the relations possible from M to F. How many such relations are possible? (2)
 - How many functions are possible from M to M. (2)
- 37) Case study 2: After retirement, Mr. D. N. Sharma purchased a farmhouse in shape of quadrilateral ABCD with $\angle A = 90^\circ$, $\angle B = 72^\circ$, $\angle C = 108^\circ$ and $\angle D = 90^\circ$. He also purchased a horse and cow. One day, he tied the horse with a rope at vertex B and observed that it describes an arc of length 88 m when it moves along a circular path keeping the rope tight. Based on above information answer the following:
- What is radian measure of $\angle B$? (1)
 - What is the length of the rope? (1)
 - What will be the length of arc described by horse if he doubles the rope length? (2)
- 38) Case study 3: Puransh is doing an experiment in which he has to arrange the alphabets of the word "HARRYANĀ" in all possible orders and notes the observations. Help him to find the answers of the following:
- What is the number of words starting with A (1)
 - How many words have all vowels together (1)
 - How many words begin with H but does not end in A (2)