General Instructions:
Read the following instructions very carefully and strictly follow them:

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

SECTION-A 1×20

This section comprises of Multiple-Choice Questions (**MCQ**s) of **1** mark each. Select the correct option (Question **1** to Question **18**):

1. Which of the following is a not a set.
(a) $\{x \in R: x^2 = 3\}$ (b) $\{x \in R: x^2 = -3\}$ (c) $\{x \in R: x^2 \neq 3\}$ (d) NOT

2. Which of the following is not an empty set.
(a) $\{x \in \mathbb{N}: 2x^2 - 1 = 0\}$ (b) $\{x \in \mathbb{Z}: 2x^2 - 1 = 0\}$
(c) $\{x \in \mathbb{R}: 2x^2 - 1 = 0\}$ (d) $\{x \in \mathbb{Z}: 2x^2 - 1 = 0\}$

3. Two finite sets have m and n elements respectively. The total number of subsets of first set is 56 more than the total number of subsets of the second set. The values of m and n respectively are.
(a) 7, 6 (b) 5, 1 (c) 6, 3 (d) 8, 7

4. The domain of the function f defined by $f(x) = \frac{1}{\sqrt{|x|-x}}$
(a) $\mathbb{R}$ (b) $\mathbb{R}^+$ (c) $\mathbb{R}^-$ (d) $\emptyset$

5. If A=$\{x \in \mathbb{N}: x \text{ is divisible by } 2\}$ and B=$\{x \in \mathbb{N}: x \text{ is divisible by } 3\}$ then Universal set can be
(a) $\{x \in \mathbb{Z}: x \text{ is divisible by } 6\}$ (b) $\{x \in \mathbb{N}: x \text{ is divisible by } 6\}$
(c) $\{x \in \mathbb{Z}: x \text{ is divisible by } 2 \text{ or } 3\}$ (d) $\{x \in \mathbb{N}: x \text{ is divisible by } 2 \text{ and } 3\}$

6. If n(A)=2 and n(B)=1 then no. of functions from A to B is:
(a) $\emptyset$ (b) 1 (c) 2 (d) 3

7. Number of non-empty relation on A, where n(A)=n is:
(a) 2^{n-1} (b) 2^{n^2-1} (d) $2^n - 1$ (d) $2^{n^2} - 1$

8. The greatest value of $\sin x$ is
(a) -1 (b) 0 (c)1 (d)$Doesn't\ exist$

9. The Range of $\tan x$ is
(a) [-1, 1] (b) $(-\infty, -1] \cup [1, +\infty)$ (c) $\mathbb{R}$ (d) $\mathbb{R} - [-1,1]$

10. If $[x]^2 - 5[x] + 6 = 0$, where [.] denote the greatest integer function, then
(a) $x \in [3,4]$ (b) $x \in (2,3]$ (c) $x \in [2,3]$ (d) $x \in [2,4)$

11. If $tan\ \theta = \frac{-4}{3}$, then $\sin\theta$ is
(a) $\frac{-4}{5}$, but not $\frac{4}{5}$ (b) $\frac{-4}{5}$, or $\frac{4}{5}$ (c) $\frac{4}{5}$, but not $\frac{-4}{5}$ (d) NOT

12. The greatest value of sin x cos x is
(a) 1 (b) 2 (c) $\sqrt{2}$ (d) $\frac{1}{2}$

13. The modulus of $-i$ is
(a) 1 (b) -1 (c) i (d) $-i$

14. The conjugate of $-1 - i$ is
(a) $1 + i$ (b) $-1 + i$ (c) $1 - i$ (d) $-1 - i$

15. $\frac{1+i}{i} =$
(a) $1 + i$ (b) $-1 + i$ (c) $1 - i$ (d) $-1 - i$

16. If x < 5, then
(a) – x < – 5 (b) – x ≤ – 5 (c) – x > – 5 (d) – x ≥ – 5

17. If $|x - 1| > 5$, then
(a) x ∈ (– 4, 6) (b) x ∈ [– 4, 6] (c) x ∈ [– ∞, – 4) ∪ (6, ∞) (d) x ∈ [– ∞, – 4) ∪ [6, ∞)

18. State which of the following statements is not True
(a) If $xy > 0$, then $x < 0$ and $y < 0$
(b) If $xy > 0$, then $x > 0$ and $y > 0$
(c) If $xy < 0$, then $x > 0$ and $y < 0$
(d) If $xy < 0$, then $x < 0$ and $y < 0$

Assertion-Reason Based Questions

DIRECTIONS: In the question number 19 and 20, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
(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.

19. Assertion (A): If $15 < 25$ then $15 \times 3 < 25 \times 3$
Reason (R): If $a < b\ then\ ac < bc\ for\ c > 0$.

20. Assertion (A): If Z is a complex number, then $\overline{(\overline{Z})} = Z$
Reason (R): $\overline{(\overline{i+i})} = 1 + i$

SECTION-B **2× 5**

Questions Number **21** to **25** are Very Short Answer (VSA) type questions of **2** marks each.

21. Let R and S be the sets defined as follows:
R = {x ∈ Z | x is divisible by 2}
S = {y ∈ Z | y is divisible by 3}
then R ∩ S =?

22. Is the following relation a function? Justify your answer
(A) $R_1 = \{(2,3), (-3,0), (2,7), (-4,6)\}$
OR
(B) $R_2 = \{(x, x^2) \mid x\ is\ a\ real\ number\}$.

23. If $\sin\theta = \frac{4}{5}$ then find $\cos\theta$ and $\tan\theta$

24. Find modulus of $1 + 3i$

25. (A) Solve the inequality, 3x – 5 < x + 7
OR
(B) Solve the inequality, 4x + 3 ≥ 2x + 17

SECTION-C **3× 6**

Questions Number **26** to **31** are Short Answer (SA) type questions of **3** marks each.

26. Write the following sets in the roaster form:
(i) $D = \{x \mid x^3 = x, x \in \mathbb{R}\}$
(ii) $E = \{x \mid x^4 - 5x^2 + 6 = 0, x \in \mathbb{R}\}$
OR
Write the following sets in the set-builder form:
(i) $F = \{\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \dots\}$
(ii) $G = \{2,5,10,17,26, \dots\}$

27. Find the domain for which the functions $f(x) = 2x^2 - 1$ and $g(x) = 1 - 3x$ are equal.

28. If $tan\ \theta = \frac{1}{2}$ and $tan\ \varphi = \frac{1}{3}$, then find the value of θ + φ.

29. If n is a positive integer, then find the value of $i^n + i^{n+1} + i^{n+2} + i^{n+3}$

30. Express the following in the form $a + ib$ of the complex number $\frac{5+\sqrt{2}i}{1-\sqrt{2}i}$

31. Solve $\frac{x}{4} < \frac{(5x-2)}{3} - \frac{(7x-3)}{5}$

SECTION-D 5× 4

Questions number **32** to **35** are Long Answer (LA) type questions of **5** marks each.

32. Find the domain of the function f given by $f(x) = \frac{1}{\sqrt{[x]^2-[x]-6}}$

33. If $tan\theta + sin\theta = m$ and $tan\theta - sin\theta = n$, then prove that $m^2 - n^2 = 4\ sin\theta\ tan\theta$

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

OR

(B) Find the Modulus of $\frac{(3-2i)(2+3i)}{(1+2i)(2-i)}$

35.(A) The longest side of a triangle is 3 times the shortest side and the third side is 2 cm shorter than the longest side. If the perimeter of the triangle is at least 61 cm, find the minimum length of the shortest side.

OR

(B) To receive Grade 'A' in a course, one must obtain an average of 90 marks or more in five examinations (each of 100 marks). If Sunita's marks in first four examinations are 87, 92, 94 and 95, find minimum marks that Sunita must obtain in fifth examination to get grade 'A' in the course.

SECTION-E 4× 3

Questions number **36** to **38** are case-study based questions of **4** marks each.

36. Maths teacher started the lesson Relations and Functions in Class XI. He explained the following topics: Ordered Pairs: The ordered pair of two elements a and b is denoted by (a, b): a is first element (or first component) and b is second element (or second component). Two ordered pairs are equal if their corresponding elements are equal. i.e., (a, b) = (c, d) ⇒ a = c and b = d Cartesian Product of Two Sets: For two non-empty sets A and B, the cartesian product A x B is the set of all ordered pairs of elements from sets A and B.

In symbolic form it can be written as A×B=$\{(a, b): a \in \mathbb{R}, b \in \mathbb{R}\}$

Based on the above topics, answer the following questions.

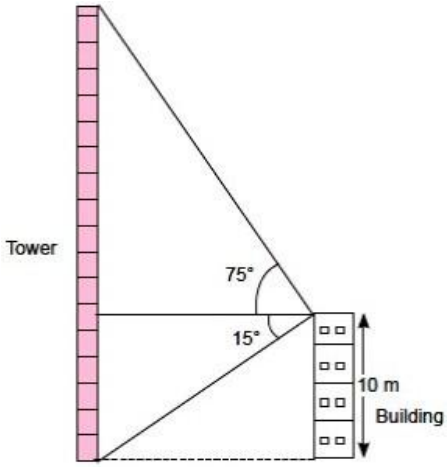
(i) If (a – 3, b + 7) = (3, 7), then find the value of a and b

(ii) If (x + 6, y – 2) = (0, 6), then find the value of x and y

(iii) If (x + 2, 4) = (5, 2x + y), then find the value of x and y

(iv) Find x and y, if (x + 3, 5) = (6, 2x + y).

37. From the top of a tower of 10 m high building the angle of elevation of top of a tower is 75° and the angle of depression of foot of the tower is 15°. If the tower and building are on the same horizontal surfaces.



(i) Find the value of tan 15°.

(ii) Find the value of cos 75°.

38. The school organised a farewell party of 100 students and the school management decided two types of drinks distributed (not compulsory for all) in the party are Milk (M) and Coffee (C).

He reported the following 20 students had all the two drinks M and C, 22 had Milk only and 15 had Coffee only.

(i) Find the number of students who prefer milk.

(ii) Find the number of students who doesn't drink neither milk nor coffee.