

Please check that this question paper contains **26** questions and **4** printed pages.

CLASS-XI
MATHEMATICS

Time Allowed : 3 Hrs.**Maximum Marks : 100**

- Please check that this question paper contains 3 printed pages.
- Please check that this question paper contains 26 questions.
- Please write down the serial number of the question before attempting it.
- There is reading time for 15 minutes. Students will read the question paper during this time and will not write any answer on the answer script during this period.

General Instructions :

1. This question paper consists of 26 questions divided into three sections.
Section A consists of 6 questions of 1 mark each.
Section B consists of 13 questions of 4 marks each.
Section C consists of 7 questions of 6 marks each.
2. There is no overall choice. However, internal choice is given in four questions of 4 marks each and two questions of 6 marks each.
3. Use of calculator is not permitted.

Section-A

1. Write the principal argument of $Z = 3 + i\sqrt{3}$
2. An arc of length R units subtends an angle θ at the centre of circle of radius R. Find the value of θ .
3. Solve the following in-equation for x , where x is a natural number :
 $5x - 2 < 3x + 3$
4. Evaluate : $\lim_{x \rightarrow 0} \frac{\sqrt{1+x} - 1}{x}$ $x \neq 0, x > -1$
5. Find the derivative of $f(x) = \cos x - \sin x$ at $x = \frac{2\pi}{3}$
6. If 10^{th} is the only middle term in the expansion of $(1+x)^n$, $n \in \mathbb{N}$. Write its last term.

Section-B

7. In an examination, 80% students passed in mathematics, 70% passed in science and 15% failed in both subjects. If 390 students passed in both subjects then find the total number of students who appeared in the examination.
8. Write the domain of $f(x) = x^2 + 1$ and draw its graph. Also find the value of x for which $f(x) = f(x + 1)$

OR

Draw the graph of $f(x) = \begin{cases} 1 - x, & x < 0 \\ 1, & x = 0 \\ 1 + x, & x > 0 \end{cases}$. Also write its range.

9. If in triangle ABC, $\frac{\cos A}{a} = \frac{\cos B}{b}$, prove that triangle is an isosceles triangle.

OR

In any triangle ABC, prove that $2(a \sin^2 \frac{C}{2} + c \sin^2 \frac{A}{2}) = c + a - b$

10. Find the general solution of $3 \tan x + \cot x = 5 \operatorname{cosec} x$, $x \neq n\pi$, $(2n + 1)\frac{\pi}{2}$ where $n \in \mathbb{Z}$.
11. If $a + ib = \frac{c + i}{c - i}$, $a, b, c \in \mathbb{R}$, $a \neq 0$, $c \neq \pm 1$. Prove that $a^2 + b^2 = 1$ and $\frac{b}{a} = \frac{c}{c^2 - 1}$

OR

Find the square root of $Z = 6 - 8i$

12. If the coefficient of $(r - 5)^{\text{th}}$ term and $(2r - 1)^{\text{th}}$ term in the expansion of $(1 + x)^{34}$ are equal. Find the value of r .
13. If the first term of G.P. is ' a ' and n th term is ' b ' and P denotes the product of first n terms. Prove that $P^2 = (ab)^n$.

OR

If the sum of n terms of two A.P.'s are in the ratio $3n + 8 : 7n + 15$, find the ratio of their 12th terms.

14. Solve the following system of in-equations graphically :
 $x - 2y \leq 0, 2x - y + 2 \geq 0, x \geq 0, y \geq 0$
15. Find the equation of ellipse whose foci are $(0, \pm 6)$ and length of minor axis is 16 units. Also find the coordinates of the points where the ellipse cut y axis and its latus rectum.
16. Find the ratio in which line segment joining the points A $(- 2, 4, 7)$ and B $(3, - 5, 8)$ is divided by YZ plane. Also find the coordinates of point of division.
17. Find the derivative of $\cos (5x + 2)$ w.r.t. x by first principle.
18. Write the converse and contra positive of following statement :
 If two lines are parallel then they do not intersect in the same plane.
19. Two dice are thrown simultaneously. Let E_1 denote getting a doublet, E_2 denote getting sum of the numbers appearing on the dice to be at least 10.
- (i) Find $P E_2$ or E_2 (ii) Are E_1 and E_2 mutually exclusive ?

Section-C

20. Let $U = \{x : x \leq 10, x \in \mathbb{N}\}$, $A = \{x : x \text{ is a prime number } < 10\}$, $B = \{3x : x \in \mathbb{N}, x < 4\}$ Verify that $(A \cup B)' = A' \cap B'$
 Represent the $(A \cup B)'$ with the help of Venn diagram.

21. If $x + y = z$ and $\tan x = k \tan y$, prove that $\sin z = \frac{k + 1}{k - 1} \sin(x - y)$

OR

Prove that $\sin^2 x + \sin^2(x + \frac{\pi}{3}) + \sin^2(x - \frac{\pi}{3}) = \frac{3}{2}$

22. Using principle of Mathematical Induction, prove that

$$1 \times 3 + 2 \times 3^2 + 3 \times 3^3 + \dots + n \times 3^n = \frac{(2n - 1)3^{n+1} + 3}{4}, \forall n \in \mathbb{N}$$

23. How many words with or without meaning can be formed using the letters of the word "DAUGHTER", if
- (i) All vowels are never together
- (ii) Vowels occupy odd places

OR

A polygon has 44 diagonals. If n denotes the number of vertices of polygon, find the value of n . Hence find the number of triangles that can be formed by joining these n points.

24. Two lines passing through point $(2, 3)$ are inclined at an angle of 45° to each other. If the slope of one of the line is 2, find the slope and equation of the other line.

25. Find the sum of n terms of the series :

$$3 + 5 + 9 + 15 + 23 + \text{-----} n \text{ terms}$$

26. ABC is an educational organization which has 140 schools. It instructed the principals to organize 'BLOOD DONATION CAMP' in their respective schools. Following are the details of number of schools collecting the number of units of blood.

No. of units	0-10	10-20	20-30	30-40	40-50	50-60	60-70
No. of schools	9	17	32	23	40	18	1

Find the mean and variance of the above data.

What values are shown by the persons who donated blood ?

