

CLASS : XI
 SUBJECT: MATHEMATICS

M.M : 100
 TIME: 3 HRS

General Instructions

1. All questions are compulsory. 2. The question paper consists of 29 questions divided into 3 sections, section A, B and C.
3. Section A contain 10 questions carrying 1 mark each. Section B contains 12 questions carrying 4 marks each and section C contains 7 questions carrying 6 marks each.

SECTION - A

1. Let $A = \{a, b, c\}$ and $B = \{4, 5\}$. Find the number of relations from A to B.
2. If $\sin \theta + \cos \theta = 0$ and θ is not in the fourth quadrant, then find $\sin \theta$ and $\cos \theta$.
3. Find the value of $\left[\frac{3}{4} \right] + \left[\frac{3}{4} + \frac{1}{100} \right] + \left[\frac{3}{4} + \frac{2}{100} \right] + \dots + \left[\frac{3}{4} + \frac{99}{100} \right]$ where $[x]$ is the greatest integer function of x .
4. Solve $|4 - x| + 1 < 3$.
5. Find the equation of the Parabola whose focus is (2,3) directrix is $x - 2y - 6 = 0$.
6. Find the equation of the line having X- intercept - 3 units and passing through (3,2).
7. Find the centre and radius of the circle $4x^2 + 4y^2 + 16x - 24y + 4 = 0$.
8. If $y = \log \sin \sqrt{x}$, find $\frac{dy}{dx}$.
9. Four cards are drawn at random from a pack of 52 playing cards. Find the probability of getting all face cards.
10. Find the variance of the data: 2,4,6,8 and 10.

SECTION - B

11. In a survey of 60 people, it was found that 25 people read newspaper H, 25 people read newspaper T, 26 people read newspaper I, 9 people read newspaper H and I, 11 read both H and T, 8 read both T and I, 3 read all three newspaper. (i) number of people who read at least one of the newspaper (ii) the number of people who read exactly one newspaper.

Let $H = \{1,2,3,4,5,6,7,8,9\}$, $A = \{1,2,3,4\}$, $B = \{2,4,6,8\}$ and $C = \{3,4,5,6\}$.

Find (i) $A - (B \cap C)$ (ii) $(A - B) \cup (A - C)$ (iii) $(A \cup B)'$ (iv) $A' \cap B'$
 (v) What can you observe from above.

12. Let $A = \{x : x \in N \text{ and } x^2 - 3x + 2 = 0\}$, $B = \{x : x \in N \text{ and } x < 2\}$, $C = \{x : x \in N \text{ and } x \leq 3\}$, then verify
 (i) $A \times (B \cap C) = (A \times B) \cap (A \times C)$, (ii) $A \times (B - C) = (A \times B) - (A \times C)$

OR
 Find the period of the following functions.
 (i) $f(x) = \sin 3x + \cos 2x$, (ii) $f(x-2) + f(x+2) = f(x)$ for all real x

13. Find the square root of $5 - 12i$

14. A and B roll a pair of dice one after the other with the condition that one who gets a sum of seven shall win the game. If A starts the game, find their respective chances of winning the game.

15. Sum the following series to n terms $6 + 66 + 666 + \dots$

16. Find the equations of lines parallel to the line $3x + 4y - 1 = 0$ at a distance 2 units from (-1,2).

OR
 Find the equation of the circle which passes through the points (1,3) and (2,-1) and has its centre on the line $2x + y - 4 = 0$.

17. Differentiate $\tan \sqrt{x}$ w.r.t x from first principle

18. Evaluate $\lim_{x \rightarrow \frac{\pi}{6}} \frac{\sqrt{3} \sin x - \cos x}{x - \frac{\pi}{6}}$

19. In a multiple choice questions having 5 alternatives of which one or more are correct, a candidate ticks the answers at random. He will get marks if he ticks all the correct answers. If he is given three chances, find the probability that he will get marks.

20. In any ΔABC , show that $2\left(a \sin^2 \frac{C}{2} + c \sin^2 \frac{A}{2}\right) = c + a - b$.

21. Solve $2 \tan \theta - \cot \theta = -1$ OR Prove that $\frac{1}{\sin 10^\circ} - \frac{\sqrt{3}}{\cos 10^\circ} = 4$.

22. If $m \tan(\theta - 30^\circ) = n \tan(\theta + 120^\circ)$, show that $\cos 2\theta = \frac{m+n}{2(m-n)}$, $m \neq n$

OR

Evaluate $\sin 20^\circ \sin 40^\circ \sin 60^\circ \sin 80^\circ$.

SECTION - C

23. By using principle of mathematical induction prove that

$$1 \cdot 3 + 3 \cdot 5 + 5 \cdot 7 + \dots + (2n-1)(2n+1) = \frac{n(4n^2 + 6n - 1)}{3}, n \in \mathbb{N}$$

OR

By using principle of mathematical induction prove that $3^{2n+2} - 8n - 9$ is divisible by 64 for all $n \in \mathbb{N}$

24. Solve $x^2 + \left(\frac{ax}{x+a}\right)^2 = 3a^2$, $x \neq -a$. OR Solve $(x+4)(x+7)(x+8)(x+11) + 20 = 0$

25. (a) Find the term independent of x in the expansion of $\left(\frac{3x^2}{2} - \frac{1}{3x}\right)^9$

(b) Find the middle term(s) in the expansion of $\left(x - \frac{1}{x}\right)^{10}$

26. Find the length of the Major axis, minor axis, foci, directrices and vertex of the ellipse $2x^2 + 3y^2 - 4x - 12y + 13 = 0$

OR

Find the equation of the parabola whose vertex is at $(-1, -3)$ and focus is at $(0, -3)$.

27. Prove that $\cos \frac{2\pi}{15} \cos \frac{4\pi}{15} \cos \frac{8\pi}{15} \cos \frac{14\pi}{15} = \frac{1}{16}$. OR Prove that $\cot \frac{1}{2} = \sqrt{2} + \sqrt{3} + \sqrt{4} + \sqrt{6}$.

28. Calculate mean deviations (from mean) for the following data

Classes	10-20	20-30	30-40	40-50	50-60	60-70
Frequencies	8	6	12	5	2	7

29. Sum the series $3 + 5x + 9x^2 + 15x^3 + 23x^4 + \dots \infty$

OR

Sum to n term of the series $\frac{1}{1 \cdot 2 \cdot 3 \cdot 4} + \frac{1}{2 \cdot 3 \cdot 4 \cdot 5} + \frac{1}{3 \cdot 4 \cdot 5 \cdot 6} + \dots$ to n terms