

Question Paper
Class XI
Subject – Mathematics

Time : 3 hrs.

M.M.-100

GENERAL INSTRUCTIONS :

1. All questions are compulsory.
2. The question paper consists of 26 questions divided into 3 sections A, B and C. Section A comprises of 6 questions of 1 mark each, Section-B comprises of 13 questions of 4 marks each and section-C comprises of 7 questions of 6 marks each.
3. There is no overall choice, however internal choice has been provided in 4 questions of four marks each and 2 questions of six marks each. You have to attempt only one of the alternatives in all such questions.
4. Use of calculators is not permitted.

(SECTION-A)

1. If $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{1, 2, 3, 4\}$, $B = \{2, 4, 6, 8\}$. Find $(A-B)'$.
2. If set A has 2 elements and set B has 3 elements, then how many relations from set A to Set B can be formed?
3. If $\sqrt{3}\operatorname{cosec} x = -2$, find x.
4. Solve the following equation.
 $x^2 + 3x + 9 = 0$

5. If $x \in \mathbb{N}$, find the smallest value of x which satisfies the inequation.

$$2x + \frac{5}{2} \geq \frac{5x}{2} + 1$$

6. Find the equation of the line, which makes intercepts -3 and 2 on the x - and y - axes respectively.

SECTION-B

7. If $P(A) = P(B)$ show that $A=B$

Or

Let A and B be sets; if $A \cap X = B \cap X = \emptyset$ and $A \cup X = B \cup X$ for some set X . show that $A=B$.

8. Find the domain and range of the function $f(x) = 1 - |x-3|$.

9. Let $A = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ a relation R from set A to A be define by

$$R = \{(x, y) : y = x+5\}$$

(i) Write R in roster form

(ii) Find the domain of R .

(iii) Find the range of R

(iv) Depict R using an arrow diagram.

10. Prove that

$$(\cos x + \cos y)^2 + (\sin x - \sin y)^2 = 4\cos^2\left(\frac{x+y}{2}\right)$$

Or

For any ΔABC , prove that

$$\frac{a+b}{c} = \frac{\cos\left(\frac{A-B}{2}\right)}{\sin\frac{C}{2}}$$

11. Find $\sin \frac{x}{2}$, if $\tan x = \frac{-4}{3}$ and x lies in quadrant IV.
12. Find the general solution for the equation $\sin 2x - \sin 4x + \sin 6x = 0$
13. For all $n \geq 1$, prove the following by using the principle of mathematical induction

$$\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \dots + \frac{1}{n(n+1)} = \frac{n}{n+1}$$

14. Find the polar form of complex number

$$\frac{-16}{1+i\sqrt{3}}$$

Or

Find the square root of complex number $-7-24i$.

15. ✓ A committee of 7 has to be formed from 9 boys and 4 girls. In how many ways can this be done when the committee consists of at least three girls?
16. ✓ How many words, with or without meaning each of 3 vowels and 2 consonants can be formed from the letters of the word INVOLUTE?
17. ✓ Find the middle term in the expansion of $(\frac{x}{3} + 9y)^{10}$.
18. – The sum of n terms of two arithmetic progressions are in the ratio $(3n+8):(7n+15)$. Find the ratio of their 12th term.

Or

Find the sum of following series upto n terms.

$$3 \times 1^2 + 5 \times 2^2 + 7 \times 3^2 + \dots$$

19. The vertices of ΔPQR are $P(2,1)$, $Q(-2,3)$ and $R(4,5)$. Find the equation of the median through the vertex R .

SECTION-C

20. A college awarded 38 medals in football, 15 in basketball and 20 in cricket. If these medals went to a total of 58 men only three men got medals in all the three sports, how many received medals in exactly two of the three sports?

✓ 21. Prove that $3^{2n+2} - 8n - 9$ is divisible by 8 using P.M.I.

22. If α and β are different complex numbers with $|\beta| = 1$, then find $\left| \frac{\beta - \alpha}{1 - \bar{\alpha}\beta} \right|$

23. Solve the system of inequalities graphically

$$4x + 3y < 60, y \geq 2x, x \geq 3, x \geq 0, y \geq 0$$

24. The coefficient of the $(r-1)^{\text{th}}$, r^{th} and $(r+1)^{\text{th}}$ terms in expansion of $(x+1)^n$ are in the ratio 1:3:5. Find n and r .

Or

If the coefficient of a^{r-1} , a^r and a^{r+1} in the expansion of $(1+a)^n$ are in arithmetic progression, prove that $n^2 - n(4r+1) + 4r^2 - 2 = 0$

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

Or

The sum of two numbers is 6 times their geometric mean, show that numbers are in the ratio $(3+2\sqrt{2}) : (3-2\sqrt{2})$.

26. Find the image of the point $(3,8)$ with respect to the line $x + 3y = 7$ assuming the line to be a plane mirror.