

Class – XI

(Sample Paper)

Subject – Mathematics

Time: 3 hours

M.M.: 100

General Instructions:

- i. All questions are compulsory.
- ii. Question 1 to 4 in Section A carrying 1 mark each.
- iii. Questions 5 to 12 in Section B carrying 2 marks each.
- iv. Questions 13 to 23 in Section C carrying 4 marks each.
- v. Questions 24 to 29 in Section D carrying 6 marks each.

Section – A

1. Prove that $\sin^2 \frac{2\pi}{3} + \cos^2 \frac{5\pi}{6} - \tan^2 \frac{3\pi}{4} = \frac{1}{2}$
2. Prove that $(A \cup B)' = A' \cap B'$
3. Find the domain of $f(x) = \frac{1}{\sqrt{9-x^2}}$
4. Solve: $1 \leq |x-2| \leq 3$

Section – B

5. If ${}^n P_r = {}^n P_{r+1}$ and ${}^n C_r = {}^n C_{r-1}$, find the value of n and r.
6. Show that $\frac{\tan\left(\frac{\pi}{4} + A\right) + \tan\left(\frac{\pi}{4} - A\right)}{\tan\left(\frac{\pi}{4} + A\right) - \tan\left(\frac{\pi}{4} - A\right)} = \operatorname{Cosec} 2A$
7. In how many ways can 5 girls and 3 boys be seated in a row so that no 2 boys are together.
8. Solve $\sqrt{3}x^2 - \sqrt{2}x + 3\sqrt{3} = 0$
9. In any triangle ABC, prove that:
$$\sin\left(\frac{B-C}{2}\right) = \left(\frac{b-c}{a}\right) \cos\frac{A}{2}$$
10. Out of 7 Consonants and 4 vowels, how many words of 3 Consonants and 2 vowels can be formed?
11. Find the number of permutations of n different things taken r at a time such that two specific things occur together.
12. Find the 13th term in the expansion of $\left(9x - \frac{1}{3\sqrt{x}}\right)^{18}$, $x \neq 0$

Section – C

13. If $\cos(\theta + \phi) = m\cos(\theta - \phi)$, then prove that $\tan\theta = \frac{1-m}{1+m} \cot\phi$
14. Show that $2\sin^2\beta + 4\cos(\alpha + \beta) \sin\alpha \sin\beta + \cos 2(\alpha + \beta) = \cos 2\alpha$
15. If P is a real number and if the middle term in the expansion of $\left(\frac{P}{2} + 2\right)^8$ is 1120, find P.
16. If the p^{th} and q^{th} terms of a G.P. are q and p respectively. Show that its $(p+q)^{\text{th}}$ term is $\left(\frac{q}{p}\right)^{\frac{1}{p-q}}$
17. Convert $Z = \frac{1+7i}{(2-i)^2}$ in the polar form.
18. Solve the following system of inequalities graphically.
 $x+2y \leq 10, x+y \geq 1, x-y \leq 0, x \geq 0, y \geq 0$
19. The Coefficients of three consecutive terms in the expansion of $(1+a)^n$ are in the Ratio 1 : 7 : 42, Find n.
20. If the coefficients of a^{r-1}, a^r and a^{r+1} in the expansion of $(1+a)^n$ are in arithmetic progression, prove that $n^2 - n(4r+1) + 4r^2 - 2 = 0$
21. Prove that $(1+x)^n \geq (1+nx)$, for all natural number n, where $x > -1$.
22. If $\tan x = \frac{-4}{3}$, x is in II quadrant then find $\sin \frac{x}{2}, \cos \frac{x}{2}$ and $\tan \frac{x}{2}$
23. If p, q, r are in G.P. and the equations, $px^2 + 2qx + r = 0$ and $dx^2 + 2ex + f = 0$ have a common root, then show that $\frac{d}{p}, \frac{e}{q}, \frac{f}{r}$ are in A.P.

Section – D

24. A college awarded 38 medals in football, 15 in basketball and 20 in cricket. If these medals went to a total of 58 men and only three men got medals in all the three sports, how many received medals in exactly two of the three sports?
25. (i). Let $A = \{1, 2, 3\}, B = \{3, 4\}$ and $C = \{4, 5, 6\}$.
 Find: a. $A \times (B \cap C)$ b. $(A \times B) \cap (A \times C)$ c. $A \times (B \cup C)$
- (ii). Find the domain of the following functions:
 a. $f(x) = \frac{1}{\sqrt{1-\cos x}}$ b. $f(x) = \frac{x^3-x+3}{x^2-1}$
26. a. If α and β are different complex numbers with $|\beta| = 1$, then find $\left| \frac{\beta - \alpha}{1 - \bar{\alpha}\beta} \right|$
- b. Find the modulus and argument of the complex number: $Z = \frac{1}{1+i}$
27. a. A manufacturer has 600lts. of a 12% Solution of acid. How many lts. of a 30% acid solution must be added to it so that acid content in the resulting mixture will be more than 15% but less than 18%?
- b. Convert 6 radians into degree measure.

28. Find the number of arrangements of the letters of the word INDEPENDENCE. In how many of these arrangements,

i. do the words start with P

ii. do all the vowels always occur together

iii. do the vowels never occur together

iv. do the word begin with I and end in P?

29. a. Find the sum to n terms of the series: $5 + 11 + 19 + 29 + 41 + \dots$

b. The sum of three numbers in G.P. is 56. If we subtract 1, 7, 21 from these numbers in that order, we obtain an arithmetic progression. Find the numbers.