

SECTION - A

I. Each question carries 1 mark.

(1 x 10 = 10)

1. If  $\sin x = \frac{\sqrt{5}}{3}$  and  $x$  lies in 2<sup>nd</sup> quadrant, find the value of  $\tan \frac{x}{2}$ .
2. If  $\tan\left(\frac{\pi}{4} + \theta\right) + \tan\left(\frac{\pi}{4} - \theta\right) = a$ , then find the value of  $\tan^2\left(\frac{\pi}{4} + \theta\right) + \tan^2\left(\frac{\pi}{4} - \theta\right)$ .
3. Solve  $\frac{(x^2 - 3x + 2)(4 - x)}{(6 + x)} \leq 0$ .
4. In how many ways can 8 Indians, 4 Americans and 4 Englishmen be seated in a row so that all persons of the same nationality sit together.
5. If  $128$  is divisible by  $3^n$ , find the maximum value of  $n$ .
6. If first and eighth term of a G.P be  $x^{-4}$  and  $x^{52}$  and its second term be  $x^t$ , then find the value of  $t$ .
7. Find the sum of the series  $2+3+5+6+8+9+\dots+2n$  terms.
8. Find the value of  $k$  if the st line  $(2x+3y+4) + k(6x-y+12) = 0$  is perpendicular to the line  $7x+5y-4=0$
9. For what value of  $k$  are the point  $(k, 2-2k)$ ,  $(-k+1, 2k)$  and  $(-4-k, 6-2k)$  are collinear?
10. Determine the equation of line through the point  $(-4, -3)$  and parallel to  $x$ -axis.

SECTION - B

II. Each questions carries 4 marks.

(4 x 12 = 48)

1. Solve  $\frac{|x+3|+x}{x+2} > 1$ .
  12. The sum of  $n$  terms of two series in A.P. are in the ratio  $(3n-13) : (5n+21)$ . Find the ratio of their 24<sup>th</sup> terms.
  13. Evaluate  $4 \cos 20^\circ - \sqrt{3} \cot 20^\circ$ .
  14. Prove that  $\cos^2 A + \cos^2(A+120^\circ) + \cos^2(A-120^\circ) = \frac{3}{2}$ .
  15. If  $\alpha$  and  $\beta$  are the solutions of the equation  $a \tan \theta + b \sec \theta = c$ , then show that  $\tan(\alpha + \beta) = \frac{2ac}{a^2 - c^2}$ .
  16. Solve  $(5+2\sqrt{6})x^{2-3} + (5-2\sqrt{6})x^{2-3} = 0$ .
- OR
- Solve  $6x^4 - 25x^3 + 12x^2 + 25x + 6 = 0$

17. If  $a, b, c$  be in A.P. and  $x, y, z$  be in G.P. then prove that  $x^{b-c} \cdot y^{c-a} \cdot z^{a-b} = 1$ .
18. Find the number of terms of the sequence 1, 3, 6, 10, 15, ..... 5050.
19. St. line L is perpendicular to the line  $5x - y = 1$ . The area of the triangle formed by the line L and coordinate axes is 5. Find the equation of the line.
20. A rod of length 1 slides with its ends on two perpendicular lines. Find the locus of its midpoints.
21. The letters of the word RANDOM are written in all possible orders and the words so formed are arranged lexicographically. Find the rank of the word RANDOM in that arrangement.
22. The sides AB, BC and CA of triangle have 3, 4 and 5 interior points respectively on them. Find the number of triangles that can be constructed using these points as vertices.

SECTION - C

II. Each questions carries 6 marks.

(6 x 7 = 42)

23. Prove that  $\tan 82 \frac{1}{2}^\circ = (\sqrt{2} + \sqrt{3})(\sqrt{2} + 1)$ .
24. By using principle of mathematical induction prove that  

$$1.3 + 3.5 + 5.7 + \dots + (2n-1)(2n+1) = \frac{n(4n^2 + 6n - 1)}{3}$$
25. Solve  $x^2 - (7-i)x + (18-i) = 0$ .
26. Find the equation of the line which cut-off intercepts on the axes whose sum and product are 1 and -6 respectively.
27. The series of natural numbers are divided into groups as follows:  
 (1); (2,3), (4,5,6), (7,8,9,10)..... Find the sum of the number in the  $n^{\text{th}}$  group.
28. Find the number of words that can be formed using the letters of the word COMBINATION taking 4 letters at a time.
29. Find the  $n^{\text{th}}$  term of the sequence and then find the sum to n terms.  $12 + 40 + 90 + 168 + 280 + \dots$

OR

Sum the series  $1.n + 2(n-1) + 3(n-2) + \dots + n.1$ .