Unsolved Paper–3
Class 11, Mathematics

Time: 3 hours **Max. Marks 100**

General Instructions

1. All questions are compulsory.
2. Use of calculator is not permitted. However you may use log table, if required.
3. Q.No. 1 to 12 are of very short answer type questions, carrying 1 mark each.
4. Q.No.13 to 28 carries 4 marks each.
5. Q.No. 29 to 32 carries 6 marks each.

1. Write the following set in the roaster form : $D = \{t \mid t^3 = t, t \in R\}$

2. If $R_3 = \{(x, x) \mid x \text{ is a real number}\}$ is a relation. Then find domain and range of R_3.

3. Is the given relation a function? Give reasons for your answer.
   $h = \{(4, 6), (3, 9), (– 11, 6), (3, 11)\}$

4. The value of tan 1° tan 2° tan 3° ... tan 89° is?

5. If $\tan \theta = 3$ and θ lies in third quadrant, then the value of $\sin \theta$ is?

6. Evaluate: $(1 + i)^6 + (1 – i)^3$

7. The sum of the digits in unit place of all the numbers formed with the help of 3, 4, 5 and 6 taken all at a time is?

8. Find the centroid of a triangle, the mid-point of whose sides are D (1, 2, – 3), E (3, 0, 1) and F (– 1, 1, – 4).

9. Differentiate the functions w. r. to *x*: (sec x – 1) (sec x + 1)

10. Differentiate the functions w. r. to *x*: $\frac{1}{ax^2 + bx + c}$

11. If the letters of the word ALGORITHM are arranged at random in a row what is the probability the letters GOR must remain together as a unit?

12. Six new employees, two of whom are married to each other, are to be assigned six desks that are lined up in a row. If the assignment of employees to desks is made randomly, what is the probability that the married couple will have nonadjacent desks?

13. For all sets A and B, Prove that: $A - (B \cap A) = A - B$

14. Find the domain & range of the following function given by $f(x) = \frac{3x}{2x-8}$

15. If $x \cos \theta = y \cos (\theta + 2\pi/3) = z \cos (\theta + 4 \pi/3)$, then find the value of xy + yz + zx.

16. Prove by using PMI $n (n^2 + 5)$ is divisible by 6, for each natural number n

17. If z_1, z_2 and z_3, z_4 are two pairs of conjugate complex numbers, then find $\arg\left(\frac{z_1}{z_4}\right) + \arg\left(\frac{z_2}{z_3}\right)$

18. The cost and revenue functions of a product are given by C(x) = 20 x + 4000 and R(x) = 60x + 2000, respectively, where x is the number of items produced and sold. How many items must be sold to realise some profit?

19. A box contains two white, three black and four red balls. In how many ways can three balls be drawn from the box, if at least one black ball is to be included in the draw?

20. Find the number of integers greater than 7000 that can be formed with the digits 3, 5, 7, 8 and 9 where no digits are repeated.

21. Find numerically the greatest term in the expansion of $(2 + 3x)^9$, where x=3/2

22. A carpenter was hired to build 192 window frames. The first day he made five frames and each day, thereafter he made two more frames than he made the day before. How many days did it take him to finish the job?

23. If the intercept of a line between the coordinate axes is divided by the point (–5,4) in the ratio 1 : 2, then find the equation of the line.

24. Find the equation of the set of all points the sum of whose distances from the points (3, 0) and (9, 0) is 12.

25. Prove that the points (0, – 1, – 7), (2, 1, – 9) and (6, 5, – 13) are collinear. Find the ratio in which the first point divides the join of the other two.

26. Let $f(x) = \begin{cases} x+2, x \le -1 \\ cx^2, x > -1 \end{cases}$

$and\ \_if\ \_ \lim_{x \to -1} f(x) \_ exists$

Find the value of c.

27. Prove by direct method that for any real numbers x, y if x = y, then $x^2 = y^2$.

28. One urn contains two black balls (labelled B1 and B2) and one white ball. A second urn contains one black ball and two white balls (labelled W1 and W2). Suppose the following experiment is performed. One of the two urns is chosen at random. Next a ball is randomly chosen from the urn. Then a second ball is chosen at random from the same urn without replacing the first ball.
    (a) Write the sample space showing all possible outcomes
    (b) What is the probability that two black balls are chosen?
    (c) What is the probability that two balls of opposite colour are chosen?

29. In a class of 60 students, 25 students play cricket and 20 students play tennis, and 10 students play both the games. Find the number of students who play neither?

30. If x = sec φ – tan φ and y = cosec φ + cot φ then show that xy + x – y + 1 = 0

31. If the sum of p terms of an A.P. is q and the sum of q terms is p, show that the sum of p + q terms is – (p + q). Also, find the sum of first p – q terms (p > q).

32. Determine the mean and standard deviation for the following distribution

Marks	2	3	4	5	6	7	8	9	10
Frequency	1	6	8	5	2	6	7	4	3