Unsolved Paper–5
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. If Y = {x | x is a positive factor of the number $2^{p-1} (2^p - 1)$, where 2^{p-1} is a prime number}.Write Y in the roaster form.

2. If R_1 = {(x, y) | y = 2x + 7, where x $\in$ R and $-5 \le x \le 5$} is a relation. Then find the domain and Range of R_1.

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

4. Number of solutions of the equation tan x + sec x = 2 cosx lying in the interval [0, 2π] is?

5. If tan θ =1/2 and tan φ =1/3 , then the value of $\theta + \varphi$ is?

6. Find the value of P such that the difference of the roots of the equation $x^2 - Px + 8 = 0$ is 2.

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. Show that the point A (1, – 1, 3), B (2, – 4, 5) and (5, – 13, 11) are collinear.

9. Differentiate the functions w. r. to x: $(\sin x + \cos x)^2$

10. Differentiate the functions w. r. to x: $\left(x + \dfrac{1}{x} \right)^3$

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. An ordinary deck of cards contains 52 cards divided into four suits. The red suits are diamonds and hearts and black suits are clubs and spades. The cards J, Q, and K are called face cards. Suppose we pick one card from the deck at random.
    (a) What is the sample space of the experiment?
    (b) What is the event that the chosen card is a black face card?

13. For all sets A and B, Prove that: A ∪ (B − A) = A ∪ B

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

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

16. Prove by using PMI $1 + 2 + 2^2 + ... + 2^n = 2^{n+1} - 1$ for all natural numbers n.

17. z_1 and z_2 are two complex numbers such that $|z_1| = |z_2|$ and $\arg(z_1) + \arg(z_2) = \pi$ then show that $z_1 = -\overline{z}_2$.

18. A solution is to be kept between 40°C and 45°C. What is the range of temperature in degree Fahrenheit, if the conversion formula is F = 9 C/5 + 32?

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 different words that can be formed from the letters of the word 'TRIANGLE' so that no vowels are together.

21. If p is a real number and if the middle term in the expansion of $\left(\dfrac{p}{2} + 2\right)^8$ is 1120, find p

22. A man accepts a position with an initial salary of Rs 5200 per month. It is understood that he will receive an automatic increase of Rs 320 in the very next month and each month thereafter.

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 length of the line-segment joining the vertex of the parabola y2 = 4ax and a point on the parabola where the line-segment makes an angle θ to the x-axis.

25. What are the coordinates of the vertices of a cube whose edge is 2 units, one of whose vertices coincides with the origin and the three edges passing through the origin, coincides with the positive direction of the axes through the origin?

26. Evaluate: $\lim\limits_{x \to 0} \dfrac{(a+h)^2 \sin(a+h) - a^2 \sin a}{h}$

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

28. A card is drawn from a deck of 52 cards. Find the probability of getting a king or a heart or a red card.

29. Let A, B and C be sets. Then show that
    A ∩ (B ∪ C) = (A ∩ B) ∪ (A ∩ C)

30. If cos (θ + φ) = m cos (θ – φ), then prove that $\tan\theta = \dfrac{1-m}{1+m}\cot\varphi$

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. The weights of coffee in 70 jars is shown in the following table.

Weight	Frequency
200-201	13
201-202	27
202-203	18
203-204	10
204-205	1
205-206	1