CBSE Board
Class XI Mathematics
Sample Paper – 2

Time: 3 hrs   **Total Marks: 100**

General Instructions:

1. All questions are compulsory.
2. The question paper consist of 29 questions.
3. Questions 1 – 4 in Section A are very short answer type questions carrying 1 mark each.
4. Questions 5 – 12 in Section B are short-answer type questions carrying 2 mark each.
5. Questions 13 – 23 in Section C are long-answer I type questions carrying 4 mark each.
6. Questions 24 – 29 in Section D are long-answer type II questions carrying 6 mark each.

SECTION – A

1. Find the sum to infinity of the sequence: $\dfrac{1}{3} + \dfrac{1}{3^2} + \dfrac{1}{3^3} + \dfrac{1}{3^4} + \ldots$

OR

Use geometric series to express $0.555\ldots = 0.\overline{5}$ as a rational number.

2. Write the truth value of the statement p: Intersection of two disjoint sets is an empty set.

3. Find $\cos\left(\dfrac{\pi}{4} - \alpha\right)\cos\left(\dfrac{\pi}{4} - \beta\right) - \sin\left(\dfrac{\pi}{4} - \alpha\right)\sin\left(\dfrac{\pi}{4} - \beta\right)$.

4. Find the argument of $\dfrac{1}{1-i}$.

SECTION – B

5. What is the eccentricity of the curve $4x^2 + y^2 = 100$?

6. What is the probability that two friends will have the same birthday?

OR

The probability that a person visiting a dentist will have his teeth cleaned is 0.44, the probability that he will have a cavity filled is 0.24. The probability that he will have his teeth cleaned or a cavity filled is 0.6. What is the probability that a person visiting a dentist will have his teeth cleaned and cavity filled?

7. Divide 20 into 4 parts which form an A.P. such that ratio of the product of the Ist and the 4th term to the product of the 2nd and the 3rd is 2: 3.

8. If the sum of n terms of an A.P is (pn + qn^2) where p, q are constants, find the common difference.

9. Let R be a relation from N to N defined by
    R = {(a, b): a, b $\in$ N and a = b^2}.
    Then, which of the following statement is true?
    (i) (a, a) $\in$ R, for all a $\in$ N
    (ii) (a, b) $\in$ R, implies (b, a) $\in$ R

10. Differentiate |2x – 1| w.r.t. x.

    OR

    Differentiate x sin x log x with respect to x.

11. One end of diameter of the circle x^2+y^2-3x+5y-4=0 is (2, 1). Find the co-ordinates of other end.

12. Find the equation of ellipse with e = ¾, foci on y axis, centre at the origin & passing through point (6, 4).

    OR

    Find the distance between the directrices the ellipse $\dfrac{x^2}{36} + \dfrac{y^2}{20} = 1$

SECTION – C

13. A school gave out medals on its sports day. 38 medals were given for soccer, 15 for basketball, and 20 for cricket. These medals were given to 58 students in all. Only three students got medals in all three sports. How many students received medals in exactly two of the three sports?

14. Show that: 2cos6θ = 64cos^{6}θ – 96cos^{4}θ + 36cos^{2}θ – 2

    OR

    Show that: $\dfrac{\sin 3\theta}{\sin \theta} - \dfrac{\cos 3\theta}{\cos \theta} = 2$

15. In how many ways can 5 children be arranged in a row such that 2 boys x and y, (i) are always together (ii) are never sit together?

    OR

In how many ways can 5 men and 4 women be seated in a row, so that the women occupy even places only?

16. Find the equation of the set of points P, the sum of whose distances from A(4, 0, 0) and B(-4, 0, 0) is equal to 10 ?

17. Prove that $2 \cos \dfrac{\pi}{13} \cos \dfrac{9\pi}{13} + \cos \dfrac{3\pi}{13} + \cos \dfrac{5\pi}{13} = 0$

18. Find the domain and range of f(x) = $\sqrt{x-5}$

OR

Find the domain and range of f(x) = $\dfrac{3}{(2-x^2)}$

19. A ladder 12 m long leaning against a wall begins to slide down. Its one end always remains on the wall and the other on the floor. Find the equation of the locus of a point P which is 3 m from the end in contact with the floor. Identify the conic section represented by the equation.

20. Prove that $a^n - b^n$ is a multiple of (a - b), where a and b are natural numbers.

21. Find the equation of a line, perpendicular to the line whose equation is 6x − 7y + 8 = 0 and which passes through the point of intersection of the two lines whose equations are 2x − 3y − 4 = 0 and 3x + 4y − 5 = 0.

22. An administration assistant is given three letters to be mailed to three different people. He is also given three addressed envelopes in which to put them and send to three people X, Y and Z. What is the probability that atleast one person out of X, Y and Z got the letter written to him?

23. If O is the sum of odd terms and E of even terms in the expansion of (x + a)^n, prove that:
(i) $O^2 - E^2 = (x^2 - a^2)^n$
(ii) $4OE = (x + a)^{2n} - (x - a)^{2n}$

SECTION – D

24. The sum of n terms of two A.P.s are in the ratio (7n + 1) : (4n + 27). Find the ratio of their 13th term.

OR

The ratio of the sums m and n terms of an A. P. is $m^2 : n^2$. Show that the ratio of the mth and nth term is (2m − 1) : (2n − 1).

25. If in a $\triangle ABC$, $\dfrac{b+c}{12} = \dfrac{c+a}{13} = \dfrac{a+b}{15}$, then prove that: $\dfrac{\cos A}{2} = \dfrac{\cos B}{7} = \dfrac{\cos C}{11}$.

OR

If in a triangle ABC, $\dfrac{\sin A}{\sin C} = \dfrac{\sin(A-B)}{\sin(B-C)}$ prove that a^2, b^2, c^2 are in A. P.

26. Show by mathematical induction that the sum to n terms of the series
$1^2 + 2 \times 2^2 + 3^2 + 2 \times 4^2 + 5^2 + 2 \times 6^2 + \ldots$ is

$$S_n = \begin{cases} \dfrac{n(n+1)^2}{2}, & \text{when n is even} \\ \dfrac{n^2(n+1)}{2}, & \text{when n is odd} \end{cases}$$

OR

Prove by induction that the sum of the cubes of three consecutive numbers is divisible by 9.

27. Graph the given inequalities and shade the common solution region.
$2x + y \geq 40$, $x + 2y \geq 50$, $x + y \geq 35$

28. Given below is the frequency distribution of weekly study hours of a group of class 11 students. Find the mean, variance and standard deviation of the distribution using the short cut method.

Classes	Frequency
0 - 10	5
10 - 20	8
20 - 30	15
30 - 40	16
40 - 50	6

29. (i) Find the derivative of $f(x) = -\dfrac{1}{x}$, using the first principle.

(ii) Evaluate: $\displaystyle\lim_{x \to 0} \dfrac{6^x - 3^x - 2^x + 1}{x^2}$