MATHEMATICS (SAMPLE PAPER)   CLASS: 11ᵗʰ

Paper – Mathematics
Class - XI

Time : 3 hrs.   M. M. 100

SECTION – A

QUESTION NUMBER 1 TO 6 CARRY 1 MARK EACH.

1. Find the multiplicative inverse of $(4 - 3i)$.
2. What is the probability that a letter choosen at random from the word "EQUALITY" is a vowel?
3. Two enemy planes are observed at $P(x, y, 19)$ and $Q(17, 11, z)$ by Indian Air Force plane at the mid-point $M(15,12,16)$ of PQ. Show $x = y = z$.
4. Write the value of tenth term of the sequence : $1(1) + 2(1 + 2) + 3(1 + 2 + 3) + 4(1 + 2 + 3 + 4) + \cdots$
5. Write the value of $\sin 75°$.
6. Write the domain of the function, $f(x) = \frac{x^2+2x+3}{x^2-5x+6}$.

SECTION – B

QUESTION NUMBER 7 TO 19 CARRY 4 MARKS EACH.

7. Solve : $2\cos^2 x + 3\sin x = 0$.

    OR

    If $\cos(A + B)\sin(C - D) = \cos(A - B)\sin(C + D)$, then show that $\tan A \tan B \tan C + \tan D = 0$.

8. Convert the complex number $z = \frac{1-i}{\cos\frac{\pi}{3}+i\sin\frac{\pi}{3}}$ in the polar form.

9. Let A, B and C be the sets such that $A \cup B = A \cup C$ and $A \cap B = A \cap C$. Show that $B = C$.

    OR

    If $A = \{3,5,7,9,11\}, B = \{7,9,11,13\}, C = \{11,13,15\}$ and $D = \{15,17\}$; find
    $(i) A \cap (B \cup C)$ $(ii)(A \cap B) \cap (B \cup C)$ $(iii)(A \cup D) \cap (B \cup C)$

10. For every positive integer n, prove that $7^n - 3^n$ is divisible by 4.

11. 300 trees are planted in a regular pattern in rows in the shape of an isosceles triangle, the numbers in the successive rows diminishing by one from the base of the apex. How many trees are there in the row which form the base of the triangle?

12. Find the sum of n terms of the series : $1^2 + (1^2 + 2^2) + (1^2 + 2^2 + 3^2) + \ldots\ldots$

    OR

    Find the sum of n terms of the series : $0.3 + 0.33 + 0.333 + \ldots\ldots$

13. If three points $(h, 0), (a, b)$ and $(0, k)$ lie on a line, show that $\frac{a}{h} + \frac{b}{k} = 1$.

    OR

    Find the equation of the line whose perpendicular distance from the origin is 4 units and the angle which the normal makes with positive direction of x-axis is 15°.

14. Find the equation of the circle concentric with the circle $x^2 + y^2 - 4x - 6y - 9 = 0$ and passing through the point $(-4, -5)$.

15. A parabolic reflector is 9 cm deep and its diameter is 24 cm. How far is its focus from the vertex? Find two possible equation of the reflector. Where will you prefer to keep the light at the vertex or the focus for better illumination?

16. Draw the graph of the function $f: R \to R$ defined by $f(x) = [x]$. The symbol $[x]$ means the greatest integer less than or equal to x. Thus $[2.3] = 2, [2] = 2, [0.99] = 0$ etc.

17. Write the negative of the following statements :
    (i)   All triangles are not equilateral triangle.   (ii)   Every natural number is an integer.
    (iii) There does not exist a quadrilateral which has all its sides equal.

18. A die has two faces each with number '1', three faces with number '2' and one face with number '3'. If die is rolled once determine
    (i) $P(2)$ (ii) $P(1 \text{ or } 3)$ (iii) $P(\text{not } 3)$ (iv) $P(2 \text{ or } 3)$

19. Reduce the equation of the ellipse
    $$4x^2 + 16y^2 - 24x - 32y - 12 = 0$$
    into standard form. Then find the centre, eccentricity e and coordinates of the foci.

SECTION C

QUESTION NUMBER 20 TO 26 CARRY 6 MARKS EACH.

20. The mean and variance of eight observations are 9 and 9.25, respectively. If six of the observations are 6,7,10,12,12 and 13, find the remaining two observations.

OR

Find the Mean and Standard Deviation for the following distribution :

x	0-30	30-60	60-90	90-120	120-150	150-180	180-210
f	9	17	43	82	81	44	24

21. (a) In a survey it was found that 21 people liked product A, 26 liked product B and 29 liked product C. If 14 people liked products A and B, 12 people liked products C and A, 14 people liked products B and C and 8 liked all the three products. Find how many liked (i) product C only (ii) product A and C but not product B (iii) at least one of three products.

(b) The Cartesian product $A \times A$ has 9 elements among which are found $(-1,0)$ and $(0,1)$. Find the set A and remaining elements of $A \times A$.

22. (i) Solve the system of inequalities graphically : $x - 2y \leq 3, 3x + 4y \geq 12, x \geq 0; y \geq 1$

(ii) Solve the inequalities : $3x - 7 > 2(x - 6), 6 - x > 11 - 2x$

and represent the solution graphically on number line.

23. Find a, b and n in the expansion of $(a + b)^n$ if the first three terms of the expansion are $729, 7290$ and 30375, respectively.

OR

(i) In how many ways can the letters of the word ASSASSINATION be arranged so that all the S's are together?

(ii) The English alphabet has 5 vowels and 21 consonants. How many words with two different vowels and 2 different consonants can be formed from the alphabet?

24. (i) Between 1 and 31, m numbers have been inserted in such a way that the resulting sequence is an A.P. and the ratio of 7th and $(m - 1)$th numbers $5 : 9$. Find the value of m.

(ii) Find the sum of infinite of the series : $\frac{1}{3} + \frac{1}{5^2} + \frac{1}{3^3} + \frac{1}{5^4} + \frac{1}{3^5} + \frac{1}{5^6} + \cdots$

25. (i) Prove that : $cos^2 x + cos^2 \left(x + \frac{\pi}{3}\right) + cos^2 \left(x - \frac{\pi}{3}\right) = \frac{3}{2}$.

(ii) In any ΔABC, prove that $\frac{a-b}{a+b} = \frac{\tan\frac{A-B}{2}}{\tan\frac{(A+B)}{2}}$

26. (i) Find the derivative of $x \sin x$ using first principle

(ii) For the function $(x) = \begin{cases} a + bx & , & x < 1 \\ 4 & , & x = 1 \\ b - ax & , & x > 1 \end{cases} \lim_{x \to 1} f(x) = f(1)$. Find the possible values of a and b.