> Please check that this question paper contains **26** questions and **4** printed pages.

CLASS-XI
MATHEMATICS

Time Allowed : 3 Hrs.   **Maximum Marks : 100**

- *Please check that this question paper contains 4 printed pages.*
- *Please check that this question paper contains 26 questions.*
- *Please write down the serial number of the question before attempting it.*
- *There is reading time for 15 minutes. Students will read the question paper during this time and will not write any answer on the answer script during this period.*

General Instructions :

1. *This question paper consists of 26 questions divided into three sections.*

Section A consists of 6 questions of 1 mark each.

Section B consists of 13 questions of 4 marks each.

Section C consists of 7 questions of 6 marks each.

2. *There is no overall choice. However, internal choice is given in four questions of 4 marks each and two questions of 6 marks each.*

3. *Use of calculator is not permitted.*

Section-A

1. Evaluate : $i^{141} + i^{142} + i^{143} + i^{144}$

2. Solve $-8 \leq 5x - 3 < 7$ where $x \in$ Z.

3. Find the distance between the lines
$4x - 3y + 5 = 0$ and $8x - 6y + 7 = 0$

4. Find the equation of the parabola with focus $(0, -3)$ and directrix $y = 3$.

5. Write the contrapositive of the statement

"If it is hot outside, then you feel thirsty".

6. State whether the 'or' used in the statement is inclusive or exclusive. Give reason for your answer :

"Two lines intersect at a point or are parallel."

Section–B

7. Let A and B be sets. If $A \cap X = B \cap X = \phi$ and $A \cup X = B \cup X$ for some set X, show that $A = B$.

8. From amongst the 100 literate individuals of a city, 50 read newspaper A, 45 read newspaper B and 25 neither A nor B. How many individuals read both the newspapers A and B ?

9. Find the domain and range of the real function $f(x) = \sqrt{25 - x^2}$

10. Find the general solution of $3 \tan x + \cot x = 5\cosec x,\ x \neq n\pi$.

OR

Prove that $\cos 20° \cos 40° \cos 60° \cos 80° = \dfrac{1}{16}$

11. α is divided into two parts such that the ratio of the tangents of parts is k. If x be the difference of two parts, prove that $\sin x = \dfrac{k-1}{k+1} \cdot \sin \alpha$

12. Convert the complex number $2 - 2i$ in the polar form. Also write its argument.

OR

Find the square root of the complex number $4 - 4\sqrt{3}\ i$

13. Solve the following system of inequalities graphically :
$x - 2y \leq 3;\quad 3x + 4y \geq 12;\quad x \geq 0;\quad x - y \geq 1$

14. Find n such that $\dfrac{a^{n+1} + b^{n+1}}{a^n + b^n}$ may be the A.M. between a and b.

OR

The product of the first three terms of a G.P. is 1000. If we add 6 to its second term and 7 to its third term, the resulting three terms form an A.P. Find the terms of the G.P.

15. Find the equation of the circle passing through the point (6, 1) and having its centre on the mid point of the line segment joining the centres of the circles

$(x - 2)^2 + (y - 4)^2 = 65$

and $(x - 4)^2 + (y - 6)^2 = 64$

OR

An equilateral triangle is inscribed in the parabola $y^2 = 4ax$, whose one vertex is at the vertex of the parabola. Find the length of a side of the triangle.

16. Using section formula, prove that the three points

A $(-2, 3, 5)$, B $(1, 2, 3)$ and C $(7, 0, -1)$ are collinear. Also find the ratio in which point C divides the line segment AB.

17. Find the derivative of $\tan(2x + 3)$ by first principle method.

18. Find the non-zero value of k, if

$$\lim_{x \to 1} \frac{x^4 - 1}{x - 1} = \lim_{x \to k} \frac{x^3 - k^3}{x^2 - k^2}$$

19. A box contains 10 bulbs, of which three are defective. If a random sample of 5 bulbs is drawn, find the probabilities that the sample contains

(i)   exactly two defective bulbs

(ii) at the most one defective bulb.

Section–C

20. By the principle of Mathematical Induction, prove that the sum of cubes of three consecutive natural numbers is divisible by 9.

OR

Using principle of Mathematical Induction, prove that

$$\frac{1}{2.5} + \frac{1}{5.8} + \frac{1}{8.11} + \ldots + \frac{1}{(3n - 1)(3n + 2)} = \frac{n}{6n + 4}, n \in \mathbb{N}$$

21. Find the sum of the following series upto n terms :

$$\frac{1^3}{1} + \frac{1^3 + 2^3}{1 + 3} + \frac{1^3 + 2^3 + 3^3}{1 + 3 + 5} + \ldots$$

22. Show that the coefficient of the middle term in the expansion of $(1 + x)^{2n}$ is equal to the sum of the coefficients of two middle terms in the expansion of $(1 + x)^{2n-1}$.

23. The mean and variance of 7 observations are 8 and 16 respectively. If 5 of the observations are 2, 4, 10, 12 and 14, find the remaining two observations.

24. One side of a rectangle lies along the line $4x + 7y + 5 = 0$. Two of its opposite vertices are $(-3, 1)$ and $(1, 1)$. Find the equations of the other three sides.

OR

The line $2x - 3y - 4 = 0$ is the perpendicular bisector of the line AB and co-ordinates of A are $(-3, 1)$. Find the co-ordinates of B.

25. In any Δ ABC, prove that : $\dfrac{\cos A}{a} + \dfrac{\cos B}{b} + \dfrac{\cos C}{c} = \dfrac{a^2 + b^2 + c^2}{2abc}$

26. Find the number of arrangements of the letters of the word 'REPUBLIC'. In how many of these arrangements :

(i) does the word start with a vowel

(ii) all the vowels occur together

(iii) What is the significance of 'Republic Day' in our life ?

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