Roll No. _____

Please check that this question paper contains **29** questions and **7** printed pages.

CLASS–XI
SUBJECT–MATHEMATICS

Time allowed : 3 Hrs.   **M.Marks : 100**

General Instructions :

1. *Question paper consists of 29 questions divided into four sections A, B, C and D.*

    Section A consists of 4 questions of 1 mark each.

    Section B consists of 8 questions of 2 marks each.

    Section C consists of 11 questions of 4 marks each.

    Section D consists of 6 questions of 6 marks each.

2. *There is no overall choice. However, internal choices are provided in three questions of 4 marks each and three questions of 6 marks each. In these questions, you have to attempt one out of the given options.*

3. *Use of calculator is not allowed.*

Section-A

1. Let A = $\{x : x \in N, \ x \leq 11\}$ and R be a relation from A to A defined by

    R = $\{(a, b) : |a - b| $ is a multiple of 4$\}$

    Find the set of all elements related to 2.

M   1

2. Write the number of distinct terms in the expansion of $(1 + 2x + x^2)^{10}$

3. Find the length of perpendicular drawn from the point P (1, 3, 5) on y-axis.

4. Identify and write the necessary condition and sufficient condition in the following statement :

   If you drive over 80 km per hour, then you will get a fine.

Section-B

5. For any three sets A, B and C, show that

   if $A \subset B$ then $C - B \subset C - A$.

6. If $\tan 35° = a$,

   find the value of $\dfrac{\tan 145° - \tan 125°}{1 + \tan 145° \tan 125°}$ in terms of a.

7. Find two real numbers x and y if $(x - iy)(3 + 5i)$ is the conjugate of $-6 - 24i$.

8. If the points P (– 4, 6, 10), Q (2, y, 6) and R (14, 0, – 2) are such that Q trisects the line segment PR and is nearer to P. Find the value of y.

9. Find the derivative of the function $\dfrac{\sqrt{a} + \sqrt{x}}{\sqrt{a} - \sqrt{x}}$ w.r.t. x

10. Three fair coins are tossed once. Write the sample space and find the probability of getting atleast 2 heads.

11. Write the contrapositive and converse of the following statement :

"If x is an even number then x is divisible by 4".

12. Draw the graph of

$f(x) = |x + 3|, \quad -5 \le x \le 0$

Section-C

13. Write the domain and range of the function

$f(x) = 2x^2 - 5$, then

(i)   find $f(-3)$

(ii) find x, if $f(x) = 27$

14. In a group of students, half the number of students know Hindi; $\dfrac{2}{3}$ of them know English; 10 know both the languages and 6 students do not know either Hindi or English.

Find how many students are there in the group.

Write the importance of national language.

15. Prove that

$$\frac{\sin 5x - 2 \sin 3x + \sin x}{\cos 5x - \cos x} = \tan x$$

16. Prove that

$$\sin^2 A + \sin^2 \left(A + \frac{\pi}{3} \right) + \sin \left(A - \frac{\pi}{3} \right) = \frac{3}{2}$$

17. Convert the complex number $3\left(\cos\frac{5\pi}{3} - i\sin\frac{\pi}{6} \right)$ into polar form.

18. How many natural numbers less than 1000 can be formed with digits 1, 2, 3, 4, 5 if

    (i)   no digit is repeated ?

    (ii) repetition of digits is allowed ?

OR

There are 12 points in a plane, no three of which are in the same straight line except 5 which are in the same line. Find–

(i)   number of lines

(ii) number of triangles

which can be formed by joining them.

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

20. If $\dfrac{2}{3} = \left(x - \dfrac{1}{y} \right) + \left(x^2 - \dfrac{1}{y^2} \right) + \left(x^3 - \dfrac{1}{y^3} \right) + \, ... \,$ upto ∞ where $xy = 2$ and $|x| < 1$,

 calculate the value of x and y.

21. Evaluate :

$$\lim_{x \to 0} \dfrac{\cos^2 x - \sin^2 x - 1}{\sqrt{x^2 + 1} - 1}$$

<div align="center">OR</div>

 Find the derivative of $\tan (ax + b)$ from the first principle.

22. Find the equation(s) of the circle(s) passing through the point (7, 3) having radius 3 units and whose centre lies on the line $y = x - 1$.

<div align="center">OR</div>

 Find the equation of the ellipse if its foci are ($\pm$ 2, 0) and the length of latus-rectum is $\dfrac{10}{3}$.

23. A, B, C are three mutually exclusive and exhaustive events associated with a random experiment

 Find P (A) given that $P(B) = \dfrac{3}{2} P(A)$ and $P(C) = \dfrac{1}{2} P(B)$

Section-D

24. If $\tan x = \dfrac{3}{4}$, $\pi < x < \dfrac{3\pi}{2}$, find the value of $\tan 2x$, $\sin\dfrac{x}{2}$ and $\cos\dfrac{x}{2}$.

OR

If $3 \tan x + \cot x = 5 \cosec x$ then find its general solution and hence find the value of x for $0 \le x \le 2\pi$.

25. The coefficients of the $(r - 1)^{\text{th}}$, r^{th} and $(r + 1)^{\text{th}}$ terms in the expansion of $(x + 1)^n$ are in the ratio $1 : 7 : 42$. Find n.

OR

In the expansion of $\left(\sqrt[3]{2} + \dfrac{1}{\sqrt[3]{3}}\right)^n$, the ratio of 7th term from beginning to 7th term from end is $1 : 6$. Find n.

26. Solve graphically the following system of inequalities :

   $x + 2y \le 10$

   $x + 2y \ge 1$

   $x - y \le 0$

   $x \ge 0, y \ge 0$

27. If one diagonal of a square is along the line $8x - 15y = 0$ and one of its vertex is at $(1, 2)$ then find the equations of sides of square passing through this vertex.

28. Using Principle of Mathematical Induction prove that :

   $x^{2n} - y^{2n}$ is divisible by $x + y$, where $n \in$ N.

OR

Using Principle of Mathematical Induction, prove that

$$1.3 + 2.3^2 + 3.3^3 + ... \, n.3^n = \frac{(2n-1)3^{n+1} + 3}{4}, \quad \text{where } n \in \text{N.}$$

29. Calculate the mean deviation about median for the following data :

Class	0–10	10–20	20–30	30–40	40–50	50–60
Frequency	6	7	15	16	4	2

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