	CENTUM ACHIEVERS' ACADEMY	
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XII STANDARD	**THEORY OF EQUATIONS**	**TIME : 2 ½ Hrs**
		MARKS : 100

Choose the correct answer from the given four alternatives :   **(20× 1 = 20)**

1. A zero of $x^3 + 64$ is

   (1) 0   (2) 4   (3) $4i$ (4) -4

2. If f and g are polynomials of degrees m and n respectively, and if $h(x) = (f \circ g)(x)$, then the degree of h is

   (1) mn (2) $m + n$ (3) m^n (4) n^m

3. A polynomial equation in x of degree n always has

   (1) n distinct roots   (2) n real roots   (3) n complex root   (4) at most one root.

4. If α, β, and γ are the zeros of $x^3 + px^2 + qx + r$, then $\sum \frac{1}{\alpha}$ is

   (1) $-\frac{q}{r}$ (2) $-\frac{p}{r}$ (3) $\frac{q}{r}$ (4) $-\frac{q}{p}$

5. According to the rational root theorem, which number is not possible rational zero of $4x^7 + 2x^4 - 10x^3 - 5$?

   (1) -1 (2) $\frac{5}{4}$ (3) $\frac{4}{5}$ (4) 5

6. The polynomial $x^3 - kx^2 + 9x$ has three real zeros if and only if, k satisfies

   (1) $|k| \le 6$ (2) $k = 0$ (3) $|k| > 6$ (4) $|k| \ge 6$

7. The number of real numbers in $[0, 2\pi]$ satisfying $\sin^4 x - 2\sin^2 x + 1$ is

   (1) 2   (2) 4   (3) 1   (4) ∞

8. If $x^3 + 12x^2 + 10ax + 1999$ definitely has a positive zero, if and only if

   (1) $a \ge 0$ (2) $a > 0$ (3) $a < 0$ (4) $a \le 0$

9. The polynomial $x^3 + 2x + 3$ has

   (1) one negative and two imaginary zeros   (2) one positive and two imaginary zeros

   (3) three real zeros   (4) no zeros

10. The number of positive zeros of the polynomial $\sum_{j=0}^{n} {}^nC_r(-1)^r x^r$ is

    (1) 0   (2) n (3) $< n$ (4) r

Answer the following questions :   **(7× 2 = 14)**

11. If p is real, discuss the nature of the roots of the equation $4x^2 + 4px + p + 2 = 0$, in terms of p.

12. If p and q are the roots of the equation $lx^2 + nx + n = 0$, show that $\sqrt{\dfrac{p}{q}} + \sqrt{\dfrac{q}{p}} + \sqrt{\dfrac{n}{l}} = 0$.

13. Examine for the rational roots of $x^8 - 3x + 1 = 0$.

14. Solve the equation $x^4 - 9x^2 + 20 = 0$.

15. Discuss the nature of the roots of $x^{2018} + 1947x^{1950} + 15x^8 + 26x^6 + 2019$

16. Show that $x^9 - 5x^5 + 4x^4 + 2x^2 + 1 = 0$ has atleast 6 imaginary solutions.

17. If α, β, γ, and δ are the roots of the polynomial equation $2x^4 + 5x^3 - 7x^2 + 8 = 0$, find a quadratic equation with integer coefficients whose roots are $\alpha + \beta + \gamma + \delta$ and $\alpha\beta\gamma\delta$.

Answer the following questions :   **(7× 3 = 21)**

18. Solve the equation $3x^3 - 16x^2 + 23x - 6 = 0$ if the product of two roots is 1 .

19. Prove that a line cannot intersect a circle at more than two points.

20. Obtain the condition that the roots of $x^3 + px^2 + qx + r = 0$ are in A.P.

21. Solve the cubic equation : $2x^3 - x^2 - 18x + 9 = 0$. if sum of two of its roots vanishes.

22. Find solution, if any, of the equation $2\cos^2 x - 9\cos x + 4 = 0$.

23. Find all real numbers satisfying $4^x - 3(2^{x+2}) + 2^5 = 0$.

24. Find a polynomial equation of minimum degree with rational coefficients, having $\sqrt{5} - \sqrt{3}$ as a root.

Answer the following questions :   **(11× 5 = 55)**

25. Form the equation whose roots are the squares of the roots of $x^3 + ax^2 + bx + c = 0$.

26. Find the condition that the roots of $x^3 + ax^2 + bx + c = 0$ are in the ratio $p:q:r$.

27. Solve $x^3 - 9x^2 + 14x + 24 = 0$ if it is given that two of its roots are in the ratio $3:2$.

28. Form a polynomial equation with integer coefficients with $\sqrt{\dfrac{\sqrt{2}}{\sqrt{3}}}$ as a root.

29. If $2 + i$ and $3 - \sqrt{2}$ are roots of $x^6 - 13x^5 + 62x^4 - 126x^3 + 65x^2 + 127x - 140 = 0$, find all roots.

30. Find the condition that the roots of $ax^3 + bx^2 + cx + d = 0$ are in geometric progression. Assume $a, b, c, d \neq 0$

31. Determine k and solve the equation $2x^3 - 6x^2 + 3x + k = 0$ if one of its roots is twice the sum of the other two roots.

32. Solve the equation $9x^3 - 36x^2 + 44x - 16 = 0$ if the roots form an A.P.

33. Solve the equation $3x^3 - 26x^2 + 52x - 24 = 0$ if its roots form a G.P.

34. Solve the equation $(2x - 3)(6x - 1)(3x - 2)(x - 2) - 5 = 0$.

35. Solve : $6x^4 - 35x^3 + 62x^2 - 35x + 6 = 0$.

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