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1) If the system of equations $x = cy + bz$, $y = az + cx$ and $z = bx + ay$ has a non-trivial solution then

- (a) $a^2 + b^2 + c^2 = 1$ (b) $abc = 1$ (c) $a + b + c = 0$ (d) $a^2 + b^2 + c^2 + 2abc = 1$

2) If A^T is the transpose of a square matrix A , then

- (a) $|A| = |A^T|$ (b) $|A| = |A^T|$ (c) $|A| + |A^T| = 0$ (d) $|A| = |A^T|$ only

3) If $A = \begin{pmatrix} \cos x & \sin x \\ -\sin x & \cos x \end{pmatrix}$ and $A(\text{adj } A) = \lambda \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ then λ is

- (a) $\sin x \cos x$ (b) 1 (c) 2 (d) none

4) The system of equations $x + 2y + 3z = 1$, $x - y + 4z = 0$, $2x + y + 7z = 1$ has

- (a) One solution (b) Two solution (c) No solution (d) Infinitely many solution

5) If $\sqrt{a + ib} = x + iy$, then possible value of $\sqrt{a - ib}$ is

- (a) $x^2 + y^2$ (b) $\sqrt{x^2 + y^2}$ (c) $x + iy$ (d) $x - iy$

6) If $i^2 = -1$, then $i^1 + i^2 + i^3 + \dots$ up to 1000 terms is equal to

- (a) 1 (b) -1 (c) i (d) 0

7) If $x = \cos \theta + i \sin \theta$, then the value of $x^n + \frac{1}{x^n}$ is

- (a) $2 \cos \theta$ (b) $2i \sin n\theta$ (c) $2i \sin \theta$ (d) $2i \cos n\theta$

8) Let $a > 0$, $b > 0$, $c > 0$. h n both th root of th quatlon $ax^2 + bx + c = 0$ are

- (a) real and negative (b) real and positive (c) rational numb rs (d) none

9) For real x , the equation $\left| \frac{x}{x-1} \right| + |x| = \frac{x^2}{|x-1|}$ has

- (a) one solution (b) two solution (c) at least two solution (d) no solution

10) If $ax^2 + bx + c = 0$, $a, b, c \in \mathbb{R}$ has no real zeros, and if $a + b + c < 0$, then _____

- (a) $c > 0$ (b) $c < 0$ (c) $c = 0$ (d) $c \geq 0$

5 x 3 = 15

11) For what value of t will the system $tx + 3y - z = 1$, $x + 2y + z = 2$, $-tx + y + 2z = -1$ fail to have unique solution?

12) Obtain the Cartesian form of the locus of z in the cases.

$$|2z - 3 - i| = 3$$

13) Find the locus of z if $\text{Re} \left(\frac{z+1}{z-i} \right) = 0$ where $z = x + iy$.

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

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

5 x 5 = 25

16) Using Gaussian Jordan method, find the values of λ and μ so that the system of equations $2x - 3y + 5z = 12$, $3x + y + \lambda z = \mu$, $x - 7y + 8z = 17$ has (i) unique solution (ii) infinite solutions and (iii) no solution.

17) If $z_1 = 3 + 4i$, $z_2 = 5 - 12i$, and $z_3 = 6 + 8i$, find $|z_1|, |z_2|, |z_3|, |z_1 + z_2|, |z_2 - z_3|$, and $|z_1 + z_3|$

- 18) Find the radius and centre of the circle $z\bar{z} - (2+3i)z - (2-3i)\bar{z} + 9 = 0$ where z is a complex number.
- 19) Show that, if p, q, r are rational, the roots of the equation $x^2 - 2px + p^2 - q^2 + 2qr - r^2 = 0$ are rational.
- 20) Show that the polynomial $9x^9 + 2x^5 - x^4 - 7x^2 + 2$ has at least six imaginary roots.
