1. If $z + z^3 = 0$ then which of the following must be true on the complex plane?

(A) $\text{Re}(z) < 0$ (B) $\text{Re}(z) = 0$ (C) $\text{Im}(z) = 0$ (D) $z^4 = 1$

2. Number of integral values of n for which the quantity $(n + i)^4$ where $i^2 = -1$, is an integer is

(A) 1 (B) 2 (C) 3 (D) 4

3. Let $i = \sqrt{-1}$. The product of the real part of the roots of $z^2 - z = 5 - 5i$ is

(A) – 25 (B) – 6 (C) – 5 (D) 25

4. There is only one way to choose real numbers M and N such that when the polynomial $5x^4 + 4x^3 + 3x^2 + Mx + N$ is divided by the polynomial $x^2 + 1$, the remainder is 0. If M and N assume these unique values, then $M - N$ is

(A) – 6 (B) – 2 (C) 6 (D) 2

⑤ $x+iy+\sqrt{x^2+y^2} = 1+7i$

$x+\sqrt{x^2+y^2} = 1$

5. The complex number z satisfying $z + |z| = 1 + 7i$ then the value of $|z|^2$ equals

(A) 625 (B) 169 (C) 49 (D) 25

$y = 7$

6. Number of values of z (real or complex) simultaneously satisfying the system of equations $1 + z + z^2 + z^3 + \dots\dots\dots + z^{17} = 0$ and $1 + z + z^2 + z^3 + \dots\dots\dots + z^{13} = 0$ is

(A) 1 (B) 2 (C) 3 (D) 4

7. If $\dfrac{x-3}{3+i} + \dfrac{y-3}{3-i} = i$ where $x, y \in R$ then

(A) $x = 2$ & $y = -8$ (B) $x = -2$ & $y = 8$ (C) $x = -2$ & $y = -6$ (D) $x = 2$ & $y = 8$

8. Number of complex numbers z satisfying $z^3 = \bar{z}$ is $(x+iy)^3 = (x-iy)$

(A) 1 (B) 2 [redacted] [redacted] (D) 5

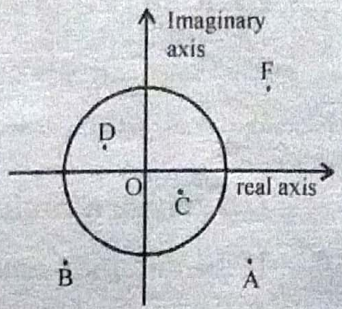
9. Let $z = 9 + bi$ where b is non zero real and $i^2 = -1$. If the imaginary part of z^2 and z^3 are equal, then b^2 equals

(A) 261 (B) 225 (C) 125 (D) 361

10. The value of sum $\sum_{n=1}^{13}(i^n + i^{n+1})$, where $i = \sqrt{-1}$, equals

(A) i (B) $i - 1$ (C) -1 (D) 0

11. The diagram shows several numbers in the complex plane. The circle is the unit circle centered at the origin. One of these numbers is the reciprocal of F, which is



(A) A (B) B

(C) C (D) D

12. If $z = x + iy$ & $\omega = \dfrac{1 - iz}{z - i}$ then $|\omega| = 1$ implies that, in the complex plane

(A) z lies on the imaginary axis (B) z lies on the real axis

(C) z lies on the unit circle (D) none

13. On the complex plane locus of a point z satisfying the inequality

$2 \le |z - 1| < 3$ denotes

(A) region between the concentric circles of radii 3 and 1 centered at (1, 0)

(B) region between the concentric circles of radii 3 and 2 centered at (1, 0) excluding the inner and outer boundaries.

(C) region between the concentric circles of radii 3 and 2 centered at (1, 0) including the inner and outer boundaries.

(D) region between the concentric circles of radii 3 and 2 centered at (1, 0) including the inner boundary and excluding the outer boundary.

14. The complex number z satisfies $z + |z| = 2 + 8i$. The value of $|z|$ is

(A) 10 (B) 13 (C) 17 (D) 23

15. Let $Z_1 = (8 + i)\sin\theta + (7 + 4i)\cos\theta$ and $Z_2 = (1 + 8i)\sin\theta + (4 + 7i)\cos\theta$ are two complex numbers. If $Z_1 \cdot Z_2 = a + ib$ where $a, b \in R$ then the largest value of $(a + b)\ \forall\ \theta \in R$, is

(A) 75 (B) 100 (C) 125 (D) 130

16. The locus of z, for $\arg z = -\pi/3$ is

(A) same as the locus of z for $\arg z = 2\pi/3$

(B) same as the locus of z for $\arg z = \pi/3$

(C) the part of the straight line $\sqrt{3}x + y = 0$ with $(y < 0, x > 0)$

(D) the part of the straight line $\sqrt{3}x + y = 0$ with $(y > 0, x < 0)$

17. If z_1 & $\bar{z}_1$ represent adjacent vertices of a regular polygon of n sides with centre at the origin & if $\dfrac{\text{Im}\, z_1}{\text{Re}\, z_1} = \sqrt{2} - 1$ then the value of n is equal to :

(A) 8 (B) 12 (C) 16 (D) 24

18. All real numbers x which satisfy the inequality $\left|1+4i-2^{-x}\right| \le 5$ where $i=\sqrt{-1}$, $x \in R$ are

(A) $[-2, \infty)$ (B) $(-\infty, 2]$ (C) $[0, \infty)$ (D) $[-2, 0]$

19. For $Z_1 = \sqrt[6]{\dfrac{1-i}{1+i\sqrt{3}}}$; $Z_2 = \sqrt[6]{\dfrac{1-i}{\sqrt{3}+i}}$; $Z_3 = \sqrt[6]{\dfrac{1+i}{\sqrt{3}-i}}$ which of the following holds good?

(A) $\sum |Z_1|^2 = \dfrac{3}{2}$

(B) $|Z_1|^4 + |Z_2|^4 = |Z_3|^{-8}$

(C) $\sum |Z_1|^3 + |Z_2|^3 = |Z_3|^{-6}$

(D) $|Z_1|^4 + |Z_2|^4 = |Z_3|^8$

20. Number of real or purely imaginary solution of the equation, $z^3 + iz - 1 = 0$ is :

(A) zero (B) one (C) two (D) three

21. A point 'z' moves on the curve $|z-4-3i| = 2$ in an argand plane. The maximum and minimum values of $|z|$ are

(A) 2, 1 (B) 6, 5 (C) 4, 3 (D) 7, 3

22. If z is a complex number satisfying the equation $|z+i| + |z-i| = 8$, on the complex plane then maximum value of $|z|$ is

(A) 2 (B) 4 (C) 6 (D) 8

23. Let z_r $(1 \le r \le 4)$ be complex numbers such that $|z_r| = \sqrt{r+1}$

and $|30 z_1 + 20 z_2 + 15 z_3 + 12 z_4| = k\,|z_1 z_2 z_3 + z_2 z_3 z_4 + z_3 z_4 z_1 + z_4 z_1 z_2|$.

Then the value of k equals

(A) $|z_1 z_2 z_3|$ (B) $|z_2 z_3 z_4|$ (C) $|z_3 z_4 z_1|$ (D) $|z_4 z_1 z_2|$

24. Let Z be a complex number satisfying the equation $(Z^3+3)^2 = -16$ then $|Z|$ has the value equal to

(A) $5^{1/2}$ (B) $5^{1/3}$ (C) $5^{2/3}$ (D) 5

25. If z_1, z_2, z_3 are 3 distinct complex numbers such that $\dfrac{3}{|z_2 - z_3|} = \dfrac{4}{|z_3 - z_1|} = \dfrac{5}{|z_1 - z_2|}$, $= k$

then the value of $\dfrac{9}{z_2 - z_3} + \dfrac{16}{z_3 - z_1} + \dfrac{25}{z_1 - z_2}$ equals

(A) 0 (B) 3 (C) 4 (D) 5

26. The area of the triangle whose vertices are the roots $z^3 + iz^2 + 2i = 0$ is

(A) 2 (B) $\dfrac{3}{2}\sqrt{7}$ (C) $\dfrac{3}{4}\sqrt{7}$ (D) $\sqrt{7}$

27. Consider two complex numbers α and β as

$\alpha = \left(\dfrac{a+bi}{a-bi}\right)^2 + \left(\dfrac{a-bi}{a+bi}\right)^2$, where $a, b \in R$ and $\beta = \dfrac{z-1}{z+1}$, where $|z| = 1$, then

(A) Both α and β are purely real (B) Both α and β are purely imaginary

(C) α is purely real and β is purely imaginary (D) β is purely real and α is purely imaginary

28. Let Z is complex satisfying the equation $z^2 - (3+i)z + m + 2i = 0$, where $m \in R$. Suppose the equation has a real root. The additive inverse of non real root, is

(A) $1-i$ (B) $1+i$ (C) $-1-i$ (D) -2

29. The minimum value of $|z-1+2i|+|4i-3-z|$ is

(A) $\sqrt{5}$ (B) 5 (C) $2\sqrt{13}$ (D) $\sqrt{15}$

30. If $i=\sqrt{-1}$, then $4+5\left(-\frac{1}{2}+\frac{i\sqrt{3}}{2}\right)^{334}+3\left(-\frac{1}{2}+\frac{i\sqrt{3}}{2}\right)^{365}$ is equal to

(A) $1-i\sqrt{3}$ (B) $-1+i\sqrt{3}$ (C) $i\sqrt{3}$ (D) $-i\sqrt{3}$

31. Let C_1 and C_2 are concentric circles of radius 1 and 8/3 respectively having centre at $(3, 0)$ on the argand plane. If the complex number z satisfies the inequality, $\log_{1/3}\left(\frac{|z-3|^2+2}{11|z-3|-2}\right)>1$ then :

(A) z lies outside C_1 but inside C_2 (B) z lies inside of both C_1 and C_2

(C) z lies outside both of C_1 and C_2 (D) none of these

32. Identify the incorrect statement.

(A) no non zero complex number z satisfies the equation, $\bar{z}=-4z$

(B) $\bar{z}=z$ implies that z is purely real

(C) $\bar{z}=-z$ implies that z is purely imaginary

(D) if z_1, z_2 are the roots of the quadratic equation $az^2+bz+c=0$ such that $\text{Im}(z_1 z_2)\neq 0$ then a, b, c must be real numbers.

33. The equation of the radical axis of the two circles represented by the equations, $|z-2|=3$ and $|z-2-3i|=4$ on the complex plane is :

(A) $3y+1=0$ (B) $3y-1=0$ (C) $2y-1=0$ (D) none

34. $z_1=\frac{a}{1-i}$; $z_2=\frac{b}{2+i}$; $z_3=a-bi$ for $a, b\in R$

if $z_1-z_2=1$ then the centroid of the triangle formed by the points z_1, z_2, z_3 in the argand's plane is given by

(A) $\frac{1}{9}(1+7i)$ (B) $\frac{1}{3}(1+7i)$ (C) $\frac{1}{3}(1-3i)$ (D) $\frac{1}{9}(1-3i)$

35. Consider the equation $10z^2-3iz-k=0$, where z is a complex variable and $i^2=-1$. Which of the following statements is True?

(A) For all real positive numbers k, both roots are pure imaginary.

(B) For negative real numbers k, both roots are pure imaginary.

(C) For all pure imaginary numbers k, both roots are real and irrational.

(D) For all complex numbers k, neither root is real.

36. Number of complex numbers z such that $|z|=1$ and $\left|\frac{z}{\bar{z}}+\frac{\bar{z}}{z}\right|=1$ is

(A) 4 (B) 6 (C) 8 (D) more than 8

37. If z is a complex number satisfying the equation $|z-(1+i)|^2=2$ and $\omega=\frac{2}{z}$, then the locus traced by 'ω' in the complex plane is

(A) $x-y-1=0$ (B) $x+y-1=0$ (C) $x-y+1=0$ (D) $x+y+1=0$

38. If P and Q are respectively by the complex numbers z_1 and z_2 such that $\left|\frac{1}{z_1}+\frac{1}{z_2}\right|=\left|\frac{1}{z_1}-\frac{1}{z_2}\right|$, then the circumcentre of ΔOPQ (where O is the origin) is

(A) $\frac{z_1-z_2}{2}$ (B) $\frac{z_1+z_2}{2}$ (C) $\frac{z_1+z_2}{3}$ (D) z_1+z_2

39. If z_1 & z_2 are two non-zero complex numbers such that $|z_1+z_2|=|z_1|+|z_2|$, then Arg z_1 − Arg z_2 is equal to

(A) $-\pi$ (B) $-\pi/2$ (C) 0 (D) $\pi/2$

40. A particle starts from a point $z_0=1+i$, where $i=\sqrt{-1}$. It moves horizontally away from origin by 2 units and then vertically away from origin by 3 units to reach a point z_1. From z_1 particle moves $\sqrt{5}$ units in the direction of $2\hat{i}+\hat{j}$ and then it moves through an angle of $\operatorname{cosec}^{-1}\sqrt{2}$ in anticlockwise direction of a circle with centre at origin to reach a point z_2. The arg z_2 is given by

(A) $\sec^{-1}2$ (B) $\cot^{-1}0$ (C) $\sin^{-1}\left(\frac{\sqrt{3}-1}{2\sqrt{2}}\right)$ (D) $\cos^{-1}\left(\frac{-1}{2}\right)$

41. Consider $az^2+bz+c=0$, where a, b, c $\in$ R and $4ac>b^2$.

(i) If z_1 and z_2 are the roots of the equation given above, then which one of the following complex numbers is purely real?

(A) $z_1\bar{z}_2$ (B) $\bar{z}_1z_2$ (C) z_1-z_2 (D) $(z_1-z_2)i$

(ii) In the argand's plane, if A is the point representing z_1, B is the point representing z_2 & $z=\frac{\overrightarrow{OA}}{\overrightarrow{OB}}$ then

(A) z is purely real (B) z is purely imaginary

(C) $|z|=1$ (D) ΔAOB is a scalene triangle.

42. If the complex number z satisfies the condition $|z|\geq 3$, then the least value of $\left|z+\frac{1}{z}\right|$ is equal to :

(A) 5/3 (B) 8/3 (C) 11/3 (D) none of these

43. Given $z_p=\cos\left(\frac{\pi}{2^P}\right)+i\sin\left(\frac{\pi}{2^P}\right)$, then $\lim\limits_{n\to\infty}(z_1z_2z_3\ldots z_n)=$

(A) 1 (B) −1 (C) i (D) −i

44. The maximum & minimum values of $|z+1|$ when $|z+3|\leq 3$ are :

(A) (5, 0) (B) (6, 0) (C) (7, 1) (D) (5, 1)

45. If $|z|=1$ and $|\omega-1|=1$ where $z,\omega\in C$, then the largest set of values of $|2z-1|^2+|2\omega-1|^2$ equals

(A) [1, 9] (B) [2, 6] (C) [2, 12] (D) [2, 18]

46. If Arg $(z+a)=\frac{\pi}{6}$ and Arg $(z-a)=\frac{2\pi}{3}$; $a\in R^+$, then

(A) z is independent of a (B) $|a|=|z+a|$ (C) $z=a\operatorname{Cis}\frac{\pi}{6}$ (D) $z=a\operatorname{Cis}\frac{\pi}{3}$

47. If z_1, z_2, z_3 are the vertices of the ΔABC on the complex plane which are also the roots of the equation, $z^3-3\alpha z^2+3\beta z+x=0$, then the condition for the ΔABC to be equilateral triangle is

(A) $\alpha^2=\beta$ (B) $\alpha=\beta^2$ (C) $\alpha^2=3\beta$ (D) $\alpha=3\beta^2$