doubtnut
India's Number 1 Education App

MATHS

BOOKS - OBJECTIVE RD SHARMA MATHS VOL I (HINGLISH)

COMPLEX NUMBERS

Illustration

1. If $n \in N$, then find the value of $i^n + i^{n+1} + i^{n+2} + i^{n+3}$.

A. 1

B. i

C. i^n

D. 0

Answer: D

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2. If $i = \sqrt{-1}$, then $\left\{i^n + i^{-n}, n \in Z\right\}$ is equal to

A. $\{0, 2\}$

B. $\{0, -2\}$

C. $\{0, -2, 2\}$

D. $\{0, -2i\}$

Answer: C

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

A. i

B. $i - 1$

C. $-i$

D. 0

Answer: B

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4. If n is an odd integer, then $(1 + i)^{6n} + (1 - i)^{6n}$ is equal to

A. 0

B. 2

C. -2

D. none of these

Answer: A

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5. If m, n, p, q are consecutive integers then the value of $i^m + i^n + i^p + i^q$ is

A. 1

B. 4

C. 0

D. none of these

Answer: C

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6. The value of $i^2 + i^4 + i^6 + i^8$.... upto (2n+1) terms , where i^2 = -1, is equal to:

A. -1

B. 1

C. $-i$

D. i

Answer: A

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7. If $a, b \in R$ such that $ab > 0$, then $\sqrt{a}\sqrt{b}$ is equal to

A. $\sqrt{|a||b|}$

B. $-\sqrt{|a||b|}$

C. $\sqrt{ab}$

D. none of these

Answer: D

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8. If $ab < 0$, then $\sqrt{a}.\sqrt{b}$ is equal to :

A. $i\sqrt{|a|b}$

B. $i\sqrt{|a||b|}$

C. $i\sqrt{|a||b|}$

D. $-\sqrt{|a||b|}$

Answer: C

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9. $\sin^{-1}\left\{\frac{1}{i}(z-1)\right\}$, where z is non real and $i=\sqrt{-1}$, can be the angle of a triangle If:

A. Re(z)=1, Im(z)=2

B. Re(z)=1,$-1 \leq \text{Im}(z) \leq 1$

C. Re(z)+Im(z)=0

D. None of these

Answer: B

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10. If $\sqrt{3} + i = (a + ib)/(c + id)$, then find the value of $\tan^{-1}(b/a)\tan^{-1}(d/c)$

A. $\frac{\pi}{3}$

B. $\frac{\pi}{6}$

C. $-\frac{\pi}{6}$

D. $\frac{5\pi}{6}$

Answer: B

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11. The conjugate of a complex number is $\frac{1}{i-1}$. Then the complex number is

A. $-\frac{1}{i+1}$

B. $\frac{1}{i-1}$

C. $-\frac{1}{i-1}$

D. $\frac{1}{i+1}$

Answer: A

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12. If $Im\left(\frac{z-1}{2z+1}\right) = -4$, then locus of z is

A. an ellipse

B. a parabola

C. a straight line

D. a circle

Answer: D

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13. Let z be a complex number such that the imaginary part of z is nonzero and a = z2 + z + 1 is real. Then a cannot take the value (A) –1 (B) 1 3 (C) 1 2 (D) 3 4

A. -1

B. $\frac{1}{3}$

C. $\frac{1}{2}$

D. $\frac{3}{4}$

Answer: D

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14. The number of solutions of $z^2 + \bar{z} = 0$ is

A. 1

B. 2

C. 3

D. 4

Answer: D

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15. If z_1, z_2 and z_3 be unimodular complex numbers, then the maximum value of $|z_1 - z_2|^2 + |z_2 - z_3|^2 + |z_3 - z_1|^2$, is

A. 6

B. 9

C. 12

D. 3

Answer: B

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16. If $|z_1| = 2, |z_2| = 3, |z_3| = 4$ and $|2z_1 + 3z_2 + 4z_3| = 4$ then the expression $|8z_2z_3 + 27z_3z_1 + 64z_1z_2|$ equals

A. 24

B. 48

C. 72

D. 96

Answer: D

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17. Let $|z_i| = i, i = 1, 2, 3, 4$ and $|16z_1z_2z_3 + 9z_1z_2z_4 + 4z_1z_3z_4 + z_2z_3z_4| = 48$, then the value of $\left|\frac{1}{\bar{z}_1} + \frac{4}{\bar{z}_2} + \frac{9}{\bar{z}_3} + \frac{16}{\bar{z}_4}\right|$

A. 1

B. 2

C. 4

D. 8

Answer: B

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18. If z_1, z_2, z_3 are complex numbers such that $|z_1| = |z_2| = |z_3| = \left|\frac{1}{z_1} + \frac{1}{z_2} + \frac{1}{z_3}\right| = 1$ then $|z_1 + z_2 + z_3|$ is equal to

A. equal to 1

B. less than 1

C. greater than 1

D. equal to 3

Answer: A

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19. The number of solutions of the equation $z^3 + \bar{z} = 0$, is

A. 2

B. 3

C. 4

D. 5

Answer: D

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20. If $|z_1| = |z_2| = |z_3| = 1$ and $z_1 + z_2 + z_3 = \sqrt{2} + i$, then the complex number $z_2\bar{z}_3 + z_3\bar{z}_1 + z_1\bar{z}_2$, is

A. purely real

B. purely imaginary

C. a positive real number

D. none of these

Answer: B

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

A. $(x - y + 1) = 0$

B. $x - y - 1 = 0$

C. $x + y - 1 = 0$

D. $x + y + 1 = 0$

Answer: B

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22. If $\left|\frac{z+i}{z-i}\right| = \sqrt{3}$, then z lies on a circle whose radius, is

A. $\frac{2}{\sqrt{21}}$

B. $\frac{1}{\sqrt{21}}$

C. $\sqrt{3}$

D. $\sqrt{21}$

Answer: C

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23. The smallest positive integral value of n for which $\left(\frac{1-i}{1+i}\right)^n$ is purely imaginary with positive imaginary part is

A. 1

B. 3

C. 5

D. none of these

Answer: B

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24. The least positive integer n for which $\left(\frac{1+i}{1-i}\right)^n$ is real, is

A. 2

B. 4

C. 8

D. none of these

Answer: A

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25. Find the smallest positive integer value of n for which $\frac{(1+i)^n}{(1-i)^{n-2}}$ is a real number.

A. 2

B. 1

C. 3

D. 4

Answer: B

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26. If $\left(\frac{1+i}{1-i}\right)^x = 1,$ then

A. $x = 2n + 1$, where n is any positive integer.

B. x=4n, where n is any positive integer

C. x=2n, where n is any positive integer

D. x=4n+1, where n is any positive integer.

Answer: B

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27. If $z = x - iy$ and $z'^{\frac{1}{3}} = p + iq$, then $\frac{1}{p^2 + q^2}\left(\frac{x}{p} + \frac{y}{q}\right)$ is equal to

A. -2

B. -1

C. 2

D. 1

Answer: A

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28. If $z = x + iy$, $z^{\frac{1}{3}} = a - ib$ and $\frac{x}{a} - \frac{y}{b} = \lambda\left(a^2 - b^2\right)$, then λ is equal to

A. 2

B. 4

C. 6

D. 1

Answer: B

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29. Let $z = x + iy$ be a complex number where $xandy$ are integers. Then, the area of the rectangle whose vertices are the roots of the equation $zz^3 + zz^3 = 350$ is 48 (b) 32 (c) 40 (d) 80

A. 48

B.

C. 32

D. 40

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30. Taking the value of the square root with positive real part only, the value of $\sqrt{7 + 24i} + \sqrt{-7 - 24i}$, is

A. $1 + 7i$

B. $-1 - 7i$

C. $7 - i$

D. $-7 + i$

Answer: C

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31. If $(x + iy)^2 - 7 + 24i$, then the value of $\left(7 + \sqrt{-576}\right)^{1/2} - \left(7 - \sqrt{-576}\right)^{1/2}$, is

A. $-6i$

B. $-3i$

C. $2i$

D. 6

Answer: A

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32. $\dfrac{\sqrt{5+12i}+\sqrt{5-12i}}{\sqrt{5+12i}-\sqrt{5-12i}}$

A. $\frac{3}{2}i$

B. $-\frac{3}{2}i$

C. $-3+\frac{2}{5}i$

D. None of these

Answer: B

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33. Principal argument of complex number $z = \frac{\sqrt{3} + i}{\sqrt{3} - i}$ equal

A. $-\frac{\pi}{3}$

B. $\frac{\pi}{3}$

C. $\frac{\pi}{6}$

D. None of these

Answer: B

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34. Let z be a purely imaginary number such that $\mathrm{Im}(z) > 0$. Then, arg (z) is equal to

A. π

B. $\pi/2$

C. 0

D. $-\pi/2$

Answer: B

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35. Let z be a purely imaginary number such that $\text{lm}(z) > 0$. Then, arg (z) is equal to

A. π

B. $\pi/2$

C. 0

D. $-\pi/2$

Answer: D

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36. If z is a purely real complex number such that $\text{Re}(z) < 0$, then, arg(z) is equal to

A. π

B. $\pi/2$

C. 0

D. -$\pi/2$

Answer: A

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37. Let z be any non-zero complex number. Then pr. arg(z) + pr.arg$\left(\bar{z}\right)$ is equal to

A. π

B. -π

C. 0

D. $\pi/2$

Answer: C

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38. If $z = x + iy$ such that $|z + 1| = |z - 1|$ and $arg\left(\frac{z - 1}{z + 1}\right) = \frac{\pi}{4}$ then

A. $x^2 - y^2 - 2x - 1 = 0$

B. $x^2 + y^2 - 2x - 1 = 0$

C. $x^2 + y^2 - 2y - 1 = 0$

D. $x^2 + y^2 + 2x - 1 = 0$

Answer: C

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39. If z is a complex number of unit modulus and argument q, then $arg\left(\frac{1+z}{1+\bar{z}}\right)$ equal

A. $-\theta$

B. $\frac{\pi}{2} - \theta$

C. θ

D. $\pi - \theta$

Answer: C

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40. Find the amplitude of $\sin\left(\frac{\pi}{5}\right) + i\left(1 - \cos\left(\frac{\pi}{5}\right)\right)$

A. $\frac{2\pi}{5}$

B. $\frac{\pi}{15}$

C. $\frac{\pi}{10}$

D. $\frac{\pi}{5}$

Answer: C

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41. The value of $\sum_{n=1}^{10}\left\{\frac{\sin(2n\pi)}{11} - i\frac{\cos(2n\pi)}{11}\right\}$, is

A. -1

B. 0

C. $-i$

D. i

Answer: D

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42. The value of

$$1+\sum_{k=0}^{14}\left\{\frac{\cos((2k+1)\pi)}{15}+i\frac{\sin((2k+1)\pi)}{15}\right\}, \text{ is}$$

A. 0

B. -1

C. 1

D. i

Answer: C

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43. For any integer k, let $\alpha_k = \frac{\cos(k\pi)}{7} + i\frac{\sin(k\pi)}{7}$, where $i = \sqrt{-1}$. Value of the expression $\frac{\sum_{k=1}^{12}\left|\alpha_{k+1}-\alpha_k\right|}{\sum_{k=1}^{13}\left|\alpha_{4k-1}-\alpha_{4k-2}\right|}$ is

A. 8

B. 6

C. 4

D. 2

Answer: C

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44. If z is a complex number of unit modulus and argument θ, then the real part of $\frac{z(1-\bar{z})}{\bar{z}(1+z)}$, is

A. $2\cos^2\left(\frac{\theta}{2}\right)$

B. $1-\cos\left(\frac{\theta}{2}\right)$

C. $1+\sin\left(\frac{\pi}{2}\right)$

D. $-2\sin^2\left(\frac{\theta}{2}\right)$

Answer: D

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45. For any two complex numbers z_1, z_2 the values of $\left|z_1 + z_2\right|^2 + \left|z_1 - z_2\right|^2$, is

A. $\left|z_1\right|^2 + \left|z_2\right|^2$

B. $2\left(\left|z_1\right|^2 + \left|z_2\right|^2\right)$

C. $\left(\left|z_1\right| + \left|z_2\right|\right)^2$

D. none of these

Answer: B

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46. For any two complex numbers, z_1, z_2

$\left|\frac{1}{2}\left(z_1 + z_2\right) + \sqrt{z_1 z_2}\right| + \left|\frac{1}{2}\left(z_1 + z_2\right) - \sqrt{z_1 z_2}\right|$ is equal to

A. $\left|z_1 + z_2\right|$

B. $\left|z_1 - z_2\right|$

C. $\left|z_1\right| + \left|z_2\right|$

D. $\left|z_1\right| - \left|z_2\right|$

Answer: C

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47. Let z_1, z_2 be two complex numbers such that $\left|z_1 + z_2\right| = \left|z_1\right| + \left|z_2\right|$.

Then,

A. $\arg\left(z_1\right) = \arg\left(z_2\right)$

B. $\arg\left(z_1\right) + \arg\left(z_2\right) = \frac{\pi}{2}$

C. $\left|z_1\right| = \left|z_2\right|$

D. $z_1 z_2 = 1$

Answer: A

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48. For any two complex numbers z_1 and z_2, we have $\left|z_1+z_2\right|^2=\left|z_1\right|^2+\left|z_2\right|^2$, then

A. $\operatorname{Re}\left(\frac{z_1}{z_2}\right)=0$

B. $\operatorname{Im}\left(\frac{z_1}{z_2}\right)=0$

C. $\operatorname{Re}\left(z_1 z_2\right)=0$

D. $\operatorname{Im}\left(z_1 z_2\right)=0$

Answer: A

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49. If z_1 and z_2, are two non-zero complex numbers such tha $\left|z_1+z_2\right|=\left|z_1\right|+\left|z_2\right|$ then $arg\left(z_1\right)-arg\left(z_2\right)$ is equal to

A. $-\pi$

B. $\pi/2$

C. 0

D. $\pi/2$

Answer: C

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50. If z_1 and z_2 are to complex numbers such that two $|z_1| = |z_2| + |z_1 - z_2|$, then arg $(z_1) - \arg(z_2)$

A. 0

B. $\pi/2$

C. $-\pi/2$

D. none of these

Answer: A

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51. If $|z + 4| \leq 3$ then the maximum value of $|z + 1|$ is

A. 6

B. 0

C. 4

D. 10

Answer: A

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52. If $|z| < \sqrt{2} - 1$, then $\left|z^2 + 2z\cos\alpha\right|$ is less than

A. 1

B. $\sqrt{2} + 1$

C. $\sqrt{2} - 1$

D. $\sqrt{2}$

Answer: A

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53. Let z_1, z_2 and z_3 be three points on $|z| = 1$. If θ_1, θ_2 and θ_3 be the arguments of z_1, z_2, z_3 respectively, then $\cos(\theta_1 - \theta_2) + \cos(\theta_2 - \theta_3) + \cos(\theta_3 - \theta_1)$

A. $\geq -\frac{3}{2}$

B. $\leq -\frac{3}{2}$

C. $\geq \frac{3}{2}$

D. none of these

Answer: A

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54. If z and ω are two non-zero complex numbers such that $|z\omega| = 1$ and $arg(z) - arg(\omega) = \frac{\pi}{2}$, then $\bar{z}\omega$ is equal to

A. $-i$

B. 1

C. -1

D. i

Answer: A

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55. If $A(z_1)$ and $B(z_2)$ are two fixed points in the Argand plane the locus of point P(z) satisfying $|z - z_1| + |z - z_2| = |z_1 - z_2|$, is

A. line passing through A and B

B. line segment joining A and B

C. an ellipse

D. a circle

Answer: B

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56. If $A(z_1)$ and $A(z_2)$ are two fixed points in the Argand plane and a point P(z) moves in the Argand plane in such a way that $|z - z_1| = |z - z_2|$, then the locus of P, is

A. the line passing through A and B

B. the perpendicular bisector of the line segment joining A and B

C. a line passing through the mid-point of AB

D. a circle

Answer: B

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57. The inequality $|z - 2| < |z - 4|$ represent the half plane

A. $\text{Re}(z) \geq 3$

B. $\text{Re}(z) = 3$

C. $\text{Re}(z) \leq 3$

D. None of these

Answer: D

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58. If $\log_{\frac{1}{3}}|z + 1| > \log_{\frac{1}{3}}|z - 1|$ then prove that Re(z) < 0.

A. $\text{Re}(z) \geq 0$

B. $\text{Re}(z) < 0$

C. $\text{Im}(z) > 0$

D. None of these

Answer: B

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59. The complex numbers $z = x + iy$ which satisfy the equation $\left|\frac{z - 5i}{z + 5i}\right| = 1$ lie on

A. the axis of x

B. the straight line x=5

C. the circle passing through the origin.

D. none of these

Answer: A

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60. If $\omega = \frac{z}{z - \left(\frac{1}{3}\right)i}$ and $|\omega| = 1$, then find the locus of z.

A. a parabola

B. a straight line

C. a circle

D. an ellipse

Answer: B

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61. The region of the complex plane for which $\left|\frac{z - a}{z + \vec{a}}\right| = 1, (Re(a) \neq 0)$ is

A. x-axis

B. y-axis

C. the straight line $x = a$

D. none of these

Answer: B

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62. $A(z_1)$ and $B(z_2)$ are two fixed points in the Argand plane and a point $P(z)$ moves in the plane such that $|z - z_1| + |z - z_2| =$ Constant $(\neq |z_1 - z_2|)$, then the locus of P, is

A. a circle

B. a parabola

C. an ellipse

D. a hyperbola

Answer: C

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63. The region of argand diagram defined by $|z - 1| + |z + 1| \leq 4$ is

A. interior of an ellipse

B. exterior of a circle

C. interior and boundary of an ellipse

D. none of these

Answer: C

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64. $A(z_1)$ and $B(z_2)$ are two fixed points in the Argand plane and a point $P(z)$ moves in the plane such that $|z - z_1| + |z - z_2| =$ Constant $(\neq |z_1 - z_2|)$, then the locus of P, is

A. a circle

B. a parabola

C. an ellipse

D. a hyperbola

Answer: D

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65. The point z in the complex plane satisfying $|z + 2| - |z - 2| = +3$ lies on

A. a circle

B. a parabola

C. an ellipse

D. a hyperbola

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66. $A(z_1)$ and $B(z_2)$ are two given points in the complex plane. The locus of a point P(z) in the complex plane satisfying $\left|z - z_1\right| - \left|z - z_2\right|$='|z1-z2 |, is

A. a circle

B. an ellipse

C. a hyperbola

D. none of these

Answer: D

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67. $A(z_1)$ and $B(z_2)$ are two fixed points in the Argand plane and P(z) is variable point satisfying $|z - z_1| = k|z - z_2|$, where $k > 0$ and $k \neq 1$. The locus of is

A. a circle

B. a parabola

C. an ellipse

D. a hyperbola

Answer: D

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68. If $z = x + iy$, then he equation $|(2z - i)/(z + 1)| = m$ represents a circle, then m can be $1/2$ b. 1 c. 2 d. `3

A. $1/2$

B. 1

C. 3

D. 2

Answer: C

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69. Points z in the complex plane satisfying $\text{Re}(z + 1)^2 = |z|^2 + 1$ lie on

A. a circle

B. a parabola

C. an ellipse

D. a hyperbola

Answer: B

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70. If z_1, z_2, z_3 be the affixes of the vertices A, BM and C of a triangle having centroid at G such ;that $z = 0$ is the mid point of AG then $4z_1 + Z_2 + Z_3 =$

A. $4z_1 + z_2 + z_3 = 0$

B. $z_1 + 4z_1 + z_3 = 0$

C. $z_1 + z_2 + 4z_3 = 0$

D. $z_1 + z_2 + z_3 = 0$

Answer: A

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71. Find the relation if z_1, z_2, z_3, z_4 are the affixes of the vertices of a parallelogram taken in order.

A. $z_1 + z_3 = z_2 + z_4$

B. $z_1 + z_2 = z_3 + z_4$

C. $z_1 - z_3 = z_2 - z_4$

D. none of these

Answer: A

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72. If z_1, z_2, z_3 are the affixes of the vertices of a triangle having its circumcenter at the origin. If z is the affix of its orthocenter, then

A. $z_1 + z_2 + z_3 + z = 0$

B. $z_1 + z_2 + z_3 - z = 0$

C. $z_1 - z_2 + z_3 + z = 0$

D. $z_1 + z_2 - z_3 + z = 0$

Answer: B

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73. The equation $z\bar{z} + a\bar{z} + \bar{a}z + b = 0, b \in R$ represents circle, if

A. $|a|^2 = b$

B. $|a|^2 > b$

C. $|a|^2 < b$

D. none of these

Answer: B

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74. The center of the circle .

$z\bar{z} + (1 + i)z + (1 + i)\bar{z} - 7 = 0$ are respectively.

A. $1 + i$

B. $-1 + i$

C. $-1 - i$

D. 1

Answer: C

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75. The radius of the circle $\left|\frac{z - i}{z + i}\right| = 3$, is

A. $\frac{5}{4}$

B. $\frac{3}{4}$

C. $\frac{1}{4}$

D. none of these

Answer: B

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76. The set of values of k for which the equation

$z\bar{z} + (-3 + 4i)\bar{z} - (3 + 4i)z + k = 0$

represents a circle, is

A. $(-\infty, 25]$

B. $[25, \infty)$

C. $[5, \infty)$

D. $(-\infty, 5)$

Answer: A

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77. if the complex no z_1, z_2 and z_3 represents the vertices of an equilateral triangle such that $|z_1| = |z_2| = |z_3|$ then relation among z_1, z_2 and z_3

A. $z_1 + z_2 = z_3$

B. $z_2 + z_3 = z_1$

C. $z_1 + z_3 = z_2$

D. $z_1 + z_2 + z_3 = 0$

Answer: D

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78. if $|z| = 3$ then the points representing the complex numbers $-1 + 4z$ lie on a

A. line

B. circle

C. parabola

D. none of these

Answer: B

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79. If z is a complex number having least absolute value and $|z - 2 + 2i| =$ | , then $z =$

A. $\left(2 - \frac{1}{\sqrt{2}}\right)(1 - i)$

B. $\left(2 - \frac{1}{\sqrt{2}}\right)(1 + i)$

C. $\left(2 + \frac{1}{\sqrt{2}}\right)(1 - i)$

D. $\left(2 + \frac{1}{\sqrt{2}}\right)(1 + i)$

Answer: A

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80. The least value of p for which the two curves $argz = \frac{\pi}{6}$ and $\left|z - 2\sqrt{3}i\right| = p$ intersect is

A. $\sqrt{3}$

B. 3

C. $1/\sqrt{3}$

D. $1/3$

Answer: B

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81. Let a be a complex number such that $|a| < 1$ and $z_1, z_2....$ be vertices of a polygon such that $z_k = 1 + a + a^3 + a^{k-1}$.

Then, the vertices of the polygon lie within a circle.

A. $|z - a| = a$

B. $\left|z - \frac{1}{1 - a}\right| = |1 - a|$

C. $\left|z - \frac{1}{1 - a}\right| = \frac{1}{|1 - a|}$

D. $|z - (1 - a)| = |1 - a|$

Answer: C

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82. The complex number having least positive argument and satisying $|z - 5i| \le 3$, is

A. $12 + 16i$

B. $\frac{12}{5} + \frac{16i}{5}$

C. $\frac{16}{5} + \frac{12i}{5}$

D. $-\frac{12}{5} + \frac{16i}{5}$

Answer: B

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83. If $|z - 3 + 2i| \leq 4$, (where $i = \sqrt{-1}$) then the difference of greatest and least values of $|z|$ is

A. $2\sqrt{11}$

B. $3\sqrt{11}$

C. $2\sqrt{13}$

D. $3\sqrt{13}$

Answer: C

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84. The least distance between the circles $|z| = 12$ and $|z - 3 - 4i| = 5$, is

A. 0

B. 2

C. 7

D. 17

Answer: B

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85. z_1, z_2, z_3 are the vertices of an equilateral triangle taken in counter clockwise direction. If its circumference is at the origin and $z_1 = 1 + i$, then

A. $z_2 = z_1 e^{i2\pi/3}, z_3 = e^{\pi/3}$

B. $z_2 = z_1 e^{i2\pi/3}, z_3 = z_1 e^{i4\pi/3}$

C. $z_2 = z_1 e^{i4\pi/3}, z_3 = z_1 e^{i2\pi/3}$

D. $z_2 = z_1 e^{i\pi/3}, z_3 = z_1 e^{i2\pi/3}$

Answer: B

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86. z_1, z_2, z_3 are the vertices of an equilateral triangle taken in counter clockwise direction. If its circumcenter is at $(1 - 2i)$ and $\left(z_1 = 2 + i\right)$, then

$z_2 =$

A. $\dfrac{1 - 3\sqrt{3}}{2} + \dfrac{\sqrt{3} - 7}{2}i$

B. $\dfrac{1 + 3\sqrt{3}}{2} - \dfrac{7 + \sqrt{3}}{2}j$

C. $\dfrac{1 + 3\sqrt{3}}{2}, \dfrac{\sqrt{3} - 7}{2}i$

D. $\dfrac{1 + 3\sqrt{3}}{2} + \dfrac{7 + \sqrt{3}}{2}$i

Answer: A

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87. The complex number z_1, z_2 and z_3 satisfying $\dfrac{z_1 - z_3}{z_2 - z_3} = \dfrac{1 - i\sqrt{3}}{2}$ are the vertices of a triangle which is :

A. of area zero

B. right angled isosceles

C. equilateral

D. obtuse-angled isosceles

Answer: C

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88. The area of the triangle on the Arand plane formed by the complex numbers z, iz and z+iz is?

A. $|z|^2$

B. $\frac{1}{2}|z|^2$

C. $\frac{1}{4}|z|^2$

D. $\frac{\sqrt{3}}{4}|z|^2$

Answer: B

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89. If z is any complex number, then the area of the triangle formed by the complex number z, wz and z+wz as its sides, is

A. $\frac{1}{2}|z|^2$

B. $\frac{3}{2}|z|^2$

C. $\frac{\sqrt{3}}{4}|z|^2$

D. $\frac{1}{2}|z|^2$

Answer: C

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90. The area of the triangle whose vertices are represented by $0, z, ze^{i\alpha}$

A. $\frac{1}{2}|z|^2\cos\alpha$

B. $\frac{1}{|z|^2}\sin\alpha$

C. $\frac{1}{2}|z|^2\sin\alpha\cos\alpha$

D. $\frac{1}{2}|z|^2$

Answer: B

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91. If z_1, z_2 are vertices of an equilateral triangle with z_0 its centroid, then $z_1^2 + z_2^2 + z_3^2 =$

A. $z_1^2 + z_2^2 + z_3^2 = z_1z_2 + z_2z_3 + z_3z_1$

B. $z_1^2 + z_2^2 + z_3^2 = 2\left(z_1z_2 + z_2z_3 + z_3z_1\right)$

C. $z_1^2 + z_2^2 + z_3^2 + z_1z_2 + z_2z_3 + z_3z_1 = 0$

D. None of these

Answer: A

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92. The vertices of a square are z_1, z_2, z_3 and z_4 taken in the anticlockwise order, then $z_3 =$

A. $-iz_1 + (1 + i)z_2$

B. $iz_1 + (1 - i)z_2$

C. $z_1 + (1 + i)z_2$

D. $(1 + i)z_1 + z_2$

Answer: A

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93. ABCD is a rhombus in the Argand plane. If the affixes of the vertices are z_1, z_2, z_3 and z_4 respectively, and $\angle CBA = \pi/3$, then

A. $z_1 + \omega z_2 + \omega^2 z_3 = 0$

B. $z_1 - \omega z_2 - \omega^2 z_3 = 0$

C. $\omega z_1 + z_2 + \omega^2 z_3 = 0$

D. $\omega^2 z_1 + \omega z_2 + z_3 = 0$

Answer: A

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94. If two triangles whose vertices are respectively the complex numbers z_1, z_2, z_3 and a_1, a_2, a_3 are similar, then the determinant.

$$\begin{vmatrix} z_1 & a_1 & 1 \\ z_2 & a_2 & 1 \\ z_3 & a_3 & 1 \end{vmatrix}$$ is equal to

A. $z_1 z_2 z_3$

B. $a_1 a_2 a_3$

C. 1

D. 0

Answer: D

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95. The point representing the complex number z for which arg $(z - 2)(z + 2) = \frac{\pi}{3}$ lies on

A. a circle

B. a straight line

C. a paralbola

D. an ellipse

Answer: A

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96. If z be any complex number $(z \neq 0)$ then $arg\left(\frac{z - i}{z + i}\right) = \frac{\pi}{2}$represents the curve

A. $|z| = 1$

B. $|z| = 1, \text{Re}(z) > 0$

C. $|z| = 1, \text{Re}(z) < 0$

D. none of these

Answer: C

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97. If $\arg\frac{z - a}{z + a} = \pm\frac{\pi}{2}$, where a is a fixed real number, then the locus of z is

A. a staight line

B. a circle with center at the origin and radius a

C. a circle with center on y-axis

D. none of these

Answer: B

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98. The length of perpendicular from $P(2 - 3i)$ on the line $(3 + 4i)Z + (3 - 4i)\bar{Z} + 9 = 0$ is equal to

A. 9

B. $9/4$

C. $9/2$

D. none of these

Answer: C

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99. Find $\left\{\frac{1 + \cos\pi/8 + i\sin\pi/8}{1 + \cos\pi/8 - i\sin\pi/8}\right\}^8 =$

A. $1 + i$

B. $1 - i$

C. 1

D. -1

Answer: D

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100. $\dfrac{(\sin\pi/8 + i\cos\pi/8)^8}{(\sin\pi/8 - i\cos\pi/8)^8} =$

A. -1

B. 0

C. 1

D. 2i

Answer: C

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101. The principal amplitude of

$\left(\sin 40^\circ + i\cos 40^\circ\right)^5$, is

A. 70°

B. -110°

C. 110°

D. -70°

Answer: B

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102. If $\cos\alpha + \cos\beta + \cos\gamma = \sin\alpha + \sin\beta + \sin\gamma = 0$, then the value of $\cos 3\alpha + \cos 3\beta + \cos 3\gamma$ is

A. 0

B. $\cos(\alpha + \beta + \gamma)$

C. $3\cos(\alpha + \beta + \gamma)$

D. $3\sin(\alpha + \beta + \gamma)$

Answer: C

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103. If $x_n = \cos\left(\frac{\pi}{2^n}\right) + i\sin\left(\frac{\pi}{2^n}\right), n \in N$ then $x_1, x_2, x_3 \dots\dots\dots\dots\dots\dots\dots x_\infty$.

Is equal to

A. 1

B. -1

C. 0

D. none of these

Answer: B

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104. If $(\cos\theta + i\sin\theta)(\cos 2\theta + i\sin 2\theta)\ldots.(\cos n\theta + i\sin n\theta) = 1$, then the value of θ, is

A. $4m\pi$

B. $\dfrac{2m\pi}{n(n+1)}$

C. $\dfrac{4m\pi}{n(n+1)}$

D. $\dfrac{m\pi}{n(n+1)}$

Answer: C

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105. If $x + \dfrac{1}{x} = 2\cos\theta$, then $x^n + \dfrac{1}{x^n}$ is equal to

A. $2\cos n\theta$

B. $2\sin n\theta$

C. $\cos n\theta$

D. $\sin n\theta$

Answer: A

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106. Let $z = \cos\theta + i\sin\theta$. Then the value of $\sum m \rightarrow 1\text{-}15 Img\left(z^{2m-1}\right)$ at $\theta = 2^\circ$ is:

A. $\dfrac{1}{\sin 2^\circ}$

B. $\dfrac{1}{3\sin 2^\circ}$

C. $\dfrac{1}{2\sin 2^\circ}$

D. $\dfrac{1}{4\sin 2^\circ}$

Answer: D

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107. The number of roots of the equation $z^6 = -64$ whose real parts are non-negative,

A. 2

B. 3

C. 4

D. 5

Answer: C

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108. If z_1 and z_2 are two n^{th} roots of unity, then arg $\left(\frac{z_1}{z_2}\right)$ is a multiple of

A. $n\pi$

B. $\frac{3\pi}{n}$

C. $\frac{2\pi}{n}$

D. none of these

Answer: C

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109. If $1, \alpha_1, \alpha_2, \ldots\ldots\ldots\ldots, \alpha_{n-1}$ are nk^{th} roots of unity, then the value of $(1-\alpha_1)(1-\alpha_2)(1-\alpha_3)\ldots\ldots(1-\alpha_{n-1})$ is equal to

A. $\sqrt{3}$

B. $1/2$

C. n

D. 0

Answer: C

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110. If $1, \alpha_1, \alpha_2, \ldots\ldots\ldots\ldots\ldots, \alpha_{n-1}$ are n^{th} roots of unity and n is an even natural number, then

$\left(1+\alpha_1\right)\left(1+\alpha_2\right)\left(1+\alpha_3\right)\ldots\ldots\left(1+\alpha_{n-1}\right)$ equals

A. 1

B. 0

C. -1

D. none of these

Answer: B

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111. If α is an n^{th} roots of unity, then $1 + 2\alpha + 3\alpha^2 + \ldots\ldots. + n\alpha^{n-1}$ equals

A. $\dfrac{n}{1-\alpha}$

B. $-\dfrac{n}{1-\alpha}$

C. $-\dfrac{n}{(1-\alpha)^2}$

D. none of these

Answer: B

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112. if $1, \omega, \omega^2$ root of the unity then The roots of the equation $(x - 1)^3 + 8 = 0$ are

A. $-1, 1 + 2\omega, 1 + 2\omega^2$

B. $-1, 1 - 2\omega, 1 - 2\omega^2$

C. $2, 2\omega, 2\omega^2$

D. $2, 1 + 2\omega, 1 + 2\omega^2$

Answer: B

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113. The argument of $\frac{1 - i\sqrt{3}}{1 + i\sqrt{3}}$, is

A. $\frac{\pi}{3}$

B. $\frac{2\pi}{3}$

C. $\frac{7\pi}{6}$

D. $\frac{4\pi}{3}$

Answer: D

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114. If ω is an imaginary cube root of unity, then $\left(1 + \omega - \omega^2\right)^7$ equals

A. 128ω

B. -128ω

C. $128\omega^2$

D. $-128\omega^2$

Answer: D

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115. If $\omega(\neq 1)$ be a cube root of unity and $\left(1+\omega^2\right)^n=\left(1+\omega^4\right)^n$, then the least positive value of n, is

A. 2

B. 3

C. 5

D. 6

Answer: B

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116. 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. $-i\sqrt{3}$

Answer: C

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117. If $\left(\frac{3}{2} + \frac{i\sqrt{3}}{2}\right)^{50} = 3^{25}(x + iy)$, where x and y are reals, then the ordered pair (x,y) is given by

A. (0,3)

B. $\left(1/2, \sqrt{3}/2\right)$

C. $(- 3, 0)$

D. $(0, - 3)$

Answer: B

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118. $x + iy = \left(1 - i\sqrt{3}\right)^{100}$, then $(x, y) =$

A. $\left(2^{99}, 2^{99}\sqrt{3}\right)$

B. $\left(2^{99}, -2^{99}\sqrt{3}\right)$

C. $\left(-2^{99}, 2^{99}\sqrt{3}\right)$

D. none of these

Answer: C

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119. If $z\left(2 - 2\sqrt{3i}\right)^{2} = i\left(\sqrt{3} + i\right)^{4}$, then $arg(z) =$

A. $\dfrac{5\pi}{6}$

B. $-\frac{\pi}{6}$

C. $\frac{\pi}{6}$

D. $\frac{7\pi}{6}$

Answer: B

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120. If ω is a complex cube root of unity, then arg $(i\omega)$ + $\arg\left(i\omega^2\right)$ =

A. 0

B. $\pi/2$

C. π

D. $\pi/4$

Answer: C

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121. The value of the expression $1.(2-\omega).\left(2-\omega^2\right)+2.(3-\omega)\left(3-\omega^2\right)+.\ +(n-1)(n-\omega)\left(n-\omega^2\right)$, where omega is an imaginary cube root of unity, is.........

A. $\left\{\frac{n(n+1)}{2}\right\}^2$

B. $\left\{\frac{n(n+1)}{2}\right\}^2-n$

C. $\left\{\frac{n(n+1)}{2}\right\}^2+n$

D. none of these

Answer: B

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122. If $z^2+z+1=0$ where z is a complex number, then the value of $\left(z+\frac{1}{z}\right)^2+\left(z^2+\frac{1}{z^2}\right)^2+\ldots.+\left(z^6+\frac{1}{z^6}\right)^2$ is

A. 54

B. 6

C. 12

D. 18

Answer: C

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123. If $\omega(\neq 1)$ is a cube root of unity, and $(1+\omega)^7 = A + B\omega$. Then (A, B) equals

A. (0,1)

B. (1,1)

C. (1,0)

D. (-1,1)

Answer: B

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124. If α and β are the roots of the equation $x^2 - x + 1 = 0$, then $\alpha^{2009} + \beta^{2009} =$

A. 1

B. 2

C. -2

D. -1

Answer: A

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125. Let $\omega \neq 1$ be a complex cube root of unity. If $\left(3 - 3\omega + 2\omega^2\right)^{4n+3} + \left(2 + 3\omega - 3\omega^2\right)^{4n+3} + \left(-3 + 2\omega + 2\omega^2\right)^{4n+3} = 0,$ then the set of possible value(s) of n is are

A. N

B. $\{3k : k \in N\}$

C. N - $(3k : k \in N)$

D. $\{6k : k \in N\}$

Answer: C

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126. If z_1, z_2 are vertices of an equilateral triangle with z_0 its centroid, then $z_1^2 + z_2^2 + z_3^2 =$

A. z_0^2

B. $3z_0^2$

C. $2z_0^2$

D. 0

Answer: B

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127. The origin and the roots of the equation $z^2 + pz + q = 0$ form an equilateral triangle If -

A. $p^2 = q$

B. $p^2 = 3q$

C. $q^2 = 3p$

D. $q^2 = p$

Answer: B

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128. If $A(z_1)$ and $B(z_2)$ are two points in the Argand plane such that $z_1^2 + z_2^2 + z_1z_2 = 0$, then $\triangle OAB$, is

A. equilateral

B. isosceles with $\angle AOB = \frac{\pi}{2}$

C. isosceles with $\angle AOB = \frac{2\pi}{3}$

D. isosceles with $\angle AOB = \frac{\pi}{4}$

Answer: C

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129. If $A(z_1), B(z_2)$ and $C(z_3)$are three points in the Argand plane such that $z_1 + \omega z_2 + \omega^2 z_3 = 0$, then

A. A,B, C are collinear triangle

B. $\triangle ABC$ is a right triangle

C. $\triangle ABC$ is an equilateral triangle

D. $\triangle ABC$ is right angled isosceles triangle.

Answer: C

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130. The value of i^i, is

A. $-\frac{\pi}{2}$

B. $e^{-\frac{\pi}{2}}$

C. $e^{\frac{\pi}{2}}$

D. none of these

Answer: B

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Section I - Solved Mcqs

1. The smallest positive integral value of n for which $\left(1+\sqrt{3}i\right)^{\frac{n}{2}}$ is real is

A. 3

B. 6

C. 12

D. 0

Answer: B

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2. The least positive integeral value of n for which $\left(\sqrt{3}+i\right)^n = \left(\sqrt{3}-i\right)^n$, is

A. 3

B. 4

C. 6

D. none of these

Answer: C

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3. If $\left(\sqrt{3} - i\right)^n = 2^n, n \in I$, the set of integers, then n is a multiple of

A. 6

B. 10

C. 9

D. 12

Answer: D

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4. If $(1 + i)z = (1 - i)\bar{z}$, then z is equal to

A. $t(1 - i), t \in R$

B. $t(1 + i), t \in R$

C. $\frac{t}{1 + i}, t \in R^+$

D. none of these

Answer: A

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5. Let $z = \frac{\cos\theta + i\sin\theta}{\cos\theta - i\sin\theta}, \frac{\pi}{4} < \theta < \frac{\pi}{2}$. Then arg(z) =

A. 2θ

B. $2\theta - \pi$

C. $\pi + 2\theta$

D. none of these

Answer: A

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6. If $arg(z) < 0$, then $arg(-z) - arg(z) =$

A. π

B. $-\pi$

C. $\frac{\pi}{2}$

D. $\frac{\pi}{2}$

Answer: A

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7. The value of $\left\{\sin\left(\log i^{i}\right)\right\}^{3} + \left\{\cos\left(\log i^{i}\right)\right\}^{3}$, is

A. 1

B. -1

C. 2

D. 2i

Answer: B

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8. If $z = a + ib$ satisfies $\arg(-1) = \arg(z + 3i)$, then $(a - 1) : b =$

A. $2 : 1$

B. $1 : 3$

C. $-1 : 3$

D. none of these

Answer: B

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9. If the area of the triangle on the complex plane formed by the points z, iz and z+iz is 50 square units, then $|z|$ is

A. 5

B. 10

C. 15

D. none of these

Answer: B

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10. If the area of the triangle on the complex plane formed by complex numbers $z, \omega z$ is $4\sqrt{3}$ square units, then $|z|$ is

A. 4

B. 2

C. 6

D. 3

Answer: A

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11. If $x^2 + x + 1 = 0$ then the value of

$$\left(x + \frac{1}{x}\right)^2 + \left(x^2 + \frac{1}{x^2}\right)^2 + \dots + \left(x^{27} + \frac{1}{x^{27}}\right)^2$$ is

A. 27

B. 72

C. 45

D. 54

Answer: D

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12. If $x^2 - x + 1 = 0$ then the value of $\sum_{n=1}^{5}\left[x^n + \frac{1}{x^n}\right]^2$ is:

A. 8

B. 10

C. 12

D. none of these

Answer: A

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13. The value of $\alpha^{-n} + \alpha^{-2n}, n \in N$ and α is a non-real cube root of unity, is

A. 3, if n is a multiple of 3

B. -1, if n is a mulitiple of 3

C. 2, if n is a multiple of 3

D. none of these

Answer: C

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14. If α is a non-real fourth root of unity, then the value of $\alpha^{4n-1} + \alpha^{4n-2} + \alpha^{4n-3}, n \in N$ is

A. 0

B. -1

C. 3

D. none of these

Answer: B

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15. If $1, \alpha, \alpha^2, \ldots\ldots\ldots, \alpha^{n-1}$ are n^{th} root of unity, the value of $(3-\alpha)\left(3-\alpha^2\right)\left(3-\alpha^3\right)\ldots\ldots\left(3-\alpha^{n-1}\right)$, is

A. n

B. 0

C. $\frac{3n-1}{2}$

D. $\frac{3n+1}{2}$

Answer: C

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16. If ω is an imaginary cube root of unity, then find the value of

$$(1+\omega)\left(1+\omega^2\right)\left(1+\omega^3\right)\left(1+\omega^4\right)\left(1+\omega^5\right)\ldots\ldots.\left(1+\omega^{3n}\right)=$$

A. 2^{3n}

B. 2^{2n}

C. 2^n

D. none of these

Answer: C

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17. If α is a non-real fifth root of unity, then the value of $3^{\left|1+\alpha+\alpha^2, \alpha^{-2}-\alpha^{-1}\right|}$, is

A. 9

B. 1

C. $11/3$

D. none of these

Answer: A

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18. If $Z_r = \cos\left(\frac{2r\pi}{5}\right) + i\sin\left(\frac{2r\pi}{5}\right), r = 0, 1, 2, 3, 4, \ldots$ then $z_1z_2z_3z_4z_5$ is equal to

A. -1

B. 0

C. 1

D. none of these

Answer: C

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19. z is a complex number satisfying $z^4 + z^3 + 2z^2 + z + 1 = 0$, then $|z|$ is equal to

A. $\frac{1}{2}$

B. $\frac{3}{4}$

C. 1

D. none of these

Answer: C

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20. if $\frac{5z_2}{7z_1}$ is purely imaginary number then $\left|\frac{2z_1 + 3z_2}{2z_1 - 3z_2}\right|$ is equal to

A. $5/7$

B. $7/9$

C. $\frac{25}{49}$

D. none of these

Answer: D

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21. The locus of point z satisfying $Re\left(\frac{1}{z}\right) = k, wherek$ is a nonzero real number, is a. a straight line b. a circle c. an ellipse d. a hyperbola

A. a straight line

B. a circle

C. an ellipse

D. a hyperbola

Answer: B

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22. If z lies on the circle $|z| = 1$, then $2/z$ lies on

A. a circle

B. an ellipse

C. a straight line

D. a parabola

Answer: A

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23. The maximum value of |z| where z satisfies the condition $\left|z + \left(\frac{2}{z}\right)\right| = 2$ is

A. $\sqrt{3} - 1$

B. $\sqrt{3}$

C. $\sqrt{3} + 1$

D. $\sqrt{2} + \sqrt{3}$

Answer: C

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24. If $\left|z - \frac{4}{z}\right| = 2$, then the maximum value of $|Z|$ is equal to (1) $\sqrt{3} + 1$ (2) $\sqrt{5} + 1$ (3) 2 (4) $2 + \sqrt{2}$

A. $\sqrt{5}$

B. $\sqrt{5} + 1$

C. $\sqrt{5} - 1$

D. none of these

Answer: B

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25. if $\left|z^2 - 1\right| = |z|^2 + 1$ then z lies on

A. a circle

B. a parabola

C. an ellipse

D. none of these

Answer: D

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26. If the number $\frac{z - 1}{z + 1}$ is purely imaginary, then

A. $|z| = 1$

B. $|z| > 1$

C. $|z| < 1$

D. $|z| > 2$

Answer: A

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27. If $|z| = k$ and $\omega = \frac{z - k}{z + k}$, then Re($\omega$)=

A. 0

B. k

C. $\frac{1}{k}$

D. $-\frac{1}{k}$

Answer: A

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28. If $k > 0, |z| = |w| = k$, and $\alpha = \frac{z - \bar{w}}{k^2 + z\bar{w}}, Re(\alpha)$

A. 0

B. $k/2$

C. k

D. none of these

Answer: A

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29. The region in the Argand diagram defined by $|z - 2i| + |z + 2i| < 5$ is the ellipse with major axis along

A. the real axis

B. the imaginary axis

C. $y = x$

D. $y = -x$

Answer: B

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30. Prove that $|Z - Z_1|^2 + |Z - Z_2|^2 = a$ will represent a real circle [with center $\left(|Z_1 + Z_2|^{/}2 + \right)$] on the Argand plane if $2a \geq |Z_1 - Z_1|^2$

A. $k < |z_1 - z_2|^2$

B. $k = |z_1 - z_2|^2$

C. $k \geq \frac{1}{2}|z_1 - z_2|^2$

D. $k < \frac{1}{2}|z_1 - z_2|^2$

Answer: C

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31. The equation $|z - 1|^2 + |z + 1|^2 = 2$, represent

A. a circle of radius one unit

B. a straight line

C. the ordered pair (0,0)

D. none of these

Answer: C

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32. The points representing the complex numbers z for which $|z + 4|^2 - |z - 4|^2 = 8$ lie on

A. a straight line parallel to x-axis

B. a straight line parallel to y-axis

C. a circle with center as origin

D. a circle with center other than the origin.

Answer: B

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33. If $\left|z+\bar{z}\right| = \left|z-\bar{z}\right|$, then value of locus of z is

A. a pair of straight line

B. a rectangular hyperbola

C. a line

D. a set of four lines

Answer: A

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34. If $|z + \bar{z}| + |z - \bar{z}| = 2$, then z lies on

A. a straight line

B. a square

C. a circle

D. none of these

Answer: A

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35. The closest distance of the origin from a curve given as $A\bar{z} + \bar{A}z + A\bar{A} = 0$ is: (A is a complex number).

A. 1 unit

B. $\frac{\mathrm{Re}(A)}{|A|}$

C. $\frac{I_m(A)}{|A|}$

D. $\frac{1}{2}|A|$

Answer: D

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36. If $z_1 = 1 + 2i, z_2 = 2 + 3i, z_3 = 3 + 4i$, then z_1, z_2 and z_3 represent the vertices of a/an.

A. equilateral triangle

B. right angled triangle

C. isosceles triangle

D. none of these

Answer: D

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37. If z_1 and z_2 are two of the 8^{th} roots of unity such that $\arg\left(\frac{z_1}{z_2}\right)$ is last positive, then $\frac{z_1}{z_2}$ is

A. $1 + i$

B. $1 - i$

C. $\frac{1+i}{\sqrt{2}}$

D. $\frac{1-i}{\sqrt{2}}$

Answer: C

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38. The number of roots of the equation $z^{15} = 1$ satisfying $|\arg(z)| \leq \pi/2$, is

A. 6

B. 7

C. 8

D. none of these

Answer: B

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39. If $z_1, z_2, \ldots\ldots\ldots\ldots\ldots, z_n$ lie on the circle $|z| = R$, then

$$\left|z_1 + z_2 + \ldots\ldots\ldots\ldots\ldots + z_n\right| - R^2\left|\frac{1}{z_1} + \frac{1}{z_2} + \ldots\ldots + \frac{1}{z} - (n)\right|$$ is equal to

A. nR

B. $-nR$

C. 0

D. n

Answer: C

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40. Q. Let z_1 and z_2 be nth roots of unity which subtend a right angle at the origin, then n must be the form $4k$.

A. $4k + 1$

B. $4k + 2$

C. $4k + 3$

D. 4k

Answer: D

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41. The complex number z_1, z_2 and z_3 satisfying $\frac{z_1 - z_3}{z_2 - z_3} = \frac{1 - i\sqrt{3}}{2}$ are the vertices of a triangle which is :

A. of area zero

B. right-angled isosceles

C. equilateral

D. obtuse-angled isosceles

Answer: C

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42. Let $\omega = -\frac{1}{2} + i\frac{\sqrt{3}}{2}$, then the value of the determinant

$$\begin{vmatrix} 1 & 1 & 1 \\ 1 & -1-\omega^2 & \omega^2 \\ 1 & \omega^2 & \omega^4 \end{vmatrix}$$, is

A. 3ω

B. $3\omega(\omega - 1)$

C. $3\omega^2$

D. $3\omega(1 - \omega)$

Answer: B

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43. For all complex numbers z_1, z_2 satisfying $|z_1| = 12$ and $|z_2 - 3 - 4i| = 5$, find the minimum value of $|z_1 - z_2|$

A. 0

B. 2

C. 7

D. 17

Answer: B

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44. Let z_1, z_2 be two complex numbers represented by points on the circle $|z_1| = \text{ and } \text{ and } |z_2| = 2$ are then

A. max $|2z_1 + z_2| = 4$

B. min $\left|z_1 - z_2\right| = 1$

C. $\left|z_2 + \frac{1}{z_1}\right| \leq 3$

D. all of the above.

Answer: D

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45. If z lies on unit circle with center at the origin, then $\frac{1+z}{1+\bar{z}}$ is equal to

A. z

B. $\bar{z}$

C. $z + \bar{z}$

D. none of these

Answer: A

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46. If $\left|z_1 - 1\right| < 1, \left|z_2 - 2\right| < 2, \left|z_3 - 3\right| < 3$ then $\left|z_1 + z_2 + z_3\right|$

A. is less than 6

B. is more than 3

C. is less than 12

D. lies between 6 and 12

Answer: C

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47. Complex numbers z_1 and z_2 lie on the rays arg(z1) $= \theta$ and arg(z1) $= -\theta$ such that $\left|z_1\right| = \left|z_2\right|$. Further, image of z_1 in y-axis is z_3. Then, the value of arg $\left(z_1 z_3\right)$ is equal to

A. $\frac{\pi}{2}$

B. $-\frac{\pi}{2}$

C. π

D. none of these

Answer: C

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48. If z is a complex number satisfying $|z|^2 - |z| - 2 < 0$, then the value of $\left|z^2 + z\sin\theta\right|$, for all values of θ, is

A. equal to 4

B. equal to 6

C. more than 6

D. less than 6

Answer: D

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49. $|z - i| \leq 2$ and $z_0 = 5 + 3i$ then max. value of $\left|iz + z_0\right|$ is :

A. $2 + \sqrt{31}$

B. 7

C. $\sqrt{31} - 2$

D. none of these

Answer: B

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50. If $|z| = \max\{|z - 2|, |z + 2|\}$, then

A. $\left|z + \bar{z}\right| = 2$

B. $z + \bar{z} = 4$

C. $\left|z + \bar{z}\right| = 1$

D. none of these

Answer: A

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51. if $\left|\frac{z-6}{z+8}\right|=1,$ then the value of $x \in R,$ where $z=x+i\begin{vmatrix}-3 & 2i & 2+i \\ -2i & 2 & 4-3i \\ 2-i & 4+3i & 7\end{vmatrix}$, is

A. 5

B. 7

C. 9

D. 0

Answer: B

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52. If $|z - 1| + |z + 3| \leq 8$, then the range of values of $|z - 4|$ is

A. (0,8)

B. [0,9]

C. [1,9]

D. [5,9]

Answer: C

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53. The equation $|z - i| + |z + i| = k, k > 0$ can represent an ellipse, if k=

A. 1

B. 2

C. 4

D. none of these

Answer: C

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54. Find the range of K for which the equation $|z + i| - |z - i| = K$ represents a hyperbola.

A. $k \in (-2, 2)$

B. $k \in [2, 2]$

C. $k \in (0, 2)$

D. $k \in (-2, 0)$

Answer: A

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55. If $|z + 3i| + |z - i| = 8$, then the locus of z, in the Argand plane, is

A. an ellipse of eccentricity $\frac{1}{2}$ and major axis along x-axis.

B. an ellipse of eccentricity $\frac{1}{2}$ and major axis of along y-axis.

C. an ellipse of eccentricity $\frac{1}{\sqrt{2}}$ and major axis along y-axis

D. none of these

Answer: A

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56. In Fig. 42, a point 'z' is equidistant from three distinct points z_1, z_2 and z_3 in the Argand plane. If z, z_1 and z_2 are collinear, then arg $\left(\frac{z_3 - z_1}{z_3 - z_2}\right)$. Will be $\left(z_1, z_2, z_3\right)$ are in anticlockwise sense).

A. $\frac{\pi}{2}$

B. $-\frac{\pi}{2}$

C. $\frac{\pi}{6}$

D. $\frac{2\pi}{3}$

Answer: B

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57. Let $P\left(e^{i\theta_1}\right), Q\left(e^{i\theta_2}\right)$ and $R\left(e^{i\theta_3}\right)$ be the vertices of a triangle PQR in the Argand Plane. Theorthocenter of the triangle PQR is

A. $e^{i\left(\theta_1+\theta_2+\theta_3\right)}$

B. $\frac{2}{3}e^{i\left(\theta_1+\theta_2+\theta_3\right)}$

C. $e^{i\left(\theta_1\right)+e^{i\theta_2}+e^{i\theta_3}}$

D. none of these

Answer: C

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58. If $A\left(z_1\right), B\left(z_2\right), C\left(z_3\right)$ are the vertices of an equilateral triangle ABC, then arg $\frac{2z_1 - z_2 - z_3}{z_3 - z_2} =$

A. $\frac{\pi}{4}$

B. $\frac{\pi}{2}$

C. $\frac{\pi}{3}$

D. $\frac{\pi}{6}$

Answer: B

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59. If $A(z_1), B(z_2)$ and $C(z_3)$ are three points in the argand plane where $|z_1 + z_2| = ||z_1 - z_2|$ and $|(1 - i)z_1 + iz_3| = |z_1| + |z_3| - z_1|$, where $i = \sqrt{-1}$ then

A. A,B and C lie on a circle with center $\frac{z_2 + z_3}{2}$

B. A,B and C are collinear points.

C. A,B,C from an equilateral triangle.

D. A,B,C form an obtuse angle triangle.

Answer: A

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60. If $a_1, a_2 \ldots a_n$ are nth roots of unity then $\frac{1}{1 - a_1} + \frac{1}{1 - a_2} + \frac{1}{1 - a_3} \ldots + \frac{1}{1 - a_n}$ is equal to

A. $\frac{n - 1}{2}$

B. $\frac{n}{2}$

C. $\frac{2^n - 1}{2}$

D. none of these

Answer: A

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61. Let $A(z_1)$ and $B(z_2)$ be such that $\angle AOB = \theta(' O')$ being the origin). If we define $z_1 \times z_2 = |z_1||z_2|\sin\theta$, then $z_1 \times z_2$ is also equal to

A. $\mathrm{Re}\left(z_1\bar{z}_2\right) = 0$

B. $\mathrm{Re}\left(\bar{z}_1 z_2\right) = 0$

C. $\mathrm{Im}\left(\bar{z}_1 z_2\right) = 0$

D. none of these

Answer: C

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62. If one root of $z^2 + (a + i)z + b + ic = 0$ is real, where $a, b, c \in R$, then $c^2 + b - ac =$

A. 0

B. -1

C. 1

D. none of these

Answer: A

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63. If A and B represent the complex numbers z_1 and z_2 such that $\left|z_1+z_2\right|=\left|z_1-z_2\right|$, then the circumcenter of $\triangle OAB$, where O is the origin, is

A. $\dfrac{z_1+z_2}{3}$

B. $\dfrac{z_1+z_2}{2}$

C. $\dfrac{z_1-z_2}{2}$

D. none of these

Answer: B

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64. If z_1, lies in $|z-3| \leq 4$, z_2 on $|z-1|+|z+1|=3$ and $A=\left|z_1-z_2\right|$, then :

A. $0 \leq A \leq \dfrac{15}{2}$

B. $0 < A < \frac{15}{2}$

C. $0 \leq A \leq \frac{17}{2}$

D. $0 \leq A < \frac{17}{2}$

Answer: D

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65. Let O, A, B be three collinear points such that $OA. OB = 1$. If O and B represent the complex numbers O and z, then A represents

A. $\frac{1}{z}$

B. $\bar{z}$

C. $\frac{1}{\bar{z}}$

D. none of these

Answer: C

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66. If z_0, z_1 represent points P and Q on the circle $|z - 1| = 1$ taken in anticlockwise sense such that the line segment PQ subtends a right angle at the center of the circle, then $z_1 =$

A. $1 + i(z_0 - 1)$

B. iz_0

C. $1 - i(z_0 - 1)$

D. $i(z_0 - 1)$

Answer: A

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67. The center of a square ABCD is at the origin and point A is reprsented by z_1. The centroid of $\triangle BCD$ is represented by

A. $\frac{z_1}{3}$

B. - $\frac{z_1}{3}$

C. $\frac{iz_1}{3}$

D. - $\frac{iz_1}{3}$

Answer: B

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68. The value of k for which the inequality $|Re(z)| + |Im(z)| \leq \lambda|z|$ is true for all $z \in C$, is

A. 2

B. $\sqrt{2}$

C. 1

D. none of these

Answer: B

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69. The value of λ for which the inequality $\left|\frac{z_1}{|z_1|}+\frac{z_2}{|z_2|}\right| \leq \lambda$ is true for all $z_1, z_2 \in C$, is

A. 1

B. 2

C. 3

D. none of these

Answer: B

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70. If $z_1 and z_2$ both satisfy $z+z=2|z-1|$ and $arg(z_1-z_2)=\frac{\pi}{4}$, then find $Im(z_1+z_2)$.

A. 0

B. 1

C. 2

D. none of these

Answer: C

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71. If z satisfies $|z+1| < |z-2|$, then $w = 3z + 2 + i$

A. $|\omega + 1| < |\omega - 8|$

B. $|\omega + 1| < |\omega - 7|$

C. $\omega + \bar{\omega} > 7$

D. $|\omega + 5| < |\omega - 4|$

Answer: A

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72. If z complex number satisfying $|z - 1| = 1$, then which of the following is correct

A. $\arg(z - 1) = 2\arg(z)$

B. $2arg(z) = \frac{2}{3}\arg\left(z^2 - z\right)$

C. $\arg(z - 1) = 2\arg(z + 1)$

D. $\arg z = 2\arg(z + 1)$

Answer: A

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73. If z_1, z_2, z_3 are the vertices of an isoscles triangle right angled at z_2, then

A. $z_1^2 + 2z_2^2 + z_3^2 = 2z_2\left(z_1 + z_3\right)$

B. $z_1^2 + z_2^2 + z_3^2 = 2z_2\left(z_1 + z_3\right)$

C. $z_1^2 + z_2^2 + 2z_3^2 = 2z_2\left(z_1 + z_3\right)$

D. $2z_1^2 + z_2^2 + z_3^2 = 2z_2(z_1 + z_3)$

Answer: A

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74. All the roots of the equation $a_1z^3 + a_2z^2 + a_3z + a_4 = 3$ where $|a_i| < 1, i = 1, 2, 3, 4,$ lie outside the circle with center at the origin and radius equal to

A. 1

B. $1/3$

C. $2/3$

D. none of these

Answer: C

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75. If z is a point on the Argand plane such that $|z - 1| = 1$, then $\frac{z - 2}{z}$ is equal to

A. tan(arg)z

B. cot(arg z)

C. itan (arg z)

D. none of these

Answer: C

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76. If z is a non-real complex number lying on the circle $|z| = 1$, then z=

A. $\dfrac{1 - i\tan\left(\frac{argz}{2}\right)}{1 + i\tan\left(\frac{argz}{2}\right)}$

B. $\dfrac{1+i\tan\left(\dfrac{\arg z}{2}\right)}{1-i\tan\left(\dfrac{\arg z}{2}\right)}$

C. $\dfrac{1-i\tan(\arg z)}{1+i\tan\left(\dfrac{\arg z}{2}\right)}$

D. none of these

Answer: B

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77. If $|z| = 2$ and the locus of 5z-1 is the circle having radius 'a' and $z_1^2 + z_2^2 - 2z_1z_2\cos\theta = 0$ then $|z_1| : |z_2| =$

A. a:1

B. $2a : 1$

C. $a : 10$

D. none of these

Answer: C

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78. If $|z+\bar{z}|+|z-\bar{z}|=8$, then z lies on

A. a circle

B. a straight line

C. a square

D. an ellipse

Answer: C

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79. If a point z_1 is the reflection of a point z_2 through the line $b\bar{z}+\bar{b}z=c, b\in 0$, in the Argand plane, then $b\bar{z}_2+\bar{b}z_1=$

A. 4c

B. 2c

C. c

D. none of these

Answer: C

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80. If z is a complex number satisfying $\left|z^2+1\right| = 4|z|$, then the minimum value of $|z|$ is

A. $2\sqrt{5}+4$

B. $2\sqrt{5}-4$

C. $\sqrt{5}-2$

D. none of these

Answer: C

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81. If z_1 and z_2 are two complex numbers satisying the equation.

$\left|\frac{iz_1 + z_2}{iz_1 - z_2}\right| = 1$, then $\frac{z_1}{z_2}$ is

A. 0

B. purely real

C. negative real

D. purely imaginary

Answer: D

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82. If α is an imaginary fifth root of unity, then $\log_2\left|1 + \alpha + \alpha^2 + \alpha^3 - \frac{1}{\alpha}\right| =$

A. 1

B. 0

C. 2

D. - 1

Answer: A

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83. The roots of the equation $\left(1 + i\sqrt{3}\right)^x - 2^x = 0$ form

A. an A.P.

B. a G.P.

C. an H.P.

D. none of these

Answer: A

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84. If $|z| = 1$ and $\omega = \dfrac{z - 1}{z + 1}$ (where $z \in - 1$), then $\text{Re}(\omega)$ is

A. 0

B. $-\dfrac{1}{|z + 1|^2}$

C. $\left|\dfrac{z}{z + 1}\right| \dfrac{.1}{|z + 1|^2}$

D. $\dfrac{\sqrt{2}}{|z + 1|^2}$

Answer: A

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85. Let z, w be complex numbers such that $\bar{z} + i\bar{w} = 0$ and $arg(zw) = \pi$ .Then $arg(z)$ equals

A. $\dfrac{5\pi}{4}$

B. $\dfrac{\pi}{2}$

C. $\dfrac{3\pi}{4}$

D. $\frac{\pi}{4}$

Answer: C

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86. Let OP.OQ=1 and let O,P and Q be three collinear points. If O and Q represent the complex numbers of origin and z respectively, then P represents

A. $\frac{1}{z}$

B. $\bar{z}$

C. $\frac{1}{\bar{z}}$

D. $-z$

Answer: C

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87. If $|z| = 1 and z \neq \pm 1$, then all the values of $\frac{z}{1 - z^2}$ lie on a line not passing through the origin $|z| = \sqrt{2}$ the x-axis (d) the y-axis

A. a line not passing through the origin

B. $|z| = \sqrt{2}$

C. the x-axis

D. the y-axis

Answer: D

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88. Let $A = \{z : \text{Im}(z) \geq 1\}, B = \{z : |z - 2 - i| = 3\}, C = \left\{z : \text{Re}\{(1 - i)z\} = \sqrt{2}\right\}$ be three sides of complex numbers. Then, the number of elements in the set $A \quad B \quad C$, is

A. 0

B. 1

C. 2

D. ∞

Answer: B

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89. Let $S = S_1 \cap S_2 \cap S_3$ where

$S_1 = \left\{z \in C : |z| < 4\right\}, S_2 = \left\{z \in C : Im\left[\frac{z - 1 + \sqrt{3}i}{1 - \sqrt{3}i}\right] > 0\right\}$ and

$S_3 : \{z \in \; : Re z < 0\}$

Let z be any point in $A \cap B \cap C$

The $|z + 1 - i|^2 + |z - 5 - i|^2$ lies between

A. 25 and 29

B. 30 and 34

C. 35 and 39

D. 40 and 44

Answer: C

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90. In Q.no. 88, if z be any point in $A \quad B \quad C$ and ω be any point satisfying $|\omega - 2 - i| < 3$. Then, $|z| - |\omega| + 3$ lies between

A. -6 and 3

B. -3 and 6

C. -6 and 6

D. -3 and 9

Answer: D

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91. A particle P starts from the point $z_0 = 1 + 2i$, where $i = \sqrt{-1}$. It moves first horizontally away from origin by 5 units and then vertically away from origin by 3 units in the direction of the vector $\hat{i} + \hat{j}$ and then it moves through an angle $\frac{\pi}{2}$ in anticlockwise direction on a circle with center at origin, to reach a point z_2. The point z_2 is given by

A. $6 + 7i$

B. $-7 + 6i$

C. $7 + 6i$

D. $-6 + 7i$

Answer: D

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92. If $w = \alpha + i\beta$ where $B\eta 0$ and $z \neq 1$ satisfies the condition that $\left(\frac{w - \bar{w}z}{1 - z}\right)$ is purely real then the set of values of z is

A. $\{z\{|z| = 1\}$

B. $\{z : z = \bar{z}\}$

C. $\{z : z \neq 1\}$

D. $\{z : |z| = 1, z \neq 1\}$

Answer: D

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93. If z_1 and $\bar{z}_1$ represent adjacent vertices of a regular polygon of n sides where centre is origin and if $\frac{Im(z)}{Re(z)} = \sqrt{2} - 1$, then n is equal to:

A. 8

B. 16

C. 24

D. 32

Answer: A

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94. $If|z| = \max\{|z-1|, |z+1|\}$, then

A. $\left|z+\bar{z}\right| = \frac{1}{2}$

B. $z+\bar{z} = 1$

C. $\left|z+\bar{z}\right| = 1$

D. z-barz=5`

Answer: C

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95. The minimum value of $\left|a+b\omega+c\omega^2\right|$, where a,b,c are all not equal integers and $\omega(\neq 1)$ is a cube root of unity, is

A. $\sqrt{3}$

B. $1/2$

C. 1

D. 0

Answer: C

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96. The shaded region, where $P = (-1, 0), Q = \left(-1 + \sqrt{2}, \sqrt{2}\right) R = \left(-1 + \sqrt{2}, -\sqrt{2}, S = (1, 0)\right.$ is represented by Figure `|z+1|>2,|a r g(z+1)2,|a r g(z+1)>>pi/4|z+1|<<2,|a r g(z+1)>pi/2`

A. $|z + 1| > 2, |\arg(z + 1)| < \frac{\pi}{4}$

B. $|z + 1| < 2, |\arg(z + 1)| < \frac{\pi}{4}$

C. $|z - 1| > 2, |\arg(z + 1)| > \frac{\pi}{4}$

D. $|z - 1| < 2, |\arg(z + 1)| > \frac{\pi}{2}$

Answer: A

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97. If a,b,c are distinct integers and $\omega(\neq 1)$ is a cube root of unity, then the minimum value of $\left|a + b\omega + c\omega^2\right| + \left|a + b\omega^2 + c\omega\right|$ is

A. $2\sqrt{3}$

B. 3

C. $4\sqrt{2}$

D. 2

Answer: A

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98. Let a and b be two positive real numbers and z_1 and z_2 be two non-zero complex numbers such that $a\left|z_1\right| = b\left|z_2\right|$. If $z = \frac{az_1}{bz_2} + \frac{bz_2}{az_1}$, then

A. Re(z)=0

B. Im(z)=0

C. $|z| = \frac{a}{b}$

D. $|z| > 2$

Answer: B

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99. If points having affixes z, $-iz$ and 1 are collinear, then z lies on

A. a straight line

B. a circle

C. an ellipse

D. a pair of straight lines.

Answer: B

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100. If $0 \leq \arg(z) \leq \frac{\pi}{4}$, then the least value of $|z - i|$, is

A. 1

B. $\frac{1}{\sqrt{2}}$

C. $\sqrt{2}$

D. none of these

Answer: B

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101. If $|z_1| + |z_2| = 1$ and $z_1 + z_2 + z_3 = 0$ then the area of the triangle whose vertices are z_1, z_2, z_3 is

A. $\frac{3\sqrt{3}}{4}$

B. $\frac{\sqrt{3}}{4}$

C. 1

D. 2

Answer: A

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102. Let Z_1 and Z_2, be two distinct complex numbers and let $w = (1 - t)z_1 + tz_2$ for some number "t" with o

A. $|z - z_2| + |z - z_2| = |z_1 - z_2|$

B. $\arg(z - z_1) = \arg(z - z_2)$

C. $\begin{vmatrix} z - z_1 & \bar{z} - \bar{z}_1 \\ z_2 - z_1 & \bar{z}_2 - \bar{z}_1 \end{vmatrix} = 0$

D. $\arg(z - z_1) = \arg(z_2 - z_1)$

Answer: B

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103. Let ω be the complex number $\cos\left(\frac{2\pi}{3}\right) + i\sin\left(\frac{2\pi}{3}\right)$. Then the number of distinct complex cos numbers z satisfying

$$\Delta = \begin{vmatrix} z+1 & \omega & \omega^2 \\ \omega & z+\omega^2 & 1 \\ \omega^2 & 1 & z+\omega \end{vmatrix} = 0 \text{ is}$$

A. 1

B. 0

C. 2

D. 3

Answer: A

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104. The set of points z in the complex plane satisfying

$|z - i|z|| = |z + i|z\ |\ |$ is contained or equal to the set of points z satisfying

A. $\text{lm}(z) = 0$

B. $\text{Im}(z) \leq 1$

C. $|\text{Re}(z)| \leq 2$

D. $|z| \leq 3$

Answer: A

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105. The set of points z satisfying $|z + 4| + |z - 4| = 10$ is contained or equal to

A. an ellipse with eccentricity $= \frac{4}{5}$

B. the set of points z satisfying $|z| \leq 3$

C. the set of points z satisfying $|\text{Re}(z)| \leq 2$

D. the set of points z satisfying $|\text{lm}(z)| < 1$

Answer: A

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106. If $|\omega| = 2$, then the set of points $z = \omega - \frac{1}{\omega}$ is contained in or equal to the set of points z satisfying

A. $\text{Im}(z) = 0$

B. $|\text{Im}(z)| \leq 1$

C. $|\text{Re}(z)| \leq 2$

D. $|z| \leq 3$

Answer: D

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107. If $|\omega| = 1$, then the set of points $z = \omega + \frac{1}{\omega}$ is contained in or equal to the set of points z satisfying.

A. $\text{Re}(z) \leq 2$ and $\text{Im}(z) = 0$

B. $\text{Re}(z) \leq 1$ and $\text{Im}(z) = 0$

C. $\text{Re}(z) \leq 2$ and $\text{Im}(z) = 0$

D. $Re(z) \leq 1$ and $\text{Im}(z) = 0$

Answer: C

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108. The number of complex numbers z such that $|z - 1| = |z + 1| = |z - i|$ is

A. 2

B. ∞

C. 0

D. 1

Answer: D

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109. Let α and β be real numbers and z be a complex number. If $z^2 + \alpha z + \beta = 0$ has two distinct non-real roots with Re(z)=1, then it is necessary that

A. $\beta \subset (0, 1)$

B. $\beta \in (-1, 0)$

C. $|\beta| - 1$

D. $\beta \in (1, \infty)$

Answer: D

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110. If $\omega \neq 1$ is the complex cube root of unity and matrix $H = \begin{bmatrix} \omega & 0 \\ 0 & \omega \end{bmatrix}$, then H^{70} is equal to

A. $-H$

B. H^2

C. H

D. O

Answer: C

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111. The maximum value of $\left|arg\left(\frac{1}{1 - z}\right)\right|f$ or $|z| = 1, z \neq 1$ is given by.

A. $\frac{\pi}{6}$

B. $\frac{\pi}{3}$

C. $\frac{\pi}{2}$

D. π

Answer: C

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112. If z is any complex number satisfying $|z - 3 - 2i| \leq 2$ then the maximum value of $|2z - 6 + 5i|$ is

A. 3

B. 4

C. 5

D. $5/2$

Answer: C

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113. Let ω be the solution of $x^3 - 1 = 0$ with $\text{Im}(\omega) > 0$. If a=2 with b and c satisfying $[abc]\begin{bmatrix} 1 & 9 & 7 \\ 2 & 8 & 7 \\ 7 & 3 & 7 \end{bmatrix} = [0, 0, 0]$, then the value of $\frac{3}{\omega^a} + \frac{1}{\omega^b} + \frac{1}{\omega^c}$ is equal to

A. -2

B. 2

C. 3

D. -3

Answer: A

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114. The set $\left\{Re\left(\frac{2iz}{1-z^2}\right): zisacomplexvmber, |z| = 1, z = \pm 1\right\}$ is________.

A. $(-\infty, -1)(1, \infty)$

B. $(-\infty, 0) \cup (1, \infty)$

C. $[2, \infty)$

D. $(-\infty, -1) \cup [1, \infty)$

Answer: D

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115. Let $\omega = e^{\frac{i\pi}{3}}$ and a, b, c, x, y, z be non-zero complex numbers such that $a + b + c = x, a + b\omega + c\omega^2 = y, a + b\omega^2 + c\omega = z$.Then, the value of $\frac{|x|^2 + |y|^2| + |y|^2}{|a|^2 + |b|^2 + |c|^2}$

A. 3

B. 6

C. 9

D. 1

Answer: A

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116. The minimum value of $|z_1 - z_2|$ as z_1 and z_2 vary over the curves $|\sqrt{3}(1 - 2z) + 2i| = 2\sqrt{7}$ and $|\sqrt{3}(- 1 - z) - 2i| = |\sqrt{3}(9 - z) + 18i|$ respectively is

A. $\frac{7\sqrt{7}}{2\sqrt{3}}$

B. $\frac{5\sqrt{7}}{2\sqrt{3}}$

C. $\frac{14\sqrt{7}}{\sqrt{3}}$

D. $\frac{7\sqrt{7}}{5\sqrt{3}}$

Answer: B

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117. Let complex numbers α and $\frac{1}{\alpha}$ lies on circle $\left(x - x_0\right)^2\left(y - y_0\right)^2 = r^2$ and $\left(x - x_0\right)^2 + \left(y - y_0\right)^2 = 4r^2$ respectively. If $z_0 = x_0 + iy_0$ satisfies the equation $2\left|z_0\right|^2 = r^2 + 2$ then $|\alpha|$ is equal to (a) $\frac{1}{\sqrt{2}}$ (b) $\frac{1}{2}$ (c) $\frac{1}{\sqrt{7}}$ (d) $\frac{1}{3}$

A. $\frac{1}{\sqrt{2}}$

B. $\frac{1}{2}$

C. $\frac{1}{\sqrt{7}}$

D. $\frac{1}{3}$

Answer: C

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118. Let w = $\left(\sqrt{3} + \frac{\iota}{2}\right)$ and $P = \left\{w^n : n = 1, 2, 3, \ldots .\right\}$, Further $H_1 = \left\{z \in C : Re(z) > \frac{1}{2}\right\}$ and $H_2 = \left\{z \in c : Re(z) < -\frac{1}{2}\right\}$ Where C is set of all complex numbers. If $z_1 \in P \cap H_1, z_2 \in P \cap H_2$ and O represent the origin, then $\angle Z_1OZ_2$ =

A. $\frac{\pi}{2}, \frac{5\pi}{6}$

B. $\pi, \frac{2\pi}{3}$

C. $\frac{2\pi}{3}, \frac{5\pi}{3}$

D. $\frac{5\pi}{3}, \frac{7\pi}{3}$

Answer: B

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119. Let $S = S_1 \cap S_2 \cap S_3$, where

$s_1 = \{z \in C : |z| < 4\}, S_2 = \left\{z \in C : \ln\left[\frac{z - 1 + \sqrt{3}i}{1 - \sqrt{31}}\right] > 0\right\}$ and $S_3 = \{z \in C : Re$

A. $\frac{10\pi}{3}$

B. $\frac{20\pi}{3}$

C. $\frac{16\pi}{3}$

D. $\frac{32\pi}{3}$

Answer: B

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120. Let $S = S_1 \cap S_2 \cap S_3$, where

$s_1 = \{z \in C : |z| < 4\}, S_2 = \left\{z \in C : \ln\left[\frac{z - 1 + \sqrt{3}i}{1 - \sqrt{31}}\right] > 0\right\}$ and $S_3 = \{z \in C : Re$

A. $\frac{2-\sqrt{3}}{2}$

B. $\frac{2+\sqrt{3}}{2}$

C. $\frac{3-\sqrt{3}}{2}$

D. $\frac{3+\sqrt{3}}{2}$

Answer: C

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121. Let $z_k = \frac{\cos(2k\pi)}{10} + i\frac{\sin(2k\pi)}{10}, k = 1, 2, \ldots\ldots\ldots\ldots, 9.$ Then, $\frac{1}{10}\left\{\left|1 - z_1\right|\left|1 - z_2\right|\ldots\ldots\left|1 - z_9\right|\right\}$ equals

A. 0

B. 1

C. 2

D. 3

Answer: B

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122. In Q. No. 121, $1 - \sum_{k=1}^{9} \frac{\cos(2k\pi)}{10}$ equals

A. 0

B. 1

C. 2

D. 10

Answer: C

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123. If z is a complex number such that $|z| \geq 2$ then the minimum value of

$\left|z + \frac{1}{2}\right|$ is

A. is strictly greater than $\frac{5}{2}$

B. is strictly greater than $\frac{3}{2}$ but less than $\frac{5}{2}$

C. is equal to $\frac{5}{2}$

D. lies in the interval (1,2)

Answer: D

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124. A complex number z is said to be uni-modular if $|z| = 1$. Suppose z_1 and z_2 are complex numbers such that $\frac{z_1 - 2z_2}{2 - z_1\bar{z}_2}$ is uni-modular and z_2 is not uni-modular. Then the point z_1 lies on a:

A. circle of radius 2

B. circle of radius $\sqrt{2}$

C. straight line parallel to x-axis.

D. straight line parallel to y-axis.

Answer: A

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125. If $|z - 2 - i| = |z|\sin\left(\frac{\pi}{4} - argz\right)|$, where $i = \sqrt{-1}$,then locus of z, is

A. pair of straight lines

B. circle of radius $\sqrt{2}$

C. parabola

D. ellipse

Answer: C

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126. $f(n) = \cot^2\left(\frac{\pi}{n}\right) + \cot^2\frac{2\pi}{n} + \ldots\ldots\ldots\ldots\ldots + \cot^2\frac{(n - 1)\pi}{n}, (n > 1, n \in N)$

then $\lim_{n \to \infty}\frac{f(n)}{n^2}$ is equal to (A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) $\frac{2}{3}$ (D) 1

A. $\frac{1}{2}$

B. $\frac{1}{3}$

C. $\frac{2}{3}$

D. 1

Answer: B

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127. If z_1 and z_2 are lying on $|z - 3| \leq 4$ and $|z - 1| = |z + 1| = 3$ respecively. Then $d = \left|z_1 - z_2\right|$ satisfies.

A. $0 \leq d < \frac{15}{2}$

B. $0 < d \leq \frac{15}{2}$

C. $0 \leq d \leq \frac{17}{2}$

D. $0 < d < \frac{17}{2}$

Answer: C

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128. If $|z - 1| = 1$ and $\arg(z) = \theta$, where $z \neq 0$ and θ is acute, then $\left(1 - \frac{2}{z}\right)$ is equal to

A. $\tan\theta$

B. $I\tan\theta$

C. $\frac{\tan\theta}{2}$

D. $I\frac{\tan\theta}{2}$

Answer: B

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129. If z is a complex number lying in the first quadrant such that $\text{Re}(z) + \text{Im}(z) = 3$, then the maximum value of $\{\text{Re}(z)\}^2\text{Im}(z)$, is

A. 1

B. 2

C. 3

D. 4

Answer: D

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130. The maximum area of the triangle formed by the complex coordinates z, z_1, z_2 which satisfy the relations $|z - z_1| = |z - z_2|$ and $\left|z - \frac{z_1 + z_2}{2}\right| \le r$, where $r > |z_1 - z_2|$ is

A. $\frac{1}{2}|z_1 - z_2|^2$

B. $\frac{1}{2}|z_1 - z_2|r$

C. $\frac{1}{2}|z_1 - z_2|^2 r^2$

D. $\frac{1}{2}|z_1 - z_2|r^2$

Answer: B

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131. If z is a complex number satisfying $|z|^2 + 2(z + 2) + 3i\left(z - \bar{z}\right) + 4 = 0$, then complex number $z + 3 + 2i$ lies on

A. circle witih center 1-5i and radius 4

B. circle with center 1+5i and radius 4

C. circle with center 1+5i and radius 3

D. circle with center 1-5i and radius 3

Answer: B

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132. Locus of z if $arg[z - (1 + i)] = \begin{cases} \frac{3\pi}{4} \text{ when } |z| \le |z - 2| \text{ and } \frac{-\pi}{4} \text{ when } \end{cases}$ $|z| > |z - 4|$ is

A. a striaght line passing through (2,0)

B. a straight line passing through (2,0) and (1,1)

C. a line segment

D. a set of two rays

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133. Let $z \in C$ and if $A = \left\{z : \arg(z) = \frac{\pi}{4}\right\}$and $B = \left\{z : \arg(z - 3 - 3i) = \frac{2\pi}{3}\right\}$. Then $n(A \quad B) =$

A. 1

B. 2

C. 3

D. 0

Answer: D

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134. Let $S = \left\{z \in C : z\left(iz_1 + 1, \left|z_1\right| < 1\right\}$. Then, for all $z \in S$, which one of the following is always true?

A. Re(z) - Im(z) < 0

B. $Re(z) + Im(z)$lt 0`

C. $Re(z)$lt 0`

D. Re(z)-Im(z) > 0

Answer: A

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135. Let $z = 1 + ai$ be a complex number, $a > 0$,such that z^3 is a real number. Then the sum $1 + z + z^2 + \ldots + z^{11}$ is equal to:

A. $-1250\sqrt{3}i$

B. $1250\sqrt{3}i$

C. $-1365\sqrt{3}i$

D. $1365\sqrt{3}i$

Answer: C

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136. Let $0 \neq a, 0 \neq b \in R$. Suppose

$S = \left\{z \in C, z = \frac{1}{a + ibt}t \in R, t \neq 0\right\}$, where $i = \sqrt{-1}$. If $z = x + iy$ and $z \in S$, then (x, y) lies on

A. on the circle with radius $\frac{1}{2a}$ and center $\left(-\frac{1}{2a}, 0\right)$

B. on the circle with radius $\frac{1}{2a}$ and center $\left(\frac{1}{2a}, 0\right)$

C. on the x-axis

D. on the y-axis.

Answer: B

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137. Let a,b ∈ R and $a^2 + b^2 \neq 0$. Suppose $S = \left\{ z \in C : z = \frac{1}{a + ibt}, t \in R, t \neq 0 \right\}$, where $i = \sqrt{-i}$. If $z = x + iy$ and z in S, then (x,y) lies on

A. the x-axis for $a \neq 0, b = 0$

B. the y-axis for $a \neq 0, b = 0$

C. the y-axis for $a \neq 0, b \neq 0$

D. the x - axis for a=0, $b \neq 0$

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138. Let a,b $\in$ R and $a^2 + b^2 \neq 0$. Suppose $S = \left\{ z \in C : z = \frac{1}{a + ibt}, t \in R, t \neq 0 \right\}$, where $i = \sqrt{-i}$. If $z = x + iy$ and z in S, then (x,y) lies on

A. $a = 0, b \neq 0$

B. $a \neq 0, b = 0$

C. $a \neq 0, b \neq 0$

D. all $a, b \in R$

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139. The point represented by $2 + i$ in the Argand plane moves 1 unit eastwards, then 2-units northwards and finally from there $2\sqrt{2}$ units in the south-westwards direction. Then its new position in the Argand plane is at the point represented by

A. $2 + 2i$

B. $-2-2i$

C. $1+i$

D. $-1-i$

Answer: C

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140. Let ω be a complex number such that $2\omega+1=\sqrt{3}i$. If

$$\begin{vmatrix} 1 & 1 & 1 \\ 1 & -\omega^2-1 & \omega^2 \\ 1 & \omega^2 & \omega^7 \end{vmatrix} = 3k$$, then k is equal to

A. -1

B. 1

C. $-i\sqrt{3}$

D. $i\sqrt{3}$

Answer: C

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141. Let $a, b, x and y$ be real numbers such that $a - b = 1 and y \ne 0$. If the complex number $z = x + iy$ satisfies $Im\left(\frac{az + b}{z + 1}\right) = y$, then which of the following is (are) possible value9s) of x?| $-1 - \sqrt{1 - y^2}$ (b) $1 + \sqrt{1 + y^2}$ $-1 + \sqrt{1 - y^2}$ (d) $-1 - \sqrt{1 + y^2}$

A. $-1 - \sqrt{1 - y^2}$

B. $1 + \sqrt{1 + y^2}$

C. $1 - \sqrt{1 + y^2}$

D. $-1 + \sqrt{1 - y^2}$

Answer: A::D

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Section II - Assertion Reason Type

1. Statement-1, For any two complex numbers z_1 and z_2

$$\left|z_1 + \sqrt{z_1^2 - z_2^2}\right| + \left|z_1 - \sqrt{z_1^2 - z_2^2}\right| = \left|z_1 + z_2\right| + \left|z_1 - z_2\right|$$

Statement-2: For any two complex numbers z_1 and z_2

$$\left|z_1 + z_2\right|^2 + \left|z_1 - z_2\right|^2 = 2\left(\left|z_1\right|^2 + \left|z_2\right|^2\right)$$

A. Statement-1 is True, Statement-2 is True: Statement-2 is a correct exp,anation for statement-1.

B. Statement-1 is true, statement -2 is true, Statement-2 is not a correct explanation for statement-1.

C. Statement-1 is True, statement-2 is false,

D. statement-1 is False, Statement-2 is true.

Answer: a

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2. Statement-1: for any two complex numbers z_1 and z_2

$$\left|z_1 + z_2\right|^2 \leq \left(1 + \frac{1}{l}amba\right)\left|z_2\right|^2$$, where λ is a positive real number.

Statement:2 $AM \geq GM.$

A. Statement-1 is True, Statement-2 is True: Statement-2 is a correct exp,anation for statement-1.

B. Statement-1 is true, statement -2 is true, Statement-2 is not a correct explanation for statement-1.

C. Statement-1 is True, statement-2 is false,

D. statement-1 is False, Statement-2 is true.

Answer: a

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3. Statement-1, If $z_1, z_2, z_3, \dots\dots\dots\dots\dots\dots, z_n$ are uni-modular complex numbers, then

$$\left|z_1 + z + (2) + \dots\dots\dots\dots + z_n\right| = \left|\frac{1}{z_1} + \frac{1}{z_2} + \dots\dots\dots\dots + \frac{1}{z_n}\right|$$

Statement-2: For any complex number z, $z\bar{z} = |z|^2$

A. Statement-1 is True, Statement-2 is True: Statement-2 is a correct exp,anation for statement-1.

B. Statement-1 is true, statement -2 is true, Statement-2 is not a correct explanation for statement-1.

C. Statement-1 is True, statement-2 is false,

D. statement-1 is False, Statement-2 is true.

Answer: b

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4. Statement-1, if z_1 and z_2 are two complex numbers such that $\left|z_1\right| \leq 1$, $\left|z_2\right| \leq 1$, then

$\left|z_1 - z_2\right|^2 \leq \left(\left|z_1\right| - \left|z_2\right|\right)^2 - \arg\left(z_2\right)\}^2$

Statement-2 $\sin\theta > \theta$ for all $\theta > 0$.

A. Statement-1 is True, Statement-2 is True: Statement-2 is a correct exp,anation for statement-1.

B. Statement-1 is true, statement -2 is true, Statement-2 is not a correct explanation for statement-1.

C. Statement-1 is True, statement-2 is false,

D. statement-1 is False, Statement-2 is true.

Answer: c

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5. Statement -1: for any complex number z, $|Re(z)| + |Im(z)| \leq |z|$

Statement-2: $|\sin\theta| \leq 1$, for all θ

A. Statement-1 is True, Statement-2 is True: Statement-2 is a correct exp,anation for statement-1.

B. Statement-1 is true, statement -2 is true, Statement-2 is not a correct explanation for statement-1.

C. Statement-1 is True, statement-2 is false,

D. statement-1 is False, Statement-2 is true.

Answer: d

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6. Statement-1: for any non-zero complex number z, $\left|\frac{z}{|z|} - 1\right| \leq \arg(z)$

Stetement-2 : $\sin\theta \leq \theta$ for $\theta \geq 0$

A. Statement-1 is True, Statement-2 is True: Statement-2 is a correct exp,anation for statement-1.

B. Statement-1 is true, statement -2 is true, Statement-2 is not a correct explanation for statement-1.

C. Statement-1 is True, statement-2 is false,

D. statement-1 is False, Statement-2 is true.

Answer: a

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7. Statement-1: for any non-zero complex number $|z - 1| \leq ||z| - 1| + |z|$ arg (z)

Statement-2 : For any non-zero complex number z

$$\left|\frac{z}{|z|} - 1\right| \leq \arg(z)$$

A. Statement-1 is True, Statement-2 is True: Statement-2 is a correct exp,anation for statement-1.

B. Statement-1 is true, statement -2 is true, Statement-2 is not a correct explanation for statement-1.

C. Statement-1 is True, statement-2 is false,

D. statement-1 is False, Statement-2 is true.

Answer: a

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8. Statement-1: If z_1, z_2 are affixes of two fixed points A and B in the Argand plane and P(z) is a variable point such that "arg"$\frac{z - z_1}{z - z_2} = \frac{\pi}{2}$, then the locus of z is a circle having z_1 and z_2 as the end-points of a diameter.

Statement-2 : arg $\frac{z_2 - z_1}{z_1 - z} = \angle APB$

A. Statement-1 is True, Statement-2 is True: Statement-2 is a correct exp,anation for statement-1.

B. Statement-1 is true, statement -2 is true, Statement-2 is not a correct explanation for statement-1.

C. Statement-1 is True, statement-2 is false,

D. statement-1 is False, Statement-2 is true.

Answer: d

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9. Statement-1: If z is a complex number satisfying $(z - 1)^n = z^n$, $n \in N$, then the locus of z is a straight line parallel to imaginary axis.

Statement-2: The locus of a point equidistant from two given points is the perpendicular bisector of the line segment joining them.

A. Statement-1 is True, Statement-2 is True: Statement-2 is a correct explanation for statement-1.

B. Statement-1 is true, statement -2 is true, Statement-2 is not a correct explanation for statement-1.

C. Statement-1 is True, statement-2 is false,

D. statement-1 is False, Statement-2 is true.

Answer: a

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10. Let z_0 be the circumcenter of an equilateral triangle whose affixes are z_1, z_2, z_3.

Statement-1 : $z_1^2 + z_2^2 + z_3^2 = 3z_0^2$

Statement-2: $z_1^2 + z_2^2 + z_3^2 = 2(z_1z_2 + z_2z_3 + z_3z_1)$

A. Statement-1 is True, Statement-2 is True: Statement-2 is a correct exp,anation for statement-1.

B. Statement-1 is true, statement -2 is true, Statement-2 is not a correct explanation for statement-1.

C. Statement-1 is True, statement-2 is false,

D. statement-1 is False, Statement-2 is true.

Answer: c

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11. Let z_1 and z_2 be the roots of the equation $z^2 + pz + q = 0$. Suppose z_1 and z_2 are represented by points A and B in the Argand plane such that $\angle AOB = \alpha$, where O is the origin.

Statement-1: If OA=OB, then $p^2 = 4q\frac{\cos^2\alpha}{2}$

Statement-2: If affix of a point P in the Argand plane is z, then ze^{ia} is represented by a point Q such that $\angle POQ = \alpha$ and $OP = OQ$.

A. Statement-1 is True, Statement-2 is True: Statement-2 is a correct exp,anation for statement-1.

B. Statement-1 is true, statement -2 is true, Statement-2 is not a correct explanation for statement-1.

C. Statement-1 is True, statement-2 is false,

D. statement-1 is False, Statement-2 is true.

Answer: a

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12. Statement-1: The locus of point z satisfying $\left|\frac{3z+i}{2z+3+4i}\right| = \frac{3}{2}$ is a straight line.

Statement-2 : The locus of a point equidistant from two fixed points is a straight line representing the perpendicular bisector of the segment joining the given points.

A. Statement-1 is True, Statement-2 is True: Statement-2 is a correct exp,anation for statement-1.

B. Statement-1 is true, statement -2 is true, Statement-2 is not a correct explanation for statement-1.

C. Statement-1 is True, statement-2 is false,

D. statement-1 is False, Statement-2 is true.

Answer: a

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13. Statement-1: If a,b,c are distinct real number and $\omega(\neq 1)$ is a cube root of unity, then $\left|\frac{a+b\omega+c\omega^2}{a\omega^2+b+c\omega}\right|=1$ Statement-2: For any non-zero complex number `z,|z / bar z)|=1

A. Statement-1 is True, Statement-2 is True: Statement-2 is a correct exp,anation for statement-1.

B. Statement-1 is true, statement -2 is true, Statement-2 is not a correct explanation for statement-1.

C. Statement-1 is True, statement-2 is false,

D. statement-1 is False, Statement-2 is true.

Answer: b

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14. Let z be a unimodular complex number.

Statement-1:arg $\left(z^2 + \bar{z}\right) = \arg(z)$

Statement-2:barz=$\cos(\arg z)$ - $i\sin(\arg z)$

A. Statement-1 is True, Statement-2 is True: Statement-2 is a correct exp,anation for statement-1.

B. Statement-1 is true, statement -2 is true, Statement-2 is not a correct explanation for statement-1.

C. Statement-1 is True, statement-2 is false,

D. statement-1 is False, Statement-2 is true.

Answer: d

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15. Let z and omega be complex numbers such that $|z| = |\omega|$ and arg (z) dentoe the principal of z.

Statement-1: If argz+ arg $\omega = \pi$, then $z = -\bar{\omega}$

Statement -2: $|z| = |\omega|$ implies arg z-arg $\bar{\omega} = \pi$, then $z = -\bar{\omega}$

A. Statement-1 is True, Statement-2 is True: Statement-2 is a correct exp,anation for statement-1.

B. Statement-1 is true, statement -2 is true, Statement-2 is not a correct explanation for statement-1.

C. Statement-1 is True, statement-2 is false,

D. statement-1 is False, Statement-2 is true.

Answer: c

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Exercise

1. Which of the following is correct?

A. $1 + i > 2 - i$

B. $2 + \text{i} > 1 + i$

C. $2 - \text{i} > 1 + i$

D. none of these

Answer: D

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2. If $a = \sqrt{2i}$, then which of the following is correct?

A. $a = 1 + i$

B. $a = 1 - i$

C. $a = -2(\sqrt{2})i$

D. none of these

Answer: A

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3. Let z_1, z_2 be two complex numbers such that $z_1 + z_2$ and $z_1 z_2$ both are real, then

A. $z_1 = -z_2$

B. $z_1 = \bar{z}_2$

C. $z_1 = -\bar{z}_2$

D. $z_1 = z_2$

Answer: B

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4. If the complex numbers z_1, z_2, z_3 are in AP, then they lie on

A. a circle

B. a parabola

C. a line

D. an ellipse

Answer: C

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5. The locus of complex number z for which $\left(\frac{z-1}{z+1}\right)=k$, where k is non-zero real, is

A. a circle with center on y-axis

B. a circle with center on x-axis

C. a straight line parallel to y-axis

D. a straight line making $\pi/3$ angle with the x-axis.

Answer: c

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6. The locus of the points z satisfying the condition arg $\left(\frac{z-1}{z+1}\right)=\frac{\pi}{3}$ is, a

A. parabola

B. Statement-1 is true, statement -2 is true, Statement-2 is not a correct explanation for statement-1.

C. circle

D. pair of straight lne

Answer: a

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7. If $\sqrt{x+iy} = \pm(a+ib)$, then find $\sqrt{-x-iy.}$

A. $\pm(b+ia)$

B. $\pm(a - ib)$

C. $\pm(b - ia)$

D. $\pm(a + ib)$

Answer: C

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8. The locus of the points z satisfying the condition arg $\left(\frac{z - 1}{z + 1}\right) = \frac{\pi}{3}$ is, a

A. parabola

B. circle

C. pair of straight lines

D. none of these

Answer: d

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9. If $\left(\sqrt{3}+i\right)^{10}=a+ib$, then a and b are respectively

A. 128 & $128\sqrt{3}$

B. 64 and $64\sqrt{3}$

C. 512 and $512\sqrt{3}$

D. none of these

Answer: C

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10. If $\text{Re}\left(\frac{z-8i}{z+6}\right)=0$, then lies on the curve

A. $x^2+y^2+6x-8y=0$

B. $4x-3y+24=0$

C. $x^2+y^2-8=0$

D. none of these

Answer: A

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11. If $z = \left(\frac{\sqrt{3}}{2} + \frac{i}{2}\right)^5 + \left(\frac{\sqrt{3}}{2} - \frac{i}{2}\right)^5$, then

A. Re(z)=0

B. Im(z)=0

C. Re(z) > 0, Im(z) > 0

D. Re(z) > 0 , Im $(z) < 0$

Answer: B

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

A. z lies on imaginary axis

B. z lies on real axis

C. z lies on unit circle

D. none of these

Answer: b

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13. Let $3 - i$ and $2 + i$ be affixes of two points A and B in the Argand plane and P represents the complex number $z = x + iy$. Then, the locus of the P if $|z - 3 + i| = |z - 2 - i|$, is

A. circle on AB as diameter

B. the line AB

C. the perpendicular bisector of AB

D. none of these

Answer: c

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14. POQ is a straight line through the origin O,P and Q represent the complex numbers a+ib and c+id respectively and OP=OQ. Then, which one of the following is true?

A. $|a+ib|=|c+id|$

B. $a+b=c+d$

C. $\arg(a+ib)=\arg(c+id)$

D. none of these

Answer: a

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15. If $z_1 = a + ib$ and $z_2 = c + id$ are complex numbers such that $|z_1| = |z_2| = 1$ and $Re(z_1\bar{z}_2) = 0$, then the pair ofcomplex nunmbers $\omega = a + ic$ and $\omega_2 = b + id$ satisfies

A. $|\omega_1| = 1$

B. $|\omega_2| = 1$

C. $\text{Re}\left(\omega_1\bar{\omega}^2\right) = 0$

D. all of these

Answer: d

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16. Let $z_1 and z_2$ be complex numbers such that $z_1 \neq z_2$ and $|z_1| = |z_2|$ If z_1 has positive real part and z_2 has negative imaginary part, then $\frac{z_1 + z_2}{z_1 - z_2}$ may be zero (b) real and positive real and negative (d) purely imaginary

A. cannot be zero

B. is real and positive

C. is real and negative

D. is purely imaginary

Answer: d

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17. $\sum_{k=1}^{6}\left(\frac{\sin(2\pi k)}{7} - i\frac{\cos(2\pi k)}{7}\right) = ?$

A. -1

B. 0

C. $-i$

D. i

Answer: D

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18. The equation $\bar{b}z + b\bar{z} = c$, where b is a non-zero complex constant and c is a real number, represents

A. a circle

B. a straight line

C. a pair of straight line

D. none of these

Answer: b

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19. If $|a_i| < 1, \lambda_i \geq 0$ for $i = 1, 2, \ldots\ldots n$ and $\lambda_1 + \lambda_2 + \ldots\ldots + \lambda_n = 1$, then the value of $|\lambda_1 a_1 + \lambda_2 a_2 + \ldots\ldots + \lambda_n a_n|$ is

A. equal to 1

B. less than 1

C. greater than 1

D. none of these

Answer: b

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20. For any two complex numbers, z_1, z_2 and any two real numbers a and b, $|az_1 - bz - (2)|^2 + |bz_1 + az_2|^2 =$

A. $(a + b)\left(|z_1|^2 + |z_2|^2\right)$

B. $\left(a^2 + b^2\right)\left(|z_1|^2 + |z_2|^2\right)$

C. $\left(a^2 + b^2\right)\left(|z_1| + |z_2|\right)$

D. none of these

Answer: B

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21. Common roots of the equation $z^3 + 2z^2 + 2z + 1 = 0$ and $z^{2020} + z^{2018} + 1 = 0$, are

A. ω, ω^2

B. $1, \omega, \omega^2$

C. $-1, \omega, \omega^2$

D. $-\omega, -\omega^2$

Answer: a

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22. If z_1 and z_2 are two complex numbers such that $\left|\frac{z_1 - z_2}{1 - \bar{z}_1 z_2}\right| = 1$, then which one of the following is true?

A. $|z_1| = 1, |z_2| = 1$

B. $z_1 = e^{i\theta}, \theta \in R$

C. $z_2 = e^{i\theta}, \theta \in R$

D. all of these

Answer: b

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23. The points representing cube roots of unity

A. are collinear

B. lie on a circle of radius $\sqrt{3}$

C. from an equilateral triangle

D. none of these

Answer: c

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24. If z_1 and z_2 are two complex numbers such that $\left|\frac{z_1 - z_2}{z_1 + z_2}\right| = 1$, then

A. $z_1 = kz_2, k \in R$

B. $z_1 = ikz_2, k \in R$

C. $z_1 = z_2$

D. none of these

Answer: B

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25. If z_1, z_2 are two complex numbers such that $\left|\frac{z_1 - z_2}{z_1 + z_2}\right| = 1$ and $iz_1 = Kz_2$, where $K \in R$, then the angle between $z_1 - z_2$ and $z_1 + z_2$ is

A. $\frac{\tan^{-1}(2k)}{k^2 + 1}$

B. $\frac{\tan^{-1}(2k)}{1 - k^2}$

C. $-2\tan^{-1}k$

D. none of these

Answer: c

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26. If n is a positive integer greater than unity z is a complex number satisfying the equation $z^n = (z+1)^n$, then

A. $\text{Re}(z) < 0$

B. $\text{Re}(z) > 0$

C. Re(z) =0

D. none of these

Answer: A

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27. If n is a positive integer greater than unity z is a complex number satisfying the equation $z^n = (z+1)^n$, then

A. Im(z) < 0

B. Im(z) > 0

C. Im(z) =0

D. none of these

Answer: d

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28. If at least one value of the complex number $z = x + iy$ satisfies the condition $\left|z + \sqrt{2}\right| = \sqrt{a^2 - 3a + 2}$ and the inequality $\left|z + i\sqrt{2}\right| < a$, then

A. $a > 2$

B. $a = 2$

C. $a < 2$

D. $a > 1$

Answer: a

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29. Given z is a complex number with modulus 1. Then the equation $[(1 + ia)/(1 - ia)]^4 = z$ has all roots real and distinct two real and two imaginary three roots two imaginary one root real and three imaginary

A. all roots, real and distinct

B. two real and two imaginary

C. three roots real and one imaginary

D. one root real and three imaginary

Answer: a

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30. The center of a regular polygon of n sides is located at the point z=0, and one of its vertex z_1 is known. If z_2 be the vertex adjacent to z_1, then z_2 is equal to

A. $z_1\left(\cos 2\frac{\pi}{n} \pm i\sin 2\frac{\pi}{n}\right)$

B. $z_1\left(\frac{\cos\pi}{n} \pm i\frac{\sin\pi}{n}\right)$

C. $z_1\left(\frac{\cos\pi}{2n} \pm \frac{\sin\pi}{2n}\right)$

D. none of these

Answer: a

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31. If the points z_1, z_2, z_3 are the vertices of an equilateral triangle in the Argand plane, then which one of the following is not correct?

A. $\frac{1}{z_1 - z_2} + \frac{1}{z_2 - z_3} + \frac{1}{z_3 - z_1} = 0$

B. $z_1^2 + z_2^2 + z_3^2 = z_1 z_2 + z_2 z_3 + z_3 z_1$

C. $\left(z_1 - z_2\right)^2 + \left(z_2 - z_3\right)^2 + \left(z_3 - z_1\right)^2 = 0$

D. $z_1^3 + z_2^3 + z_3^3 + 3z_1z_2z_3 = 0$

Answer: d

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32. For any complex number z, the minimum value of $|z| + |z - 1|$

A. Re(z) < 0

B. Re (z) > 0

C. Re(z) > 2

D. Re(z) > 3

Answer: a

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33. The inequality $|z - 4| < |z - 2|$ represents

A. Re(z) ≥ 0

B. Re(z) < 0

C. Re(z) > 0

D. None of these

Answer: d

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34. Number of non-zero integral solution of the equation $|1 - i|^n = 2^n$, is

A. 1

B. 2

C. infinite

D. none of these

Answer: D

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35. If $\text{Im}\frac{2z+1}{iz+1} = -2$, then locus of z, is

A. a circle

B. a parabola

C. a straight line

D. none of these

Answer: A

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36. If $z(\neq -1)$ is a complex number such that $\frac{z-1}{z+1}$ is purely imaginary, then $|z|$ is equal to

A. 1

B. 2

C. 3

D. 4

Answer: a

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37. If $x = -5 + 2\sqrt{-4}$, find the value of $x^4 + 9x^3 + 35x^2 - x + 4$.

A. 0

B. -160

C. 160

D. -164

Answer: b

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38. If z_1, z_2, z_3 are vertices of an equilateral triangle with z_0 its centroid, then $z_1^2 + z_2^2 + z_3^2 =$

A. z_0^2

B. $9z_0^2$

C. $3z_0^2$

D. $2z_0^2$

Answer: c

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39. If z_1, z_2 are two complex numbers such that $Im\left(z_1 + z_2\right) = 0, Im\left(z_1 z_2\right) = 0$, then:

A. $z_1 = -z_2$

B. $z_1 = z_2$

C. $z_1 = \bar{z}_2$

D. $z_1 = -\bar{z}_2$

Answer: c

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40. If $z^2 + z|z| + |z^2| = 0,$ then the locus z is a. a circle b. a straight line c. a pair of straight line d. none of these

A. a circle

B. a straight line

C. a pair of straight lines

D. none of these

Answer: c

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41. If $\log_{\sqrt{3}}\left(\frac{|z|^2 - |z| + 1}{2 + |z|}\right) > 2$, then the locus of z is

A. $|z| = 5$

B. $|z| < 5$

C. $|z| > 5$

D. none of these

Answer: c

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42. Let $g(x)$ and $h(x)$ are two polynomials such that the polynomial P(x) $= g(x^3) + xh(x^3)$ is divisible by $x^2 + x + 1$, then which one of the following is not true?

A. $g(1) = h(1) = 0$

B. g(1)=h(1) $\neq 0$

C. $g(1) = -h(1)$

D. $g(1) + h(1) = 0$

Answer: a

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43. If $g(x)$ and $h(x)$ are two polynomials such that the polynomials $P(x) = g(x^3) + xh(x^3)$ is divisible by $x^2 + x + 1$, then which one of the following is not true?

A. $g(1) = h(1) = 0$

B. $g(1) = h(1) \neq 0$

C. $g(1) = -h(1)$

D. $g(1) + h(1) = 0$

Answer: b

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44. If $|z_1| = |z_2| = |z_3|$ and $z_1 + z_2 + z_3 = 0$, then z_1, z_2, z_3 are vertices of

A. a right angled triangle

B. an equilateral triangle

C. isosceles triangle

D. scalene triangle

Answer: b

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45. If $x_n = \cos\left(\frac{\pi}{3^n}\right) + i\sin\left(\frac{\pi}{3^n}\right)$, then $x_1, x_2, x_3, \ldots\ldots\ldots\ldots\ldots\ldots . x_\infty$ is equal to

A. 1

B. -1

C. i

D. - i

Answer: C

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46. If $\left(a_1+ib_1\right)\left(a_2+ib_2\right)\ldots.\left(a_n+ib_n\right)=A+iB$, then $\left(a_1^2+b_1^2\right)\left(a_2^2+b_2^2\right)\ldots\ldots\left(a_n^2+b_n^2\right)$ is equal to (A) 1 (B) $\left(A^2+B^2\right)$ (C) $(A+B)$ (D) $\left(\frac{1}{A^2}+\frac{1}{B^2}\right)$

A. 1

B. A^2+B^2

C. $A+B$

D. $\frac{1}{A^2}+\frac{1}{B^2}$

Answer: b

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47. If $(a_1 + ib_1)(a_2 + ib_2)\ldots\ldots\ldots\ldots\ldots\ldots(a_n + ib_n) = A + iB,$ then $\sum_{i=1}^{n} \tan^{-1}\left(\frac{b_i}{a_i}\right)$ is equal to

A. $\frac{B}{A}$

B. $\tan\left(\frac{B}{A}\right)$

C. $\tan^{-1}\left(\frac{B}{A}\right)$

D. $\tan^{-1}\left(\frac{A}{B}\right)$

Answer: c

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48. If $\cos\alpha + 2\cos\beta + 3\cos\gamma = \sin\alpha + 2\sin\beta + 3\sin\gamma = 0$ then the value of $\sin 3\alpha + 8\sin 3\beta + 27\sin 3\gamma$, is

A. $\sin(\alpha + \beta + \gamma)$

B. $3\sin(\alpha + \beta + \gamma)$

C. $18\sin(\alpha + \beta + \gamma)$

D. $\sin(\alpha + 2\beta + 3\gamma)$

Answer: c

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49. If α, β, γ are the cube roots of p, then for any x,y,z $\dfrac{x\alpha + y\beta + z\gamma}{x\beta + y\gamma + z\alpha}$ =

A. ω, ω^2

B. $-\omega, -\omega^2$

C. $1, -1$

D. none of these

Answer: a

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50. Prove that $tan\left(i(\log)_e\left(\frac{a - ib}{a + ib}\right)\right) = \frac{2ab}{a^2 - b^2}\left(wherea, b \in R^+\right)$

A. $\frac{ab}{a^2 + b^2}$

B. $\frac{2ab}{a^2 - b^2}$

C. $\frac{ab}{a^2 - b^2}$

D. $\frac{2ab}{a^2 + b^2}$

Answer: b

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51. Find the relation if z_1, z_2, z_3, z_4 are the affixes of the vertices of a parallelogram taken in order.

A. $z_1 + z_4 = z_2 + z_3$

B. $z_1 + z_3 = z_2 + z_4$

C. $z_1 + z_2 = z_3 + z_4$

D. none of these

Answer: b

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52. The locus of the points representing the complex numbers z for which

$|z| - 2 = |z - i| - |z + 5i| = 0$, is

A. a circle with center at the origin

B. a straight line passing through the origin

C. the angle point $(0, -2)$

D. none of these

Answer: c

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53. For $n = 6k, k \in z$, $\left(\frac{1 - i\sqrt{3}}{2}\right)^n + \left(\frac{-1 - i\sqrt{3}}{2}\right)^n$ has the value

A. -1

B. 0

C. 1

D. 2

Answer: d

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54. The product of all values of $(\cos\alpha + i\sin\alpha)^{3/5}$ is

A. 1

B. $\cos\alpha + i\sin\alpha$

C. $\cos 3\alpha + i\sin 3\alpha$

D. $\cos 5\alpha + i\sin 5\alpha$

Answer: C

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55. If $C^2 + S^2 = 1$, then $\dfrac{1 + C + iS}{1 + C - iS}$ is equal to

A. $C + iS$

B. $C - iS$

C. $S + iC$

D. $S - iC$

Answer: a

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56. The center of a square ABCD is at z=0. The affix of the vertex A is z_1.

Then, the affix of the centroid of the triangle ABC is

A. $z_1(\cos\pi \pm i\sin\pi)$

B. $\frac{z_1}{3}(\cos\pi \pm \sin\pi)$

C. $z_1\left(\cos\left(\frac{\pi}{2}\right) \pm \sin\left(\frac{\pi}{2}\right)\right)$

D. $\frac{z_1}{3}\left(\cos\left(\frac{\pi}{2}\right) \pm \sin\left(\frac{\pi}{2}\right)\right)$

Answer: d

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57. The number of solutions of the system of equations $Re\left(z^2\right) = 0, |z| = 2$, is

A. 4

B. 3

C. 2

D. 1

Answer: a

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58. The vector z=-4+5i is turned counter clockwise through an angle of 180° and stretched 1.5 times. The complex number corresponding to the newly obtained vector is

A. $6 - \frac{15}{2}i$

B. $-6 + \frac{15}{2}i$

C. $6 + \frac{15}{2}i$

D. $6 + \frac{15}{2}i$

Answer: a

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59. The value of $\left[\sqrt{2}\left(\cos\left(56^\circ 15'\right) + i\sin\left(56^\circ 15'\right)\right)\right]^8$, is

A. $4i$

B. $8i$

C. $16i$

D. $-16i$

Answer: c

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60. Find the complex number z satisfying the equations

$$\left|\frac{z-12}{z-8i}\right| = \frac{5}{3}, \left|\frac{z-4}{z-8}\right| = 1$$

A. 6

B. $6 \pm 8i$

C. $6 + 8i, 6 + 17i$

D. $8 \pm 6i$

Answer: c

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61. The vertices B and D of a parallelogram are $1 - 2i$ and $4 - 2i$ If the diagonals are at right angles and AC=2BD, the complex number representing A is

A. $\frac{5}{2}$

B. $3i - \frac{3}{2}$

C. $3i - 4$

D. $3i + 4$

Answer: b

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62. If for complex numbers z_1 and z_2, arg $z_1 - \arg\left(z_2\right) = 0$ then $\left|z_1 - z_2\right|$ is equal to

A. $|z_1| + |z_2|$

B. $|z_1| - |z_2|$

C. $||z_1| - |z_2|$

D. 0

Answer: c

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63. The join of $z_1 = a + ib$ and $z_2 = \frac{1}{-a + ib}$ passes through

A. z=0

B. $z = 1 + i0$

C. $z = 0 + i$

D. $z = 1 + i$

Answer: a

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64. If z_1, z_2, z_3, z_4 are the affixes of four point in the Argand plane, z is the affix of a point such that $|z - z_1| = |z - z_2| = |z - z_3| = |z - z_4|$, then prove that z_1, z_2, z_3, z_4 are concyclic.

A. concylic

B. vertices of a triangle

C. vertices of a rhombus

D. in a straight line

Answer: a

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65. The value of $\sum_{r=1}^{8}\left(\frac{\sin(2r\pi)}{9} + i\frac{\cos(2r\pi)}{9}\right)$, is

A. -1

B. 1

C. i

D. - i

Answer: d

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66. If $z_1, z_2, z_3, \ldots\ldots\ldots\ldots, z_n$ are n nth roots of unity, then for $k = 1, 2, , \ldots\ldots\ldots, n$

A. $|z_k| = k|z_n + 1|$

B. $|z_{k+1}| = k|z_k|$

C. $|Z_{K+1}| = |Z_k|Z_{k+1}|$

D. $|z_k| = |z_{k+1}|$

Answer: d

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67. If z_1, z_2 and z_3, z_4 are two pairs of conjugate complex numbers then

$$arg\left(\frac{z_1}{z_4}\right) + arg\left(\frac{z_2}{z_3}\right) =$$

A. 0

B. $\pi/2$

C. $3\pi/2$

D. π

Answer: A

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68. If $|z_1| = |z_2|$ and $\arg(z_1) + \arg(z_2) = 0$, then

A. $z_1 = z_2$

B. $z_1 = \bar{z}_2$

C. $z_1 z_2 = 1$

D. $z_1 \bar{z}_2 = 1$

Answer: B

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69. If one vertex of a square whose diagonals intersect at the origin is $3(\cos\theta + i\sin\theta)$, then find the two adjacent vertices.

A. $\pm 3(\sin\theta - i\sin\theta)$

B. $\pm(\sin\theta + i\cos\theta$

C. $\pm(\cos\theta - i\sin\theta)$

D. $z_1 \bar{z}_2 = 1$

Answer: a

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70. The value of z satisfying the equation

$\log z + \log z^2 + \ldots\ldots. + \log z^n = 0$, is

A. $\frac{\cos(4m\pi)}{n(n+1)} + i\frac{\sin(4m\pi)}{n(n+1)0}, m = 1, 2, \ldots\ldots\ldots$

B. $\frac{\cos(4m\pi)}{n(n+1)} - i\frac{\sin(4m\pi)}{n(n+1)}, m = 1, 2, \ldots\ldots\ldots\ldots$

C. $\frac{\sin(4m\pi)}{n} + i\frac{\cos(4m\pi)}{n}, m = 1, 2, \ldots\ldots\ldots\ldots$

D. 0

Answer: a

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71. If $|z_1| = |z_2| = \ldots\ldots\ldots\ldots = |z - (n)| = 1$, then the value of $|z_1 + z_2 + \ldots\ldots\ldots + z_n|$, is

A. n

B. $\left|\frac{1}{z_1} + \frac{1}{z_2} + \ldots\ldots\ldots\ldots\ldots + \frac{1}{z_n}\right|$

C. 0

D. none of these

Answer: b

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72. If $\omega(\neq 1)$ be a cube root of unity and $(1+\omega)^7 = A + B\omega$, then A and B are respectively the numbers.

A. 0,1

B. 1,1

C. 1,0

D. $-1, 1$

Answer: b

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73. If ω is the complex cube root of unity then

$$\begin{vmatrix} 1 & 1 + i + \omega^2 & \omega^2 \\ 1 - i & -1 & \omega^2 - 1 \\ -i & -i + \omega - 1 & -1 \end{vmatrix} =$$

A. 0

B. 1

C. i

D. ω

Answer: A

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74. Let z and omega be two non-zero complex numbers, such that $|z| = |\omega|$ and $\arg(z) + \arg(\omega) = \pi$. Then, z equals

A. ω

B. - ω

C. $\bar{\omega}$

D. - $\bar{\omega}$

Answer: ad

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75. If $z \neq 0$ be a complex number and $\arg(z) = \pi/4$, then

A. $\text{Re}(z) = \text{Im}(z)$ only

B. $Re(z) = Im(z) > 0$

C. $Re\left(z^2\right) = Im\left(z^2\right)$

D. none of these

Answer: b

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76. $(1 + i)^8 + (1 - i)^8 = ?$

A. 2^8

B. 2^5

C. $2^4 \frac{\cos\pi}{4}$

D. $2^8 \frac{\cos\pi}{8}$

Answer: B

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77. What is the smallest positive integer n for which $(1 + i)^{2n} = (1 - i)^{2n}$?

A. 4

B. 8

C. 3

D. 12

Answer: C

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78. If $\alpha$and $\beta$are different complex numbers with $|\beta| = 1$, then find $\left|\frac{\beta - \alpha}{1 - \bar{\alpha}\beta}\right|$.

A. 0

B. 8

C. 2

D. 2

Answer: c

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79. For any complex number z, the minimum value of $|z| + |z - 1|$

A. 1

B. 0

C. $1/2$

D. $3/2$

Answer: a

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80. If $\frac{3\pi}{2} > \alpha > 2\pi$, find the modulus and argument of $(1 - \cos 2\alpha) + i\sin 2\alpha$.

A. $-2\cos\alpha[\cos(\pi + \alpha) + i\sin(\pi + \alpha)]$

B. $2\cos\alpha[\cos\alpha + i\sin\alpha\}$

C. $2\cos\alpha[\cos(\pi - \alpha) + i\sin(\pi - \alpha)\}$

D. $-2\cos\alpha[\cos(\pi - \alpha) + i\sin(\pi - \alpha)\}$

Answer: a

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81. If the roots of $(z - 1)^n = i(z + 1)^n$ are plotted in ten Argand plane, then prove that they are collinear.

A. lie on a parabola

B. are concylic

C. are collinear

D. the vertices of a triangle

Answer: b

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82. Area of the triangle formed by 3 complex numbers, $1 + i, i - 1, 2i$, in the Argand plane, is

A. $1/2$

B. 1

C. $\sqrt{2}$

D. 2

Answer: B

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83. If ω is a complex cube root of unity, then $\left(1 - \omega + \omega^2\right)^6 + \left(1 - \omega^2 + \omega\right)^6 =$

A. 0

B. 6

C. 64

D. 128

Answer: D

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84. The locus represented by the equation $|z - 1| = |z - i|$ is

A. a circle of radius 1

B. an ellipse with foci at 1 and $-i$

C. a line through the origin

D. a circle on the line joining 1 and $-i$ as diameter.

Answer: C

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85. If $z = i\log(23, then \cos z = \ -1$ b. $-1/2$ c. 1 d. $1/2$

A. i

B. 2i

C. 1

D. 2

Answer: d

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86. If

$\alpha = \cos\alpha + i\sin\alpha, b = \cos\beta + i\sin\beta, c = \cos\gamma + i\sin\gamma$ and $\frac{b}{c} + \frac{c}{a} + \frac{a}{b} = 1,$

then $\cos(\beta - \gamma) + \cos(\gamma - \alpha) + \cos(\alpha - \beta) =$

A. $3/2$

B. $-3/2$

C. 0

D. 1

Answer: D

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87. If z_1, z_2, z_3 are vertices of an equilateral triangle inscribed in the circle $|z| = 2$ and if $z_1 = 1 + \iota\sqrt{3}$, then

A. $z_1 = -2, z_3 = 1 - i\sqrt{3}$

B. $z_2 = 2, z_3 = 1 - i\sqrt{3}$

C. $z_2 = -2, z_3 = -1 - i\sqrt{3}$

D. $z_2 = 1 - i\sqrt{3}, z_3 = 1 - i\sqrt{3}$

Answer: a

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88. The general value of θ which satisfies the equation $(\cos\theta + i\sin\theta)(\cos 3\theta + i\sin 3\theta)(\cos 5\theta + i\sin 5\theta)\ldots\ldots\ldots((\cos 2n - 1)\theta + i\sin(2n - 1)$ = 1 is

A. $\dfrac{r\pi}{n^2}$

B. $\dfrac{(r-1)\pi}{n^2}$

C. $\dfrac{(2r+1)\pi}{n^3}$

D. $\dfrac{2r\pi}{n^2}$

Answer: d

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89. If z is a complex numbers such that $z \neq 0$ and $\text{Re}(z) = 0$, then

A. $\text{Re}\left(z^2\right) = 0$

B. $\text{Im}\left(z^2\right) = 0$

C. $\text{Re}\left(z^2\right) = \text{Im}\left(z^2\right)$

D. none of these

Answer: b

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90. If $z + z^{-1} = 1$, then find the value of $z^{100} + z^{-100}$.

A. i

B. $-i$

C. 1

D. -1

Answer: d

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91. Let A,B and C represent the complex number z_1, z_2, z_3 respectively on the complex plane. If the circumcentre of the triangle ABC lies on the origin, then the orthocentre is represented by the number

A. $z_1 + z_2 - z_3$

B. $z_2 + z_3 - z_1$

C. $z_3 + z_1 - z_2$

D. $z_1 + z_2 + z_3$

Answer: d

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92. Number of solutions of the equation $z^2 + |z|^2 = 0$, where $z \in C$, is

A. 1

B. 2

C. 3

D. infinity many

Answer: D

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93. The number of solutions of the equation $z^2 + z = 0$ where z is a a complex number, is

A. 2

B. 4

C. 6

D. none of these

Answer: b

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94. The centre of a square is at the origin and one of the vertex is $1 - i$ extremities of diagonal not passing through this vertex are

A. $1 - I, \ - 1 + i$

B. $1 - I, \ - 1 - i$

C. $- 1 + I, \ - 1 - i$

D. none of these

Answer: a

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95. Let $z and \omega$ be two complex numbers such that $|z| \leq 1, |\omega| \leq 1 and |z - i\omega| = |z - i\omega| = 2, then z$ equals $1 \text{ or } i$ b. $i \text{ or } -i$ c. $1 \text{ or } -1$ d. $i \text{ or } -1$

A. 1 or i

B. i or $-i$

C. 1 or -1

D. i or -1

Answer: b

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96. The system of equation $|z + 1 + i| = \sqrt{2}$ and $|z| = 3\}$, (where $i = \sqrt{-1}$)

has

A. no solutions

B. one solution

C. two solution

D. none of these

Answer: a

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97. The triangle with vertices at the point $z_1 z_2, (1 - i)z_1 + iz_2$ is

A. right angled but not isoscles

B. isosceles but not right angled

C. right angled and isosceles

D. equilateral

Answer: C

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98. Let α and β be two fixed non-zero complex numbers and 'z' a variable complex number. If the lines $\alpha\bar{z} + \bar{\alpha}z + 1 = 0$ and $\beta\bar{z} + \bar{\beta}z - 1 = 0$ are mutually perpendicular, then

A. $\alpha\beta + \bar{\alpha}\bar{\beta} = 0$

B. $\alpha\beta - \bar{\alpha}\bar{\beta} = 0$

C. $\bar{\alpha} - \alpha\bar{\beta} = 0$

D. $\alpha\bar{\beta} + \bar{\alpha}\beta = 0$

Answer: D

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99. The center of a square is at z=0. A is z_1, then the centroid of the triangle ABC is

A. $z_1(\cos\pi \pm i\sin\pi)$

B. $\frac{1}{3}z_1(\cos\pi \pm i\sin\pi)$

C. $z_1\left(\cos\left(\frac{\pi}{2}\right) \pm i\sin\left(\frac{\pi}{2}\right)\right)$

D. $\frac{1}{3}z_1\left(\cos\left(\frac{\pi}{2}\right) \pm i\sin\left(\frac{\pi}{2}\right)\right)$

Answer: D

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100. If $z = x + iy$, then he equation $|(2z - i)/(z + 1)| = m$ represents a circle, then m can be $1/2$ b. 1 c. 2 d. `3

A. $1/2$

B. 1

C. 2

D. 3

Answer: c

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101. If $x^2 - 2x\cos\theta + 1 = 0$, then the value of $x^{2n} - 2x^n\cos n\theta + 1, n \in N$ is equal to

A. $\cos 2n\theta$

B. $\sin 2n\theta$

C. 0

D. $\cos n\theta$

Answer: C

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102. If $p^2 - p + 1 = 0$, then the value of p^{3n} can be

A. 1

B. -1

C. 0

D. $\cos n\theta$

Answer: d

Watch Video Solution

103. If $n \in Z$, then $\dfrac{2^n}{(1+i)^{2n}} + \dfrac{(1+i)^{2n}}{2^n}$ is equal to

A. 0

B. 2

C. $\left[1 + (-1)^n\right]i^n$

D. 1

Answer: d

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104. If $\arg\left(z_1 z_2\right) = 0$ and $\left|z_1\right| = \left|z_2\right| = 1$, then

A. $z_1 + z_2 = 0$

B. $z_1 \bar{z}_2 = 1$

C. $z_1 = \bar{z}_2$

D. $z_1 + \bar{z}_2 = 0$

Answer: C

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105. If ω is a complex cube root of unity, then $\dfrac{(1+i)^{2n} - (1-i)^{2n}}{\left(1 + \omega^4 - \omega^2\right)\left(1 - \omega^4 + \omega^2\right)}$

is equal to

A. 0, if n is an even integer

B. 0 for all $n \in Z$

C. $2^{n-1}i$ for all $n \in N$

D. none of these

Answer: A

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106. If z is a complex number satisfying $z + z^{-1} = 1$ then $z^n + z^{-n}, n \in N$, has the value

A. $2(-1)^n$, where n is a multiple of 3

B. $(-1)^n$, where n is not a multiple of 3

C. $(-1)^{n+1}$, where n is not a multiple of 3

D. none of these

Answer: a

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107. $x^{3m} + x^{3n-1} + x^{3r-2}$, where, $m, n, r \in N$ is divisible by

A. m,n,k are rational

B. m,n,k are integers

C. m,n,k are positive integers

D. none of these

Answer: b

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108. If z is nonreal root of $[-1]^{\frac{1}{7}}$ then,find the value of $z^{86}+z^{175}+z^{289}$

A. 0

B. -1

C. 3

D. 1

Answer: B

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109. The locus of point z satisfying Re$\left(z^2\right) = 0$, is

A. a pair of straight lines

B. a circle

C. a rectangular hyperbola

D. none of these

Answer: A

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110. The curve represented by $\text{Im}\left(z^2\right) = k$, where k is a non-zero real number, is

A. a pair of straight line

B. an ellipse

C. a parabola

D. a hyperbola

Answer: D

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111. If $\log_{\tan 30^\circ}\left[\dfrac{2|z|^2 + 2|z| - 3}{|z| + 1}\right] < -2$ then $|z| =$

A. $|z| < 3/2$

B. $|z| > 3/2$

C. $|z| > 2$

D. $|z| < 2$

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112. The roots of the cubic equation (z + α β)^3 = α^3 , α is not equal to 0, represent the vertices of a triangle of sides of length

A. $\frac{1}{\sqrt{3}}|\alpha\beta|$

B. $\sqrt{3}|\alpha|$

C. $\sqrt{3}|\beta|$

D. $\frac{1}{\sqrt{3}}|\alpha|$

Answer: cb

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113. The roots of the cubic equation (z + α β)^3 = α^3 , α is not equal to 0, represent the vertices of a triangle of sides of length

A. represent sides of an equilateral triangle

B. represent the sides of an isosceles triangle

C. represent the sides of a triangle whose one side is of length $\sqrt{3}\alpha$

D. none of these

Answer: d

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114. If α, β, γ and δ are the equation $x^4 - 1 = 0$, then the value of $\frac{a\alpha + b\beta + c\gamma + d\delta}{a\gamma + b\delta + c\alpha + d\beta} + \frac{a\gamma + b\delta + c\alpha + d\beta}{a\alpha + b\beta + c\gamma + d\delta}$, is

A. 3β

B. 0

C. 2γ

D. 3α

Answer: d

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115. If ω is a complex cube root of unity, then the equation $|z - \omega|^2 + \left|z - \omega^2\right|^2 = \lambda$ will represent a circle, if

A. $\gamma \in (0, 3/2)$

B. $\gamma \in [3/2, \infty)$

C. $\gamma \in (0, 3)$

D. $\gamma \in [3, \infty)$

Answer: b

Watch Video Solution

116. If ω is a complex cube root of unity, then the equation $|z - \omega|^2 + \left|z - \omega^2\right|^2 = \lambda$ will represent a circle, if

A. 4

B. 3

C. 2

D. $\sqrt{2}$

Answer: B

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117. The equation $z\bar{z} + (4 - 3i)z + (4 + 3i)\bar{z} + 5 = 0$ represents a circle of radius

A. 5

B. $2\sqrt{5}$

C. $5/2$

D. none of these

Answer: B

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118. z is such that $arg\left(\frac{z - 3\sqrt{3}}{z + 3\sqrt{3}}\right) = \frac{\pi}{3}$ then locus z is

A. $|z - 3i| = 6$

B. $|z - 3i| = 6, \text{Im}(z) > 0$

C. $|z - 3i| = 6, \text{Im}(z) < 0$

D. none of these

Answer: B

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119. Let $z = 1 - t + i\sqrt{t^2 + t + 2}$, where t is a real parameter.the locus of the z in argand plane is

A. a hyperbola

B. an ellipse

C. a straight line

D. none of these

Answer: A

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120. If $|z - 4 + 3i| \leq 1$ and m and n be the least and greatest values of $|z|$ and K be the least value of $\frac{x^4 + x^2 + 4}{x}$ on the interval $(0, \infty)$, then $K =$

A. m

B. n

C. $m + n$

D. mn

Answer: b

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121. If $1, \alpha, \alpha^2, \ldots\ldots\ldots\ldots, \alpha^{n-1}$ are the n, n^{th} roots of unity and z_1 and z_2 are any two complex numbers such that $\sum_{r=0}^{n-1} \left|z_1 + \alpha^R z_2\right|^2 = \lambda\left(\left|z_1\right|^2 + \left|z_2\right|^2\right)$, then $\lambda =$

A. n

B. $(n - 1)$

C. $(n + 1)$

D. 2n

Answer: a

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122. If $z_r(r = 0, 1, 2, \ldots\ldots\ldots\ldots, 6)$ be the roots of the equation $(z+1)^7 + z^7 = 0$, then $\sum_{r=0}^{6} \text{Re}\left(z_r\right) =$

A. 0

B. 3/2

C. 7/2

D. -7/2

Answer: D

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123. The least positive integer n for which $\left(\frac{1+i}{1-i}\right)^n = \frac{2}{\pi}\sin^{-1}\left(\frac{1+x^2}{2x}\right)$, where $x > 0$ and $i = \sqrt{-1}$ is

A. 2

B. 4

C. 8

D. 12

Answer: B

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124. The area of the triangle formed by the points representing $-z$, iz and $z - iz$ in the Argand plane, is

A. $\frac{1}{2}|z|^2$

B. $|z|^2$

C. $\frac{3}{2}|z|^2$

D. $\frac{1}{4}|z|^2$

Answer: c

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125. If $z_0 = \frac{1 - i}{2}$, then the value of the product $\left(1 + z_0\right)\left(1 + z_0^2\right)\left(1 + z_0^{2^2}\right)\left(1 + z_0^{2^3}\right)\ldots\ldots\left(1 + z_0^{2^n}\right)$ must be

A. $(1 - i)\left(1 + \frac{1}{\frac{2}{2^{n-1}}}\right)$, if $n > 1$

B. $(1 - i)\left(1 - \frac{1}{2^{2^n}}\right)$, if $n > 1$

C. $(1 - i)\left(1 - \frac{1}{2^{n-1}}\right)$, if $n > 1$

D. $(1 - i)\left(1 + \frac{1}{2^{2^n}}\right)$, if $n > 1$

Answer: b

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126. The greatest positive argument of complex number satisfying $|z - 4| = Re(z)$ is

A. $\frac{\pi}{3}$

B. $\frac{2\pi}{3}$

C. $\frac{\pi}{2}$

D. $\frac{\pi}{4}$

Answer: D

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127. If the points in the complex plane satisfy the equations $\log_5(|z| + 3) - \log_{\sqrt{5}}(|z - 1|) = 1$ and arg $(z - 1) = \frac{\pi}{4}$ are of the form $A_1 + iB_1$, then the value of $A_1 + B_1$, is

A. $2\sqrt{2}$

B. $\sqrt{2}$

C. $4\sqrt{2}$

D. 0

Answer: a

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128. A complex number z with (Im)(z)=4 and a positive integer n be such that $\frac{z}{z+n}=4i$, then the value of n, is

A. 4

B. 16

C. 17

D. 32

Answer: C

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129. If $\arg\left(\frac{z_1 - \frac{z}{|z|}}{\frac{z}{|z|}}\right) = \frac{\pi}{2}$ and $\left|\frac{z}{|z|} - z_1\right| = 3$, then $\left|z_1\right|$ equals to

A. $\sqrt{26}$

B. $\sqrt{10}$

C. $\sqrt{3}$

D. $2\sqrt{2}$

Answer: B

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130. If z_1 and z_2 satisfy the equation $2|z + 3| = |\text{Re}(z)|$ and $\arg\frac{z + 3}{1 + i} = \frac{\pi}{2}$, then $\arg\frac{z_1 + 3}{z_2 + 3}$ is equal to

A. 0

B. $\pm\frac{\pi}{2}$

C. $\pm\pi$

D. $\pm\frac{\pi}{4}$

Answer: c

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131. If $A = \ | z \in C : z = x + ix - 1$ for all $x \in R\}$ and $|z| \leq |\omega|$ for all z, $\omega \in A$, then z is equal to

A. $\frac{1}{2}(1 + i)$

B. $-\frac{1}{2}(1 - i)$

C. $-\frac{1}{2}(1 + i)$

D. $\frac{1}{3}(1 - 2i)$

Answer: b

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Chapter Test

1. The locus of the center of a circle which touches the circles $\left|z - z_1\right| = a, \left|z - z_2 = b\right|$ externally will be

A. an ellipse

B. a hyperbola

C. a circle

D. none of these

Answer: b

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2. If n_1, n_2 are positive integers, then $(1 + i)^{n_1} + \left(1 + i^3\right)^{n_1} + \left(1 + i_5\right)^{n_2} + \left(1 + i^7\right)^{n_2}$ is real if and only if :

A. $n_1 = n_2 + 1$

B. $n_1 = n_2 - 1$

C. $n_1 = n_2$

D. $n_1 > 0, n_2 > 0$

Answer: d

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3. The modulus of $\sqrt{2i} - \sqrt{-2i}$ is

A. 2

B. $\sqrt{2}$

C. 0

D. $2\sqrt{2}$

Answer: a

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4. Prove that the triangle formed by the points $1, \frac{1+i}{\sqrt{2}}, andi$ as vertices in the Argand diagram is isosceles.

A. scalene

B. equilateral

C. isosceles

D. right-angled

Answer: c

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5. The value of $\frac{1+i\sqrt{3}}{\left(1-i\sqrt{3}\right)^6}+\frac{1-i\sqrt{3}}{\left(1+i\sqrt{3}\right)^6}$ is

A. 2

B. -2

C. 1

D. 0

Answer: a

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6. If $\alpha + i\beta = \tan^{-1}(z)$, $z = x + iy$ and α is constant, the locus of 'z' is

A. $x^2 + y^2 + 2x\cot 2\alpha = 1$

B. $\cot 2\alpha\left(x^2 + y^2\right) = 1 + x$

C. $x^2 + y^2 + 2y\tan\alpha = 1$

D. $x^2 + y^2 + 2x\sin x 2\alpha = 1$

Answer: a

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7. If $\cos A + \cos B + \cos C = 0, \sin A + \sin B + \sin C = 0$ and $A + B + C = 180^0$, then the value of $\cos 3A + \cos 3B + \cos 3C$ is

A. 3

B. -3

C. $\sqrt{3}$

D. 0

Answer: b

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8. The value of the expression $1.(2 - \omega).\left(2 - \omega^2\right) + 2.(3 - \omega)\left(3 - \omega^2\right) + . + (n - 1)(n - \omega)\left(n - \omega^2\right),$ where omega is an imaginary cube root of unity, is.........

A. $\left\{\frac{n(n+1)}{2}\right\}^2$

B. $\left\{\frac{n(n+1)}{2}\right\}^2 - n$

C. $\left\{\frac{n(n+1)}{2}\right\}^2+n$

D. none of these

Answer: c

Watch Video Solution

9. The value of the expression

$$\left(1+\frac{1}{\omega}\right)\left(1+\frac{1}{\omega^2}\right)+\left(2+\frac{1}{\omega}\right)\left(2+\frac{1}{\omega^2}\right)+\left(3+\frac{1}{\omega}\right)\left(3+\frac{1}{\omega^2}\right)+\ldots\ldots\ldots\ldots\ldots +$$

, where ω is an imaginary cube root of unity, is

A. $\frac{n\left(n^2+2\right)}{3}$

B. $\frac{n\left(n^2-2\right)}{3}$

C. $\frac{n\left(n^2+1\right)}{3}$

D. none of these

Answer: A

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10. The condition that $x^{n+1} - x^n + 1$ shall be divisible by $x^2 - x + 1$ is that

A. $n = 6k + 1$

B. $n = 6k - 1$

C. $n = 3k + 1$

D. none of these

Answer: a

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11. The expression $(1 + i)^{n_1} + \left(1 + i^3\right)^{n_2}$ is real iff

A. $n_1 = - n_2$

B. $n_1 = 4r + (-1)^r n_2$

C. $n_1 = 2r + (-1)^r n_2$

D. none of these

Answer: b

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12. $\begin{vmatrix} 6i & -3i & 1 \\ 4 & 3i & -1 \\ 20 & 3 & i \end{vmatrix}$ =x+iy then

A. $x = 3, y = 1$

B. $x = 1, y = 3$

C. $x = 0, y = 3$

D. none of these

Answer: D

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13. The centre of a square ABCD is at z_0. If A is z_1, then the centroid of the

ABC is $2z_0 - (z_1 - z_0)$ (b) $\left(z_0 + i\left(\frac{z_1 - z_0}{3}\right)\right.$ $\frac{z_0 + iz_1}{3}$ (d) $\frac{2}{3}(z_1 - z_0)$

A. $z_1(\cos\pi \pm i\sin\pi)$

B. $\frac{z_1}{3}(\cos\pi \pm i\sin\pi)$

C. $z_1\left(\cos\alpha \pm i\frac{\sin\pi}{2}\right)$

D. $\frac{z_1}{3}\left(\frac{\cos\pi}{2} \pm i\frac{\sin\pi}{2}\right)$

Answer: d

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14. If $\cos\alpha + 2\cos\beta + 3\cos\gamma = \sin\alpha + 2\sin\beta + 3\sin\gamma = 0$ and $\alpha + \beta + \gamma = 0$,

then $\cos3\alpha + 8\cos3\beta + 27\sin3\gamma =$

A. 0

B. 3

C. 18

D. - 18

Answer: c

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15. If $\cos\alpha + 2\cos\beta + 3\cos\gamma = \sin\alpha + 2\sin\beta + 3\sin\gamma = 0$ and $\alpha + \beta + \gamma = 0$, then $\cos 3\alpha + 8\cos 3\beta + 27\sin 3\gamma =$

A. 0

B. 3

C. 8

D. - 18

Answer: a

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16. Sum of the series $\sum_{r=0}^{n} (-1)^r \wedge nC_r\left[i^{5r} + i^{6r} + i^{7r} + i^{8r}\right]$ is

A. 2^n

B. $2^{n/2+1}$

C. $n^n + 2^{n/2+1}$

D. $2^n + 2^{n/2+1}\dfrac{\cos(n\pi)}{4}$

Answer: d

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17. If $az_1 + bz_2 + cz_3 = 0$ for complex numbers z_1, z_2, z_3 and real numbers a,b,c then z_1, z_2, z_3 lie on a

A. straight line

B. circle

C. depends on the choice of a,b,c

D. none of these

Answer: c

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18. If $2z_1 - 3z_2 + z_3 = 0$, then z_1, z_2 and z_3 are represented by

A. three vertices of a triangle

B. three collinear points

C. three vertices of a rhombus

D. none of these

Answer: B

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19. $Re\left(\frac{z+4}{2z-1}\right) = \frac{1}{2}$, then z is represented by a point lying on

A. a circle

B. an ellipse

C. a straight line

D. none of these

Answer: C

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20. The vertices of a square are z_1, z_2, z_3 and z_4 taken in the anticlockwise order, then $z_3 =$

A. $z_1 + z_2 + z_3 + z_4 = 0$

B. $z_1 + z_2 = z_3 + z_4$

C. $\text{amp}\left(\frac{z_2 - z_4}{z_1 - z_3}\right) = \frac{\pi}{2}$

D. $\text{amp}\frac{z_1 - z_2}{z_3 - z_4} = \frac{\pi}{2}$

Answer: c

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21. Let $\lambda \in R$. If the origin and the non-real roots of $2z^2 + 2z + \lambda = 0$ form the three vertices of an equilateral triangle in the Argand lane, then λ is 1 b. $\frac{2}{3}$ c. 2 d. - 1

A. 1

B. 2

C. - 1

D. none of these

Answer: d

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22. if the complex no z_1, z_2 and z_3 represents the vertices of an equilateral triangle such that $|z_1| = |z_2| = |z_3|$ then relation among z_1, z_2 and z_3

A. $z_2 + z_2 + z_3 = 0$ and $z_1 z_2 z_3 = 1$

B. $z_1 + z_2 + z_3 = 1$ and $z_1 z_2 z_3 = 1$

C. $z_1 z_2 + z_2 z_3 + z_3 z_1 = 0$ and $z_1 + z_2 + z_3 = 0$

D. $z_1 z_2 + z_2 z_3 + z_3 z_1 = 0$ and $z_1 z_2 z_3 = 1$

Answer: a

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23. If P, P' represent the complex number z_1 and its additive inverse respectively, then the equation of the circle with PP' as a diameter is

A. $\frac{z}{z_1} = \frac{\bar{z}_1}{z}$

B. $z\bar{z} + z_1\bar{z}_1 = 0$

C. $z\bar{z}_1 + \bar{z}z_1 = 0$

D. none of these

Answer: a

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24. Let $A(z_1), B(z_2), C(z_3)$ be the vertices of an equilateral triangle ABC in the Argand plane, then the number $\frac{z_2 - z_3}{2z_1 - z_2 - z_3}$, is

A. purely real

B. purely imaginary

C. a complex number with non-zero and imaginary parts

D. none of these

Answer: b

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25. The area of the triangle (in square units) whose vertices are i, ω and ω^2 where $i = \sqrt{-1}$ and ω, ω^2 are complex cube roots of unity, is

A. $\frac{3\sqrt{3}}{2}$

B. $\frac{3\sqrt{3}}{4}$

C. 0

D. $\frac{\sqrt{3}}{4}$

Answer: d

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26. The complex number z satisfying $|z + 1| = |z - 1|$ and arg $\frac{z - 1}{z + 1} = \frac{\pi}{4}$, is

A. $\left(\sqrt{2} + 1\right) + 0i$

B. $0 + \left(\sqrt{2} + 1\right)i$

C. $0 + \left(\sqrt{2} - 1\right)i$

D. $\left(-\sqrt{2}+1\right)+0i$

Answer: B

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27. If A,B,C are three points in the Argand plane representing the complex numbers, z_1, z_2, z_3 such that $z_1 = \frac{\lambda z_2 + z_3}{\lambda + 1}$, where $\lambda \in R$, then the distance of A from the line BC, is

A. λ

B. $\frac{\lambda}{\lambda + 1}$

C. 1

D. 0

Answer: d

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28. If $z\left(\overline{z+\alpha}\right)+\bar{z}(z+\alpha)=0$, where α is a complex constant, then z is represented by a point on

A. a circle

B. a straight line

C. a parabola

D. none of these

Answer: A

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29. Let A,B,C be three collinear points which are such that AB.AC=1 and the points are represented in the Argand plane by the complex numbers, 0, z_1 and z_2 respectively. Then,

A. $z_1z_2=1$

B. $z_1\bar{z}_2=1$

C. $\left|z_1\right|\left|z_2\right| = 1$

D. $z_1 = \bar{z}_2|$

Answer: b

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30. If z_1, z_2, z_3, z_4 are the four complex numbers represented by the vertices of a quadrilateral taken in order such that $z_1 - z_4 = z_2 - z_3$ and $\text{amp}\frac{z_4 - z_1}{z_2 - z_1} = \frac{\pi}{2}$ then the quadrilateral is a

A. a rhombus

B. a square

C. a rectangle

D. not a cyclic quadrilateral

Answer: c

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31. If z be a complex number, then

$|z - 3 - 4i|^2 + |z + 4 + 2i|^2 = k$ represents a circle, if k is equal to

A. 30

B. 40

C. 55

D. 35

Answer: c

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32. In Argand diagram, O, P, Q represent the origin, z and z+ iz respectively then $\angle OPQ$=

A. $\frac{\pi}{4}$

B. $\frac{\pi}{3}$

C. $\frac{\pi}{2}$

D. $\frac{2\pi}{3}$

Answer: c

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33. If $\frac{2z_1}{3z_2}$ is purely imaginary number, then $\left|\frac{z_1 - z_2}{z_1 + z_2}\right|^4$ is equal to

A. $3/2$

B. 1

C. $2/3$

D. $4/9$

Answer: B

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34. If ω is a cube root of unity then find the value of

$$\sin\left(\left(\omega^{10} + \omega^{23}\right)\pi - \frac{\pi}{4}\right)$$

A. $\frac{1}{\sqrt{2}}$

B. $\frac{\sqrt{3}}{2}$

C. $-\frac{1}{\sqrt{3}}$

D. $-\frac{\sqrt{3}}{2}$

Answer: A

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35. If center of a regular hexagon is at the origin and one of the vertices on the Argand diagram is $1 + 2i$, then its perimeter is `

A. $2\sqrt{5}$

B. $6\sqrt{2}$

C. $4\sqrt{5}$

D. $6\sqrt{5}$

Answer: D

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36. If $z^2 + (p + iq)z + (r + is) = 0$, where,p,q,r,s are non-zero, has real roots, then

A. $pqs = s^2 + q^2 r$

B. $pqr = r^2 + p^2 s$

C. $prs = q^2 + r^2 p$

D. $qrs = p^2 + s^2 q$

Answer: A

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37. Let z_1, z_2, z_3 be three vertices of an equilateral triangle circumscribing the circle $|z| = \frac{1}{2}$,if $z_1 = \frac{1}{2} + \sqrt{3}\frac{i}{2}$ and z_1, z_2, z_3 are in anticlockwise sense then z_2 is

A. $1 + i\sqrt{3}$

B. $1 - i\sqrt{3}$

C. 1

D. -1

Answer: D

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38. If ω is the complex cube root of unity, then the value of

$\omega + \omega^{\frac{1}{2} + \frac{3}{8} + \frac{9}{32} + \frac{27}{128} + \dots \dots \dots \dots}$,

A. -1

B. 1

C. - i

D. i

Answer: A

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39. the locus of $z = i + 2\exp\left(i\left(\theta + \frac{\pi}{4}\right)\right)$ is

A. a circle

B. an ellipse

C. a parabola

D. hyperbola

Answer: A

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40. If z lies on the circle $|z - 1| = 1$, then $\frac{z - 2}{z}$ is

A. purely real

B. Purely imaginary

C. positive real

D. hyperbola

Answer: B

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41. If $a > 0$ and the equation $\left|z - a^2\right| + |z - 2a| = 3$, represents an ellipse, then 'a' belongs to the interval

A. (1,3)

B. $\left(\sqrt{2}, \sqrt{3}\right)$

C. (0,3)

D. $\left(1, \sqrt{3}\right)$

Answer: C

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42. For any complex number z, find the minimum value of $|z| + |z - 2i|$

A. 0

B. 1

C. 2

D. 4

Answer: C

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43. Find the greatest and the least value of $\left|z_1 + z_2\right|$ if $z_1 = 24 + 7iand\left|z_2\right| = 6.$

A. 31,19

B. 25,16

C. 31,25

D. 19,16

Answer: a

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44. For all complex numbers z_1, z_2 satisfying $\left|z_1\right| = 12 \text{ and } \left|z_2 - 3 - 4i\right| = 5$, the minimum value of $\left|z_1 - z_2\right|$ is

A. 0

B. 2

C. 7

D. 17

Answer: B

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45. If $k > 1$, $|z_1| < k$ and $\left|\frac{k - z_1\bar{z}_2}{z_1 - kz_2}\right| = 1$, then

A. $|z_2| < k$

B. $|z_2| = k$

C. $z_2 = 0$

D. $|z_2| = 1$

Answer: d

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46. If $|z - i| = 1$ and arg (z) $= \theta$ where $0 < \theta < \frac{\pi}{2}$, then $\cot\theta - \frac{2}{z}$ equals

A. $2i$

B. $-i$

C. i

D. $1 + i$

Answer: C

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47. If $Re(z) < 0$ then the value of $\left(1 + z + z^2 + \ldots . + z^n\right)$ cannot exceed

A. $\left|z^n\right| - \frac{1}{|z|}$

B. $n|z|^n + 1$

C. $|z|^n - \frac{1}{|z|}$

D. $|z|^n + \frac{1}{|z|}$

Answer: d

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48. Let z_1, z_2, z_3 be three complex numbers satisfying $\frac{1}{z_1} + \frac{1}{z_2} + \frac{1}{z_3} = 0.$ Let $z_k = r_k\left(\cos\alpha_k + i\sin\alpha_k\right)$ and $\omega_k = \frac{\cos 2\alpha_k + i\sin 2\alpha_k}{z_k}$ for $k = 1, 2, 3.$ If ω_1, ω_2 and ω_3 are the affixes of points A_1, A_2 and A_3 respectively in the Argand plane, then $\Delta A_1A_2A_3$ has its

A. incenter at the origin

B. centroid at the origin

C. circumcenter at the origin

D. orthocenter at the origin

Answer: b

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49. a and b are real numbers between 0 and 1 such that the points $z_1 = a + i, z_2 = 1 + bi, z_3 = 0$ form an equilateral triangle, then a and b are equal to

A. $a = \sqrt{3} - 1, b = \frac{\sqrt{3}}{2}$

B. $a = 2 - \sqrt{3}, b = 2 - \sqrt{3}$

C. $a = 1/2, b = 3/4$

D. none of these

Answer: B

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50. If ω is a cube root of unity, then find the value of the following: $\frac{a + b\omega + c\omega^2}{b + c\omega + a\omega^2} + \frac{a + b\omega + c\omega^2}{b + c\omega + a\omega^2}$

A. 1

B. 0

C. -1

D. 2

Answer: D

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51. If a, b, c and u, v, w are the complex numbers representing the vertices of two triangles such that $(c = (1 - r)a + rb$ and $w = (1 - r)u + rv,$ where r is a complex number, then the two triangles

A. have the same area

B. are similar

C. are congruent

D. none of these

Answer: B

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52. If $z = re^{i}\theta$ then $\left|e^{iz}\right|$ is equal to:

A. $e^{-r\sin\theta}$

B. $re^{-r\sin\theta}$

C. $e^{-r\cos\theta}$

D. $re^{-r\cos\theta}$

Answer: A

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53. If a complex number z lies in the interior or on the boundary of a circle or radius 3 and center at $(-4, 0)$, then the greatest and least values of $|z+1|$ are

A. 5,0

B. 6,1

C. 6,0

D. none of these

Answer: C

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54. Let z_1 and z_2 be two non - zero complex numbers such that $\frac{z_1}{z_2} + \frac{z_2}{z_1} = 1$ then the origin and points represented by z_1 and z_2

A. z_1, z_2 are collinear

B. z_1, z_2 are the origin from a right angled triangle

C. z_1, z_2 and the origin form an equilateral triangle

D. none of these

Answer: c

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55. If z_1, z_2, z_3 be vertices of an equilateral triangle occurig in the anticlockwise sense, then

A. $z_1^2 + z_2^2 + z_3^2 = 2(z_1z_2 + z_2z_3 + z_3z_1)$

B. $\dfrac{1}{z_1 + z_2} + \dfrac{1}{z_2 + z_3} + \dfrac{1}{z_3 + z_1} = 0$

C. $z_1 + \omega z_2 + \omega^2 z_3 = 0$

D. none of these

Answer: C

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56. Let z be a complex number satisfying $|z - 5i| \leq 1$ such that $amp(z)$ is minimum, then z is equal to

A. $\dfrac{2\sqrt{6}}{5} + \dfrac{24i}{5}$

B. $\dfrac{24}{5} + \dfrac{2\sqrt{6}i}{5}$

C. $\frac{2\sqrt{6}}{5} - \frac{24i}{5}$

D. none of these

Answer: A

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57. If $|z - 25i| \leq 15.$ then $|\text{maximum } arg(z) - \text{minimum } arg(z)|$ equals

A. $\cos^{-1}\left(\frac{3}{5}\right)$

B. $\pi - 2\cos^{-1}\left(-\frac{3}{5}\right)$

C. $\frac{\pi}{2} + \cos^{-1}\left(\frac{3}{5}\right)$

D. none of these

Answer: B

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58. Let z be a complex number (not lying on x-axis) of maximum modulus such that $\left|z + \frac{1}{z}\right| = 1$. Then,

A. Im(z)=0

B. Re(z)=0

C. amp(z)=π

D. Re(z)=1

Answer: b

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59. The maximum distance from the origin of coordinates to the point z satisfying the equation $\left|z + \frac{1}{z}\right| = a$ is

A. $\frac{1}{2}\left(\sqrt{a^2 + 1} + a\right)$

B. $\frac{1}{2}\left(\sqrt{a^2 + 2} + a\right)$

C. $\frac{1}{2}\left(\sqrt{a^2+4}+a\right)$

D. $\frac{1}{2}\left(\sqrt{a^2+1}-a\right)$

Answer: c

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