MATHS

BOOKS - ML KHANNA

COMPLEX NUMBERS

Problem Set (1) (M.C.Q)

1. Which of the following is correct ?

A. $2 + 3i > 1 + 4i$

B. $6 + 2i > 3 + 3i$

C. $5 + 8i > 5 + 7i$

D. none of these

Answer: D

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2. The argument of $\left(1+i\sqrt{3}\right)/\left(1-i\sqrt{3}\right)$ is

A. 60°

B. 120°

C. 210°

D. 240°

Answer: D

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3. The value of i^{i}, is

A. ω

B. $-\omega^{2}$

C. $\pi/2$

D. none of these

Answer: D

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4. The argument of the complex number z $= \frac{\left(1+i\sqrt{3}\right)^2}{4i\left(1-i\sqrt{3}\right)}$

A. $\pi/6$

B. $\pi/4$

C. $\pi/2$

D. none of these

Answer: C

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5. If $z_1 = \frac{\left(\sqrt{3}+i\right)^2\left(1-\sqrt{3}i\right)}{1+i}$ and $z_2 = \frac{\left(1+\sqrt{3}i\right)^2\left(\sqrt{3}-i\right)}{1-i}$

then

A. $ampz_1 + ampz_2 = 0$

B. $3(ampz_1) + ampz_2 = 0$

C. $|z_1| = |z_2|$

D. $3|z_1| = |z_2|$

Answer: B::C

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6. If $x + iy = \sqrt{\frac{a+ib}{c+id}}$, then $\left(x^2+y^2\right)^2$ is equal to

A. $\frac{a^2+b^2}{c^2+d^2}$

B. $\frac{c^2+d^2}{a^2+b^2}$

C. $\frac{a^2-b^2}{c^2-d^2}$

D. none

Answer: A

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7. If $\frac{x+i}{x-i}=a+ib$, then $a^2+b^2=$

A. x^2

B. $-x^2$

C. 1

D. -1

Answer: C

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8. The conjugate of a complex number is $\frac{1}{i-1}$. Then the complex number is (1) $\frac{-1}{i-1}$ (2) $\frac{1}{i+1}$ (3) $\frac{-1}{i+1}$ (4) $\frac{1}{i-1}$

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

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

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

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

Answer: C

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9. If $z = 1 - i\sqrt{3}$, then | arg z| + $|arg\bar{z}|$ equals

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

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

C. 0

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

Answer: B

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10. The amplitude of $\frac{1+i\sqrt{3}}{\sqrt{3}+i}$ is $\frac{\pi}{3}$ b. $-\frac{\pi}{6}$ c. $\frac{\pi}{3}$ d. $\frac{\pi}{6}$

A. $\pi/6$

B. $\pi/4$

C. $\pi/3$

D. none of these

Answer: C

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11. arg $\frac{i\left(\sqrt{3}+i\right)^{6}}{4\left(1-i\sqrt{3}\right)^{2}}$ is equal to

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

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

C. $\frac{3\pi}{12}$

D. $\frac{5\pi}{10}$

Answer: B

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12. For any integer n, arg of

z $= \frac{\left(\sqrt{3}+i\right)^{4n+1}}{\left(1-i\sqrt{3}\right)^{4n}}$ is

A. $\pi/6$

B. $\pi/3$

C. $\pi/2$

D. $2\pi/3$

Answer: A

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13. The real value of θ for which the expression $\frac{1 - i\sin\theta}{1 + 2i\sin\theta}$ is purely real is

A. $n\pi$

B. $(n+1)\pi/2$

C. $(2n+1)\pi/2$

D. None

Answer: A

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14. If $z = \frac{\left(\sqrt{3}+i\right)^{17}}{(1-i)^{50}}$, then find $amp(z)\cdot$

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

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

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

D. none of these

Answer: C

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15. If $a, b, \in R \text{ then } |e^{a+ib}|$

A. e^a

B. e^b

C. 1

D. None

Answer: A

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16. The argument of the complex number $z = (1 + i\sqrt{3})(1+i)(\cos\theta + i\sin\theta) is 7\frac{\pi}{2} + \theta$

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

B. $\frac{\pi}{4} + \theta$

C. $\frac{7\pi}{12} + \theta$

D. none

Answer: C

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17. The modulus of the complex number $z = \frac{\left(1 - i\sqrt{3}\right)(\cos\theta + i\sin\theta)}{2(1-i)(\cos\theta - i\sin\theta)}$

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

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

C. $\frac{1}{\sqrt{3}}$

D. none of these

Answer: A

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18. $\frac{\left(-1+i\sqrt{3}\right)^{15}}{(1-i)^{20}}+\frac{\left(-1-i\sqrt{3}\right)^{15}}{(1+i)^{20}}$ is equal to

A. 32

B. 64

C. -64

D. none of these

Answer: A

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19. If $27iz^3 + 18z^2 - 12z + 8i = 0,$ then |z| =

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

B. $\frac{4}{9}$

C. 1

D. none

Answer: B

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20. In a geometrical progression first term and common ratio are both $\frac{1}{3}\left(1\sqrt{3} + i\right)$. Then the absolute value of the nth term of the progression is

A. 2^n

B. 4^n

C. 1

D. none of these

Answer: C

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21. $e^{2ni\cot^{-1}(x)}\left[\frac{xi+1}{xi-1}\right]^{n}$

where n and x are real numbers, is equal to

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

B. $\frac{(n+1)}{2}$

C. 1

D. e^{ix}

Answer: C

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22. If α and β are different complex number of with $|\beta| = 1$, then $\left|\frac{\beta - \alpha}{1 - \overline{\alpha}\beta}\right|$ is equal to

A. 0

B. $1/2$

C. 1

D. 2

Answer: C

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23. The complex numbers sin x - icos 2x and cos x - isin 2x are conjugate to each other for

A. $x = n\pi$

B. $x = \left(n + \frac{1}{2}\right)\pi$

C. $x = 0$

D. no value of x

Answer: D

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24. If $-3 + ix^2y$ and $x^2 + y + 4i$ be conjugate complex, then (x, y) is

A. (1, - 4)

B. (-1, - 4)

C. (2, 1)

D. (-2, 1)

Answer: A::B

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25. Let $z = x + iy$ be a complex number where $x and y$ 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. 32

C. 40

D. 80

Answer: A

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26. If

$(a_1 + ib_2)(a_2 + ib_2)\ldots(a_n + ib_n) = A + iB, \quad \text{then} \quad (a_1^2 + b_1^2)(a_2^2 + b_2^2)\ldots$

is equal to

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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27. If $\infty(a_1 + ib_1)(a_2 + ib_2)\ldots\ldots\ldots\ldots\ldots\ldots(a_n + ib_n) = A + iB$, then $\sum_{i=1}^{n} \tan^{-1}\left(\frac{b_i}{a_i}\right)$ is equal to

A. $\frac{B}{A}$

B. $\tan\frac{B}{A}$

C. $\tan^{-1}\frac{B}{A}$

D. $\tan^{-1}\frac{A}{B}$

Answer: C

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

A. $\frac{\pi}{3}+2n\pi, n\in Z$

B. $n\pi+\frac{\pi}{6}, n\in Z$

C. $n\pi-\frac{\pi}{3}, n\in Z$

D. $2n\pi-\frac{\pi}{3}, n\in Z$

Answer: B

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29. Let z be a complex number such that $\left|z+\frac{1}{z}\right|=2$ If |z| $=r_1$ and r_2 for arg $z=\frac{\pi}{4}$ than

$|r_1-r_2|$ =

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

B. 1

C. $\sqrt{2}$

D. 2

Answer: C

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30. Let z be a complex number such that $\left|z+\frac{1}{z}\right|=2$ If |z| $=r_1$ and r_2 for arg $z=\frac{\pi}{4}$ than

As arg z varies $|r_1-r_2|=$

A. [0,2]

B. [0,1]

C. $\left[\frac{1}{\sqrt{2}}, \sqrt{2}\right]$

D. [1,2]

Answer: A

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31. Let z_1, z_2 be two complex numbers such that $|z_1 + z_2| = |z_1| + |z_2|$.

Then,

A. $arg(z_1) = arg(z_2)$

B. $arg(z_1) + arg(z_2) = 0$

C. $arg\left(\frac{z_1}{z_2}\right) = 0$

D. none of these

Answer: A::C

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32. For any two complex numbers z_1, z_2 we have $|z_1 + z_2|^2 = |z_1|^2 + |z_2|^2$. Then

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

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

C. $Re(z_1 z_2) = 0$

D. $Im(z_1 z_2) = 0$

Answer: A

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33. If $|z_1 + z_2| = |z_1 - z_2|$, the difference in the amplitudes of z_1 and z_2 is

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

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

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

D. none

Answer: B

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34. If z_1 and z_2 be two complex numbers such that $|z_1 - z_2| = |z_1| - |z_2|$, then arg $\frac{z_1}{z_2}$ is

A. $\pi/4$

B. $\pi/2$

C. 0

D. none

Answer: C

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

A. 1

B. 2

C. ∞

D. 0

Answer: A

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36. If for complex numbers z_1 and z_2, arg $z_1 - \arg(z_2) = 0$ then $|z_1 - z_2|$ 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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37. If $z_1 z_2$ are two complex numbers such that Im $(z_1 + z_2) = 0,$ Im $(z_1 z_2)$ = 0 then

A. $z_1 = -z_2$

B. $z_1 = z_2$

C. $z_1 = \overline{z_2}$

D. none of these

Answer: C

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38. If arg $z = \pi / 4$

A. $Rez^2 = Imz^2$

B. $Imz^2 = 0$

C. $Rez^2 = 0$

D. none of these

Answer: C

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39. The point z_1, z_2, z_3, z_4 in the complex plane are the vertices of a parallogram taken in order, if and only if.

$(1) z_1 + z_4 = z_2 + z_3$ (2) $z_1 + z_3 = z_2 + z_4$

(3) $z_1 + z_2 = z_3 + z_4$ (4) $z_1 + z_3 \neq z_2 + z_4$

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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40. The complex numbers z_1, z_2, z_3 are the vertices of a triangle . Then the complex numbers z which make the triangle into a parallelogram is

A. $z_1 + z_2 - z_3$

B. $z_2 + z_3 - z_1$

C. $z_3 + z_1 - z_2$

D. none

Answer: A::B::C

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41. The complex number z_1, z_2, z_3 are the vertices A, B, C of a parallelogram ABCD, then the fourth vertex D is:

A. $\frac{1}{2}(z_1 + z_2)$

B. $\frac{1}{4}(z_1 + z_2 + z_3 + z_4)$

C. $\frac{1}{2}(z_1 + z_2 + z_3)$

D. $z_1 + z_3 - z_2$

Answer: D

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42. If $z \neq 0, z' \neq 0$ be any two complex numbers such that $|z| = |z'| = 1$ and arg z = - arg z' then zz' =

A. 1

B. -1

C. 2

D. none

Answer: A

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43. If z ans w are two non-zero complex numbers such that $|zw| = 1$ and arg (z) = arg (w) $= \frac{\pi}{2}$, $\bar{z}w$ is equal to

A. 1

B. -1

C. i

D. $-i$

Answer: D

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44. Let $zandw$ be two non-zero complex number such that $|z| = |w|$ and $arg(z) + arg(w) = \pi$, then z equals. w (b) $-w$ (c) w (d) $-w$

A. w

B. $-w$

C. $\overline{w}$

D. $-\overline{w}$

Answer: D

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45. If z_1, z_2 are conjugate complex numbers, and z_3, z_4 are also conjugate, then arg $\frac{z_3}{z_2}$

A. $arg\frac{z_1}{z_4}$

B. $arg\frac{z_4}{z_1}$

C. $arg\frac{z_2}{z_4}$

D. $arg\frac{z_1}{z_3}$

Answer: A

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46. 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. none

Answer: B

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47. (z_1, z_2) and (z_3, z_4) are two pairs of conjugate complex numbers then arg $\frac{z_1}{z_3} + arg\frac{z_2}{z_4}$ is equal to

A. 0

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

C. π

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

Answer: A

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48. If $arg\left(z^{1/3}\right) = \frac{1}{2}arg\left(z^2 + \bar{z}z^{1/3}\right)$ then | z| =

A. 4

B. 3

C. 2

D. 1

Answer: D

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49. $\sqrt{2i}$ equals

A. $1 + i$

B. $1 - i$

C. $-\sqrt{2}i$

D. none of these

Answer: A

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50. If $arg(z) < 0,$ then find $arg(-z) - arg(z)$.

A. π

B. $-\pi$

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

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

Answer: A

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51. Let z and ω be be complex numbers such that $\bar{z} + i\omega = 0$ and $arg z\omega = \pi$ then arg z =

A. $\pi/4$

B. $\pi/2$

C. $3\pi/4$

D. $5\pi/4$

Answer: C

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52. If the complex numbers $z_1, z_2, z - (3)$ are in AP, then they lie on

A. circle

B. Parabola

C. line

D. ellipse

Answer: C

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53. If z_1, z_2, z_3 are in H.P., they lie on a

A. circle

B. sphere

C. straight line

D. none of these

Answer: C

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54. Given that e^{iA}, e^{iB}, e^{iC} are in A.P., where A, B, C are angles of a triangle then the triangle is

A. isosceles

B. equilateral

C. right angled

D. none

Answer: B

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

A. a circle of radius 1 unit

B. a straight line

C. the ordered pair (0,0)

D. none of these

Answer: C

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56. If $2|z-1|=|z-2|$ and if $x^2+y^2=\lambda x, \text{then} \quad \lambda =$

A. $1/3$

B. $2/3$

C. $4/3$

D. none

Answer: C

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57. If $|(z-2)/(z-3)|=2$ represents a circle, then find its radius.

A. 1

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

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

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

Answer: D

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58. The complex number z satisfying $|z-1| = |z-3| = |z-i|$ is

A. 2 +i

B. $\frac{3}{2} + \frac{1}{2}i$

C. $2 + 2i$

D. none of these

Answer: C

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59. The two complex numbers satisfying the equation

$z\bar{z}-(1+i)z-(3+2i)\bar{z}+(1+5i)=0$ are

A. $1+i, e-2i$

B. $1+i, 3+2i$

C. $1-i, 3+2i$

D. $1-i, 3-2i$

Answer: C

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60. If z_1 and z_2 are two complex numbers satisfying the equation

$$\left|\frac{z_1+z_2}{z_1-z_2}\right|=1$$

then z_1/z_2 is a number which is

A. positieve real

B. negative real

C. zero

D. purely imaginary

Answer: C::D

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61. 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. $z_1 = \lambda z_2$

B. $z_1 = i\lambda z_2$

C. $z_1 = z_2$

D. none

Answer: B

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

A. tan (arg z)

B. cot (arg z)

C. i tan (arg z)

D. none

Answer: C

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63. Angle subtended by chord of a circle at the centre is twice the angle subtended at the circumference . If OP is rotated through an angle ϕ in anti - clockwise direction to become OQ then $OQ = OPe^{i\phi}$

If $|z-3|=3 \text{ then } \frac{z-6}{z}$ is equal to

A. i tan (arg z)

B. i cot (arg z)

C. cot (arg z)

D. tan [arg (z - 3)]

Answer: A

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64. Angle subtended by chord of a circle at the centre is twice the angle subtended at the circumference . If OP is rotated through an angle ϕ in anti - clockwise direction to become OQ then $OQ = OPe^{i\phi}$

If $z_1 = 10 + 6i, z_2 = 4 + 2i$ such that arg $\left(\frac{z - z_1}{z - z_2}\right) = \frac{\pi}{4}$, then find the centre and radius of the locus of complex numbers z

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65. Angle subtended by chord of a circle at the centre is twice the angle subtended at the circumference . If OP is rotated through an angle ϕ in anti - clockwise direction to become OQ then $OQ = OPe^{i\phi}$

If ω is a complex number such that $|\omega| = r \neq 1$ then $z = \omega + \frac{1}{\omega}$ describes a conic. The distance between the foci is

A. 2

B. $2(\sqrt{2} - 1)$

C. 3

D. 4

Answer: D

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

A. $|a|^2 = b$

B. $|a^2| > b$

C. $|a|^2 < b$

D. none of these

Answer: B

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67. 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. $7/5$

C. $25/49$

D. none of these

Answer: D

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68. If $\omega=\left(\frac{z-i}{1+iz}\right)^n$ n integral, then ω lies on the unit circle for

A. only even n

B. only odd n

C. only positive n

D. all n

Answer: D

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69. If $\left(\frac{1+i}{1-i}\right)^{x}=1$ then (A) $x=2n+1$, where n is any positive ineger (B) $x=3n, wherenisanypositive \int e \geq r(C)$x=2n $wherenisanypositive \int e \geq r(D)$x=4n+1` where n is any positive integer

A. 4 n

B. 4 n + 1

C. 2 n

D. 2 n + 1

Answer: A

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

A. z lies on the imaginary axis

B. z lies on the real axis

C. z lies on the axis

D. none of these

Answer: B

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71. If $|z^2 = 1| = |z|^2 + 1$, then show that z lies on the imaginary axis.

A. real axis

B. imag. Axis

C. circle

D. ellipse

Answer: B

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72. If z = x + iy , then | 3z - 1| = 3 | z - 2| represents

A. x- axis

B. y - axis

C. circle

D. $x = \frac{7}{6}$

Answer: D

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73. If $|z| = 1 and z \ne \pm 1,$ 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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74. If $|z + \bar{z}| = |z - \bar{z}|$, then the locus of z is

A. a pair of straight lines

B. a rectangular hyperbola

C. a line

D. a set of four lines

Answer: A

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75. 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: B

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

A. 4

B. 10

C. 6

D. 0

Answer: C

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77. If $|z_1| = |z_2| = \dot{=} |z_n| = 1,$ prove that $|z_1 + z_2 + z_3 + \; + z_n| = \frac{1}{z_1} + \frac{1}{z_2} + \frac{1}{z_3} + \; + \frac{1}{z_n}.$

A. n

B. $\left|\frac{1}{z_1} + \frac{1}{z_2} + \ldots + \frac{1}{z_n}\right|$

C. 0

D. none of these

Answer: B

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78. if $z_1, z_2, z_3, \ldots . z_n$ are complex numbers such that $|z_1| = |z_2| = \ldots. = |z_n| = \left|\frac{1}{z_1} + \frac{1}{z_2} + \frac{1}{z_3} + \ldots. + \frac{1}{z_n}\right| = 1$

Then show that $|z_1 + z_2 + z_3 + \ldots\ldots + z_n| = 1$

A. equal to 1

B. less than 1

C. greater than 3

D. equal to 3

Answer: A

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79. If $z = re^{i\theta}$, then prove that $|e^{iz}| = e^{-rs \int h\eta.}$

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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80. 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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81. The locus of the points representing the complex numbers z for which $|z| - 2 = |z - i| - |z + 5i| = 0$, is

A. a circle with centre at origin

B. a straight line passing through origin

C. the single point (0,-2)

D. none of these

Answer: C

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82. The points representing the complex numbers z for which $|z + 3i|^2 - |z - 3|^2 = 6$ lie on the line given by

A. x + y = 1

B. x + y = - 1

C. x + y = 2

D. x + y = 0

Answer: A

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83. If $u = \frac{2z + 5i}{z - 3}$ and | u| = 2 , then locus of z is a

A. straight line

B. circle

C. parabola

D. none

Answer: A

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84. If $w = z/[z - (1/3)i] and |w| = 1,$ then find the locus of z.

A. line

B. Parabola

C. circle

D. ellipse

Answer: A

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85. If n is a positive integer greater than unity and z is a complex number satisfying the equation $z^n = (z+1)^n$ then

A. $Re(z) < 0$

B. $Re(z) > 0$

C. $Re(z) = 0$

D. z lies on x = - 1//2

Answer: A::D

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

A. |z| = 1

B. $|z| = 1, Re(z) > 0$

C. $|z| = 1, Re(z) < 0$

D. none of these

Answer: A

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87. 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: C

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

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

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

C. $\dfrac{\sqrt{2}}{(|z+1|)^2}$

D. 0

Answer: D

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89. If arg $\frac{z-1}{z+1}=\frac{\pi}{4}$ then the locus of z is

A. straight line

B. circle

C. ellipse

D. hyperbola

Answer: D

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90. 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: A

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91. Let A, B, C represent the complex numbers z_1, z_2, z_3 respectively on the complex plane. If the circumcentre of the triangle ABC lies at the origin, then the orthocentre is represented by the complex 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. The complex number z = 1 + i is rotated through an angle $3\pi/2$ anticlockwise direction about the origin and stretched by additional $\sqrt{2}$ units, then the new complex number is

A. 2 (1 + i)

B. 2 (1 - i)

C. $\sqrt{2}(1-i)$

D. $-\sqrt{2}(1+i)$

Answer: C

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93. The vector z = - 4 + 5 i is turned counterclockwise through an angle of 180° and stretched $1\frac{1}{2}$ times. The complex number corresponding to newly obtained vector is

A. $6-\frac{15}{2}i$

B. $-6+\frac{15}{2}i$

C. $6+\frac{15}{2}i$

D. none of these

Answer: A

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94. 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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95. If $\frac{\pi}{2} < \theta < \frac{3\pi}{2}$, the modulus and argument form of $(1 + \cos 2\theta) + i \sin 2\theta$ is

A. $-2\cos\theta[\cos(\pi + \theta) + i\sin(\pi + \theta)]$

B. $2\cos\theta[\cos\theta + i\sin\theta]$

C. $2\cos\theta[\cos\theta + i\sin(-\theta)]$

D. $-2\cos\theta\{\cos(\pi - \theta) + i\sin(\pi - \theta)\}$

Answer: A

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96. Let $A_0A_1A_2A_3A_4A_5$ be a regular hexagon inscribed in a circle of unit radius. Then the product of the lengths of the line segments A_0A_1, A_0A_2 and A_0A_4 is

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

B. $3\sqrt{3}$

C. 3

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

Answer: C

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97. If α, β, γ and a, b, c are complex numbers such that $\frac{\alpha}{a}+\frac{\beta}{b}+\frac{\gamma}{c}=1+i$ and $\frac{a}{\alpha}+\frac{b}{\beta}+\frac{c}{\gamma}0$, then the value of $\frac{\alpha^2}{a^2}+\frac{\beta^2}{b^2}+\frac{\gamma^2}{c^2}$ is equal to

A. 0

B. -1

C. 2i

D. $-2i$

Answer: C

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98. If x, y, z are three distinct complex numbers such that $\frac{x}{y-z}+\frac{y}{z-x}+\frac{z}{x-y}=0$ then the value of $\sum\frac{x^2}{(y-z)^2}$ is

A. 2

B. 1

C. -1

D. -2

Answer: A

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99. For any two complex numbers z_1, z_2 and any real numbers $aandb, |az_1-bz_2|^2+|bz_1+az_2|^2=$

A. $(a+b)\left(|z_1|^2+|z_2|^2\right)$

B. $(a^2+b^2)\left(|z|^2+|z_2|^2\right)$

C. $(a^2+b^2)(|z_1|+|z_2|)$

D. none of these

Answer: B

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100. z_1 and z_2 are two complex numbers with different moduli, then $\left|\sqrt{3}z_1+i\sqrt{2}z_2\right|^2+\left|\sqrt{2}z_1+i\sqrt{3}z_2\right|^2$ is equal to

A. 0

B. $2|z_1|^2+3|z_2|^2$

C. $<5\left(|z_1|^2+|z_2|^2\right)$

D. $>10|z_1z_2|$

Answer: D

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101. 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. none

Answer: B

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102. For any three complex numbers z_1, z_2, z_3, if $\Delta = \begin{vmatrix} 1 & z_1 & \overline{z_1} \\ 1 & z_2 & \overline{z_2} \\ 1 & z_3 & \overline{z_3} \end{vmatrix}$, then

A. R.P. of $\Delta = 0$

B. R.P. of $\Delta = -$ ive

C. R.P. of $\Delta = +$ ive

D. none

Answer: A

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103. If z_1, z_2, z_3 are three complex numbers and $A = \begin{vmatrix} \arg z_1 & \arg z_2 & \arg z_3 \\ \arg z_2 & \arg z_3 & \arg z_1 \\ \arg z_3 & \arg z_1 & \arg z_2 \end{vmatrix}$ then A is divisible by

A. arg $(z_1 + z_2 + z_3)$

B. arg $z_1 z_2 z_3$

C. arg $z_1 + arg z_2 + arg z_3$

D. none

Answer: B::C

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104. Let a be a complex number such that $|a| < 1$ and $z_1, z_2 \ldots .$ 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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105. If z_1 and z_2 are two complex number such that $\left|\frac{z_1 - z_2}{1 - z_1 z_2}\right| = 1$ then

A. $|z_1| = 1$

B. $|z_2| = 1$

C. $z_1 = e^{i\theta}, \theta \in R$

D. $z_2 = e^{i\theta}, \theta \in R$

Answer: A::B::C::D

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106. 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) $= \pi$

D. none of these

Answer: B

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107. The maximum distance from the origin of coordinates of 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. none of these

Answer: C

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108. Arg $\frac{z_1}{z_2} = Argz_1 - Argz_2$

$|z| = |a + ib| = \sqrt{(a^2 + b^2)}$

$\tan^{-1} x - \tan^{-1} y = \frac{\tan^{-1}(x - y)}{1 + xy}$

Let $z_1 = 10 + 6i$ and $z_2 = 4 + 6i$. If z is a complex number such that the argument of $(z - z_1) / (z - z_2) is \pi / 4$ then prove that $|z - 7 - 9i| = 3\sqrt{2}$

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109. Arg $\frac{z_1}{z_2} = Argz_1 - Argz_2$

$|z| = |a + ib| = \sqrt{(a^2 + b^2)}$

$\tan^{-1} x - \tan^{-1} y = \frac{\tan^{-1}(x - y)}{1 + xy}$

If arg $\frac{z-2}{z+2} = \frac{\pi}{4}$, then prove that $|z - 2i| = 2\sqrt{2}$

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

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111. Arg $\frac{z_1}{z_2} = Argz_1 - Argz_2$

$|z| = |a + ib| = \sqrt{(a^2 + b^2)}$

$\tan^{-1} x - \tan^{-1} y = \frac{\tan^{-1}(x - y)}{1 + xy}$

Find all complex numbers z for which arg $\left(\frac{3z-6-3i}{2z-8-6i}\right)=\frac{\pi}{4}$ and $|z-3+i|=3$

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112. If z is a complex number which simultaneously satisfies the equations $3|z-12|=5|z-8i|$ and $|z-4|=|z-8|$, where $i=\sqrt{-1}$, then Im(z) can be

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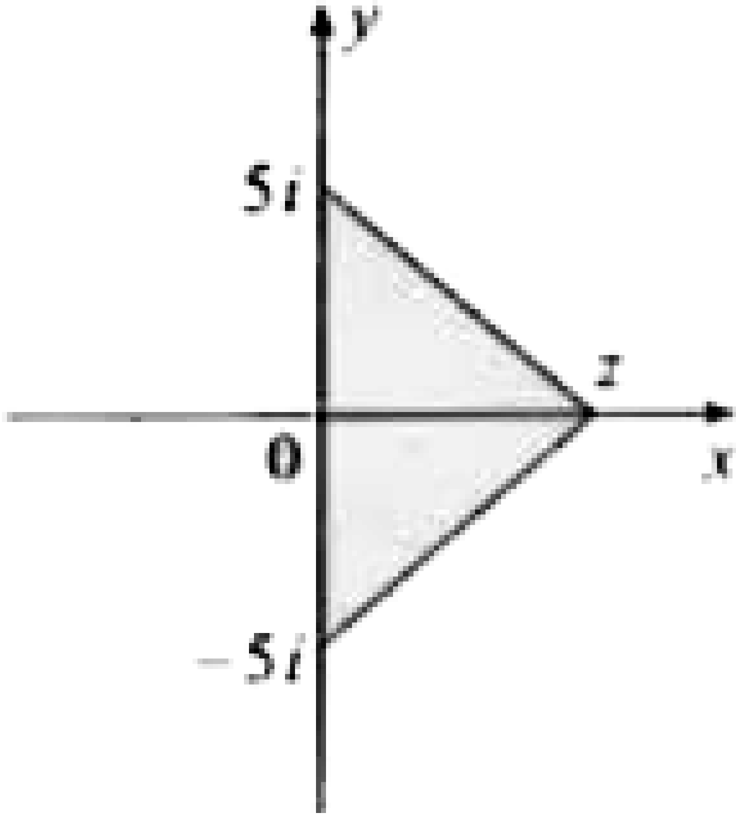
113. The complex numbers z = x + iy which satisfy the equation $\left|\frac{z-5i}{z+5i}\right|=1$, lie on



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Problem Set (1) (True and False)

1. Which of the following statements is false

$|z^2| = |z|^2$

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2. Which of the following statements is false

$|z|^2 = z^2$

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3. For any two non-zero complex numbers z_1, z_2 the inequality

$$(|z_1| + |z_2|)\left|\frac{z_1}{|z_1|} + \frac{z_2}{|z_2|}\right| \leq 2(|z_2| + |z_2|)$$

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4. If $iz^3 + z^2 - z + i = 0$, then $|z|$ is equal to

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5. If x, y, z are three distinct complex numbers and a, b, c are three + ive real numbers satisfying the relation

$$\frac{a}{|y-z|} = \frac{b}{|z-x|} = \frac{c}{|x-y|} \text{ then}$$
$$\frac{a^2}{y-z} + \frac{b^2}{z-x} + \frac{c^2}{x-y} = 0$$

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Problem Set (2) (M.C.Q)

1. $\left(3+\omega+3\omega^2\right)^4$ equals

A. 16

B. 16ω

C. $10\omega^2$

D. none of these

Answer: B

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2. 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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3. If $\omega^3=1$ and $\omega\neq1$ then $(1+\omega)\left(1+\omega^2\right)\left(1+\omega^4\right)\left(1+\omega^5\right)$ is equal to

A. 3

B. -3

C. 9

D. 1

Answer: D

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4. If ω is a cube root of unity, then find the value of the following: $\left(1+\omega-\omega^2\right)\left(1-\omega+\omega^2\right)$

A. 1

B. 0

C. 2

D. 4

Answer: D

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5. If $1, \omega, \omega^2$ be the cube roots of unity, then the value of $(1 - \omega + \omega^2)^5 + (1 + \omega - \omega^2)^5$ is :

A. 4

B. 8

C. 16

D. 32

Answer: D

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6. $1, \omega, \omega^2$ are the cube roots of unity, then the value of $(1 + \omega)^3 - (1 + \omega^2)^3$ is

A. 2ω

B. 2

C. -2

D. 0

Answer: D

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7. If ω complex cube root of unity, then $\left(\frac{1+\omega}{\omega^2}\right)^3$ =

A. 1

B. -1

C. ω

D. ω^2

Answer: B

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8. If ω is complex cube root of unity, then the value of $(1+2\omega)^{-1}+(2+\omega)^{-1}-(1+\omega)^{-1}$ =

A. 2

B. 1

C. 0

D. -1

Answer: C

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

A. 2

B. 3

C. 4

D. 5

Answer: B

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10. If ω imaginary cube root of unity , then $\sin\left\{\left(\omega^{13}+\omega^{20}\right)\pi+\frac{\pi}{4}\right\}$ is equal to

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

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

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

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

Answer: B

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11. If $\sin^{-1}\left\{\frac{1}{2i}(z-3)\right\}$ be the angle of a triangle and if z = x + iy then

A. x = 1, y = 3

B. $x=3, 0<y\leq 2$

C. $x=, y=2$

D. $x+y=1$

Answer: B

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12. $\sin\frac{\pi}{900}\left\{\sum_{r=1}^{10}(r-\omega)\left(r-\omega^2\right)\right\}$ =

A. -1

B. 0

C. 1

D. $\sqrt{3}/2$

Answer: C

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13. The cube roots of unity lie on a circle

A. $z = 1$

B. $|z - 1| = 1$

C. $|z + 1| = 1$

D. $|z - \omega| = 1$

Answer: A

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14. The cube roots of unity

A. are collinear

B. lie on a circle of radius $\sqrt{3}$

C. form an equilateral triangle

D. none of these

Answer: C

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15. The equation $|z-\omega|^2 \pm |z-\omega^2|^2 = \lambda$ represents the equation of a circle with ω, ω^2 as the extremities of a diameter, then λ is

A. $\sqrt{2}$

B. 2

C. 3

D. 4

Answer: C

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16. If α and β are the complex cube roots of unity, then $\alpha^4 + \beta^4 + \alpha^{-1}\beta^{-1}$

A. 1

B. 2

C. 3

D. 0

Answer: D

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17. If $\omega(\neq 1)$ is a cube root of unity, then $(1-\omega+\omega^2)(1-\omega^2+\omega^4)(1-\omega^4+\omega^8)$...upto $2n$ is factors, is

A. 2^n

B. 2^{2n}

C. 0

D. 1

Answer: B

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18. 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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19. If α is a complex number such that $\alpha^2 + \alpha + 1 = 0$, then what is α^{31} equal to ?

A. α

B. α^2

C. 0

D. 1

Answer: A

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20. If α and β are the roots of the equation $x^2 - x + 1 = 0$, then $\alpha^{2009} + \beta^{2009} = -1$ (b) 1 (c) 2 (d) -2

A. -1

B. 1

C. 2

D. -2

Answer: B

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21. The expression $x^{3p}+x^{3q-1}+x^{3r-2}$, where $p, q, r \in N$ is divisible by

A. x^2-x+1

B. x^2+x+1

C. x^2+x-1

D. x^2-x-1

Answer: B

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22. If $f(x)=g(x^3)+xh(x^3)$ is divisiblel by x^2+x+1, then

A. A (x) is divisible by (x - 1)

B. B (x) is divisible by (x - 1)

C. f (x) is divisible by (x - 1)

D. none

Answer: A::B::C

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23. The value of $\sum_{n=1}^{5}\left(x^{n}+\frac{1}{x^{n}}\right)^{2}$ where $x^{2}-x+1=0$ is

A. 0

B. 10

C. 12

D. none

Answer: A

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24. If $t^2 + t + 1 = 0$ then, the value of $\left(t + \frac{1}{t}\right)^2 + \left(t^2 + \frac{1}{t^2}\right)^2 + \ldots + \left(t^{27} + \frac{1}{t^{27}}\right)^2$ is

A. 27

B. 72

C. 45

D. 54

Answer: D

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

A. 6

B. 12

C. 18

D. 54

Answer: B

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26. The common roots of the equation $z^3 + 2z^2 + 2z + 1 = 0 \& z^{1985} + z^{100} + 1 = 0$ are: $1, \omega$ b. $1, \omega^2$ c. ω, ω^2 d. none of these

A. ω, ω^2

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

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

D. $-\omega, -\omega^2$

Answer: A

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27. If the cube roots of unity are $1, \omega, \omega^2,$ then the roots of the equation $(x-1)^3+8=0$ are $-1, 1+2\omega, 1+2\omega^2$ b. $-1, 1-2\omega, 1-2\omega^2$ c. $-1, -1, -1$ d. none of these

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

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

C. $-1, -1, -1$

D. none of these

Answer: B

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28. $\left(\frac{-1+\sqrt{(-3)}}{2}\right)^{100}+\left(\frac{-1-\sqrt{(-3)}}{2}\right)^{100}$ equals

A. 2

B. 0

C. -1

D. 1

Answer: C

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29. $\left(i+\sqrt{3}\right)^{100}+\left(i-\sqrt{3}\right)^{100}+2^{100}=$

A. 1

B. -1

C. 0

D. none

Answer: C

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30. What is the value of :

$$\left(\frac{-1+i\sqrt{3}}{2}\right)^{3n}+\left(\frac{-1-i\sqrt{3}}{2}\right)^{3n}$$

Where, $i=\sqrt{-1}$?

A. 0

B. 1

C. 2

D. 3

Answer: C

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31. 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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32. If $1; w; w^2$ are cube root of unity and n is a positive integer;then $1+w^n+w^{2n}$ = {3; When n is multiple of 3; 0; when n is not a multiple of 3

A. 1

B. -1

C. 0

D. 3

Answer: C

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33. If n is a multiple of 3, then $1+\omega^{n}+\omega^{2n}=$

A. 1

B. 2

C. 3

D. 0

Answer: C

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34. If α, β are the roots of $x^{2}-2x+4=0 \text{ then } \frac{\alpha}{\beta}$ is equal to

A. $\frac{1}{2}\left(1-\sqrt{3i}\right)$

B. $-\frac{1}{2}\left(1+\sqrt{3}\right)$

C. $\frac{1}{2}\left(-1 \pm \sqrt{3i}\right)$

D. $\frac{1}{2}(\sqrt{3}-i)$

Answer: C

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35. 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. $g(1) = \; - h(i)$

D. $g(1) + h(1) = 01$

Answer: A::C::D

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36. If α, β are complex cube roots of unity and $x = a + b, y = a\alpha + b\beta, z = a\beta + b\alpha$, then xyz =

A. $(a + b^3)$

B. $a^3 + b^3$

C. $(a - b)^3$

D. $a^3 - b^3$

Answer: B

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37. If $a + b + c = 0$ and ω, ω^2 are imaginary cube roots of unity, then $(a + b\omega + c\omega^2)^2 + (a + b\omega^2 + c\omega)^3 =$ 3abc (b) 6abc (c) 9 abc (d) 27 abc

A. $(2a + b + c)(2b - c - a)(2c - a - b)$

B. 27abc

C. abc

D. 2abc

Answer: B

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38. If ω is a cube root of unity but not equal to 1, then minimum value of $\left|a+b\omega+c\omega^2\right|$, (where a,b and c are integers but not all equal), is

A. 0

B. $\sqrt{3}/2$

C. 1

D. 2

Answer: C

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39. If $x = a + b, y = a\omega + b\omega^2 ndz = \omega^2 + b\omega,$ prove that $x^3 + y^3 + z^3 = 3(a^3 + b^3)$

A. $3(a^3 + b^3)$

B. $3(a^3 - b^3)$

C. 0

D. $a^3 + b^3 + c^3 - 3abc$

Answer: A

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40. If $x = a + b, y = a\omega + b\omega^2 ndz = \omega^2 + b\omega,$ prove that $x^3 + y^3 + z^3 = 3(a^3 + b^3)$

A. $x \pm y + z \neq 0$

B. $x^2 + y^2 + z^2 = a^2 + b^2$

C. $x^3 + y^3 + z^3 = 3(a^3 + b^3)$

D. $xyz = 2(a^3 + b^3)$

Answer: C

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41. If $\omega \pm 1$ is a cube root of unity, the value of $\frac{a + b\omega + c\omega^2}{b + c\omega + a\omega^2} + \frac{a + b\omega + c\omega^2}{c + a\omega + b\omega^2} = ?$

A. 1

B. 0

C. 2

D. -1

Answer: D

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42. If α, β, γ are the cube roots of $p, p < 0$ then for any x, y and z

$\dfrac{x\alpha + y\beta + z\gamma}{x\beta + y\gamma + z\alpha}$ =

A. 1

B. ω

C. ω^2

D. none

Answer: C

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43. If α, β, γ are cube roots of p lt 0, then for any x , y,z

$\dfrac{\alpha^2, x^2, + \beta^2 y^2 + \gamma^2 z^2}{\beta^2 x^2 + \gamma^2 y^2 + \alpha^2 z^2}$ is

A. 1

B. $\dfrac{\alpha}{\gamma}$

C. $\dfrac{\beta}{\alpha}$

D. $\frac{\gamma}{\beta}$

Answer: B::C::D

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44. The value $\begin{vmatrix} 1+\omega & \omega^2 & -\omega \\ 1+\omega^2 & \omega & -\omega^2 \\ \omega^2+\omega & \omega & -\omega^2 \end{vmatrix}$ is equal to (ω is an imaginary cube root of unity)

A. 0

B. 2ω

C. $2\omega^2$

D. $-3\omega^2$

Answer: D

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45. If ω is imaginary cube root of unity then

$$\Delta = \begin{vmatrix} 1 & 1+i+\omega & \omega \\ 1-i & -1 & \omega-1 \\ -i & -i+\omega^2-1 & -1 \end{vmatrix}$$ is equal to

A. 1

B. ω

C. 1

D. 0

Answer: D

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46. $\begin{vmatrix} 6i & -3i & 1 \\ 4 & 3i & -1 \\ 20 & 3 & i \end{vmatrix}$ = x + iy then (x,y) is

A. x = 3, y = 1

B. x = 1, y = 3

C. x = 0, y = 3

D. x = 0 = y

Answer: D

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47. If α is a root of $x^4 - 1 = 0$ with negative principal argument then the principal argument of $D(\alpha)$ where

$$D(\alpha) = \begin{vmatrix} 1 & 1 & 1 \\ \alpha^n & \alpha^{n+1} & \alpha^{n+3} \\ \frac{1}{\alpha^{n+1}} & \frac{1}{\alpha^n} & 0 \end{vmatrix}$$ is

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

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

C. $-\frac{3\pi}{4}$

D. $\frac{5\pi}{4}$

Answer: C

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48. If ω be complex cube root of unity satisfying the equation $\frac{1}{a+\omega}+\frac{1}{b+\omega}+\frac{1}{c+\omega}=2\omega^2$ and $\frac{1}{a+\omega^2}+\frac{1}{b+\omega^2}+\frac{1}{c+\omega^2}=2\omega$ then $\frac{1}{a+1}+\frac{1}{b+1}+\frac{1}{c+1}$ is equal to

A. 2

B. -2

C. $-1+\omega^2$

D. $-1+\omega$

Answer: A

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49. If $1, \omega, \omega^2, \ldots \omega^{n-1}$ are the n, nth roots of unity, then $(1-\omega)(1-\omega^2)\ldots(1-\omega^{n-1})$ equals

A. 0

B. 1

C. n

D. n^2

Answer: C

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50. If α is an n th root of unity other than unity itself, then the value of $1 + \alpha + \alpha^2 + \ldots + \alpha^{n-1}$ is

A. 0

B. 1

C. -1

D. none of these

Answer: A

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51. If ω is an imaginary fifth root of unity, then find the value of $loe_2 \left|1+\omega+\omega^2+\omega^3-1/\omega\right|$.

A. 1

B. 0

C. -1

D. 2

Answer: A

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52. The product of all n^{th} root of unity is always

A. 1

B. -1

C. $(-1)^{n-1}$

D. $(-1)^n$

Answer: C

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53. The roots of the cubic equation $(z+ab)^3 = a^3, a \neq 0$ represent the vertices of a triangle of sides of length

A. $\frac{1}{\sqrt{3}}|ab|$

B. $\sqrt{3}|a|$

C. $\sqrt{3}|b|$

D. $\frac{1}{\sqrt{3}}|a|$

Answer: B

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54. If If $1, \alpha_1, \alpha_2, \alpha_3, \ldots \alpha_{n-1}$ are the n nth roots of unity and n is odd or even natural numbers, then $(1+\alpha_1)(1+\alpha_2)\ldots(1=\alpha_{n-1})$ equals

A. 1

B. -1

C. 0

D. none of these

Answer: A::C::D

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55. If $\beta \neq 1$ be any nth root of unity, then $1+3\beta+5\beta^2+\ldots n$ terms equals

A. $\dfrac{2n}{1-\beta}$

B. $-\dfrac{2\beta}{1-\beta}$

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

D. none

Answer: B

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

A. n

B. 0

C. $\dfrac{3^n - 1}{2}$

D. $\dfrac{3^n + 1}{2}$

Answer: C

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57. If p is a multiple of n , then the sum of pth powers of nth roots of unity is

A. p

B. n

C. 0

D. none of these

Answer: B

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58. If p is not a multiple of n, then the sum of pth powers of nth roots of unity is

A. 0

B. 1

C. n

D. p

Answer: A

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59. If $\alpha_1, \alpha_2, \ldots \alpha_{100}$ are all the 100 th roots of unity, then $\sum \sum \left(\alpha_i \alpha_j\right)^5 1 \leq i < j \leq 100$

A. 20

B. $(20)^{1/20}$

C. 0

D. none

Answer: C

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60. If $z=\frac{\sqrt{3}+i}{2}$ then $\left(z^{101}+i^{103}\right)^{105}$ equals

A. z

B. z^2

C. z^3

D. none of these

Answer: C

Watch Video Solution

61. The square root of $3+4i$ is

A. $\sqrt{3}+i$

B. $2-i$

C. $\pm(2+i)$

D. none of these

Answer: C

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62. The square root of the number $5 + 12i$ is

A. $(3 + 2i)$

B. $(3 - 2i)$

C. $\pm(3 + 2i)$

D. none

Answer: C

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63. The square root of the numbers $(-7 - 24i)$ is

A. (3 +4i)

B. (3-4i)

C. $\pm(3-4i)$

D. none

Answer: C

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

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

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

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

D. none of these

Answer: B

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65. If $\left(\sqrt{3}+i\right)^{100} = 2^{99}(a+ib), \quad \text{then} \quad a^2+b^2$ is equal to

A. $\sqrt{2}$

B. 4

C. $\sqrt{3}$

D. none of these

Answer: B

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66. If $\left(\sqrt{3}+i\right)^{100} = 2^{99}$ (a + i b) then b =

A. $\sqrt{3}$

B. $\sqrt{2}$

C. 1

D. none of these

Answer: A

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

A. $128 \text{ and } 128\sqrt{3}$

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

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

D. none of these

Answer: C

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68. The solution of the equation $\left(1+i\sqrt{3}\right)^{x}=2^{x}$ are in

A. A.P.

B. G.P.

C. H.P.

D. none

Answer: A

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69. If $(x+iy)^5 = p+iq,$ then prove that $(y+ix)^5 = q+ip$.

A. q +ip

B. p-iq

C. q-ip

D. $-p-ip$

Answer: A

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70. Sum of sixth power of the roots of the equation $t^2 - 2t + 4 = 0$ is

A. 256

B. 128

C. 64

D. 32

Answer: B

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71. $(1 + i)^8 + (1 - i)^8 =$

A. 2^8

B. 2^5

C. $2^4 \cos \frac{\pi}{4}$

D. $2^6 \cos \frac{\pi}{8}$

Answer: B

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72. If $\left[\frac{\sqrt{3}/2+(1/2)i}{\sqrt{3}/2-(1/2)i}\right]^{120}=a+ib$ then

A. $a=\cos 20^{\circ}, b=\sin 20^{\circ}$

B. $a=-\cos 20^{\circ}, b=-\sin 20^{\circ}$

C. $a=\cos 20^{\circ}, b=-\sin 20^{\circ}$

D. $a=1, b=0$

Answer: D

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73. $(-64)^{1/4}$ is equal to-

A. $\pm 2(1+i)$

B. $\pm 2(1-i)$

C. $\pm 2(1 \pm i)$

D. none of these

Answer: C

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74. The points representing $3\sqrt{\sqrt{5}+i\sqrt{3}}$ lie

A. on a circle centre (0,0) and radius $2\sqrt{2}$

B. on a straight line

C. on a circle centre (0,0) and radius $\sqrt{2}$

D. none of these

Answer: C

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75. Given z is a complex number with modulus 1. Then the equation $\left(\frac{1+ia}{1-ia}\right)^4 = z$ has

A. all roots real and distinct

B. two roots real and two imaginary

C. three roots real and one imaginary

D. one root real and three imaginary

Answer: A

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76. If $z = \left(\frac{\sqrt{3}}{2} + \frac{i}{2}\right)^5 + \left(\frac{\sqrt{3}}{2} - \frac{i}{2}\right)^5$, then prove that $Im(z) = 0.$

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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77. $\dfrac{(\cos\theta + i\sin\theta)^4}{(\sin\theta + i\cos\theta)^5}$ is equal to

A. $\cos\theta - i\sin\theta$

B. $\cos 9\theta - i\sin 9\theta$

C. $\sin\theta - i\cos\theta$

D. $\sin 9\theta - i\cos 9\theta$

Answer: D

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78. If $a^2 + b^2 = 1$, prove that $\dfrac{1 + b + ia}{1 + b - ia} = b + ia.$

A. a+ib

B. a-ib

C. b+ia

D. b-ia

Answer: A

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79. If $z(1+a) = b + icanda^2 + b^2 + c^2 = 1,$ then $[(1+iz)/(1-iz) = \frac{a+ib}{1+c}$ b. $\frac{b-ic}{1+a}$ c. $\frac{a+ic}{1+b}$ d. none of these

A. $\frac{a+ib}{1+c}$

B. $\frac{a-ib}{1+c}$

C. $\frac{a+ib}{1-c}$

D. $\frac{a-ib}{1-c}$

Answer: A

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80. The value of $\sum_{k=1}^{6}\left(\sin\frac{2\pi k}{7}-i\cos\frac{2\pi k}{7}\right)$ is

A. -1

B. 0

C. $-i$

D. i

Answer: D

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81. The value of $\sum_{k=0}^{10}\left(\sin\frac{2k\pi}{11}+i\cos\frac{2k\pi}{11}\right)$ is

A. 1

B. -1

C. 0

D. i

Answer: C

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82. $\left[\frac{1+\sin\frac{\pi}{8}+i\cos\frac{\pi}{8}}{1+\sin\frac{\pi}{8}-i\cos\frac{\pi}{8}}\right]^{8}=$

A. -1

B. 1

C. i

D. $-i$

Answer: A

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83. If $\left[\dfrac{1+\cos\theta+i\sin\theta}{\sin\theta+i(1+\cos\theta)}\right]^4=\cos n\theta+i\sin n\theta,$ then n =

A. 2

B. 3

C. 4

D. none

Answer: C

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84. The value of $1+\sum_{k=0}^{12}\left\{\cos\dfrac{(2k+1)\pi}{13}+i\sin\dfrac{(2k+1)\pi}{13}\right\}$ is

A. 0

B. -1

C. 1

D. i

Answer: C

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85. If $z_r = \cos(\pi / 2^r) + i \sin(\pi / 2^r) r = 1, 2, \dots \infty$ then $z_1 . z_2 . z_3, \dots \infty =$

A. 1

B. $-i$

C. i

D. -1

Answer: D

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86. If $z_r = \cos\left(\frac{\pi}{3_r}\right) + i \sin\left(\frac{\pi}{3_r}\right), r = 1, 2, 3, ,$ prove that $z_1 z_2 z_3 z_{\infty} = i.$

A. 1

B. $-i$

C. i

D. -1

Answer: C

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87. If $z = i \log_e (2 - \sqrt{3})$, where $i = \sqrt{-1}$ then the cos z is equal to

A. i

B. 2i

C. 1

D. 2

Answer: D

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88. The value of $\left(\tan\left(i \cdot \log\left(\frac{a-ib}{a+ib}\right)\right)\right)$ is

A. $\frac{ab}{a^2b^2}$

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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89. If x satisfies the equation $x^2 - 2x\cos\theta + 1 = 0$ then the value of $x^n + 1/x^n$ is

A. $2^n \cos n\theta$

B. $2^n \cos^n \theta$

C. $2\cos n\theta$

D. $2\cos^n\theta$

Answer: C

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90. If $2\cos\theta = x + \frac{1}{x}$, $2\cos\phi = y + \frac{1}{y}$ then

A. $\frac{x}{y} + \frac{y}{x} = 2\cos(\theta - \phi)$

B. $xy + \frac{1}{xy} = 2\cos(\theta + \phi)$

C. $x^m y^n + \frac{1}{x^m y^n} = 2\cos(m\theta + n\phi)$

D. $\frac{x^m}{y^n} + \frac{y^n}{x^m} = 2\cos(m\theta - n\phi)$

Answer: A::B::C::D

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91. The equation whose roots are nth power of the roots of the equations is $x^2 - 2x \cos \theta + 1 = 0$ is given by

A. $(x + \cos n\theta)^2 + \sin^2 n\theta = 0$

B. $(x - \cos n\theta)^2 + \sin \theta^2 n\theta = 0$

C. $x^2 + 2x \cos n\theta + 1 = 0$

D. $x^2 - 2x \cos n\theta + 1 = 0$

Answer: D

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92. If $x^2 - 2x \cos \theta + 1 = 0 \text{ then } x^{2n} - 2x^n \cos n\theta$ is equal to

A. 1

B. -1

C. 0

D. none of these

Answer: B

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93. The following in the form A + i B $(\cos 2\theta + i\sin 2\theta)^{-5}(\cos 3\theta - i\sin 3\theta)^{6}(\sin\theta - i\cos\theta)^{3}$ is

A. $(\cos 25\theta + i\sin 25\theta)$

B. $i(\cos 25\theta + i\sin 25\theta)$

C. $i(\cos 25\theta - i\sin 25\theta)$

D. $(\cos 25\theta - i\sin 25\theta)$

Answer: C

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94. If $x = \cos\theta + i\sin\theta, y = \cos\phi + i\sin\phi z = \cos\Psi + i\sin\Psi$ and $\frac{y}{z} + \frac{z}{x} + \frac{x}{y}$

then

$\cos(\phi - \Psi) + \cos(\Psi - \theta) + \cos(\theta - \phi)$ is equal to

A. $3/2$

B. $-3/2$

C. 0

D. 1

Answer: D

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95. If $a = \cos\alpha + i\sin\alpha, b = \cos\beta + i\sin\beta, \quad \text{then} \quad \frac{1}{2}\left(ab + \frac{1}{ab}\right) =$

A. $\cos(\alpha + \beta)$

B. $\cos(\alpha - \beta)$

C. $\sin(\alpha + \beta)$

D. $\sin(\alpha - \beta)$

Answer: A

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96. If

$\cos A+\cos B+\cos C=0, \sin A+\sin B+\sin C=0$ and $A+B+C=$

, then the value of $\cos 3A+\cos 3B+\cos 3Cis$

A. 3

B. -3

C. $\sqrt{3}$

D. 0

Answer: B

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97. If $\cos A+\cos B+\cos C=0=\sin A+\sin B+\sin C$, then

A. $\sum \cos 2A = 0$

B. $\sum \sin 2A = 0$

C. $\sum \cos(B + C) = 0$

D. $\sum \sin(B + C) = 0$

Answer: A::B::C::D

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98. The general value of x which satisfies the equation $(\cos x + i \sin x)(\cos 3x + i \sin 3x)$ $(\cos 5x + i \sin 5x) \ldots [\cos(2n - 1)x + i \sin(2n - 1)x] = 1$ is

A. $\frac{r\pi}{n^2}$

B. $\frac{(r - 1)\pi}{n^2}$

C. $\frac{(2r + 1)\pi}{n^3}$

D. $\frac{2r\pi}{n^2}$

Answer: D

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99. Find the θ such that $\dfrac{3+2i\sin\theta}{1-2i\sin\theta}$ is

(a) real

(b) purely imaginary

A. $n\pi$

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

C. $n\pi \pm \dfrac{\pi}{3}$

D. $2n\pi \pm \dfrac{\pi}{4}$

Answer: A::C

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100. If $\dfrac{\tan\theta - i[\sin(\theta/2) + \cos(\theta/2)]}{1 + 2i\sin(\theta/2)}$ is purely imaginary then θ is given by

A. $n\pi + \dfrac{\pi}{4}$

B. $n\pi - \dfrac{\pi}{4}$

C. $2n\pi$

D. $2n\pi + \dfrac{\pi}{4}$

Answer: A::C::D

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101. Let

$$f_p(\beta) = \left(\cos\frac{\beta}{p^2} + i\sin\frac{\beta}{p^2}\right)\left(\cos\frac{2\beta}{p^2} + i\sin\frac{2\beta}{p^2}\right)\dots\left(\cos\frac{\beta}{p} + i\sin\frac{\beta}{p}\right)$$

then $\lim_{n\to\infty} f_n(\pi)$ =

A. i

B. $-i$

C. 2i

D. $-2i$

Answer: A

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102. The continued product of the four values of $\left[\cos\left(\frac{\pi}{3}\right)+i\sin\left(\frac{\pi}{3}\right)\right]^{3/4}$ is

A. 1

B. 2

C. 3

D. none

Answer: A

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103. If $a = \cos\alpha + i\sin\alpha, b = \cos\beta + i\sin\beta, \quad \text{then} \quad \frac{a-b}{a+b} =$

A. $i\tan\frac{\alpha-\beta}{2}$

B. $i\cos\frac{\alpha-\beta}{2}$

C. $\tan\frac{\alpha-\beta}{2}$

D. $\cot\frac{\alpha-\beta}{2}$

Answer: A

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104. If α, β be the roots of the the equation $x^2 - 2x + 2 = 0$ and $\cot\theta = x + 1 \quad \text{then} \quad \frac{(x+\alpha)^n - (x+\beta)^n}{\alpha-\beta} =$

A. $\frac{\cos n\theta}{\sin^n\theta}$

B. $\frac{\sin n\theta}{\cos^n\theta}$

C. $\frac{\sin n\theta}{\sin^n\theta}$

D. $\frac{\cos n\theta}{\cos^n\theta}$

Answer: C

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105. The complex number z has argZ = θ ,$0 < \theta < \frac{\pi}{2}$ and satisfy the equation $|z - 3i| = 3$. Then value of $\left(\cot\theta - \frac{6}{z}\right) =$

A. -1

B. 1

C. $-i$

D. i

Answer: D

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106. $1 + i = \sqrt{2}\left(\cos\frac{\pi}{4} + i\sin\frac{\pi}{4}\right)$

$1 + \omega + \omega^2 = 0, \omega = \left(\frac{2\pi i}{3}\right)$

$(1 + x)^n = P_0 + P_1 x + P_2 x^2 + P_3 x^3 + P_4 x^4 + \ldots + P_n x^n$

$p_0 - p_2 + p_4 - \ldots = 2^{n/2} \cos(n\pi/4)$

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107. $1 + i = \sqrt{2}\left(\cos\frac{\pi}{4} + i\sin\frac{\pi}{4}\right)$

$1 + \omega + \omega^2 = 0, \omega = e^{\frac{2\pi i}{3}}$

$(1 + x)^n = P_0 + P_1 x + P_2 x^2 + P_3 x^3 + P_4 x^4 + \ldots + P_n x^n$

$p_1 - p_3 + p_5 - \ldots = 2^{n/2} \sin(n\pi/4)$ .True or False?

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108. $1 + i = \sqrt{2}\left(\cos\frac{\pi}{4} + i\sin\frac{\pi}{4}\right)$

$1 + \omega + \omega^2 = 0, \omega = \left(\frac{2\pi i}{3}\right)$

$(1 + x)^n = P_0 + P_1 x + P_2 x^2 + P_3 x^3 + P_4 x^4 + \ldots + P_n x^n$

$p_0 + p_4 + p_8 + \ldots = 2^{n/2-1} \cos\frac{n\pi}{4} + 2^{n-2}$

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109. $1+i=\sqrt{2}\left(\cos\frac{\pi}{4}+i\sin\frac{\pi}{4}\right)$

$1+\omega+\omega^2=0, \omega=e^{\frac{2\pi i}{3}}$

$(1+x)^n=P_0+P_1x+P_2x^2+P_3x^3+P_4x^4+\ldots+P_nx^n$

$p_0+p_3+p_6+\ldots=\frac{1}{3}\left(2^n+2\cos\frac{n\pi}{3}\right)$. True or False?

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110. $1+i=\sqrt{2}\left(\cos\frac{\pi}{4}+i\sin\frac{\pi}{4}\right)$

$1+\omega+\omega^2=0, \omega=e^{\frac{2\pi i}{3}}$

$(1+x)^n=P_0+P_1x+P_2x^2+P_3x^3+P_4x^4+\ldots+P_nx^n$

$p_1+p_4+p_7+\ldots=\frac{1}{3}\left[2^n+2\cos(n-2)\frac{\pi}{3}\right]$. True or False?

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111. $1+i=\sqrt{2}\left(\cos\frac{\pi}{4}+i\sin\frac{\pi}{4}\right)$

$1+\omega+\omega^2=0, \omega=e^{\frac{2\pi i}{3}}$

$(1+x)^n=P_0+P_1x+P_2x^2+P_3x^3+P_4x^4+\ldots+P_nx^n$

$p_2+p_5+p_8+\ldots=\frac{1}{3}\left[2^n+2\cos(n+2)\frac{\pi}{3}\right]$. True or False?

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Problem Set (2) (True and False)

1. $\left(\frac{1+\cos\phi+i\sin\phi}{1+\cos\phi-i\sin\phi}\right)=\cos n\phi+i\sin n\phi$

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2. If α,β are the roots of the equations $x^2-2x+4=0, \text{ then } \alpha^n+\beta^n=2^{n+1}\cos(n\phi/3)$

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3. If $1,\omega,\omega^2$ are the three cube roots of unity, then

$\left(a+b\omega+c\omega^2\right)^3+\left(a+b\omega^2+c\omega\right)^3$

$=(2a-b-c)(2b-c-a)(2c-a-b)=27abc$ if $a+b+c=0$

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4. If $\cos\alpha + \cos\beta + \cos\gamma = 0 = \sin\alpha + \sin\beta + \sin\gamma$ then

$\cos(\beta + \gamma) + \cos(\gamma + \alpha) + \cos(\alpha + \beta) = 0$

sin $(\beta + \gamma) + \sin(\gamma + \alpha) + \sin(\alpha + \beta) = 0$

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Problem Set (2) (Fill in the blanks)

1. If ω is a cube root of unity and $\omega^n + \omega^{2n} = -1$ then the integer n is of the form km + l where (k , l) = . . .

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2. If $\alpha = \cos\left(\frac{2\pi}{7}\right) + i\sin\left(\frac{2\pi}{7}\right)$ then a quadratic equation whose roots are $(\alpha + \alpha^2 + \alpha^4)$ and $(\alpha^3 + \alpha^5 + \alpha^6)$

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Problem Set (3) (M.C.Q)

1. The real part of $(1+i)^2/(3-i)$ is

A. $\frac{1}{5}$

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

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

D. none of these

Answer: D

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2. $\left(\frac{2i}{1+i}\right)^2 =$

A. i

B. 2i

C. 1-i

D. 1-2i

Answer: B

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3. $\left(\frac{1+i}{\sqrt{2}}\right)^8 + \left(\frac{1-i}{\sqrt{2}}\right)^8 =$

A. 1

B. 2

C. 3

D. 0

Answer: B

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4. $\left(\frac{1-i}{1+i}\right)^2 =$

A. 1

B. $-1/2$

C. $1/\sqrt{2}$

D. -1

Answer: D

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5. The smallest positive integer n forwhich $\left(\frac{1+i}{1-i}\right)^n = 1$ is:

A. n = 8

B. n = 4

C. n = 16

D. none of these

Answer: B

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6. What is the smallest positive integer n for which $(1+i)^{2n} = (1-i)^{2n}$?

A. 4

B. 8

C. 2

D. 12

Answer: C

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7. 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

Answer: B

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8. $\dfrac{2^n}{(1-i)^{2n}} + \dfrac{(1+i)^{2n}}{2^n}, n \in I$ is equal to

A. 2

B. 0

C. $[1+(-1)^n]i^n$

D. $\dfrac{2}{(-i)^n}$

Answer: D

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9. If the number $\dfrac{(1-i)^n}{(1+i)^{n-2}}$ is real and positive , then n is

Put the following numbers in trigonometrical form, that is, int he form (r, θ) where r is a positive real number and $-\pi < \theta \leq \pi$

A. any integer

B. any even integer

C. any odd integer

D. none of these

Answer: D

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10. $\dfrac{(1+i)^{2n+1}}{(1-i)^{2n-1}}, n \in N$ in (r, θ) form is

A. (2,0)

B. $(2, \pi/2)$

C. $(2, \pi)$

D. $(2, \pi/4)$

Answer: A::C

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11. $\frac{1+7i}{(2-i)^2} in (r, \theta)$ form is

A. $\left(\sqrt{2}, \pi/4\right)$

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

C. $\left(\sqrt{2}, 3\pi/4\right)$

D. none

Answer: C

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12. If $\left(\frac{1+i}{1-i}\right)^3-\left(\frac{1-i}{1+i}\right)^3=x+iy$, then (x,y) is equal to

A. (-2,0)

B. (2,0)

C. (0,2)

D. (0,-2)

Answer: D

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13. The complex number $\frac{1+2i}{1-i}$ lies in the Quadrant number

A. I quadrant

B. II quadrant

C. III quadrant

D. IV quadrant

Answer: B

Watch Video Solution

14. $i^{57} + 1/i^{125}$, when simplified has the value

A. 0

B. 2i

C. $-2i$

D. 2

Answer: B

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15. The value of $1 + i^2 + i^4 + i^6 + \ldots\ldots\ldots i^{2n}$ is

A. positive

B. negative

C. 0

D. cannot be determined

Answer: D

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

A. i

B. $-i$

C. 1

D. -1

Answer: B

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17. If $i=\sqrt{-1}$ and n is a positive integer, then $i^n+i^{n+1}+i^{n+2}+i^{n+3}$

A. 1

B. i

C. i^n

D. 0

Answer: D

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18. One of the values of i^i is

A. e^{π}

B. $e^{-\pi}$

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

D. $e^{-\pi/2}$

Answer: D

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19. If $(x + iy)(2 - 3i) = 4 + i$ then

A. x = 1, y = 2

B. x = $\frac{5}{12}$, y = $\frac{14}{13}$

C. x = 3, y = 4

D. none of these

Answer: B

Watch Video Solution

20. If $\frac{(1+i)x - 2i}{3+i} + \frac{(2-3i)y + i}{3-i} = i$ then the real value of x and y are given by

A. x = - 3, y = - 1

B. x= 3, y = - 1

C. x = 3, y = 1

D. x= 1, y = - 3

Answer: B

Watch Video Solution

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

A. 3

B. 4

C. 2

D. none of these

Answer: B

Watch Video Solution

22. If $z = x + iy, , x, y$ real and $|x| + |y| \leq \lambda|z| \quad \text{then} \quad \lambda$ is equal to

A. $\sqrt{3}$

B. $\sqrt{2}$

C. 1

D. none

Answer: B

Watch Video Solution

23. If $\sqrt{x+iy} = \ \pm (a+ib), \quad \text{then} \quad \sqrt{-x-iy}$ is equal to

A. $\pm (b+ia)$

B. $\pm (a-ib)$

C. $\pm (b-ia)$

D. none of these

Answer: C

Watch Video Solution

24. If $(x+iy)(p+iq) = (x^2+y^2)i$, prove that $x = q, \; = p.$

A. p = x, q = y

B. $p = x^2, q = y^2$

C. $x = q, y = p$

D. none of these

Answer: C

Watch Video Solution

25. The real part of $(1 - \cos\theta + 2i\sin\theta)^{-1}$ is

A. $1/(3+5\cos\theta)$

B. $1/(5-3\cos\theta)$

C. $1/(3-5\cos\theta)$

D. $1/(5+3\cos\theta)$

Answer: D

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26. The number of solutions of the equation $z^2=\bar{z}$ is

A. 2

B. 3

C. 4

D. none

Answer: C

Watch Video Solution

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

A. 4

B. 3

C. 2

D. 5

Answer: A

Watch Video Solution

28. Number of solutions of the equation $z^2 + |z|^2 = 0$, where $z \in C$, is

A. one

B. two

C. three

D. infinitely many

Answer: D

Watch Video Solution

29. The solution of the equation $|z| - z = 1 + 2i$ is

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

B. $3 - 2i$

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

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

Answer: A

Watch Video Solution

30. Find a complex number z satisfying the equation $z+\sqrt{2}|z+1|+i=0.$

A. 2-i

B. 2+i

C. $-2+i$

D. $-2-i$

Answer: D

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31. 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

Watch Video Solution

32. The system of equations $|z+1-i| = \sqrt{2} \text{ and } |z| = 3$ has

A. 4

B. 2

C. 1

D. none

Answer: D

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33. The number of jsolutions of the equation $z^2 + \bar{z} = 0,$ is

A. 1

B. 2

C. 3

D. 4

Answer: D

Watch Video Solution

34. 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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35. The number of points in the complex plane that satisfy the conditions $|z-2|=2\sqrt{2}, z(1-i)+\bar{z}(1+i)=4$ is

A. 0

B. 1

C. 2

D. more than 2

Answer: C

Watch Video Solution

36. The number of values of z which satisfy both the equations $|z-1-i|=\sqrt{2}$ and $|z+1+i|=2$ is

A. 0

B. 1

C. 2

D. none

Answer: C

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37. The solution of the equation $|z| - z = 1 + 2i$ is

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

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

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

D. none of these

Answer: A

Watch Video Solution

38. If $z^2+(p+iq)z+(r+is)=0$, where,p,q,r,s are non-zero has real roots, then

A. $pqr=r^2+p^2s$

B. $prs=q^2+r^2p$

C. $qrs=p^2+s^2q$

D. $pqs=s^2+q^2r$

Answer: D

Watch Video Solution

39. If $f(x)=x^4-8x^3+4x^2+4x+39$ and $f(3+2i)=a+ib$ then $a:b$ is equal to

A. $-\frac{1}{8}$

B. $-\frac{1}{4}$

C. $\frac{1}{8}$

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

Answer: A

Watch Video Solution

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

A. a circle

B. a straight line

C. none of these

D.

Answer: B

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41. Let a and b be two non- zero complex numbers. If the lines $a\bar{z} + \bar{a}z + 1 = 0$ and $b\bar{z} + \bar{b}z - 1 = 0$ are mutually perpendicular, then a, b are connected by the relation

A. $ab + \bar{a}\bar{b} = 0$

B. $ab - \bar{a}\bar{b} = 0$

C. $\bar{a}b - a\bar{b} = 0$

D. $a\bar{b} + \bar{a}b = 0$

Answer: D

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42. The closest distance of origin from the curve given by $b\bar{z} + \bar{b}z + b\bar{b} = 0$ (b is also a complex number) is

A. 1 unit

B. $\dfrac{Re(b)}{|b|}$

C. $\frac{IM(b)}{|b|}$

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

Answer: D

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Problem Set (3) (M.C.Q) Locus:

1. If the imaginary part of $\frac{2z+1}{iz+1}$ is -4, then the locus of the point representing z in the complex plane is

A. a circle

B. a straight line

C. a parabola

D. none of these

Answer: B

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2. If $Im\left(\frac{z-1}{e^{\theta i}}+\frac{e^{\theta i}}{z-1}\right)=0$, then find the locus of z.

A. st. line

B. parabola

C. unit circle

D. none

Answer: C

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3. Locus of the point z satisfying the equation $|iz-1|+|z-i|=2$ is

A. straight line

B. circle

C. parabola

D. ellipse

Answer: B

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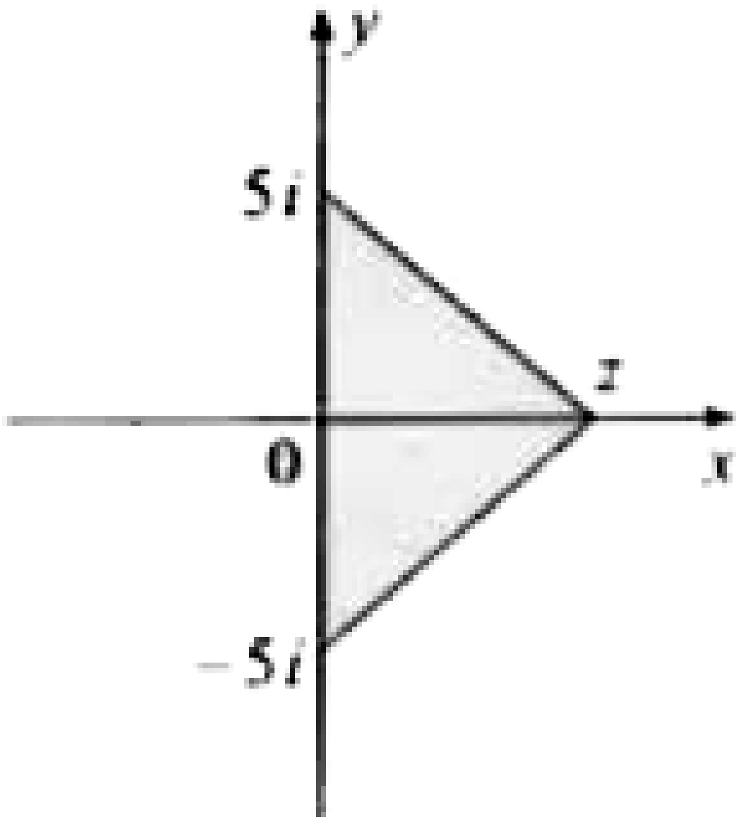
4. The complex numbers z = x + iy which satisfy the equation $\left|\frac{z-5i}{z+5i}\right|=1$, lie on



A. the x-axis

B. the straight line y = 5

C. a circle passing through the origin

D. none of these

Answer: A

Watch Video Solution

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

A. a straight line

B. a circle

C. a parabola

D. none of these

Answer: B

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6. z_1, z_2, z_3, z_4 are distinct complex numbers representing the vertices of a quadrilateral $ABCD$ taken in order. If $z_1 - z_4 = z_2 - z_3 and \arg[(z_4 - z_1)/(z_2 - z_1)] = \pi/2$, the quadrilateral is a. rectangle b. rhombus c. square d. trapezium

A. rectangle

B. rhombus

C. square

D. trapezium

Answer: A

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7. If 'z, lies on the circle $|z - 2i| = 2\sqrt{2}$, then the value of $arg\left(\frac{z-2}{z+2}\right)$ is the equal to

A. $\frac{\pi}{8}$

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

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

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

Answer: C

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8. 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 lien x = |a|

D. none of these

Answer: B

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

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

B. 4 x - 3y + 24 = 0

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

D. none of these

Answer: A

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10. The locus represented by |z-1|=|z+i| is:

A. a circle of radius 1

B. an ellipse with foci at (1,0) and (0,-1)

C. a straight line through the origin

D. a circle on the line joining (1,0) ,(0,1) as diameter

Answer: C

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11. If $|\bar{z}| = 25$ then the points representing the number $-1 + 75\bar{z}$ will be on a

A. circle

B. parabola

C. ellipse

D. none of these

Answer: A

Watch Video Solution

12. If P is the affix of z in the Argand diagram and P moves so that $\frac{z-i}{z-1}$ is always purely imaginary, then locus of z is

A. circle, centre (2,2) radius 1/2

B. circle, centre (-1/2, -1/2) , radius $1/\sqrt{2}$

C. circle, centre (1/2,1/2) , radius $1/\sqrt{2}$

D. none of these

Answer: C

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13. If $w=\alpha+i\beta$ where $B\eta0$ and $z\neq1$ satisfies the condition that $\left(\frac{w-\overline{w}z}{1-z}\right)$ is purely real then the set of values of z is

A. $z:|z|\neq1$

B. $z:|z|=1$

C. $z:z\neq1$

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

Answer: B

Watch Video Solution

14. If $|a_k| < 3, 1 \leq k \leq n,$ then all complex numbers z satisfying equation $1 + a_1 z + a_2 z^2 + \text{.........} + a_n z^n = 0$

A. lie outside the circle $|z| = \frac{1}{4}$

B. lie inside the circle $|z| = \frac{1}{4}$

C. lie on the circle $|z| = \frac{1}{4}$

D. lie in $\frac{1}{3} < |z| < \frac{1}{2}$

Answer: A

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15. Prove that the distance of the roots of the equation $|\sin\theta_1|z^3 + |\sin\theta_2|z^2 + |\sin\theta_3|z + |\sin\theta_4| = |3|$ from z=0 is greater than $2/3$.

A. greater than 2/3

B. less than 2/3

C. greater than $|\sin\theta_1| + |\sin\theta_2| + |\sin\theta_2| + |\sin\theta_4|$

D. less than $|\sin\theta_1| + |\sin\theta_2| + |\sin\theta_2| + |\sin\theta_4|$

Answer: A

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16. If $z^2 + z|z| + |z|^2 = 0$, then the locus of z is

A. a circle

B. a straight line

C. a pair of straight lines

D. none of these

Answer: C

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17. 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. $\cot 2\alpha (x^2 + y^2) = 1 + x$

C. $x^2 + y^2 + 2y \tan 2\alpha = 1$

D. $x^2 + y^2 + 2x \sin 2\alpha = 1$

Answer: A

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Problem Set (3) (M.C.Q) Inequalities:

1. State true or false for the following.

The inequality $|z-4| < |z-2|$ represents the region given by $x > 3$.

A. $Re(z) > 0$

B. $Re(z) < 0$

C. $Re(z) > 2$

D. none of these

Answer: D

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2. 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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3. 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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4. 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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5. 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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6. If $\left|z-\frac{4}{z}\right|=2$, then the maximum value o f $|z|$ is equal to :

A. $2+\sqrt{2}$

B. $\sqrt{3}+1$

C. $\sqrt{5}+1$

D. 2

Answer: C

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7. " If $Z \in C$ satisfies $|z| \geq 3$ then the least value of $\left|z+\frac{1}{z}\right|$ is

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

B. $\frac{8}{3}$

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

D. 2

Answer: B

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8. The greatest value of $|z+1| \quad \text{if} \quad |z+4| \leq 3$ is

A. 4

B. 5

C. 6

D. none

Answer: C

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9. Find the greatest and the least value of $|z_1 + z_2|$ if $z_1 = 24 + 7iand|z_2| = 6.$

A. 31,25

B. 25,19

C. 31,19

D. none

Answer: C

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10. If z is a complex number, then minimum value of

(i) $|z| + |z - 1| + |2z - 3|$ and

(ii) $|z + 1| + |z - 1|$ is

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11. If z_1 and z_2 are two unimodular complex numbers such that $z_1^2 + z_2^2 = 3$ then $(z_1 + \bar{z}_1)^2 + (z_2 + \bar{z}_2)^2$ =

A. 10

B. 9

C. 6

D. 3

Answer: A

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12. Let S be the set of complex number a which satisfyndof $\log_{\frac{1}{3}}\left\{\log_{\frac{1}{2}}\left(|z|^2 + 4|z| + 3\right)\right\} < 0$, then S is (where $i = \sqrt{-1}$)

A. four points

B. no point

C. two points

D. infinite points

Answer: B

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13. If $\log_{\tan 30^\circ}\left[\frac{2|z|^2+2|z|-3}{|z|+1}\right] < -2$ then $|z| =$

A. $|z| < 3/2$

B. $|z| > 3/2$

C. $|z| > 2$

D. $|z| < 2$

Answer: C

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14. The locus of z which satisfies the inequality $\log_{0.3}|z-1| > \log_{0.3}|z-i|$ is given by :

A. $x+y<0$

B. $x+y>0$

C. $x-y>0$

D. $x-y<0$

Answer: C

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15. If $\log_{1/3}|z+1| > \log_{1/3}|z-1|$: then

A. $Rez<0$

B. $Rez>0$

C. $Rez \geq 0$

D. none

Answer: A

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16. Let $z(\neq 2)$ be a complex number such that $\log_{1/2}|z-2| > \log_{1/2}|z|$

. Then

A. $Re(z) > 1$

B. $Im(z) > 1$

C. $Re(z) = 1$

D. $Im(z) = 1$

Answer: A

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17. 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: B

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18. The focus of the complex number z in argand plane satisfying the inequality $\log_{\frac{1}{2}}\left(\frac{|z-1|+4}{3|z-1|-2}\right) > 1\left(where|z-1| \neq \frac{2}{3}\right)$ is

A. a circle

B. interior of a circle

C. exterior of a circle

D. none

Answer: C

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19. Among the complex numbers z satisfying the condition $|z+1-i| \leq 1$ then number having the least positive argument is

A. 1-i

B. $-1+i$

C. $-i$

D. i

Answer: D

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20. Let z be a complex number satisfying $|z-5i| \leq 1$ such that $amp(z)$ is minimum, then z is equal to

A. $\frac{2\sqrt{6}}{5}+\frac{24i}{5}$

B. $\frac{24}{5}+\frac{2\sqrt{6}i}{5}$

C. $\frac{2\sqrt{6}}{5}-\frac{24i}{5}$

D. none of these

Answer: A

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21. 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: A

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22. 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

B. 3

C. $4\sqrt{2}$

D. $6\sqrt{2}$

Answer: B

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

A. $(2-1/\sqrt{2})(1-i)$

B. $(2-1/\sqrt{2})(1+i)$

C. $(2+1/\sqrt{2})(1-i)$

D. $(2+1/\sqrt{2})(1+i)$

Answer: A

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24. If $|z-25i| \leq 15$ then | max: amp(z) - min amp (z) | =

A. $2\cos^{-1}\left(\frac{3}{5}\right)$

B. $2\cos^{-1}\left(\frac{4}{5}\right)$

C. $\frac{\pi}{2}+\cos^{-1}\left(\frac{3}{5}\right)$

D. $\sin^{-1}\left(\frac{3}{5}\right)-\cos^{-1}\left(\frac{3}{5}\right)$

Answer: B

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25. The least value of p for which the two curves $arg z = \frac{\pi}{6}$ 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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26. If at least one value of the complex number z = x + i y satisfies the condition $\left|z + \sqrt{2}\right| = a^2 - 3a - 2$ and the inequality $\left|z + i\sqrt{2}\right| < a$ then

A. $a > 6$

B. a= 6

C. $a < 6$

D. none of these

Answer: A

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27. PQ and PR are two infinite rays, QAR is an arc. Point lying in the shaded region excluding the boundary satisfies

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

B. $|z-1| > 2 : |arg(z-1)| < \frac{\pi}{2}$

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

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

Answer: C

View Text Solution

Problem Set (3) Fill in the blanks

1. If $\left(x^4+2xi\right)-\left(3x^2+yi\right)=(3-5i)+(1+2yi)$

then the number of ordered pairs (x, y) is/are equal to

$\{\forall x, y \in R \text{ and } i^2=-1\}$

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2. If $x+iy=\sqrt{\frac{a+ib}{c+id}}$, then write the value of $\left(x^2+y^2\right)^2$.

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3. Find the non-zero complex numbers z satisfying $z=iz^2$.

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4. Find the all complex numbers satisying the equation $2|z|^2 + z^2 - 5 + i\sqrt{3} = 0, wherei = \sqrt{-1}$.

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5. The region represented by the inequality $2 < |z + i| \leq 3$ is ....

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Problem Set (4) M.C.Q

1. 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: B

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2. The three vertices of a triangle are represented by the complex numbers $0, z_1$ and z_2. If the triangle is equilateral, then

A. $z_1^2 - z_2^2 = z_1 z_2$

B. $z_1^2 + z_2^2 = z_1 z_2$

C. $z_2^2 - z_1^2 = z_1 z_2$

D. $z_1^2 + z_2^2 + z_1 z_2 = 0$

Answer: B

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3. One vertex of an equilateral triangle is at the origin and the other two vertices are given by $2z^2 + 2z + k = 0$ then k is

A. $2/3$

B. 1

C. 2

D. -1

Answer: A

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4. Let z_1 and z_2 be the root of the equation $z^2 + pz + q = 0$ where the coefficient p and q may be complex numbers. Let A and B represent z_1 and z_2 in the complex plane. If $\angle AOB = \alpha \ne 0$ and 0 and $OA = OB, where O$ is the origin prove that $p^2 = 4q\cos^2\left(\frac{\alpha}{2}\right)$

A. $4q\cos\frac{\alpha}{2}$

B. $4q\cos^2\frac{\alpha}{2}$

C. $4q\sin\frac{\alpha}{2}$

D. $4q\sin^2\frac{\alpha}{2}$

Answer: B

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5. Let z_1, z_2 be two non - zero complex numbers such that $z_1^2 - 2z_1z_2 + 2z_2^2$ = 0 then the triangle OAB, where O is origin and A, B are z_1 and z_2 is

A. isosceles right angled

B. equilateral

C. isosceles but not right angled

D. only right angled

Answer: A

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

A. $a^2 = b$

B. $a^2 = 3b$

C. $b^2 = 3a$

D. $b^2 = a$

Answer: B

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7. The roots of the equation $1 + z + z^3 + z^4 = 0$ are represented by the vertices of

A. equilateral triangle

B. square

C. rhombus

D. none

Answer: B

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

A. 4

B. 2

C. 6

D. 3

Answer: A

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

D. 0

Answer: C

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11. If the points represented by complex numbers $z_1 = a + ib, z_2 = c + id$ and $z_1 - z_2$ are collinear, where $i = \sqrt{-1}$, then

A. ab' + d b = 0

B. ab' - d b = 0

C. ab + d b' = 0

D. ab - d b' =0

Answer: B

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12. 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. an equilateral triangle

B. a right angled triangle

C. an isosceles triangle

D. none of these

Answer: D

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13. 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. none of these

Answer: B

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14. The triangle with vertices at the point $z_1 z_2, (1-i)z_1 + iz_2$ is

A. right angled but not isosceles

B. isosceles but not right angled

C. right angled and isosceles

D. equilateral

Answer: C

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15. Prove that the triangle formed by the points $1, \frac{1+i}{\sqrt{2}}, and i$ as vertices in the Argand diagram is isosceles.

A. scalene

B. equilateral

C. isosceles

D. right angled

Answer: C

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16. 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. 4 k - 1

B. 4 k + 2

C. 4 k + 3

D. 4 k

Answer: D

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17. 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. $(z_1 - z_2)^2 + (z_2 - z_3)^2 + (z_3 - z_1)^2 = 0$

D. $z_1^3 + z_2^3 + z_3^3 + 3z_1 z_2 z_3 = 0$

Answer: A::B::C

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18. 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. $9z_0^2$

C. $3z_0^2$

D. $2z_0^2$

Answer: C

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19. The roots of the equation $t^3 + 3at^2 + 3bt + c = 0 are z_1, z_2, z_3$ which represent the vertices of an equilateral triangle. Then $a^2 = 3b$ b. $b^2 = a$ c. $a^2 = b$ d. $b^2 = 3a$

A. $a^2 = 3b$

B. $b^2 = a$

C. $a^2 = b$

D. $b^2 = 3a$

Answer: C

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20. If a and b are real numbers between 0 and 1 such that the points $z_1 = a + i, z_2 = 1 + bi$ and $z_3 = 0$ from an equilateral triangle then (a,b) =

A. $(2 - \sqrt{3}, 2 - \sqrt{3})$

B. $(1/3, 1/3)$

C. $(1/2, 1/2)$

D. none

Answer: A

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21. The centre of a square is at the origin and 1 + i is one of its vertices. The extremities of its diagonal which does not pass 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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22. The points 1 + i, 1 - i, - 1 + i and - 1 - i are

A. collinear

B. concyclic

C. four vertices of a regular polygon

D. lie within a circle of radius 1

Answer: C

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23. 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. $\pm(\sin\theta + i\cos\theta)$

B. $\pm(\cos\theta - i\sin\theta)$

C. $\pm 3(\sin\theta - i\cos\theta)$

D. none

Answer: C

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

A. 24

B. 18

C. 16

D. 8

Answer: D

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25. A man walks a distance of 3 units from the origin towards the North-East $(N45^0 E)$ direction.From there, he walks a distance of 4 units towards the North-West $(N45^0 W)$ direction to reach a point P. Then, the position of P in the Argand plane is $3e^{\frac{i\pi}{4}} + 4i$ (b) $(3 - 4i)e^{\frac{i\pi}{4}}$ $(4 + 3i)e^{\frac{i\pi}{4}}$ (d) $(3 + 4i)e^{\frac{i\pi}{4}}$

A. $3e^{i\pi/4} + 4i$

B. $(3 - 4i)e^{i\pi/4}$

C. $(4 + 3i)e^{i\pi/4}$

D. $(3 + 4i)e^{i\pi/4}$

Answer: D

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26. 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 to reach a point z_1. From z_1 the particle moves $\sqrt{2}$ 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 centre at origin, to reach a point z_2. The point z_2 is given by $6 + 7i$ (b) $-7 + 6i$ $7 + 6i$ (d) $-6 + 7i$

A. 6 + 7i

B. $-7 + 6i$

C. 7 +6i

D. $-6+7i$

Answer: D

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Problem Set (4) (True and False)

1. 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

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2. Suppose that three points z_1, z_2, z_3 are connected by the relation $az_1 + bz_2 + cz_3 = 0$, where a + b + c = 0, then the points are

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3. Let the complex numbers Z_1, Z_2 and Z_3 are the vertices A, B and C respectively of an isosceles right - angled triangle ABC with right angle at C, then the value of $\frac{(Z_1 - Z_2)^2}{(Z_1 - Z_3)(Z_3 - Z_2)}$ is equal to

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4. The cune roots of unity when represented on Argand diagram form the vertces of an equilateral triangle.

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Problem Set (4) (fill in the blanks)

1. 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

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2. The vertices A, B of a square ABCD are given to be z_1, z_2 then the vertices z_3, z_4 in terms of z_1, z_2 are $\dots$.

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Self Assessment Test

1. If $\left(\frac{1+i}{1-i}\right)^3 - \left(\frac{1-i}{1+i}\right)^3 = x + iy$, then (x,y) is equal to

A. x =0, y = - 2

B. x = - 2, y = 0

C. x = 1, y = 1

D. x = - 1, y = 1

Answer: A

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2. If $2x = 3 + 5i,$ then what is the value of $2x^3 + 2x^2 - 7x + 72$?

A. 4

B. -4

C. 8

D. -8

Answer: A

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3. If the imaginary part of $\frac{2+i}{ai-1}$ is zero where $a \in R$ then a =

A. $1/2$

B. 2

C. $-1/2$

D. -2

Answer: C

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4. The multiplicative inverse of a number is the number itself, then its initial value is

A. -1

B. i

C. 2

D. 0

Answer: A

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5. The argument of the complex number $\left(\frac{i}{2}-\frac{2}{i}\right)$ is equal to

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

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

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

D. $\frac{\pi}{12}$

Answer: B

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6. The number of jsolutions of the equation $z^2 + \bar{z} = 0,$ is

A. 1

B. 2

C. 4

D. 3

Answer: C

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7. The conjugate of $\frac{(2+i)^2}{3+i}$ in the form of a + ib is

A. $\frac{13}{10}+i\left(-\frac{9}{10}\right)$

B. $\frac{13}{2}+i\left(\frac{15}{2}\right)$

C. $13+i\left(-\frac{15}{2}\right)$

D. none of these

Answer: A

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8. The solution of the equation $|z|-z=1+2i$ is

A. 2 - 3i

B. 3 +2i

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

D. none of these

Answer: C

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9. Let $z_1 = 3 + 4i$ and $z_2 = -1 + 2i$ then $|z_1 + z_2|^2 - 2\left(|z_1|^2 + |z_2|^2\right)$ is equal to

A. $|z_1 - z_2|^2$

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

C. $|z_1 + z_2|^2$

D. none of these

Answer: B

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10. Let z, be a complex number with $|z_1| = 1$ and z_2 be any complex number, then $\left|\frac{z_1 - z_2}{1 - z_1 z_2}\right|$ =

A. 1

B. 0

C. -1

D. 2

Answer: A

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11. 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. (1,3)

B. $(2, \sqrt{3})$

C. (-3,0)

D. $\left(\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$

Answer: D

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12. The value of $\left|\frac{1+i\sqrt{3}}{\left(1+\frac{1}{i+1}\right)^2}\right|$ is

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

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

C. 20

D. $\frac{9}{4}$

Answer: B

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13. The modulus of the complex number z such that $|z+3-i|=1$ and $\arg z=\pi$ is equal to

A. 3

B. 1

C. 2

D. 9

Answer: A

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14. If $z=\dfrac{4}{1-i}$ then $\bar{z}$ is equal to

A. (1 - i)

B. $\dfrac{1+i}{4}$

C. $\dfrac{4}{1+i}$

D. $\dfrac{2}{1-i}$

Answer: C

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15. If one root of the equation $x^2 + (1 - 3i)x - 2(1 + i) = 0$ is $-1 + i$, then the other root is

A. $-1 - i$

B. 2i

C. i

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

Answer: B

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16. Convert the complex number $z = \frac{i - 1}{\frac{\cos \pi}{3} + i \frac{\sin \pi}{3}}$ in the polar form.

A. $r = \sqrt{2}\left[\cos\frac{5\pi}{12} + i\sin\frac{5\pi}{12}\right]$

B. $r = \sqrt{2}\left(\cos\frac{\pi}{4} + i\sin\frac{\pi}{4}\right)$

C. $r = \sqrt{2}\left(\cos\frac{\pi}{6} + i\sin\frac{\pi}{6}\right)$

D. none of these

Answer: A

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17. If z_1, z_2, z_3 are three complex numbers in A.P., then they lie on :

A. a circle in the complex plane

B. a straight line in the complex plane

C. a parabola on the complex plane

D. none of these

Answer: B

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18. The complex number $\frac{1+2i}{1-i}$ lies in the Quadrant number

A. first quadrant

B. second quadrant

C. third quadrant

D. IV quadrant

Answer: B

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19. If $x_r = \cos\left(\frac{\pi}{2^r}\right) + i\sin\left(\frac{\pi}{2^r}\right)$ then $x_1, x_2, x_3, \ldots . \infty$

A. 1

B. -1

C. 3

D. 2

Answer: B

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20. If p(x,y) denotes z = x + iy in Argand plane and $\left|\frac{z-1}{z+2i}\right|$ = 1 the locus of P is a/an

A. Hyperbola

B. Ellipse

C. Circle

D. Straight line

Answer: D

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21. If $\omega(\neq 1)$ is a cube root of unity, then the sum of the series $S = 1 + 2\omega + 3\omega^2 + \ldots. + 3n\omega^{3n-1}$ is

A. $\frac{3n}{\omega - 1}$

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

C. $(3n - 1)\omega$

D. 0

Answer: A

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22. The smallest positive integral value of $'n'$ such that $\left[\frac{1 + \sin\frac{\pi}{8} + i\cos\frac{\pi}{8}}{1 + \sin\frac{\pi}{8} - i\cos\frac{\pi}{8}}\right]^n$ is purely imaginary if

A. 2

B. 3

C. 4

D. 1

Answer: C

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23. If $1, \omega$ and ω^2 are the cube roots of unity, then the value of $\left[1-\omega+\omega^2\right]\left[1-\omega^2+\omega^4\right]\ldots$. upto 8 terms is

A. 2^6

B. 2^{10}

C. 2^{12}

D. 2^8

Answer: A

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24. If $Z = i \log(2 - \sqrt{3})$,then $\cos(Z)$=

A. i

B. 2i

C. 1

D. 2

Answer: D

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25. If z = $\begin{vmatrix} 1 & 1+2i & -5i \\ 1-2i & -3 & 5+3i \\ 5i & 5-3i & 7 \end{vmatrix}$, then $(i = \sqrt{-1})$

A. z is purely real

B. z is purely imaginary

C. $z + \bar{z} = 0$

D. none of these

Answer: A

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

A. i

B. -1

C. $-i$

D. 0

Answer: A

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27. 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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28. If $z \neq 1$ and $\frac{z^2}{z-1}$ is real, the point represented by the complex numbers z lies

A. either on the real axis or on a circle passing through the origin

B. on a circle with centre at origin

C. either on the real axis or on a circle not passing through the origin

D. on the imaginary axis

Answer: A

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29. 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. 1,0

C. 1,1

D. $-1, 1$

Answer: C

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30. Let z_1 and z_2 be two distinct complex numbers and $z = (1-t)z_1 + iz_2$, for some real number t with $0 < t < 1$ and $i = \sqrt{-1}$. If arg(w) denotes the principal argument of a non-zero compolex number w, then

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

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: A::C::D

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31. If z is any complex number satisfying $|z - 3 - 2i| \leq 1$ then the minimum value of $|2z - 6 + 5i|$ is

A. 5

B. 6

C. 7

D. 0

Answer: A

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32. 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. 4

C. 0

D. 1

Answer: B

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33. If z is a complex number of unit modulus and argument θ then arg $\left(\frac{1+z}{1-\bar{z}}\right) =$

A. $-\theta$

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

C. θ

D. $\pi-\theta$

Answer: C

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Miscellaneous Exercise (Matching Entries)

1. Match the entries of List - a and List - b :

	List-A		List-B
(a)	$\arg \frac{i(\sqrt{3}+i)^6}{4(1-i\sqrt{3})^2} =$	1.	0
(b)	If $\lvert z_1+z_2\rvert = \lvert z_1\rvert + \lvert z_2\rvert$, then $\arg\left(\frac{z_1}{z_2}\right) =$	2.	$2(\text{Re } z)^2 = 2x^2$
(c)	If $\arg z < 0$, then $\arg(-z) - \arg(z) =$	3.	$\pi/6$
(d)	If $\arg z = \frac{\pi}{4}$, then $\text{Im } z^2 =$	4.	π

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2. Match the entries of List - a and List - b :

List-A	List-B
(a) $\sin\frac{\pi}{900}\left\{\sum_{r=1}^{10}(r-\omega)(r-\omega^2)\right\}=$	1. 0
(b) If roots of $t^2+t+1=0$ be α,β then $\alpha^4+\beta^4+\alpha^{-1}\beta^{-1}=$	2. 4
(c) If $\left[\frac{1+\cos\theta+i\sin\theta}{\sin\theta+i(1+\cos\theta)}\right]^4=\cos n\theta+i\sin n\theta$, then $n=$	3. i
(d) If $z_r=\cos\frac{\pi}{3^r}+i\sin\frac{\pi}{3^r}$, $r=1,2,3,\ldots$, then value of $z_1z_2z_3\ldots\infty=$	4. 1

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3. Match the entries of List - a and List - b :

List-A	List-B
(a) If $\left(\frac{1+i}{1-i}\right)^n=1$, then the least value of n is	1. $1+\sqrt{3}$
(b) If $\left\|z+\frac{2}{z}\right\|=2$, then max. value of $\|z\|$ is	2. circle
(c) If $\arg\frac{z-1}{z+1}=\frac{\pi}{3}$, then locus of the point z is	3. $\|z\|<5$
(d) If $\log_{\sqrt{3}}\left[\frac{\|z\|^2-\|z\|+1}{2+\|z\|}\right]<2$, then locus of z is	4. 4

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4. Match the entries of List - a and List - b :

List-A	List-B
(a) If z_1 and z_2 be two nth roots of unity, then $\arg\left(\frac{z_1}{z_2}\right)$ is a multiple of	1. $-\frac{1}{\omega_1\omega_2}$
(b) If $\omega \neq 1$ be nth root of unity, then $\omega+\omega^2+\omega^3+\ldots+\omega^{n-1}=$	2. $-\frac{2n}{1-\omega}$
(c) $1+3\omega+5\omega^2+\ldots n$ terms $=$	3. -1
(d) $(1-\omega)(1-\omega^2)\ldots(1-\omega^{n-1})=$	4. $\frac{2\pi}{n}$
(e) If ω_1, ω_2 be complex cube roots of unity, then $\omega_1^4+\omega_2^4=$	5. n

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5. Match the entries of List - a and List - b :

List-A	List-B
(a) $\lvert A\rvert^2$	1. $\Sigma\lvert z_1\rvert^2+\bar{z}_1(z_2w+z_3w^2)+\bar{z}_2(z_3w+z_1w^2)+\bar{z}_3(z_1w+z_2w^2)$
(b) $\lvert B\rvert^2$	2. $\Sigma\lvert z_1\rvert^2+\bar{z}_1(z_2w^2+z_3w)+\bar{z}_2(z_3w^2+z_1w)+\bar{z}_3(z_1w^2+z_2w)$
(c) $\lvert C\rvert^2$	3. $3\Sigma\lvert z_1\rvert^2$
(d) $\Sigma\lvert A\rvert^2$	4. $\Sigma\lvert z_1\rvert^2+\bar{z}_1(z_2+z_3)+\bar{z}_2(z_3+z_1)+\bar{z}_3(z_1+z_2)$

(e) Express z_1, z_2, z_3 in terms of A, B, C.

(f) Prove : $\lvert A\rvert^2+\lvert B\rvert^2+\lvert C\rvert^2=3(\lvert z_1\rvert^2+\lvert z_2\rvert^2+\lvert z_3\rvert^2)$.

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6. If a, b, c are distant integers and $w \neq 1$ is a cube root of unity, then

Column-I	Column-II
(a) $\lvert a+bw+cw^2\rvert^2$	(p) 1
(b) $\lvert a+bw+cw^2\rvert^2+\lvert a+bw^2+cw\rvert^2$	(q) ≥ 1
(c) $\left\lvert\frac{a+bw+cw^2}{a+bw^2+cw}\right\rvert$	(r) ≥ 2
(d) $\lvert a+bw^2+cw\rvert$	(s) 2

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7. Number of solutions of

Column-I	Column-II
(a) $z^2 + \lvert z \rvert = 0$	(p) 1
(b) $z^2 + \bar{z}^2 = 0$	(q) 3
(c) $z^2 + 8\bar{z} = 0$	(r) 4
(d) $\lvert z - 2 \rvert = 1$ and $\lvert z - 1 \rvert = 2$	(s) Infinite

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8. Centres of the following circles are :

Column-I	Column-II
(a) $\lvert z - 2 \rvert^2 + \lvert z - 4i \rvert^2 = 20$	(p) $(1, -1)$
(b) $\left\lvert \frac{z-1}{z+1} \right\rvert = \frac{1}{2}$	(q) $\left(\frac{5}{3}, 0\right)$
(c) $z\bar{z} - (1+i)z - (1-i)\bar{z} + 7 = 0$	(r) $(-4, -1)$
(d) $\arg \frac{(z+3+4i)}{(z+5-2i)} = \frac{\pi}{2}$	(s) $(1, 2)$

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9. The following curves represents the equations of

Column-I	Column-II
(a) $\lvert z-3\rvert+\lvert z-i\rvert=10$	(p) Circle
(b) $\left\lvert\frac{2z-3}{z-i}\right\rvert=2$	(q) Hyperbola
(c) $z^2+\bar{z}^2=5$	(r) Straight line
(d) $\left\lvert\frac{z-6}{z-2i}\right\rvert=3$	(s) Ellipse

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Assertion / Reason

1. 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/barz|=1

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2. Statement - 1 : a, b, c are three non - zero real numbers such that a + b + c = 0 and z_1, z_2, z_3 are three complex number such that

$az_1 + bz_1 + cz_3 = 0 \text{ then } z_1, z_2, z_3$ lie on a circle .

Statement -2 : If z_1, z_2, z_3 are collinear, then $\begin{vmatrix} z_1 & \bar{z}_1 & 1 \\ z_2 & \bar{z}_2 & 1 \\ z_3 & \bar{z}_3 & 1 \end{vmatrix} = 0$

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