MATHS

JEE (MAIN AND ADVANCED) MATHEMATICS

COMPLEX NUMBERS

EXAMPLE

1. If $z_1 = (2, 3), z_2 = (5, 6)$, then find $\frac{z_1}{z_2}$.

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2. Simplify $\sqrt{5}\sqrt{-3}$

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3. Simplify $\sqrt{-7} \times \sqrt{-8}$?

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SOLVED EXAMPLES

1. Simplify

$i^2 + i^4 + i^6 + \ldots . + (2n + 1)$ terms

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2. Show that the least positive integral value of n for which $\left(\frac{1+i}{1-i}\right)^n = 1$ is 4.

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3. If $\left(\frac{1+i}{1-i}\right) - \left(\frac{1-i}{1+i}\right)$ = x +iy find x and y .

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4. Show that $\sum_{n=1}^{25} \left(i^n + i^{n+1}\right) = i - 1$

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5. Show that $\frac{2-i}{(1-2i)^2}$ and $\left(\frac{-2-11i}{25}\right)$ are conjugate to each other

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6. Find the real values of θ , such that $\frac{3+2i\sin\theta}{1-2i\sin\theta}$ is purely Real

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7. Find the real values of θ, such that $\frac{3+2i\sin\theta}{1-2i\sin\theta}$ is purely Imaginary

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8. If $\left(\sqrt{3}i\right)^{100} = 2^{99}(a+ib)$. Then shot that $a^2+b^2=4$

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9. If z_1, z_2, z_3 are complex numbers such that $|z|_1 = |z|_2 = |z|_3 = \left|\frac{1}{z_1}+\frac{1}{z_2}+\frac{1}{z_3}\right| = 1$ then show that $|z_1+z_2+z_3| = 1.$

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10. Area of the triangle formed by the Argrand diagram formed by the complex numbers z , iz and z + iz is

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11. If z_z, z_2 are two non-zero complex numbers satisfying $|z_2 + z_2| = |z_1| + |z_2|$, show that Arg z_1- Arg $z_2 = 0$

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12. If z = x + iy and if the point P in the argand plane represents z then find the locus of P satisfying the following equations

$$Re\left(\frac{z-4}{z-2i}\right) = 0(z \neq 2i)$$

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13. If z = x + iy and if the point P in the argand plane represents z then find the locus of P satisfying the following equations

$\left|\frac{z-a}{z+\bar{a}}=1\right|$ (Real part of a is non-zero)

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14. Show that the locus of z = x + iy such that the amplitude of $\frac{z-1}{z+1}$ is equal to $\frac{\pi}{4}$. prove that $x^2+y^2-2y-1=0$

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15. Reduce the complex numbers $3+4i, \frac{3}{2}(7+i)(1+i), \frac{2(i-18)}{(1+i)^2}, \frac{5(i-3)}{1+i}$ to a + ib form. Show that the four points represented by these complex numbers from a square

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16. If $\frac{z_3 - z_1}{z_2 - z_1}$ is a real number, show that the points represented by the complex numbers z_1, z_2, z_3 are collinear.

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17. Describe geometrically the following subsets of C :

$\{z \in C | z - 1 + i| = 1\}$

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18. Describe geometrically the following subsets of C :

$\{z \in C | z + i| \leq 3\}$

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ADDITIONAL SOLVED EXAMPLES

1. $\sum_{n=0}^{\infty}\left(\frac{2i}{3}\right)^n =$

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2. If $\begin{vmatrix} 6i & -3i & 1 \\ 4 & 3i & -1 \\ 20 & 3 & i \end{vmatrix}$ = x +iy show that x = y = 0

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3. If a , b , c are integers not all equal and w is a cube root of unity $(w \neq 1)$ then find the minimum value of $\left|a+bw+cw^2\right|$

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4. If z_1, z_2, z_3 are the vertices of an equilateral triangle with centroid at z_0 show that $z_1^2+z_2^2+z_3^2=3z_0^2$

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5. If z is a complex number such that |z| = 2 , find the maximum and minimum value of $|z-2+3i|$

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6. Show that the equation of any circle in the complex plane is of the form

$z\bar{z}+\mathbf{a}rz+\bar{b}z+c=0,(b\in C,c\in R)$

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7. If a complex number z satisfies the relation $z^2+z^{-2}=2$, then the locus of z is

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EXERCISE - 5.1(VERY SHORT ANSWER QUESTIONS)

1. Simplify $i^{18} - 3i^7 + i^2(1 + i^4)(-i)^{26}$.

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2. Write the following complex numbers in the form $A + iB$. $(1 + 2i)^3$

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3. Express the following in the form a + ib

$$\frac{4 + 3i}{(2 + 3i)(4 - 3i)}$$

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4. Express the following in the form a + ib

$(-5i)\left(\frac{i}{8}\right)$

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5. Write the complex numbers in the form $A + iB$

$(-1)2i$

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6. Express the following in the form a + ib

i^9

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7. Express the following in the form a + ib

i^{-19}

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8. Express the following in the form a + ib

$3(7+7i)+i(7+7i)$

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9. Express the following in the form a + ib

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

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10. Express $\frac{4+2i}{1-2i}+\frac{3+4i}{2+3i}$ in the form $a+b, a \in R, b \in R$

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11. Express the following in the form a + ib

$(1-i)^3(1-i)$

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12. Express the following in the form a + ib

$\left(-\sqrt{3}+\sqrt{-2}\right)\left(2\sqrt{3}-i\right)$

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13. If $z_1 = (2, -1), z_2 = (6, 3)$ find $z_1 - z_2$

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14. If $z_1 = (3, 5)$ and $z_2 = (2, 6)$ find $z_1 . z_2$

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15. If $z_1 = (6, 3), z_2 = (2, -1)$, find $\frac{z_1}{z_2}$

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16. If 4x + i(3x-y) =3+ i(-6), where x and y are real numbers, then find the values of x and y.

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17. Find the real values of x and y if $\frac{x-1}{3+1} + \frac{y-1}{3-i} = i$

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18. Write the additive inverse of the complex numbers.

$(2, 1)(-4, 6)$

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19. Write the additive inverse of the complex numbers.

$(\sqrt{3}, \sqrt{5}$

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20. Write the additive inverse of the complex numbers. ltbr

$(-6, 5) + (10, -4)$

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21. Find the additive inverse of the following

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

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22. Find the multiplicative inverse of $7+24i$

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23. Find the multiplicative inverser of the following

$(-2, 1)$

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24. Find the multiplicative inverser of the following

$(3, 4)$

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25. Find the multiplicative inverser of the following

$(\sin\theta, \cos\theta)$

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26. Find the multiplicative inverser of the following

$$\frac{3+i}{1+i}$$

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27. Find the multiplicative inverser of the following

i^{-35}

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28. Find the multiplicative inverser of the following

$\sqrt{5} + 3i$

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29. Find the multiplicative inverser of the following

$-i$

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30. Find the modulus of the following

$(3 - 4i)(3 + 4i)$

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31. Find the modulus of the following

$$\frac{4+3i}{5-12i}$$

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32. If $\frac{z_2}{z_1}(z_1 \neq 0)$ is an imaginary number, then find the value of $\left|\frac{2z_1+z_2}{2z_1-z_2}\right|$

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33. If $z = 5 + \left(3\sqrt{2}\right)i$, find $z\bar{z}$.

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34. Find the complex conjugate fo the following

$(3+4i)$

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35. Find the complex conjugate fo the following

$(15 + 3i) - (4 - 20i)$

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36. Write the conjugate of the complex numbers

$(2 + 5i)(-4 + 6i)$

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37. Write the conjugate of the following complex number $\frac{5i}{7 + i}$

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38. Find the complex conjugate fo the following

$(3+4i)(2-3i)$

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39. If $z=(\cos\theta,\sin\theta)$, find $\left(z-\frac{1}{z}\right)$

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40. If $z=2-3i$, then show that $z^2-4z+13=0$

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41. If $(a+ib)^2=x+iy$ find x^2+y^2

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42. Find real and imaginary parts of the complex number $\frac{a+ib}{a-ib}$

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43. In the Argrand plane, the points represented by the complex numbers $1+2i, 2+3i$ and $-4-3i$ form

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EXERCISE - 5.1 (SHORT ANSWER QUESTIONS)

1. If x and y are real numbers of such that $\frac{(1+i)x-2i}{3+i}+\frac{(2-3i)y+i}{3-i}=i$, then determine the values of x and y.

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2. Write $\left(\frac{a+ib}{a-ib}\right)^2 - \left(\frac{a-ib}{a+ib}\right)^2$ in the fom of x+iy

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3. If $x+iy = \frac{1}{1+\cos\theta+i\sin\theta}$, show that $4x^2-1=0$

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4. If $x+iy = \frac{3}{2+\cos\theta+i\sin\theta}$, show that $x^2+y^2 = 4x-3$

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5. If $u+iv = \frac{2+i}{z+3}$ and $z = x+iy$ find u, v

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6. Show that $\frac{2-i}{(1-2i)^2}$ and $\left(\frac{-2-11i}{25}\right)$ are conjugate to each other

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7. If $(1-i)(2-i)(3-i)\ldots.(1-ni)=\xi y$ then prove that $2.510\ldots..(1+n)^2=x^2+y^2$

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8. Simplify the following complex numbers and find their modulus.

$=\frac{(2+4i)(1+2i)}{(-1-i)(3-i)}$

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9. Simplify the number and find modulus .

$$\frac{(1+i)^3}{(2+i)(1+2i)}$$

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10. Simplify $-2i(3+i)(2+4i)(1+i)$ and obtain the modulus of that complex number.

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11. If $z = 3 - 5i$ Show that $z^3 - 10z^2 + 58z - 136 = 0$

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12. If $z = 2 - i\sqrt{17}$, then show that $3z^3 - 4z^2 + z + 88 = 0$

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13. Find a square root for the complex number $3 + 4i$

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14. Find the square root fo $(-5 + 12i)$

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15. Find a squar root for the complex number $7 + 24i$

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16. Find the square root of $-47 + i8\sqrt{3}$

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17. Find the square root of $-8-6i$

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EXERCISE - 5.2 (VERY SHORT ANSWER QUESTIONS)

1. Express the complex number in modulus amplitudes form $1+I\sqrt{3}$

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2. Express the complex numbers modulus -amplitude form

$-1-i\sqrt{3}$

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3. Express in polar form (mod-Amplitude form)

$\sqrt{3}+i$

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4. The mod -amplitude form of $1 + \cos\theta - i\sin\theta$ is

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5. Express in polar form (mod-Amplitude form)

$-1 + i$

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6. Express in polar form (mod-Amplitude form)

$-2 + 2i\sqrt{3}$

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7. Express of the following complex numbers in modulus amplidutes form. $1 - i$

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8. Express in polar form (mod-Amplitude form)

$-\sqrt{7} + i\sqrt{21}$

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9. Express in polar form (mod-Amplitude form)

$-1 - i$

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10. If $\sqrt{3}+i=r(\cos\theta+i\sin\theta)$, then find the value of θ in radian measure.

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11. If $z_1=-1$ and $z_2=-i$, then find Arg (z_1z_2)

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12. If $z_1=-1, z_2=i$ then find Arg $\left(\frac{z_1}{z_2}\right)$

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13. If $z_1=-1, z_2=i$ then find Arg $\left(\frac{z_1}{z_2}\right)$

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14. If the Arg $\bar{z}_1$ Arg $z_1 \text{are} \frac{\pi}{5}$ and $\frac{\pi}{3}$ respectively find (Arg $z_1 Arg z_2$)

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15. If $z \neq 0$, find Arge $z + Arg\bar{z}$

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16. If $z = \frac{1+2i}{1-(1-i)^2}$ then find Arg z

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17. If z = x + iy and if the point P in the argand plane represents z , then the locus of P satisfying the equation

Im $\left(z^2\right) = 4$

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18. If z = x + iy and if the point P in the argand plane represents z , then the locus of P satisfying the equation

$z(z+2)=3$

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19. If z = x + iy and if the point P in the argand plane represents z , then the locus of P satisfying the equation

$|z|=2$

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20. If z = x + iy and if the point P in the argand plane represents z , then the locus of P satisfying the equation

$|z-2+3i|=4$

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21. If z = x + iy and if the point P in the argand plane represents z , then the locus of P satisfying the equation

$|2z - 3| = 7$

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22. If $z = (x + iy)$ and if the point P in the Argarand plane represent z, then desrcibe geo-metrically the locus of P satispfying the equation.

$|z|^2 4Re(z + 2)$

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23. If z = x + iy and if the point P in the argand plane represents z , then the locus of P satisfying the equation

$|z + i|^2 - |z - i|^2 = 2$

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24. If z = x + iy and if the point P in the argand plane represents z , then the locus of P satisfying the equation

$\{z \in C, |z-2| = 2|z-1|\}$

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25. If a is real number such that |z-ai|=|z+ai| , then the locus of z is

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26. If z = x + iy and if the point P in the argand plane represents z , then the locus of P satisfying the equation

Amplitude of $(z-1)$ is $\frac{\pi}{2}$

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27. If z = x + iy and if the point P in the argand plane represents z , then the locus of P satisfying the equation

$|z-3+i|=4$

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28. If z = x + iy and if the point P in the argand plane represents z , then the locus of P satisfying the equation

$|z-2-3i|=5$

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29. If z = x + iy and if the point P in the argand plane represents z , then the locus of P satisfying the equation

$|z|=1$

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30. If z = x + iy and if the point P in the argand plane represents z , then the locus of P satisfying the equation

|z-2-3i|=5

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31. Show that the points in the Argand diagram represented by the complex number $1+3i, 4-3i, 5-5i$ are collinear.

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32. Show that the equation of the straight line joining the points $2-3i, \ -4+3i$ is $x+y+1=0$

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33. Find the equation of the straight line joining the points $-9+6i, 11-4i$ in the Argand plane .

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34. Find the equation of the perpendicular bisector of the segment joining the points $7+7i, 7-7i$ in the Argand diagram.

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EXERCISE - 5.2 (Short Answer Questions)

1. If z = x +iy and if the point P in the argand plane represents z then find the locus of P satisfying the equation

Re $\left(\frac{z+1}{z+i}\right)=1$

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2. If z = x +iy and if the point P in the argand plane represents z then find the locus of P satisfying the equation

$\frac{z-i}{z-1}$ is purely imaginary

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3. If z = x +iy and if the point P in the argand plane represents z then find the locus of P satisfying the equation

$|z+4i|+|z-4i|=10$

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4. If z = x +iy and if the point P in the argand plane represents z then find the locus of P satisfying the equation

Amplitude $\left(\frac{z-2}{z-6i}\right)=\frac{\pi}{2}$

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5. Show that the points in the Argand digraam represented by the complex numbers $2+2i,\ -2-2i, 2\sqrt{3}+2\sqrt{3}i$ are the vertices of an equilateral triangle.

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6. Show that the points in the Argand plane represented by the complex numbers $-2+7i,\ -\frac{3}{2}+\frac{1}{2}+i4-3i\frac{7}{2}(1+i)$ are the vertices of a rhombus.

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7. Show that the points in the Argand plnae, represented by the complex numbers $2+i4+3i, 2+5i, 3i$ are the vertices of a square.

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8. The points P,Q denote the complex numbers, $\bar{z}_1, \bar{z}_2$ in the Argand diagram. O. is the origin. If $\overline{z_1 z_2} + \overline{z_2 z_1} = 0$, show that $\angle POQ = 90^\circ$

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9. Find the eccentricity of the ellipse whose equation is $|z-4| + \left|z - \frac{12}{5}\right| = 10$

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10. The complex z has argument $\theta\left(0 < \theta < \frac{\pi}{2}\right)$ and satisfy the equation $|z - 3i| = 3$ then prove that $\left(\cot\theta - \frac{6}{z}\right) = i$

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ADDITIONAL EXERCISE

1. If z_1, z_2 are two complex numbers satisfying $\left|\frac{z_1 - 3z_2}{3 - z_1\bar{z}_2}\right| = 1, |z_1| \neq 3$ then $|z_2| =$

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2. If $(1 + \cos\theta + i\sin\theta)(1 + \cos 2\theta + i\sin 2\theta) = x + iy$ then y =

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3. Find the general value of x if the expression $\frac{\sin\frac{x}{2} + \cos\frac{x}{2} + i\tan x}{1 + 2i\sin\frac{x}{2}}$ is real .

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4. Find the area of the triangle whose vertices are the roots of $z^3 + iz^2 + 2i = 0$

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5. If a and b are real numbers between 0 and 1 such that $z_1 = a + i$ and $z_2 = 1 + bi$ and $z_3 = 0$ form an equilateral triangle then find a and b .

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6. If z_1, z_2 are complex numbers and if $|z_1 + z_2| = |z_1 - z_2|$ show that are $(z_1) - arg(z_2) = \pm \frac{\pi}{2}$

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7. If z_1, z_2 are complex numbers and if $|z_1 + z_2| = |z_1| - |z_2|$ show that arg $(z_1) - arg(z_2) = \pi$.

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8. Let z,w be complex number such that $\bar{z} + i\overline{w} = 0$ and arg zw $= \pi$.

Then arg z =

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

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10. Find the nature of the triangle with vertices z_1, z_2, z_3 satisfying $\frac{z_1 - z_3}{z_2 - z_3} = \frac{1 + i\sqrt{3}}{2}$

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11. Find the number of solutions of the equation $z^2 + |z|^2 = 0$

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12. Find the solutions of the equation $z^2 + |z| = 0$.

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13. If $\left|z - \frac{2}{z}\right| = 1$ then find the maximum value of |z|.

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14. If $z_1 = -1$ and $z_2 = -i$, then find Arg $(z_1 z_2)$

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15. If $z = (x + iy)$ and if the point P in the Argand plane represents z , then discribe geometrically the locus of P satisfying the equations $|2z - 3| = 7$

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16. If $z = (x + iy)$ and if the point P in the Argarand plane represent z, then desrcibe geo-metrically the locus of P satispfying the equation.

$|z|^2 4Re(z + 2)$

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17. If $z = (x + iy)$ and if the point P in the Argand plane represents z , then discribe geometrically the locus of P satisfying the equations

$|z + i|^2 - |z - i|^2 = 2$

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EXERCISE - I

1. $\sqrt{5}\sqrt{-125} =$

A. 25

B. -25

C. 25i

D. $-25i$

Answer: B

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

A. i^n

B. 0

C. 1

D. i

Answer: B

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3. The least positive integer n for which $\frac{(1+i)^n}{((1-i))^{n-2}}$ is a real number is

A. 1

B. 4

C. 6

D. 14

Answer: A

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4. $(1+i)^6+(1-i)^3=$

A. $2+i$

B. $2-10i$

C. $-2-10i$

D. $-2+10i$

Answer: C

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5. The multiplicative inverse of $\frac{(3+4i)}{25}$ is

A. $4+3i$

B. $3-4i$

C. $-4-3i$

D. $-4+3i$

Answer: B

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6. The additive inverse of $(1+2i)(3-4i)$ is

A. $11+2i$

B. $11-2i$

C. $-11+2i$

D. $-11-2i$

Answer: D

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7. $\sum_{n=0}^{\infty}\left(\frac{2i}{3}\right)^n$ =

A. $\frac{9+6i}{13}$

B. $\frac{9-6i}{13}$

C. $9+6i$

D. $9-6i$

Answer: A

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8. $\left(\frac{2+3i}{2-3i}\right)-\left(\frac{2-3i}{2+3i}\right)$ in the form of a + ib

A. $\frac{24i}{13}$

B. $\frac{27i}{13}$

C. $\frac{28i}{13}$

D. $\frac{30i}{13}$

Answer: A

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9. The conjugate complex number of $\frac{2-i}{(1-2i)^2}$ is

A. $\frac{2}{25}+\frac{11}{25}i$

B. $\frac{2}{25}-\frac{11}{25}i$

C. $-\frac{2}{25}+\frac{11}{25}i$

D. $-\frac{2}{25}-\frac{11}{25}i$

Answer: D

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10. The complex number $\sin x + i\cos 2x$ and $\cos x - i\sin 2x$ are conjugate to each other for

A. $x = n\pi$

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

C. $x = 0$

D. No value of x

Answer: D

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11. The modulus of $\frac{\sqrt{3} + i}{(1 + i)\left(1 + \sqrt{3}i\right)}$ is

A. 1

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

C. $\sqrt{2}$

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

Answer: D

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12. If α and β are real them $\left|\frac{\alpha+i\beta}{\beta+i\alpha}\right| =$

A. lies between 0 and 1

B. 1

C. >1

D. 0

Answer: B

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13. If $\left(\sqrt{3}i\right)^{100} = 2^{99}(a+ib)$. Then shot that $a^2+b^2=4$

A. $\sqrt{2}$

B. 4

C. $\sqrt{3}$

D. 3

Answer: B

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14. If $\alpha_1, \alpha_2, \alpha_3$ respectively denote the moduli of the complex number $-i$, $\frac{1}{3}(1+i)$ and $-1+i$, then their increasing order is

A. $\alpha_1, \alpha_2, \alpha_3$

B. $\alpha_3, \alpha_2, \alpha_1$

C. $\alpha_2, \alpha_1, \alpha_3$

D. $\alpha_3, \alpha_1, \alpha_2$

Answer: C

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15. If $\frac{\pi}{2}$ and $\frac{\pi}{4}$ are the arguments of z_1 and $\bar{z}_2$ respectively , then Arg $\frac{z_1}{z_2}$ =

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

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

C. π

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

Answer: A

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16. If $z_1 = -1, z_2 = i$ then find Arg $\left(\frac{z_1}{z_2}\right)$

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

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

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

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

Answer: A

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17. The mod-amplitude form of $-\sqrt{3}-i$

A. $2cis\left(\frac{5\pi}{6}\right)$

B. $2cis\left(\frac{-5\pi}{6}\right)$

C. $2cis\left(\frac{-\pi}{6}\right)$

D. $2cis\left(\frac{\pi}{6}\right)$

Answer: B

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18. $z = 1 + i\sqrt{3} \Rightarrow |Arg z| + |Arg \bar{z}| =$

A. 0

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

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

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

Answer: D

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19. $\sqrt{-8-6i}$ is equal to

A. $\pm(1-3i)$

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

C. $\pm(1+3i)$

D. none of these

Answer: A

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20. The value of $\sqrt{15+8i}+\sqrt{15-8i}$ is equal to

A. 15

B. 8

C. 23

D. 7

Answer: B

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

A. 0

B. 1

C. -1

D. 2

Answer: D

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22.

$(1+\omega)(1+\omega^2)(1+\omega^3)(1+\omega^4)(1+\omega^5)(1+\omega^6)\ldots.(1+\omega^{3n}) =$

A. 2^{3n}

B. 2^{2n}

C. 2^n

D. 0

Answer: C

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23. If $1, \omega, \omega^2$ are the cube roots of unity, then prove that $\frac{1}{2+\omega} - \frac{1}{1+2\omega} = \frac{1}{1+\omega}$.

A. ω

B. ω^2

C. $a^2 + b^2$

D. 0

Answer: D

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24. The value of $\left(\frac{-1+\sqrt{-3}}{2}\right)^{26} + \left(\frac{-1-\sqrt{-3}}{2}\right)^{26}$ is equal to

A. -1

B. 1

C. 0

D. 2

Answer: A

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25. If $(1+\omega)^7 = A + B\omega$ then (A , B) =

A. $(1, 1)$

B. (1 , 2)

C. (2 , 1)

D. (2 , 2)

Answer: A

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26. If |3z-2|=5 then the locus of z is

A. $9x^2 + 9y^2 + 12x - 21 = 0$

B. $9x^2 + 9y^2 - 12x - 21 = 0$

C. $9x^2 + 9y^2 + 12x + 21 = 0$

D. $9x^2 - 9y^2 + 12x - 21 = 0$

Answer: B

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27. If $|z - 2 - 3i| = 5$ then the locus of $z = x + iy$ is

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

B. $x^2 + y^2 - 4x - 6y - 12 = 0$

C. $x^2 + y^2 + 3x - 2y = 0$

D. $3x^2 + 3y^2 - 22x + 35 = 0$

Answer: B

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28. The equation $|z-1|^2 + |z+1|^2 = 2$ represents

A. a circle of radius one unit

B. a straight line

C. the ordered pair (0,0)

D. parabola

Answer: C

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29. If Re $\left(z^2\right) = 2$ then the locus of z is

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

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

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

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

Answer: D

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30. If amp (z-i) $= \pi/3$ then the locus of z is

A. $\sqrt{3} - y + 10, x > 0, y > 1$

B. $\sqrt{3}x + y - 1 = 0$

C. $\sqrt{3}x - y - 1 = 0$

D. $\sqrt{3}x + y + 1 = 0$

Answer: A

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31. The locus of Z satisfying $|z| + |z - 1| = 3$ is

A. a circle

B. a pair of straight line

C. an ellipse

D. a parabola

Answer: C

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32. If the amplitude of $z - 2 - 3i$ is $\pi/4$, then the locus of z = x +iy is

A. $x + y - 1 = 0$

B. $x - y - 1 = 0$

C. $x + y + 1 = 0$

D. $x - y + 1 = 0$

Answer: D

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

A. 1^{st} quadrant

B. 2^{nd} quadrant

C. 3^{rd} quadrant

D. 4^{th} quadrant

Answer: B

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34. If three complex number are in A.P then they lie on

A. straight line

B. a circle

C. a parabola

D. ellipse

Answer: A

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35. In the Argand plane, the points represented by the complex numbers $2-6i, 4-7i, 3-5i$ and $1-4i$ form

A. parallelogram

B. rectangle

C. rhombus

D. square

Answer: C

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36. The condition for the points z_1, z_2, z_3, z_4 taken in order in the Argand plane to be the vertices of the parallelogram is

A. $z_1 + z_2 = z_3 + z_4$

B. $z_1 + z_3 = z_2 + z_4$

C. $z_1 + z_2 + z_3 + z_4 = 0$

D. $z_1 + z_2 + z_3 = z_4$

Answer: B

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37. The equation of the line joining the points represented by 2- 3i and -3+ 4i in the Argand plane is

A. $7x - 5y - 1 = 0$

B. $7x + 5y - 1 = 0$

C. $7x + 5y + 1 = 0$

D. $7x - 5y + 1 = 0$

Answer: C

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38. The number of complex number z such |z-1|=|z+1|=|z-i| equals

A. 0

B. 1

C. 2

D. ∞

Answer: B

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39. Statement - I : If z_1 and z_2 are two nonzero complex numbers such that $|z_1 + z_2| = |z_1| + |z_2|$ then arg z_1 - arg z_2 is $\pi / 2$

Statement - II : z_1 and z_2 are two complex numbers such that $|z_1 z_2| = 1$ and arg z_1 - arg z_2 is $\pi / 2$ then $\bar{z}_1 z_2 = -i$

A. Only I is true

B. Only II is true

C. Both I and II are true

D. Neither I nor II are true

Answer: B

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40. Statement - I : If a and b are positive real numbers then $\sqrt{-a} \times \sqrt{-b}$ is equal to $\sqrt{ab}$

Statement - II : The argument of $\frac{1+i\sqrt{3}}{1-i\sqrt{3}}$ is 120^0

A. Only I is true

B. Only II is true

C. Both I and II are true

D. Neither I nor II are true

Answer: B

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41. Statement - I : If $z = \bar{z}$ then z is purely imaginary

Statement- II : If $z = -\bar{z}$ then z is purely real

A. Only I is true

B. Only II is true

C. Both I and II are true

D. Neither I nor II are true

Answer: D

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42. In Argand plane , the quadrant in which $\frac{1+2i}{1-i}$ lies is

A. First

B. Second

C. Third

D. Fourth

Answer: B

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43. The descending order of the moduli of

$z_1 = (3 - 4i)(4 + 3i), z_2 = \frac{3 + 4i}{1 + i}, z_3 = \frac{(3 + i)(2 - i)}{1 + i}, z_4 = 5 + 12i$

is

A. z_1, z_4, z_3, z_2

B. $z_4, z_2, z_1 z_3$

C. z_3, z_1, z_2, z_4

D. z_4, z_3, z_2, z_1

Answer: A

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44. Match the following:

List-I	List-II
A) $\sin^{-1} x = \cos^{-1} x$ then x	1) 0
B) $\sin^{-1} x = \tan^{-1} x$ then x	2) $\sqrt{\frac{\sqrt{5}-1}{2}}$
C) $\cos^{-1} x = \tan^{-1} x$ then x	3) $\frac{1}{\sqrt{2}}$
D) $\sin^{-1} x = \cos^{-1}\left(\frac{1}{x}\right)$ then x	4) no value

A. a , c , b , d

B. b , d , c , a

C. a , d , c , b

D. c , a , b ,d

Answer: C

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45. $(3-\omega)\left(3-\omega^2\right)\left(3-\omega^4\right)\left(3-\omega^8\right)$ =

A. 81

B. 13^4

C. 169

D. 0

Answer: C

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46. $i+i^2+i^3+i^4+\ldots.+i^{100}$

A. 0

B. i

C. $i-1$

D. -1

Answer: A

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47. $1 + \omega + \omega^2 + \ldots\ldots + \omega^{300}$

A. 0

B. $-\omega^2$

C. $-\omega$

D. 1

Answer: D

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48. $i + 2i^2 + 3i^3 + 4i^4 + \ldots. + 100i^{100}$ =

A. $25(1+i)$

B. $50(1-i)$

C. $100(1-i)$

D. 0

Answer: B

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49. $\omega + 2\omega^2 + 3\omega^3 + \ldots . 90\omega^{90} =$

A. $30(1-\omega)$

B. $45(1-\omega)$

C. $90(1-\omega)$

D. 0

Answer: A

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EXERCISE -II

1. If Q denotes the set of all rational numbers and f(p/q) = $\sqrt{p^2 - q^2}$ for any $\frac{p}{q} \in Q$ then observe the following Statements

Statement-I : $f\left(\frac{p}{q}\right)$ is real for each $\frac{p}{q} \in Q$

Statement -II : $f\left(\frac{p}{q}\right)$ is a complex number for each $\frac{p}{q} \in Q$

A. Both I and II are true

B. I is true , II is false

C. I is false , II is true

D. Both I and II are false

Answer: C

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2. If $\frac{3}{2+\cos\theta+i\sin\theta}=x+iy$ then (x-1)(x-3)=

A. y^2

B. $-y^2$

C. 0

D. 1

Answer: B

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3. If $(1+\cos\theta+i\sin\theta)(1+\cos 2\theta+i\sin 2\theta)=x+iy$ then y =

A. $x\tan\left(\frac{3\theta}{2}\right)$

B. $x\tan\left(\frac{5\theta}{2}\right)$

C. $x\tan\left(\frac{7\theta}{2}\right)$

D. $x\tan\left(\frac{9\theta}{2}\right)$

Answer: A

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4. If $(x+iy)^{\frac{1}{3}} = a+ib$, then $\left(\frac{x}{a}\right)+\left(\frac{y}{b}\right)$ =

A. a^2-b^2

B. $4\left(a^2-b^2\right)$

C. $2\left(a^2-b^2\right)$

D. $2\left(a^2+b^2\right)$

Answer: B

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5. Find the real values of θ, such that $\frac{3+2i\sin\theta}{1-2i\sin\theta}$ is purely Imaginary

A. $n\pi, n \in Z$

B. $n\pi \pm \frac{\pi}{2}, n \in Z$

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

D. $n\pi \pm \frac{\pi}{6}, n \in Z$

Answer: C

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6. If $\frac{\sin(x/2) + \cos(x/2) + i\tan x}{1 + 2i\sin(x/2)}$ is real then x =

A. $n\pi \text{ or } n\pi + \frac{\pi}{4}$

B. $2n\pi \text{ or } n\pi + \frac{\pi}{4}$

C. $n\pi \text{ or } n\pi + \frac{\pi}{2}$

D. $n\pi \text{ or } n\pi + \frac{\pi}{6}$

Answer: B

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7. If $\begin{vmatrix} 6i & -3i & 1 \\ 4 & 3i & -1 \\ 20 & 3 & i \end{vmatrix}$ = x +iy show that x = y = 0

A. $x = 3, y = 1$

B. $x = 0, y = 0$

C. $x = 1, y = 3$

D. $x = 0, y = 3$

Answer: B

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8. If $(a + ib)^5 = \alpha + i\beta$ then $(b + ia)^5 =$

A. $\beta + i\alpha$

B. $\beta - i\alpha$

C. $\alpha + i\beta$

D. $\alpha - i\beta$

Answer: A

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9. If $x = -5 + 4i$ then $x^4 + 9x^3 + 35x^2 - x + 4 =$

A. 170

B. 160

C. 170

D. -160

Answer: D

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10. If the point $z = (1+i)(1+2i)(1+3i)\ldots(1+10i)$ lies on a circle with centre at origin and radius r, then r^2 =

A. $10!$

B. $2 \times 3 \times 4 \times \ldots \times 10$

C. $2 \times 5 \times 10 \times \ldots \times 10!$

D. $11!$

Answer: C

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11. If $\frac{2+3i\sin\theta}{1-2i\sin\theta}$ is purely imaginary , then $\cos^2\theta =$

A. $1/2$

B. $3/2$

C. $1/3$

D. $2/3$

Answer: D

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12. If the first term and common ratio of a G.P are both $(1/2)\left(\sqrt{3}+i\right)$, then the absolute value of its n^{th} term is

A. 2^n

B. 3^n

C. 1

D. 4^n

Answer: C

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13. If $(1+\cos\theta-i\sin\theta)(1+\cos 2\theta+i\sin 2\theta)=x+iy$ then $x^2+y^2=$

A. $16\cos^2\theta\sin^2\left(\frac{\theta}{2}\right)$

B. $16\sin^2\theta\cos^2\left(\frac{\theta}{2}\right)$

C. $16\sin^2\theta\sin^2\left(\frac{\theta}{2}\right)$

D. $16\cos^2\theta\cos^2\left(\frac{\theta}{2}\right)$

Answer: D

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14. If $\frac{5z_2}{7z_1}$ is purely imaginary , then $\left|\frac{2z_1+3z_2}{2z_1-3z_2}\right|=$

A. $5/7$

B. $7/9$

C. $25/49$

D. 1

Answer: D

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

A. 0

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

C. 1

D. 2

Answer: C

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16. If z_1, z_2 are two complex numbers satisfying $\left|\frac{z_1 - 3z_2}{3 - z_1\bar{z}_2}\right| = 1, |z_1| \neq 3$ then $|z_2| =$

A. 1

B. 2

C. 3

D. 4

Answer: A

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17. If $\left|z - \frac{4}{z}\right| = 2$, then the maximum value |z| is equal to

A. $\sqrt{5}$

B. $\sqrt{5} + 1$

C. $\sqrt{5} - 1$

D. $1 - \sqrt{5}$

Answer: B

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18. The minimum value of $|z - 1| + |z - 5|$ is

A. 5

B. 4

C. 3

D. 2

Answer: B

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19. If $|z+2-i|=5$ then the maximum value of $|3z-9-7i|$ is

A. 18

B. 19

C. 20

D. 8

Answer: C

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20. The minimum value of

$|z-1|+|z-2|+|z-3|+|z-4|+|z-5|$ is

A. 3

B. 5

C. 7

D. 6

Answer: D

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

A. 6

B. 0

C. 4

D. 10

Answer: A

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22. If $|z_1| = |z_2| = |z_3| = \ldots |z_n| = 1$, then $|z_1 + z_2 + z_3 + \ldots . + z_n| =$

A. $\left|\frac{1}{z_1} + \frac{1}{z_2} + \frac{1}{z_3} + \ldots . + \frac{1}{z_n}\right|$

B. $\left|\frac{1}{z_1} - \frac{1}{z_2} + \frac{1}{z_3} - \ldots . + \frac{1}{z_n}\right|$

C. $\left|\frac{1}{z_1^2} + \frac{1}{z_2^2} + \frac{1}{z_3^2} + \ldots . . + \frac{1}{z_n^2}\right|$

D. $\left|\frac{1}{z_1^2} - \frac{1}{z_2^2} + \frac{1}{z_3^2} + \ldots + \frac{1}{z_n^2}\right|$

Answer: A

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23. If the equation $(1+i)^x = 2^x$, has integer solution , has the only integral solution is

A. 0

B. 2

C. 3

D. 1

Answer: A

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

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

B. 2

C. 1

D. 3

Answer: C

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25. The complex number z satisfying $z^2 + |z| = 0$ is

A. i

B. $-i$

C. $\pm i$

D. $i + 1$

Answer: C

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26. If z is a complex number satisfying the relation $|z + 1| = z + 2(1 + i)$, then z is

A. $\frac{1}{2}(1 + 4i)$

B. $\frac{1}{2}(3 + 4i)$

C. $\frac{1}{2}(3 - 4i)$

D. $\frac{1}{2}(1-4i)$

Answer: D

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27. If z_1, z_2 are conjugate complex numbers and z_3, z_4 are also conjugate , then $Arg\left(\frac{z_3}{z_2}\right) =$

A. Arg $\left(\frac{z_1}{z_4}\right)$

B. Arg $\left(\frac{z_4}{z_1}\right)$

C. Arg $\left(\frac{z_2}{z_4}\right)$

D. Arg $\left(\frac{z_1}{z_3}\right)$

Answer: A

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28. If z_z, z_2 are two non-zero complex numbers satisfying $|z_2 + z_2| = |z_1| + |z_2|$, show that Arg z_1- Arg $z_2 = 0$

A. $-\pi$

B. π

C. 0

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

Answer: C

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29. If $|z_1 + z_2| = |z_1 - z_2|$ then the difference in the arguments of z_1 and z_2 is

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

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

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

D. π

Answer: C

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30. The mod-amplitude form of $\frac{1+7i}{(2-i)^2}$ is

A. $\sqrt{2}cis\frac{3\pi}{4}$

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

C. cis $\left(-\frac{\pi}{2}\right)$

D. cis $\left(\frac{3\pi}{3}\right)$

Answer: A

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31. The mod -amplitude form of $1 + i\tan\theta$ is

A. $-\sec\theta cis(\pi + \theta)$

B. $-\sec\theta cis(\pi - \theta)$

C. $\sec\theta cis(\pi + \theta)$

D. $\sec\theta cis(\pi - \theta)$

Answer: A

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32. Let z,w be complex number such that $\bar{z} + i\overline{w} = 0$ and arg zw $= \pi$. Then arg z =

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

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

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

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

Answer: C

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33. If $(a_1 + ib_1)(a_2 + ib_2)\ldots(a_n + ib_n) = A + iB$ then

$\tan^{-1}\left(\frac{b_1}{a_1}\right) + \tan^{-1}\left(\frac{b_2}{a_2}\right) + \ldots. + \tan^{-1}\left(\frac{b_n}{a_n}\right) =$

A. $\tan^{-1}\left(\frac{A}{B}\right)$

B. tan^(-1) ((B)/(A))`

C. $\tan^{-1}\left(\frac{2A}{B}\right)$

D. $n\pi + \tan^{-1}\left(\frac{B}{A}\right)$

Answer: B

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

A. 1

B. -1

C. i

D. $-i$

Answer: C

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35. If z is a complex number of unit modulus and argument θ then, arg $\left(\frac{1+z}{1-z}\right)$ equals:

A. $-\theta$

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

C. θ

D. $\pi - \theta$

Answer: C

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36. $\sqrt{4ab - 2i\left(a^2 - b^2\right)}$ =

A. $\pm\left\{\frac{(a-b)+i(a-b)}{2}\right\}$

B. $\pm\{(i+5b)+(a-4b)\}$

C. $\pm\{(a+b)-i(a-b)\}$

D. $\pm\{(I+b)-i(a-b)\}$

Answer: C

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37. x + isqrt(x^(4) + x^(2) + 1)) = `

A. $\frac{\sqrt{x^2+x+1}+i\sqrt{x^2-x+1}}{\sqrt{2}}$

B. $\frac{\sqrt{x^2+x+1}-i\sqrt{x^2-x+1}}{2}$

C. $\sqrt{x+1}+i\sqrt{x-1}$

D. $\sqrt{x-1}+i\sqrt{x+1}$

Answer: A

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

A. $\pm(b+ia$

B. $\pm(a-ib)$

C. $\pm(a+ib)$

D. $\pm(b-ia)$

Answer: B

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39. $(1-\omega)(1-\omega^2)(1-\omega^4)(1-\omega^5)(1-\omega^7)(1-\omega^8)$ =

A. 25

B. 36

C. 27

D. 30

Answer: A

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40. If ω is a imaginary cube root of unity , then $225+\left(3\omega+8\omega^2\right)^2+\left(3\omega^2+8\omega\right)^2=$

A. 72

B. 192

C. 200

D. 248

Answer: D

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41. $\left(1-\omega+\omega^2\right)\left(1-\omega^2+\omega^4\right)\left(1-\omega^4+\omega^8\right)$ to 2n factors =

A. 2

B. 2^{2n}

C. $2n$

D. 2^n

Answer: B

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42. If ω is a complex cube root of unity , then $(x+1)(x+\omega)(x-\omega-1) =$

A. $x^3 - 1$

B. $x^3 + 1$

C. $x^3 + 2$

D. $x^3 - 2$

Answer: B

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43. If $1, \omega, \omega^2$ are the cube roots of unity , then $(x+y+z)\left(z+y\omega+z\omega^2\right)\left(x+y\omega^2+z\omega\right) =$

A. $x^3 + y^3 + z^3$

B. $x^3 + y^3 + z^3 - 3xyz$

C. $x^3 + y^3 + z^3 + 3xyz$

D. $x^3 + y^3 + z^3 - 6xyz$

Answer: B

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44. $4 + 5\left(-\frac{1}{2} + \frac{i\sqrt{3}}{2}\right)^{334} + 3\left(-\frac{1}{2} + \frac{i\sqrt{3}}{2}\right)^{365} =$

A. $1 - i\sqrt{3}$

B. $-1 + i\sqrt{3}$

C. $i\sqrt{3}$

D. $-i\sqrt{3}$

Answer: C

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45. If $a = \cos\frac{4\pi}{3} + i\sin\frac{4\pi}{3}$ then $\left(\frac{1+a}{2}\right)^{3n} =$

A. $\left(\frac{1}{2}\right)^{3n}$

B. $\left(-\frac{1}{2}\right)^{3n}$

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

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

Answer: B

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46. If ω is a cube root of unity , then

$$\begin{vmatrix} 1 & \omega & 2\omega^2 \\ 2 & 2\omega^2 & 4\omega^3 \\ 3 & 3\omega^3 & 6\omega^4 \end{vmatrix} =$$

A. 1

B. 3

C. 2

D. 0

Answer: D

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

A. 27

B. 72

C. 45

D. 54

Answer: D

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48. If $1, \omega, \omega^2$ are the cube roots of unity , then the roots of $(x-1)^3+8=0$ are

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

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

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

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

Answer: B

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49. If ω is a complex cube root of unity , then the value of $\frac{a+b\omega+c\omega^2}{c+a\omega+b\omega^2}+\frac{a+b\omega+c\omega^2}{b+c\omega+a\omega^2}$ is

A. 0

B. -1

C. 1

D. 2

Answer: B

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50. If omega is a complex cube root unity then $\sin\left\{\left(\omega^{10}+\omega^{23}\right)\pi-\frac{\pi}{4}\right\}$ equals

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

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

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

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

Answer: B

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51. If $z + \frac{1}{z} = -1$ then $z^5 + \frac{1}{z^5} =$

A. 1

B. -1

C. ω

D. ω^2

Answer: B

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52. If $(\omega \neq 1)$ is a cube root of unity , then

`{:(1 , 1 + i+ omega^(2) , omega^(2)) , (1-i, -1 , omega^(2) -1) , (-i , -1 + omega - i, -1):}|

A. Zero

B. 1

C. i

D. ω

Answer: A

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53. If $n(\neq 3)$ is an integer and $z = -1 + i\sqrt{3}$, then $z^{2n} + 2^n, z^n + 2^{2n}$ =

A. 0

B. 2

C. 3

D. 4

Answer: A

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54. If $\left|\frac{z-4\bar{i}}{z-2}\right| = 2$ then the locus of z is

A. a circle with centre 0

B. a real circle

C. an imaginary circle

D. line

Answer: B

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55. The locus of the point $z = x + iy$ satisfying $\left|\frac{z - 2i}{z + 2i}\right| = 1$ is

A. x-axis

B. y-axis

C. y = 2

D. x = 2

Answer: A

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56. If $|z| = \sqrt{2}$ then the point given by $3 + 4z$ lies on a circle whose radius is

A. $2\sqrt{2}$

B. $3\sqrt{2}$

C. $4\sqrt{2}$

D. $5\sqrt{2}$

Answer: C

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57. The complex equation $|z+1-i| = |z+i-1|$ represents a

A. straight line

B. circle

C. parabola

D. hyperbola

Answer: A

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58. If z = x + iy is a complex numbers z for which $|z + i/2|^2 = |z - i/2|^2$ then the locus of z is

A. x -axis

B. y - axis

C. y = x

D. 2y = x

Answer: A

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

A. a straight line

B. a square

C. a circle

D. parallelogram

Answer: B

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60. If $\left|z^2-1\right|=|z|^2+1$, then z lies on

A. the real axis

B. an ellipse

C. a circle

D. the imaginary axis

Answer: D

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61. If ω is a complex cube root of unity , then $\sum_{k=1}^{6}\left(\omega^k+\frac{1}{\omega^k}\right)^2$ =

A. 6

B. 8

C. 12

D. 24

Answer: C

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62. If $z(\bar{z}+3)=2$ then the locus of z = x + iy is

A. $x^2+y^2+3x-2=0, y=0$

B. $x=0$ such that $y>2/3$

C. $x^2+y^2+2x-4y=0$ such that $y<0, x^2+y^2>1$

D. $x^2 + y^2 + 2x - 4y = 0$ such that $2x - y + 4 > 0$

Answer: A

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63. If $\alpha + i\beta = \tan^{-1}(z), z = x + iy$ and α is constant then the locus of z is

A. $x^2 + y^2 + 2x \cot 2\alpha = 1$

B. $\cot 2\alpha\left(x^2 + y^2\right) = 1 + x$

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

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

Answer: A

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64. If $\frac{z-i}{z+1}$ is purely imaginary then the locus of $z = x + iy$ is

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

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

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

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

Answer: C

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65. If $\log_{\tan 30^\circ}\left(\frac{2|z|^2 + 2|z| - 3}{|z| + 1}\right) < -2$, then

A. $|z| < 3/2$

B. $|z| > 3/2$

C. $|z| > 2$

D. $|z| < 2$

Answer: C

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66. The locus of z satisfying the inequality $\log_{\frac{1}{3}}|z+1| > \log_{\frac{1}{3}}|z-1|$ is

A. Re $(z) > 0$

B. Re $(z) < 0$

C. Im $(z) > 0$

D. Im $(z) < 0$

Answer: B

View Text Solution

67. If $z_1 = 8 + 4i$, $z_2 = 6 + 4i$ and z be a complex number such that Arg $\left(\frac{z - z_1}{z - z_2}\right) = \frac{\pi}{4}$, then the locus of z is

A. $(x - 7)^2 + (y - 5)^2 = 2$

B. $(x - 7)^2 + (y + 5)^2 = 2$

C. $(x - 7)^2 + (y - 5)^2 = 4$

D. $(x + 7)^2 + (y + 5)^2 = 4$

Answer: A

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68. The triangle formed by the points 1, $\frac{1 + i}{\sqrt{2}}$ and ias vertices in the Argand diagram is

A. scalane

B. equilateral

C. isosceles

D. right angled

Answer: C

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69. If $|z| = 3$, the area of the triangle whose sides are $z, \omega z$ and $z + \omega z$ (where ω is a complex cube root of unity) is

A. $\frac{9\sqrt{3}}{4}$

B. $\frac{8\sqrt{3}}{2}$

C. $\frac{5}{2}$

D. $\frac{8\sqrt{3}}{3}$

Answer: A

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70. Let z_1, z_2 be two roots of the equation $z^2 + az + b = 0$, z being complex . Further assume that the origin z_1 and z_2 form an equilateral triangle , then

A. $a^2 = b$

B. $a^2 = 2b$

C. $a^2 = 3b$

D. $a^2 = 4b$

Answer: C

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71. In Argand diagram , O , P , Q represent the origin , z and z +iz respectively , then $\angle OPQ =$

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

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

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

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

Answer: C

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72. If a is a complex number and b is a real number then the equation $\bar{a}z + a\bar{z} + b = 0$ represents

A. straight line

B. Parabola

C. Circle

D. hyperbola

Answer: A

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

A. of area zero

B. right angled isosceles

C. equilateral

D. obtuse angled isosceles

Answer: C

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74. The cube roots of unity in an Argand plane represent the vertices of a triangle whose area is

A. $\frac{3\sqrt{3}}{2}$ sq. units

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

C. $4\sqrt{3}$ sq.units

D. $8\sqrt{3}$ sq. units

Answer: B

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75. Let z_1 and z_2 be two non-zero complex numbers such that $\frac{z_1}{z_2} + \frac{z_2}{z_1} = 1$, then the origin and points represented by z_1 and z_2

A. Lie on a straight line

B. Form a right triangle

C. Form an equilateral triangle

D. form an isosceles triangle

Answer: C

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76. Let the complex number z_1, z_2, z_3 be the vertices of an equilateral triangle . Let z_θ be the circumcentre of the triangle . Then $z_1^2 + z_2^2 + z_3^2 =$

A. $2z_0^2$

B. $3z_0^2$

C. $4z_0^2$

D. $4z_0^3$

Answer: B

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77. Log (log i) =

A. $\log\left[\left(\frac{\pi}{2}\right) + i\left(\frac{\pi}{2}\right)\right]$

B. $\log\left[\left(\frac{\pi}{2}\right)-i\left(\frac{\pi}{2}\right)\right]$

C. $\log\left(\frac{\pi}{2}\right)+i\left(\frac{\pi}{2}\right)$

D. `log ((pi)/(2))- i((pi)/(2))

Answer: C

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78. The value of $i^{i^{-i\ldots\ldots\infty}}$ = x + iy then $x^2+y^2=$

A. $e^{-\pi y}$

B. $e^{+\pi y}$

C. πy

D. $-\pi y$

Answer: A

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79. The real and imaginary parts of $\log(1+i)$ =

A. $\left(\frac{1}{2}, \frac{\pi}{4}\right)$

B. $\left(\log 2, \frac{\pi}{4}\right)$

C. $\left(\log\sqrt{2}, \frac{\pi}{4}\right)$

D. $\left(\log\frac{1}{2}, \frac{\pi}{4}\right)$

Answer: C

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80. $\left(\sin\left(\log i^i\right)\right)^3 + \left(\cos\left(\log i^i\right)\right)^3 =$

A. 0

B. -1

C. 1

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

Answer: B

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81. $z = 6.\ e^{i\frac{\pi}{3}}$ then $\left|e^{iz}\right|$ =

A. $e^{-\sqrt{3}}$

B. $e^{+3\sqrt{3}}$

C. $e^{-\sqrt{2}}$

D. $e^{-3\sqrt{3}}$

Answer: D

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82. $\tan\left\{i\log\left(\frac{a-ib}{a+ib}\right)\right\} =$

A. ab

B. $\frac{2ab}{a^2-b^2}$

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

D. $\frac{2ab}{a^2+b^2}$

Answer: B

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

A. circle with radius 1

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

C. a straight line through the origin

D. circle with diameter joining $-i, i$

Answer: C

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84. Let $z = 1 - t + i\sqrt{t^2 + t + 2}$, where t is a real parameter . The locus of z in the Argand plane is

A. a hyperbola

B. an ellipse

C. a straight line

D. a circle

Answer: A

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85. In the Argand Diagram , all the complex numbers z satisfying $|z-4i|+|z+4i|=10$ lie on a

A. straight line

B. circle

C. ellipse

D. parabola

Answer: C

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86. The region of the argand plane defined by $|z-i|+|z+i| \leq 4$ is

A. interior of an ellipse

B. exterior of a circle

C. interior and boundary of an ellipse

D. parabola

Answer: C

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87. If $\frac{z+2}{z+6i}$ is purely real then the locus of z = x +iy is

A. $3x + y + 6 = 0$

B. $3x + y - 6 = 0$

C. $3x - y - 6 = 0$

D. $3x - y + 6 = 0$

Answer: A

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88. If $|z-1|<2|z-2|$ then the locus of $z=x+iy$ is

A. $x^2+y^2+3x-2=0$

B. $3x^2+3y^2-14x+15>0$

C. $3x^2+3y^2-14x+15<0$

D. $3x^2+3y^2-14x+15=0$

Answer: B

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

A. a straight line

B. a circle

C. a parabola

D. an ellipse

Answer: A

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90. z = $x + iy$ and $w = \frac{1 - iz}{z - i}$, then $|w| = 1 \Rightarrow$ in the complex plane

A. z lies on the imaginary axis

B. z lies on the real axis

C. z lies on the unit circle

D. z lies on the parabola

Answer: B

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91. If Amp $\left(\frac{z+2}{z-4i}\right) = \frac{\pi}{2}$ then the locus of z = x + iy is .

A. $x^2 + y^2 + 3x - 2 = 0, y = 0$

B. $x = 0$ such that $y > 2/3$

C. $x^2 + y^2 + 2x - 4y = 0$ such that $y < 0, x^2 + y^2 > 1$

D. $x^2 + y^2 + 2x - 4y = 0$ such that $2x - y + 4 > 0$

Answer: D

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92. If Arg $\left(\frac{2-z}{2+z}\right) = \frac{\pi}{6}$ and $z = x + iy$, then the locus of z is

A. a straight line

B. a circle

C. a parabola

D. an ellipse

Answer: B

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93. If $\omega = \frac{z}{z - \frac{1}{3}i}$ and $|\omega| = 1$ then z lies on

A. an ellipse

B. a circle

C. a straight line

D. a parabola

Answer: C

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94. The points in the set $\left\{ z \in C : Arg\left(\frac{z-2}{Z-6i} \right) = \frac{\pi}{2} \right\}$ lie on the curve which is a (where C denotes the sets of all complex number)

A. circle

B. pair of lines

C. parabola

D. hyperbola

Answer: A

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95. $Statement - I$: If n = 4m + 3 , is integer then i^n is equal to $-i$

$Statement - II$: If $n \in N$ then

$(1+i)^{2n} + (1-i)^{2n}$ is purely real number

A. Only I is true

B. Only II is true

C. Both I and II are true

D. Neither I nor II are true

Answer: C

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96. The complex equation $|z+1-i| = |z+i-1|$ represents a

A. Only I is true

B. Only II is true

C. Both I and II are true

D. Neither I nor II are true

Answer: A

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97. If $z_1 = 1, z_2 = i$ and A = Arg $(z_1 z_2)$

B = Arg $\left(\frac{z_1}{z_2}\right)$, C = Arg $(z_1 + z_2)$, D = Arg $(z_1 - z_2)$ arrange A , B , C ,

D in ascending order

A. A , C ,D , B

B. B, D , C , A

C. B , C , D , A

D. B , A , D , C

Answer: B

View Text Solution

98. The descending order of the principal values of arguments of the complex numbers

$z_1 = 1 + i, z_2 = -\sqrt{3} + i, z_3 = 1 + \sqrt{3}i, z_4 = 1 - i$ is

A. z_3, z_2, z_1, z_4

B. z_2, z_3, z_1, z_4

C. z_3, z_1, z_2, z_4

D. z_4, z_1, z_3, z_2

Answer: B

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99. If $x_n + iy_n = (1+i)^n$ then $x_{n-1}y_n - x_n y_{n-1}$ =

A. 2^{n-2}

B. 2^{n+1}

C. 2^{2n-1}

D. 2^{n-1}

Answer: D

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100. If $x = -5 + 4i$ then $x^4 + 9x^3 + 35x^2 - x + 4 =$

A. 0

B. 14

C. -14

D. 28

Answer: A

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101. If x is a fifth root of unity then $1 + x + x^2 + \ldots x^{100}$

A. A) 0

B. B) 1

C. C) $1 + x$

D. D) -1

Answer: B

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102. If $\omega = \sqrt{z^2 - 1}$ where ω is a cube root of unity and z = x +iy then $\frac{1}{2}\left[\tan^{-1}\left(\frac{y}{x+1}\right) + \tan^{-1}\left(\frac{y}{x-1}\right)\right]$

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

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

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

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

Answer: B

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103. If $x_n = \omega^n + \frac{1}{\omega^n}$ then $x_1 x_2 x_3 \ldots, x_{12}$ =

A. 4

B. 8

C. 16

D. 32

Answer: C

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104. If three complex number are in A.P then they lie on

A. Circle

B. Parabola

C. Straight line

D. ellipse

Answer: C

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105. The maximum value of $|3z + 9 - 7i|$ if $|z + 2 - i| = 5$ is

A. 10

B. 15

C. 20

D. 5

Answer: C

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106. I: The modulus of $\frac{\sqrt{3} + i}{(1 + i)\left(1 + \sqrt{3}i\right)}$ is $\frac{1}{\sqrt{2}}$

II : The least positive value of n for which $\left(\frac{1 - i}{1 + i}\right)^n = 1$ is 2

Which of the statements are true

A. only I

B. only II

C. Both I & II

D. neither I nor II

Answer: C

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107. I: If a and b are positive real numbers then $\sqrt{-a} \times \sqrt{-b} = -\sqrt{ab}$

II : The Arg $\left[\frac{1+i\sqrt{3}}{1-i\sqrt{3}}\right]$ is 240°

Which of the statements are true

A. only I

B. only II

C. Both I & II

D. neither I nor II

Answer: A

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108. I : The number of solutions of the equation $z^2 + |z|^2 = 0$ is 2

II : The number of solutions of $z^2 + |z| = 0$ is 3

Which of the statements are true

A. only I

B. only II

C. Both I & II

D. neither I nor II

Answer: B

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109. $z_1 = 1 + i, z_2 = -\sqrt{3} + i, z_3 = 1 + \sqrt{3}i, z_4 = 1 - i$

Arrange z_1, z_2, z_3, z_4 is descending order of their principal values

A. z_3, z_2, z_1, z_4

B. z_2, z_3, z_1, z_4

C. z_3, z_1, z_2, z_4

D. z_4, z_1, z_3, z_2

Answer: B

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110. Match the following:

List-I	List-II
A) $\sin^{-1} x = \cos^{-1} x$ then x	1) 0
B) $\sin^{-1} x = \tan^{-1} x$ then x	2) $\sqrt{\frac{\sqrt{5}-1}{2}}$
C) $\cos^{-1} x = \tan^{-1} x$ then x	3) $\frac{1}{\sqrt{2}}$
D) $\sin^{-1} x = \cos^{-1}\left(\frac{1}{x}\right)$ then x	4) no value

A. e , d , b , c

B. d , e , c , b

C. d , e , b , c

D. e , d , c ,b

Answer: B

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111. (A) : The mod amplitude form of $\frac{1+7i}{(2-i)^2}$ is $\sqrt{2}$ c is $\frac{3\pi}{4}$

(R) : The mod-amplitude form z = a+ ib is r cis θ where r = |z| , θ is amplitude of z

A. Both A and R are true R is correct explanation to A

B. Both A and R are true but R is not correct explanation of A

C. A is true R is false

D. A is false R is true

Answer: A

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112. (A) : If $|z+1|-|z-1|=\frac{3}{2}$ then least value of |z| is 3/4

(R) : If z_1, z_2 are two complex numbers then $|z_1-z_2| \geq ||z_1|-|z_2||$

A. Both A and R are true R is correct explanation to A

B. Both A and R are true but R is not correct explanation of A

C. A is true R is false

D. A is false R is true

Answer: B

View Text Solution

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

A. 0

B. 1

C. 2

D. 4

Answer: C

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114. If a complex number z satisfies $|z|^2 + 1 = |z^2 - 1|$, then the locus of z is

A. the real axis

B. the imaginary axis

C. y = x

D. a circle

Answer: B

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

A. 0

B. 2

C. 7

D. 17

Answer: B

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116. If $|z+2i| \leq 1$ and $z_1 = 6-3i$ then the maximum value of $|iz + z_1 - 4|$ is ___

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

B. 6

C. 3

D. 2

Answer: B

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117. The number of real roots of the equation $z^3 + iz - 1 = 0$ is

A. 0

B. 1

C. 2

D. 3

Answer: A

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118. If $\omega \neq 1$ is a cube root of unity satisfying $\frac{1}{a+w} + \frac{1}{b+w} + \frac{1}{c+w} = 2w^2$ and $\frac{1}{a+w^2} + \frac{1}{b+w^2} + \frac{1}{c+w^2} = 2w$ then the value of $\frac{1}{a+1} + \frac{1}{b+1} + \frac{1}{c+1}$ is

A. 2

B. -2

C. ω^2

D. ω

Answer: A

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

A. $\frac{1}{\sqrt{3}}|\alpha\beta|$

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

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

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

Answer: B

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120. If $|z - 25i| \leq 15$, then |maximum arg (z) - minimum arg (z)| equals

A. $2\cos^{-1}(3/5)$

B. $2\cos^{-1}(4/5)$

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

D. $\sin^{-1}(3/5) - \cos^{-1}(3/5)$

Answer: B

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121. The complex number z =1 + i is rotated through an angle $3\pi/2$ in anticlock wise direction about the origin and stretched by $\sqrt{2}$ times , then the new complex number is

A. $-\sqrt{2}-\sqrt{2}i$

B. $\sqrt{2}-\sqrt{2}i$

C. $2-\sqrt{2}i$

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

Answer: B

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122. The equation $z\bar{z}+(2-3i)z+(2+3i)\bar{z}+4=0$ represents a circle of radius

A. 2

B. 3

C. 4

D. 6

Answer: B

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123. Assertion (A) : The origin and the roots of the equation $x^2 + ax + b = 0$ form an equilateral triangle if $a^2 = 3b$

Reason (R) : If z_1, z_2, z_3 are vertices of an equilateral triangle then $z_1^2 + z_2^2 + z_3^2 = z_1z_2 + z_2z_3 + z_3z_1$

A. Both A and R are true R is correct explanation to A

B. Both A and R are true but R is not correct explanation of A

C. A is true R is false

D. A is false R is true

Answer: A

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124. Assertion (A) : If z = ilog $\left(2-\sqrt{3}\right)$ then cos z= 2

Reason (R) : $\cos h\theta = \frac{e^{i\theta}+e^{i\theta}}{2}$

A. Both A and R are true R is correct explanation to A

B. Both A and R are true but R is not correct explanation of A

C. A is true R is false

D. A is false R is true

Answer: C

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125. Match the following:

List-I	List-II
A) $\sin\left\{\frac{\pi}{3}-\sin^{-1}\left(-\frac{1}{2}\right)\right\}$	1) $\frac{3-\sqrt{5}}{2}$
B) $\cos\left\{\cos^{-1}\left(-\frac{\sqrt{3}}{2}\right)+\frac{\pi}{6}\right\}$	2) 0
C) $\sec^{-1}\left(\frac{\sqrt{5}}{2}\right)-\sin^{-1}\left(\frac{1}{\sqrt{5}}\right)$	3) 1
D) $\tan\left\{\frac{1}{2}\cos^{-1}\left(\frac{\sqrt{5}}{3}\right)\right\}$	4) –1

A. c , d , e, d

B. d , b , a , c

C. c ,b , d , a

D. c , b , a ,d

Answer: D

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126. If $|z,| = 1, |z_2| = 2, |z_3| = 3$ and $|9z_1z_2 + 4z_1z_3 + z_2z_3| = 12$, then the value of $|z_1 + z_2 + z_3|$ is

A. 3

B. 4

C. 8

D. 2

Answer: D

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PRACTICE EXERCISE

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

A. i

B. $i-1$

C. $-i$

D. 0

Answer: B

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2. $1+i^2+i^4+i^6+\ldots+i^{2n}$ =

A. positive

B. negative

C. 0

D. cannot be determined

Answer: D

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

A. x = 4n where n is any positive integer

B. x = 2n where n is any positive integer

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

D. x = 2n + 1 where n is any positive integer

Answer: A

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4. The value of $\frac{(1+i)^{2n+1}}{(1-i)^{2n-1}} =$

A. 1

B. 2

C. ± 2

D. -2

Answer: C

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5. The value of $(1+i)^6+(1-i)^6$ is

A. 0

B. -16

C. 16

D. 36

Answer: A

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6. If $u+iv=\frac{3i}{x+iy+2}$, then y in terms of u , v is

A. $\frac{3u}{u^2+v^2}$

B. $\frac{4u}{u^2+v^2}$

C. $\frac{5u}{u^2+v^2}$

D. $\frac{2u}{u^2+v^2}$

Answer: A

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7. If $\frac{x+3i}{2+iy}=1-i$ then the value of $(5x-7y)^2=$

A. 4

B. 6

C. 8

D. 0

Answer: D

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8. If $x + iy = \frac{1}{(1 + \cos\theta + i\sin\theta)}$ then $\sin^{-1} x =$

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

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

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

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

Answer: C

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

A. $\theta = n\pi$

B. $\theta = n\pi/2$

C. $\theta = n\pi/3$

D. $\theta = n\pi/4$

Answer: A

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10. Find the values of the following :

$$\left(\frac{\sqrt{3}}{2} + \frac{i}{2}\right)^5 - \left(\frac{\sqrt{3}}{2} - \frac{i}{2}\right)^5$$

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

B. Re $(z) > 0, Im(z) > 0$

C. Re (z) = 0

D. Im (z) = 0

Answer: D

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

A. 49

B. 48

C. 42

D. -42

Answer: C

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12. If $z = 3 - 5i$ then `z^(2) - 10z + 30=

A. 20i-16

B. 1

C. 2

D. 3

Answer: A

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13. If θ is real then the modulus of $\frac{1}{1+\cos\theta+i\sin\theta}$ is

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

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

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

D. $\cos\frac{\theta}{2}$

Answer: A

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14. If $(x+iy)^{\frac{1}{3}} = 5+3i$, then 3x + 5y =

A. 480

B. 152

C. 990

D. 960

Answer: D

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15. If α is a non-real root of $x^7 = 1$ then $\alpha(1+\alpha)\left(1+\alpha^2+\alpha^4\right) =$

A. 2

B. -1

C. 1

D. -2

Answer: B

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16. Express $\frac{3-2i}{5+4i}+\frac{3+2i}{5-4i}$ in the form of a + ib

A. $\frac{6}{41}i.0$

B. $15+i.0$

C. $\frac{14}{41}+i.0$

D. $15-i.0$

Answer: C

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17. The conjugate of $\frac{2+3i}{1+2i}$ is

A. $\frac{8+i}{5}$

B. $\frac{8-i}{5}$

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

D. $\frac{2-3i}{5}$

Answer: A

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18. If $\frac{2-i}{(1-2i)^2}$ and $\frac{-(x+11i)}{25}$ are conjugate complex numbers , then x =

A. 2

B. -2

C. 3

D. -3

Answer: A

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19. The modulus of $\frac{(3+i)(2-i)}{1+i}$ is

A. 5

B. $\sqrt{5}$

C. $5\sqrt{2}$

D. $\sqrt{5}/\sqrt{2}$

Answer: A

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20. If $x - iy = \sqrt{\left[\frac{a - ib}{c - id}\right]}$, then $\left(x^2 + y^2\right)^2 =$

A. $\frac{\left(a^2 + b^2\right)}{\left(c^2 - d^2\right)}$

B. $\frac{\left(a^2 - b^2\right)}{\left(c^2 + d^2\right)}$

C. $\frac{\left(a^2 + b^2\right)}{\left(c^2 + d^2\right)}$

D. $\frac{\left(a^2 - b^2\right)}{\left(c^2 - d^2\right)}$

Answer: C

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21. If m_1, m_2, m_3 and m_4 respectively denote the moduli of the complex numbers $1 + 4i, 3 + I, 1 - I$ and $2 - 3i$, then the correct one, among the following is

A. $m_1 < m_2 < m_3 < m_4$

B. $m_4 < m_3 < m_2 < m_1$

C. $m_3 < m_2 < m_4 < m_1$

D. $m_3 < m_1 < m_2 < m_4$

Answer: C

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22. The mod-amplitude form of $-\sqrt{3} - i$

A. 2 cis $\frac{-5\pi}{6}$

B. 2 cis $\frac{\pi}{6}$

C. cis $\frac{5\pi}{6}$

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

Answer: A

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23. The mod-amplitude form of $\sin\theta + i\cos\theta$ is

A. $cis\theta$

B. cis $\left(\frac{\pi}{2} - \theta\right)$

C. cis $\left(\frac{\pi}{2} + \theta\right)$

D. cis $\left(\theta - \frac{\pi}{2}\right)$

Answer: B

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24. If $\frac{\pi}{2} < \alpha\frac{3\pi}{2}, the \text{ mod } \underline{u}sargumentf \text{ or } mof$(1 + cos 2 alpha) + isin 2 alpha` is

A. $-2\cos\alpha\{\cos(\alpha - \pi) + i\sin(\alpha - \pi)\}$

B. $2\cos\alpha(\cos\alpha + i\sin\alpha)$

C. $2\cos\alpha\{\cos(-\alpha) + i\sin(-\alpha)\}$

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

Answer: A

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25. If $\frac{\pi}{5}$ and $\frac{\pi}{3}$ are respectively the arguments of $\bar{z}_1$ and z_2 , then the value of Arg (z_1-z_2) is

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

B. $\frac{3\pi}{15}$

C. $-\frac{8\pi}{15}$

D. $\frac{4\pi}{15}$

Answer: C

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26. If Arg (3z-2i) = pi//2 then the locus of z = x +iy is

A. $x^2 + y^2 - 3x - 2 = 0, y = 0$

B. x = 0 such that $y > \frac{2}{3}$

C. $x^2 + y^2 + 2x - 4y = 0$ such that $y < 0, x^2 + y^2 > 1$

D. $x^2 + y^2 + 2x - 4y = 0$ such that $2x - y + 4 > 0$

Answer: B

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27. The argument of $\frac{\left(1 - i\sqrt{3}\right)}{\left(1 + i\sqrt{3}\right)}$ is equal to

A. -90°

B. 120°

C. 210°

D. 240°

Answer: D

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28. Given $|z| = 14$ and amp $z = \frac{7\pi}{6}$, then z is =

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

B. $7\sqrt{3} + 7i$

C. $7\sqrt{3} - 7i$

D. $\sqrt{3} - i$

Answer: B

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29. If $\left(\sqrt{3} + i\right) = (a + ib)(c + id)$ then $\frac{\tan^{-1}(b)}{a} + \frac{\tan^{-1}(d)}{c} =$

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

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

C. $2n\pi + \frac{\pi}{6}, n \in Z$

D. $2n\pi + \frac{\pi}{6}, n \in Z$

Answer: B

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30. Let z,w be complex number such that $\bar{z} + i\overline{w} = 0$ and arg zw $= \pi$. Then arg z =

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

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

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

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

Answer: C

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31. If Arg $\left(\frac{z+1}{z-1}\right) = \frac{\pi}{6}$ then the locus of z = x + iy is

A. $x^2 + y^2 + 3x - 2 = 0, y = 0$

B. $x = 0$ such that $y > \frac{2}{3}$

C. $x^2 + y^2 + 2\sqrt{3}y - 1 = 0$ such that $y < 0, x^2 + y^2 > 1$

D. $x^2 + y^2 + 2x - 4y = 0$ such that $2x - y + 4 > 0$

Answer: C

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32. If $|z| = 1$ and arg $\left[z^2 + \bar{z}\right] = x$ arg z then x

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

B. 2

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

D. 1

Answer: A

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33. If $z = x + iy$ and if the point P in the Argand plane represents z , then the locus of P satisfying the equation $|z - 3i| + |z + 3i| = 10$ is

A. Circle with centre $(-3, 3)$

B. Hyperbola with eccentricity $\frac{5}{3}$

C. Ellipse with eccentricity $\frac{3}{5}$

D. Ellipse with eccentricity $\frac{5}{4}$

Answer: D

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34. If |z-3+i| = 4 then the locus of z = x +iy is

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

B. $x^2 + y^2 - 6 = 0$

C. $x^2 + y^2 - 3x + y - 6 = 0$

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

Answer: A

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35. If $\left|\frac{z-1}{z-3}\right|$ = 2 then the locus of z = x +iy is

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

B. $x^2 + y^2 - 4x - 6y - 12 = 0$

C. $x^2 + y^2 + 4x - 2y = 0$

D. $3x^2 + 3y^2 - 22x + 35 = 0$

Answer: D

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36. The locus of the point z = x +iy satisfying the equation $\left|\frac{z-1}{z+1}\right| = 1$ is given n=by

A. $x = 0$

B. $y = 0$

C. $x = y$

D. $x + y = 0$

Answer: A

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37. The equation of the locus of 2 such that $\left|\frac{z-i}{z+i}\right| = 2$, where z = x + iy is a complex number , is

A. $3x^2 + 3y^2 + 10y - 3 = 0$

B. $3x^2 + 3y^2 + 10y + 3 = 0$

C. $3x^2 + 3y^2 - 10y - 3 = 0$

D. $x^2 + y^2 - 5y + 2 = 0$

Answer: B

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38. The locus of the point z in the argrand plane for which $|z+1|^2+|z-1|^2=4$ is a

A. straight line

B. pair of straight lines

C. circle

D. parabola

Answer: C

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39. If $|z+i|^2-|z-i|^2=3$ then the locus of z is

A. $4y=0$

B. $4y=2$

C. $4y=3$

D. $4y = 4$

Answer: C

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

A. a straight line parallel to x-axis

B. a straight line parallel to y-axis

C. a circle with centre as origin

D. a circle with centre other than the origin

Answer: B

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41. If $\frac{2z_1}{3z_2}$ is purely , an imaginary number , then $\left|\frac{z_1 - z_2}{z_1 + z_2}\right|$ is equal to

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

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

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

D. 1

Answer: D

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42. If $|z_1| = |z_2| = 1$, then $|z_1 + z_2| =$

A. $\left|\frac{1}{z_1} + \frac{1}{z_2}\right|$

B. $\left|\frac{1}{z_1} - \frac{1}{z_2}\right|$

C. $\left|\frac{1}{z_1} \cdot \frac{1}{z_2}\right|$

D. $\left|\frac{1}{z_1^2} + \frac{1}{z_2^2}\right)\Bigg|$

Answer: A

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43. The modulus of $\sqrt{2}i - \sqrt{-2i}$ is

A. -2

B. 2

C. $-2i$

D. $2i$

Answer: B

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44. If |z-1| = 2 then the locus of z is

A. x-axis

B. y-axis

C. x= y

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

Answer: A

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45. If $|z+1| = \sqrt{2}|z-1|$ and z is a complex number , then the locus of z is

A. straight line

B. a circle

C. an ellipse

D. a parabola

Answer: B

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46. If the complex numbers z_1, z_2, z_3 represents the vertices of an equilateral triangle such that $|z_1| = |z_2| = |z_3|$ then

A. $z_1 + z_2 = z_3$

B. $z_1 + z_3 = z_2$

C. $z_2 + z_3 = z_1$

D. $z_1 + z_2 + z_3 = 0$

Answer: D

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47. If $z = 2e^{i\frac{\pi}{4}}$ then $\left|e^{iz}\right|$ =

A. $e^{-\sqrt{2}}$

B. $e^{\sqrt{2}}$

C. $e^{-2\sqrt{2}}$

D. $e^{-2\sqrt{2}}$

Answer: A

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48. 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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49. If $|z+4|+|z-4|=10$ represents an ellipse then length of its minor axis is

A. 3

B. 4

C. 6

D. 8

Answer: C

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50. The region represented by $|z+a|+|z-a|<4a$ is

A. $x^2+y^2<4a$

B. $x^2 + y^2 > 4a^2$

C. $3x^2 - 4y^2 < 4a^2$

D. $3x^2 + 4y^2 < 12a^2$

Answer: D

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51. $|z - 4| < |z - 2|$ represents the region given by

A. Re $(z) > 3$

B. Re $(z) < 3$

C. Im $(z) > 3$

D. Im $(z) < 3$

Answer: A

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52. For any two complex numbers z_1 & z_2 and any two real numbers $a, b|az_1 - bz_2|^2 + |bz_1 + az_2|^2 =$

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

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

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

D. $\left(a^2 - b^2\right)\left(|z_1|^2 - |z_2|^2\right)$

Answer: B

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

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

B. $\pm(2 - 3i)$

C. $\pm(2+4i)$

D. $\pm(2-4i)$

Answer: A

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54. $\sqrt{i}$ =

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

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

C. $\pm\frac{(1+i)}{2}$

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

Answer: A

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55. The value of $\sqrt{x^2 + 2ix - 1}$ is

A. $x - i$

B. $i - x$

C. $x + i$

D. $x - 2i$

Answer: C

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56. If n is an integer and not a multiple of 3 then $\omega^n + \omega^{2n} =$

A. 0

B. 1

C. -1

D. 2

Answer: C

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57. $\left(3+5\omega+3\omega^2\right)^6 =$

A. 42

B. 48

C. 52

D. 64

Answer: D

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58. $(1+\omega)\left(1+\omega^2\right)\left(1+\omega^5\right)$.....$2n$ factors =

A. 0

B. 1

C. -1

D. 2

Answer: B

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59. $\left(1-\omega+\omega^2\right)^7+\left(1+\omega-\omega^2\right)^7=$

A. 2^5

B. 2^7

C. 2^9

D. 2^{10}

Answer: B

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60. $\left(1-\omega+\omega^2\right)\left(1-\omega^2+\omega^4\right)\left(1-\omega^4+\omega^8\right)\left(1-\omega^8+\omega^{16}\right)$

A. 4

B. 8

C. 12

D. 16

Answer: D

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61. If $1, \omega, \omega^2$ are the cube roots of unity , then find the values of the following .

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

A. 8ab

B. 9 ab

C. 11 ab

D. 12 ab

Answer: D

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62. If $1, \omega, \omega^2$ are the cube roots of unity , then the roots of $(x-2)^2+1=0$ are

A. ω

B. ω^2

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

D. 0

Answer: C

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63. If $1, \omega, \omega^2$ are the cube roots of unity, then prove that

$(2-\omega)\left(2-\omega^2\right)\left(2-\omega^{10}\right)\left(2-\omega^{11}\right)=49.$

A. 7

B. 36

C. 49

D. 6

Answer: C

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64. The value of $\left(\frac{-1+i\sqrt{3}}{2}\right)^{100}+\left(\frac{-1-i\sqrt{3}}{2}\right)^{100}$ is equal to

A. 1

B. -1

C. 0

D. 2

Answer: B

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65. If x = a + b , y = $a\omega^2 + b\omega$ and $z = a\omega + b\omega^2$, then $x^2 + y^2 + z^2$ is equal to

A. 6a b

B. 12 ab

C. $6a^2b^2$

D. $12a^2b^2$

Answer: A

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66. If α, β are the imaginary cube roots of unity then $\alpha^4 + \beta^4 - (\alpha + \beta)^4$=

A. -1

B. 1

C. -2

D. 0

Answer: C

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67. If $1, \omega, \omega^2$ are the cube roots of unity , then $(a+b)^3+\left(a\omega+b\omega^2\right)^3+\left(a\omega^2+b\omega\right)^3=$

A. a^3+b^3

B. $3\left(a^3+b^3\right)$

C. a^3-b^3

D. a^3+b^3+3ab

Answer: B

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68. The value of $\left(\frac{-1+i\sqrt{3}}{2}\right)^{36}+\left(\frac{-1-i\sqrt{3}}{2}\right)^{36}=$

A. 1

B. 0

C. 2

D. 72

Answer: C

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

A. $\left(\frac{3}{2}\right) + i$

B. $\left(\frac{3}{2}\right) - 2i$

C. $\left(\frac{3}{2}\right) + 2i$

D. $\left(\frac{3}{2}\right) - i$

Answer: B

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70. If $\left(1+i\sqrt{2}\right)^x = 3^x$, then its only integral solution is

A. 2

B. 0

C. 3

D. 4

Answer: B

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71. If $\bar{z} = iz^2$ then the number of values of z is

A. 1

B. 2

C. 3

D. 4

Answer: D

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72. The number of solutions of $z + \sqrt{2}(|z+1|) + i = 0$

A. 1

B. 2

C. 3

D. infinite

Answer: A

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73. If the complex number z lies on $|z| = 1$ then $\frac{2}{z}$ lies on

A. straight line

B. a circle

C. parabola

D. ellipse

Answer: B

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74. If $z\bar{z} = 4$ then the locus of z is

A. $x^2 + y^2 = 4$

B. $x^2 + y^2 = 2$

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

D. $x^2 + y^2 = 3$

Answer: A

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75. Match the items of List - I with those of List-II

List-I (Complex numbers)	**List-II (Polar form)**
i) $\sqrt{3}-i$	a) $2\text{cis}\frac{\pi}{6}$
ii) $\sqrt{3}+i$	b) $2\text{cis}\frac{5\pi}{6}$
iii) $-\sqrt{3}+i$	c) $2\text{cis}\left(\frac{-5\pi}{6}\right)$
iv) $-\sqrt{3}-i$	d) $2\text{cis}\left(\frac{-\pi}{6}\right)$
	e) $2\text{cis}\frac{9\pi}{6}$

The correct matching is

	(i)	(ii)	(iii)	(iv)
1)	(d)	(b)	(a)	(e)
2)	(d)	(a)	(b)	(c)
3)	(b)	(d)	(a)	(c)
4)	(b)	(c)	(a)	(d)

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76. If z = x +iy and P represents z in the Argand plane and mod (2z-3) = 4 , then the locus of P is

A. $(2x-3)^2-4y^2=16$

B. $(2x+3)^2+4y^2=12$

C. $(2x-3)^2+4y^2=16$

D. $(2x+3)^2-4y^2=12$

Answer: C

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77. If $z=(\lambda+3)+i\sqrt{5-\lambda^2}$, then the locus of z is a circle with centre at

A. (0,0)

B. (0,3)

C. (3,0)

D. $(-3, 0)$

Answer: C

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78. If $z = (x + iy)$ and if the point P in the Argarand plane represent z, then desrcibe geo-metrically the locus of P satispfying the equation.

$|z|^2 4Re(z + 2)$

A. a straight line

B. an ellipse

C. a parabola

D. a circle

Answer: D

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79. If $z_1 = 1 + 2i, z_2 = 2 + 3i, z_3 = 3 + 4i,$ then z_1, z_2 and z_3 represents the vertices of

A. equilateral triangle

B. right angled triangle

C. isosceles triangle

D. collinear

Answer: D

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80. If z is a complex number with $|z| \geq 5$. Then the least value of $\left|z + \frac{2}{z}\right|$ is

A. $\frac{23}{5}$

B. $\frac{24}{5}$

C. $\frac{26}{5}$

D. $\frac{29}{5}$

Answer: B

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81. $(1+x)^n = p_0 + p_1 x + p_2 x^2 + \ldots + p_n x^n$, then $p_0 + p_3 + p_6 + \ldots\ldots =$

A. $\frac{1}{3}\left[2^{n-1} + \cos\frac{n\pi}{3}\right]$

B. $\frac{2}{3}\left[2^{n-1} + \cos\frac{n\pi}{3}\right]$

C. $\frac{1}{3}\left[2^{n-2}+\sin\frac{n\pi}{3}\right]$

D. $\frac{2}{3}\left[2^{n-2}+\sin\frac{n\pi}{6}\right]$

Answer: B

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82. The cube roots of unity when represented on the Argand diagram form the vertices of an

A. isosceles triangle

B. right angled triangle

C. equilateral triangle

D. right angled isosceles triangle

Answer: C

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83. If $a, b, c \in R$ such that $a+b+c=0$ and $az_1+bz_2+cz_3=0$ then z_1, z_2, z_3 are

A. collinear

B. right angled triangle

C. equilateral triangle

D. isosceles triangle

Answer: A

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84. In the Argand plane the area in square units of the triangle formed by the points $1+i, 1-i, 2i$ is

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

B. 1

C. $\sqrt{2}$

D. 2

Answer: B

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

A. 5

B. 10

C. 15

D. 20

Answer: B

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86. If $\left|z-\frac{2}{z}\right|=2$ then the greatest value of |z| is

A. $\sqrt{3}-1$

B. $\sqrt{3}$

C. $\sqrt{3}+1$

D. $\sqrt{3}+2$

Answer: C

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87. If $|z| \geq 3$, then the least value of $\left|z+\frac{1}{z}\right|$ is

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

B. $\frac{5}{3}$

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

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

Answer: D

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88. The value of $(i)^i$ is

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

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

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

D. $e^{-i\frac{\pi}{2}}$

Answer: A

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89. $\log_e\left(\frac{1+i}{1-i}\right) =$

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

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

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

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

Answer: C

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90. The real and imaginary points of $\log\left(1+i\sqrt{3}\right)$ are

A. $\left(\log 2, \frac{\pi}{3}\right)$

B. $\left(\log\sqrt{2}, \frac{\pi}{6}\right)$

C. $\left(\log\sqrt{2}, \frac{\pi}{3}\right)$

D. $\left(\log 2, \frac{\pi}{6}\right)$

Answer: A

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91. Assertion (A) : If 3 + iy is a root of $x^2 + ax + b = 0$ then a = -6

Reason (R) : If a, b , c are real and $\Delta < 0$ the roots of $ax^2 + bx + c = 0$ are conjugate complex numbers

A. Both A and R are true R is correct explanation to A

B. Both A and R are true but R is not correct explanation of A

C. A is true R is false

D. A is false R is true

Answer: A

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92. If $\log_{\frac{1}{\sqrt{3}}}\left\{\frac{|z|^2 - |z| + 1}{2 + |z|}\right\} > -2$, then z lies inside

A. a square

B. a triangle

C. a circle

D. an ellipse

Answer: C

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93. If ω is a complex cube root of unity , then for any $n > 1 \sum_{r=1}^{n-1} r(r+1-\omega)\left(r+1-\omega^2\right] =$

A. $\frac{n^2(n+1)^2}{4}$

B. $\frac{n(n-1)}{4}\left(n^2+3n+4\right)$

C. $\frac{n(n+1)(2n+1)}{4}$

D. $\frac{n(n+1)(2n+1)}{6}$

Answer: B

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