MATHS

BOOKS - MTG WBJEE MATHS (HINGLISH)

COMPLEX NUMBERS

Wb Jee Workout Category 1 Single Option Correct Type 1 Mark

1. The principal amplitude of $(\sin 40^\circ + i \cos 40^\circ)^5$ is

A. 70°

B. -100°

C. 110°

D. -70°

Answer: B

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2. A and Bare two points on the Argand plane such that the segment AB is bisected at the point (0, 0). If the point A, which is in the third quadrant has principal amplitude θ, then the principal amplitude of the point B is

A. $-\theta$

B. $\pi - \theta$

C. $\theta - \pi$

D. $\pi + \theta$

Answer: D

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3. $arg(\bar{z}) - arg(-\bar{z})$ is

A. π

B. π

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

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

Answer: A

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4. If $\left(\frac{3}{2}+i\frac{\sqrt{3}}{2}\right)=3^{25}(x+iy)$, where x and y are real then ordered pair (x,y) is

A. (- 3, 0)

B. (0,3)

C. (0, -3)

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

Answer: D

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5. The points representing the complex number z for which $arg\left(\frac{z-2}{z+2}\right)=\frac{\pi}{3}$ lie on

A. A circle

B. A straight line

C. An ellipse

D. A parabola

Answer: A

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6. Let z be a purely imaginary number such that Im (z) < 0. Then arg (z) is equal to

A. π

B. $\pi/2$

C. 0

D. $-\pi/2$

Answer: D

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

A. π

B. $-\pi$

C. 0

D. $\pi/2$

Answer: C

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8. The roots of the equation $(x-1)^3+8=0$ are

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

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

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

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

Answer: B

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

A. Re (z) = 0

B. Im (z) = 0

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

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

Answer: B

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10. If the complex numbers sin x + i cos 2 x and cos x - i sin 2 x are conjugate to each other, then x is equal to

A. $n\pi$

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

C. 0

D. None of these

Answer: D

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11. If $\frac{z_2}{z_1}$ is pure imaginary, then $\left|\frac{6z_1-8z_2}{4z_2+3z_1}\right| =$

A. 1

B. $\sqrt{2}$

C. 2

D. 4

Answer: C

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12. If $\log_{\sqrt{3}}\left(\frac{|z|^2-|z|+1}{2+|z|}\right) > 2$, then the locus of z is

A. $|z| = 5$

B. $|z| < 5$

C. $|z| > 5$

D. None of these

Answer: C

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13. If n is an integer other than a multiple of 3, then the value of $1 + \omega^n + \omega^{2n}$ is

A. 1

B. -1

C. 0

D. 3

Answer: C

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14. If z_1, z_2, z_3 are affixes of the vertices A, B and C respectively of a triangle ABC having centroid at G such that z = 0 is the mid point of AG, then

A. $z_1 + z_2 + z_3 = 0$

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

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

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

Answer: D

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15. For any two complex numbers z_1, z_2 the value of $|z_1 + z_2|^2 + |z_1 - z_2|^2$ is

A. $|z_1|^2 + |z_2|^2$

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

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

D. None of these

Answer: B

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16. If $1m\left(\frac{2z+1}{iz+1}\right)=3$, then locus of z is

A. A circle

B. A parabola

C. A straight line

D. None of these

Answer: A

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17. If z_1 , z_2, z_3, z_4 are the affixes of the vertices of a parallelogram taken in order in Argand plane, then

A. $z_1+z_3=z_2+z_4$

B. $z_1+z_2=z_3+z_4$

C. $z_1-z_3=z_2-z_4$

D. None of these

Answer: A

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

A. 1

B. -1

C. 0

D. None of these

Answer: B

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19. For $n = 6k, k \in Z$, $\left(\frac{1 - i\sqrt{3}}{2}\right)^n + \left(\frac{-1 - i\sqrt{3}}{2}\right)^n$ has the value

A. -1

B. 0

C. 1

D. 2

Answer: D

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20. If $|z - 2| \leq \sqrt{2}$, then the maximum value of $|3 + i(z - 1)|$ is

A. $\sqrt{2}$

B. $2\sqrt{2}$

C. $2 + \sqrt{2}$

D. $3 + \sqrt{2}$

Answer: B

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21. Let z = x + iy, where x and y are integers. The area of the rectangle whose vertices are the roots of the equation $zz^3 + z\bar{z}^3 = 350$ is

A. 32

B. 40

C. 48

D. 80

Answer: C

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22. If k= 4n + 7 then i^k equals $(n \in l)$

A. -1

B. 1

C. $-i$

D. i

Answer: C

View Text Solution

23. $(1+i)^6+(1-i)^6=$

A. $15i$

B. $-15i$

C. 15

D. 0

Answer: D

View Text Solution

24. $\left(\frac{1+i\frac{\sin\pi}{8}+\frac{\cos\pi}{8}}{1-i\frac{\sin\pi}{8}+\frac{\cos\pi}{8}}\right)^8$ equals

A. 2^8

B. 0

C. -1

D. 1

Answer: C

View Text Solution

25. If $|z_1|=2, |z_2|=3$ then $|z_1+z_2+5+12i|$ is less then

A. 8

B. 18

C. 10

D. 5

Answer: B

View Text Solution

26. If $x + 1/x = 1$ then $x^{200} + 1\left(x^{200}\right)$ equals

A. -1

B. 0

C. 1

D. ω^2

Answer: A

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27. If ω is cube root of unity, then

$\tan\left\{\left(\omega^{200}+\frac{1}{\omega^{200}}\right)\pi+\frac{\pi}{4}\right\}$ equals

A. 1

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

C. 0

D. None of these

Answer: A

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28. If a, b, c are positive integers and ro is imaginary cube root of unity andf(x) $= x^{6a}+x^{6b+1}+x^{6c+2}$ then $f(\omega)$ equals

A. 0

B. 1

C. -1

D. None of these

Answer: A

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29. The Euler form of $\frac{2+6\sqrt{3}i}{5+i\sqrt{3}}$ is

A. $2.\ e^{i\pi/6}$

B. $e^{i\pi/3}$

C. $e^{-2\pi/3}$

D. $2e^{-\pi/3}$

Answer: D

View Text Solution

30. If x = 2 + 5i then value of the expression $x^3 - 5x^2 + 33x - 49$ equals

A. -20

B. 10

C. 20

D. -29

Answer: A

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Wb Jee Workout Category 2 Single Option Correct Type 2 Marks

1. The value of $\left(1-\omega+\omega^2\right)^5+\left(1+\omega-\omega^2\right)^5$, where ro and ro2 are the complex cube roots of unity is

A. 0

B. 32ω

C. -32

D. 32

Answer: D

View Text Solution

2. For the real parameter t, the locus of the complex number $z = \left(1 - t^2\right) + i\sqrt{1 + t^2}$ in the complex plane is

A. an ellipse

B. a parabola

C. a circle

D. a hyperbola

Answer: B

View Text Solution

3. If $x + \frac{1}{x} = 2\cos\theta$, then for any integer n, $x^n + \frac{1}{x^n} =$

A. $2\cos n\theta$

B. $2\sin ntheta$

C. $2i\cos n\theta$

D. $2i\sin n\theta$

Answer: A

View Text Solution

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

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

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

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

D. 0

Answer: A

View Text Solution

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

A. a= 1+ i

B. $a = 1 - i$

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

D. None of these

Answer: A

View Text Solution

6. The area of the triangle formed by the complex numbers z, iz, z + iz in the Argand plane is

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

B. $|z^2|$

C. $2\left|z^2\right|$

D. None of these

Answer: A

View Text Solution

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

A. Parabola

B. Circle

C. Pair of straight lines

D. None of these

Answer: B

View Text Solution

8. Common roots of the equations $z^3 + 2z^2 + 2z + 1 = 0$ and $z^{1985} + z^{100} + 1 = 0$ are

A. ω, ω^2

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

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

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

Answer: A

View Text Solution

9. 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

View Text Solution

10. If $1, \alpha_1, \alpha_2, \cdot \cdot \cdot \cdot \cdot, \alpha_{n-1}$ are the n^{th} roots of unity, then $(2-\alpha_1), (2-\alpha_2) \ldots . (2-\alpha_{n-1}) =$

A. n

B. 2^n

C. $2^n + 1$

D. $2^n - 1$

Answer: D

View Text Solution

11. The expression $\tan\left[i \log\left(\frac{a-ib}{a+ib00}\right.\right.$ reduces to

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

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

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

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

Answer: B

View Text Solution

12. If $z = -1$, then principal value of $arg\left(z^{2/3}\right)$ is

A. $0, \frac{2\pi}{3}, -\frac{2\pi}{3}$

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

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

D. $-\pi, \pi$

Answer: A

View Text Solution

13. If $iz^3 + z^2 - z + i = 0$, then $|z|$ equals

A. 2

B. 1

C. 0

D. None of these

Answer: B

View Text Solution

14. Real part of $\frac{1}{1 - \cos\theta + i\sin theta a}$ is

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

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

C. $\frac{1}{2}\tan\theta/2$

D. 2

Answer: B

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15. If $z\bar{z} + (3 - 4i)z + (3 + 4i)\bar{z} = 0$ represent a circle, then area of the circle (in square units) is

A. 5π

B. 10π

C. $25\pi^2$

D. 25π

Answer: D

View Text Solution

Wb Jee Workout Category 3 One Or More Than One Option Correct Type 2 Marks

1. If α, β, γ are the cube roots of p, p $<$ 0, then for any x, y and z the value of $\frac{x\alpha + y\beta + z\gamma}{z\beta + y\gamma + z\alpha}$ is

A. ω

B. $-\omega$

C. ω^2

D. $-\omega^2$

Answer: A::C

View Text Solution

2. If $(a_1 + ib_1)(a_2 + ib_2)\ldots.(a_n + ib_n) = A + iB$, then $\left(a_1^2 + b_1^2\right)\left(a_2^2 + b_2^2\right)\ldots..\left(a_n^2 + b_n^2\right)$ is equal to

A. 1

B. $A^2 + B^2$

C. $A + B$

D. $\frac{1}{A^2} + \frac{1}{B^2}$

Answer: B

View Text Solution

3. 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 the origin

B. A straight line passing through the origin

C. The single point (0, -2)

D. None of these

Answer: C

View Text Solution

4. The square root of -5 - 12i is

A. (3 + 2i)

B. - (3 + 2i)

C. (2 - 3i)

D. - (2 - 3i)

Answer: C::D

View Text Solution

5. Solution(s) of the equation $|z|^2 + 7\bar{z} = 0$ is/are

A. z=0

B. z=3

C. z=7

D. z=-7

Answer: A::D

View Text Solution

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

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

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

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

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

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

View Text Solution

7. If a and b arc rcul numbers between O and 1 such that $z_1 = a + i, z_2 = 1 + bi, z_3 = 0$ form an equilateral triangle, then

A. $a = \sqrt{2} - 1$

B. $b = \sqrt{-1}$

C. $a = 2 - \sqrt{3}$

D. $b = 2 - \sqrt{3}$

Answer: C::D

View Text Solution

8. If $x^2 - ix + 1 = 0$ then $x^{10} + \frac{1}{x^{10}}$ is an integer divisible by

A. 3

B. 13

C. 23

D. 41

Answer: A::D

View Text Solution

9. If z_1, z_2 and z_3 are three complex numbers such that $|z_1| = |z_2| = |z_3| = 1$, then $|z_1 - z_2|^2 + |z_2 - z_3|^2 + |z_3 - z_1|^2$ is less than or equal to

A. 6

B. 9

C. 12

D. 18

Answer: B

View Text Solution

10. Complex numbers z_1, z_2, z_3 and z_4 correspond to the points A, B, C and D respectively, on a circle $|z| = 1$. If $z_1 + z_2 + z_3 + z_4 = 0$. ThenABCD is necessarily

A. a rectangle

B. a square

C. a rhombus

D. a parallelogram

Answer: A::D

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Wb Jee Previous Years Questions Category 1 Single Option Correct Type 1 Mark

1. Let $z_1 = 2 + 3i$ and $z_2 = 3 + 4i$ be two points on the complex plane. Then the set of complex numbers z satisfying $|z - z_1|^2 + (z - z_2)^2 = (z_1 - z_2)^2$ represents

A. a straight line

B. a point

C. a circle

D. a pair of straight lines

Answer: C

View Text Solution

2. Suppose z = x + iy where x and y are real numbers and $i = \sqrt{-1}$. The points (x, y) for which $\frac{z-1}{z-1}$ is real, lie on

A. an ellipse

B. a circle

C. a parabola

D. a straight line

Answer: D

View Text Solution

3. If P, Q, R are angles of an isosceles triangle and $\sqrt{P} = \pi/2$, then the value of

$$\left(\frac{\cos P}{3} - i\frac{\sin P}{3}\right)^3 + (\cos Q + i\sin Q)(\cos R - i\sin R) + (\cos P - i\sin$$

is equal to

A. i

B. $-i$

C. 1

D. -1

Answer: B

View Text Solution

4. In the Argand plane, the distinct roots of $1 + z + z^3 + z^4 = 0$ (z is a complex number) represent vertices of

A. a square

B. an equilateral triangle

C. a rhombus

D. a rectangle

Answer: B

View Text Solution

5. Suppose that z_1, z_2, z_3 are three vertices of an equilateral triangle in the Argand plane.

Let $\alpha = \frac{1}{2}(\sqrt{3}+1)$ and β be a non- zero complex number. The points $\alpha z_1 + \beta, \alpha z_2 + \beta, \alpha z_3 + \beta$ will be .

A. the vertices of an equilateral triangle

B. the vertices of an isosceles triangle

C. colliner

D. the verticle of an scalener triangle .

Answer: A

View Text Solution

6. The value of $\left|z^2\right| + |z+3|^2 + |z-i|^2$ is minimum when z equals.

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

B. $45 + 3i$

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

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

Answer: C

View Text Solution

7. Let z_1 be a fixed point on the circle of radius 1 centered at the origin the Argand plane and $z_1 \neq \pm 1$ .Consider an equilaternal triangle

inscribed in the circle with z_1, z_2, z_3 as the vertices taken in the counter clockwise direction. Then $z_1 z_2 z_3$ is equal to

A. z_1^2

B. z_1^3

C. z_1^4

D. z_1

Answer: B

View Text Solution

8. If 2 + i and $\sqrt{5} - 2i$ are the roots of the equation $\left(x^2 + ax + b\right)\left(x^2 + cx + d\right) = 0$, where a, b, c, dare real constants, then product of all roots of the equation is

A. 40

B. $9\sqrt{5}$

C. 45

D. 35

Answer: C

View Text Solution

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

A. 0

B. -1

C. 1

D. i

Answer: B

View Text Solution

10. Find the maximum value of $|z|$ when $\left|z - \frac{3}{z}\right| = 2$, z being a complex number.

A. $1 + \sqrt{3}$

B. 3

C. $1 + \sqrt{2}$

D. 1

Answer: B

View Text Solution

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

A. i

B. i-1

C. 1

D. 0

Answer:

View Text Solution

12. If $|z_1| = |z_2| = |z_3| = \left|\frac{1}{z_1} + \frac{1}{z_2} + \frac{1}{z_3}\right| = 1$ and z_1, z_2, z_3 are imaginary numbers, then $|z_1 + z_2 + z_3|$ is

A. equal to 1

B. less than 1

C. greater than 1

D. equal to 3

Answer: A

View Text Solution

13. The expression $\frac{(1+i)^n}{(1-i)^{n-2}}$ equals

A. $-i^{n+1}$

B. i^{n+1}

C. $-2i^{n+1}$

D. 1

Answer: C

View Text Solution

14. Let 2 = x + iy, where x and y are real. The points (x, y) in the X-Yplane or which $\frac{z+1}{z-1}$ purely imaginary lie on

A. a straight line

B. an ellipse

C. a hyperbola

D. a circle

Answer: D

View Text Solution

15. If $z_r = \frac{\sin(2\pi r)}{11} - i\frac{\cos(2\pi r)}{11}$, then $\sum_{r=0}^{10} z_r$=

A. -1

B. 0

C. i

D. $-i$

Answer: B

View Text Solution

16. If 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 the points represented by z_1 and z_2

A. lie on a straight l!ne

B. form a right angled triangle

C. form an equilaleral triangle

D. form an isosceles triangle

Answer: C

View Text Solution

17. Let z be a complex number such that the principal value of argument, arg$z > 0$. Then arg z-arg(-z) is

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

B. $\pm\pi$

C. π

D. $-\pi$

Answer: C

View Text Solution

18. The general value of the real angle θ, which satisfies the equation, $(\cos\theta + i\sin\theta)(\cos 2\theta + i\sin 2\theta)\ldots\ldots(\cos n\theta + i\sin n\theta) = 1$ is given by, (assuming k is an integer)

A. $\frac{2k\pi}{n+2}$

B. $\frac{4k\pi}{n(n+1)}$

C. $\frac{4k\pi}{n+1}$

D. $\frac{6k\pi}{n(n+1)}$

Answer: B

View Text Solution

Wb Jee Previous Years Questions Category 2 Single Option Correct Type 2 Marks

1. Let α, β denote the cube roots ofunity other than I and $\alpha a \neq \beta$. Let $s = \sum_{n=0}^{302} (-1)^n \left(\frac{\alpha}{\beta}\right)^n$. Then the value of s is

A. either -2ω or-$2\omega^2$

B. either -2ω or $2\omega^2$

C. either 2ω or $-2\omega^2$

D. either 2ω or $2\omega^2$

Answer: A

View Text Solution

2. If ω is an imaginary cube root of unity, then the value of $(2-\omega)(2-\omega^2) + 2(3-\omega)(3-\omega^2) + \ldots\ldots + (n-1)(n-\omega)(n-\omega^2)$ is

A. $\frac{n^2}{4}(n+1)^2 - n$

B. $\frac{n^2}{4}(n+1)^2 + n$

C. $\frac{n^2}{4}(n+1)^2$

D. $\frac{n^2}{4}(n+1)^2 - n$

Answer: A::D

View Text Solution

3. Let α and β be the roots of $x^2 + x + 1 = 0$. If n be positive integer, then $\alpha^n + \beta^n$ is

A. $2\frac{\cos(2n\pi)}{3}$

B. $2\frac{\sin(2n\pi)}{3}$

C. $2\frac{\cos(n\pi)}{3}$

D. $2\frac{\sin(n\pi)}{3}$

Answer: A

View Text Solution

4. Let z_1 and z_2 be complex numbers such that $z_1 \neq z_2$ and $|z_1|$ and $|z_2|$. If $Re(z_1) > 0$ and $Im(z_2) < 0$, then $\frac{z_1 + z_2}{z_1 - z_2}$ is

A. one

B. real and positive

C. real and negative

D. purely imaginary

Answer: D

View Text Solution

5. For any non-zero complex number z, the minimum value of $|z| + |z - 1|$ is

A. 1

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

C. 0

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

Answer: A

View Text Solution

Wb Jee Previous Years Questions Category 3 One Or More Than One Option Correct Type 2 Marks

1. If $z = \sin theta - i\cos\theta$ then for any integer n

A. $z^n + \frac{1}{z^n} = 2\cos\left(\frac{n\pi}{2} - n\theta\right)$

B. $z^n + \frac{1}{z^n} = 2\sin\left(\frac{n\pi}{2} - n\theta\right)$

C. $z^n - \frac{1}{z^n} = 2i \in \left(n\theta - \frac{n\pi}{2}\right)$

D. $z^n - \frac{1}{z^n} = 2i\cos\left(\frac{n\pi}{2} - n\theta\right)$

Answer: A::C

View Text Solution

2. The complex number z satisfying the equation $|z-1| = |z+1| = 1$ is

A. 0

B. 1+i

C. $-1+i$

D. $1-i$

Answer: A::C

View Text Solution

3. If $\theta \in R$ and $\frac{1-\cos\theta}{1+2i\cos\theta}$ is real number, then θ will be (when T : set of integers)

A. $(2n+1)\frac{\pi}{2}, n \in I$

B. $\frac{3n\pi}{2}, n \in I$

C. $n\pi, n \in I$

D. $2n\pi, n \in I$

Answer: A

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