



MATHS

BOOKS - SAI MATHS (TELUGU ENGLISH)

COMPLEX NUMBERS AND DE MOIVRE'S THEOREM

Problems

1. If α, β are the roots of the equation $x^2 - 4x + 8 = 0$. Then for any $n \in N$, $\alpha^{2n} + \beta^{2n}$ equals

A. $2^{2n+1} \cos \frac{n\pi}{2}$

B. $2^{3n} \cos \frac{n\pi}{2}$

C. $2^{3n+1} \cos \frac{n\pi}{2}$

D. $2^{3n} \cos \frac{n\pi}{4}$



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2. If α, β are the non-real cube roots of 2, then

$$\alpha^6 + \beta^6 =$$

A. 8

B. 4

C. 2

D. 1



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3. If ' ω ' is a complex cube root of unity, then

$$\omega \left(\frac{1}{3} + \frac{2}{9} + \frac{4}{27} + \dots \infty \right) + \omega \left(\frac{1}{2} + \frac{3}{8} + \frac{9}{32} + \dots \infty \right) =$$

A. 1

B. -1

C. ω

D. i



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

A. 1

B. -1

C. 2

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



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5. The number of solutions for $z^3 + \bar{z} = 0$ is

A. 5

B. 1

C. 2

D. 3



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6. The least positive integer n for which

$$(1 + i)^n = (1 - i)^n \text{ is}$$

A. 8

B. 2

C. 4

D. 6



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7. If $x = p + q$, $y = p\omega + q\omega^2$ and $z = p\omega^2 + q\omega$, where ω is a complex cube root of unity, then xyz equals to

A. $p^3 + q^3$

B. $p^2 - pq + q^3$

C. $1 + p^3 + q^3$

D. $p^3 - q^3$



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

A. 0

B. 1

C. 2

D. 4



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9. If a complex number z satisfies

$$|z|^2 + 1 = |z^2 - 1|, \text{ then the locus of } z \text{ is}$$

A. the real axis

B. the imaginary axis

C. $y = x$

D. a circle



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10.

$$\frac{(1+i)x - i}{2+i} + \frac{(1+2i)y + i}{2-i} = 1 \Rightarrow (x, y) =$$

A. $\left(\frac{7}{3}, \frac{-7}{15}\right)$

B. $\left(\frac{7}{3}, \frac{7}{15}\right)$

C. $\left(\frac{7}{5}, \frac{-7}{15}\right)$

D. $\left(\frac{7}{5}, \frac{7}{15}\right)$



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11. If $a, b, c, d \in \mathbb{R}$ are such that $a^2 + b^2 = 4$ and $c^2 + d^2 = 2$ and if $(a + ib)^2 = (c + id)^2(x + iy)$ then $x^2 + y^2 =$

A. 4

B. 3

C. 2

D. 1



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12. If α is a non real root of the equation

$$x^6 - 1 = 0 \text{ then } \frac{\alpha^2 + \alpha^3 + \alpha^4 + \alpha^5}{\alpha + 1}$$

A. α

B. 1

C. 0

D. -1



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13.

Let

$$z = a - \frac{i}{2}, a \in \mathbb{R} \quad \text{Then} \quad |i + z|^2 - |i - z|^2 =$$

A. 2

B. -2

C. 4

D. -4



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14. The locus of the complex number z such

that $\arg \left(\frac{z - 2}{z + 2} \right) = \frac{\pi}{3}$ is :

- A. a circle
- B. a straight line
- C. a parabola
- D. an ellipse



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15. $\frac{(1 + i)^{2011}}{(1 - i)^{2009}} =$

A. -1

B. 1

C. 2

D. -2



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

A. 0

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

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

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



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17. 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. $x^3 - 2$



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18. The locus of z satisfying the $\left| \frac{x + 2i}{2z + i} \right| < 1$, inequality where $z = x + iy$, is

A. $x^2 + y^2 < 1$

B. $x^2 - y^2 < 1$

C. $x^2 + y^2 > 1$

D. $2x^2 + 3y^2 < 1$



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19. The points in the set

$\left\{ z \in C : \text{Arg} \left(\frac{z - 2}{Z - 6i} \right) = \frac{\pi}{2} \right\}$ 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



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20. If ω is a complex cube root of unity, then

$$\sin \left[(\omega^{10} + \omega^{23})\pi - \frac{\pi}{4} \right]$$

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

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

C. 1

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



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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. $m_3 < m_1 < m_2 < m_4$



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22. 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. $x = 2$



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23. The equation of the locus of z such that

$$\left| \frac{z - i}{z + i} \right| = 2, \text{ where } z = x + iy \text{ is a complex}$$

number, is

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

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

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

$$D. x^2 + y^2 - 5y + 3 = 0$$



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24. 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. $\alpha_3, \alpha_1, \alpha_2$



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$$25. \sum_{n=0}^{\infty} \left(\frac{2i}{3} \right)^n =$$

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

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

C. $9 + 6i$

D. $9 - 6i$



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26. If $X_n = \cos \frac{\pi}{2^n} + i \sin \frac{\pi}{2^n}$, then

$x_1, x_2, x_3 \dots \infty$

A. -1

B. 1

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

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



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27. 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. $x - y + 1 = 0$



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28. If ω is a complex cube root of unity, then

$$225 + (3\omega + 8\omega^2)^2 + (3\omega^2 + 8\omega)^2$$

A. 72

B. 192

C. 200

D. 248



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29. If $z = x + iy$ is a complex number satisfying $|z + i/2|^2 = |z - i/2|^2$ then the locus of z is

A. x-axis

B. y-axis

C. $y = x$

D. $2y = x$



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30. If $1 - i$ is a root of the equation $x^2 + ax + b = 0$, then b is equal to

A. 1

B. -1

C. -2

D. 2



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31. If $x_n = \cos\left(\frac{\pi}{4^n}\right) + i \sin\left(\frac{\pi}{4^n}\right)$, then

$x_1, x_2, x_3, \dots \infty$ is equal to

A. $\frac{1 + i\sqrt{3}}{2}$

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

C. $\frac{1 - i\sqrt{3}}{2}$

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



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32. If $\frac{3 + 2i \sin \theta}{1 - 2i \sin \theta}$ is a real number and $0 < \theta < 2\pi$, then $\theta =$

A. π

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

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

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



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33. If $z = 3 + 5i$ then $z^3 + \bar{z} + 198$ is equal to

A. $-3 - 5i$

B. $-3 + 5i$

C. $3 - 5i$

D. $3 + 5i$



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34. If $\begin{vmatrix} 1 - i & i \\ 1 + 2i & -i \end{vmatrix} = x + iy$, then x is equal to

A. -2

B. -1

C. 1

D. 2



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