



India's Number 1 Education App

MATHS

BOOKS - SURA MATHS (TAMIL ENGLISH)

COMPLEX NUMBERS

Exercise 2 1

1. Simplify the following:

$$i^{1947} + i^{1950}$$



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2. Simplify the following:

$$i^{1948} + i^{-1869}$$



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3. Simplify the following:

$$\sum_{n=1}^{12} i^n$$



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4. Simplify the following:

$$i^{59} + \frac{1}{i^{59}}$$



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5. Simplify the following:

$$i \cdot i^2 \cdot i^3 \cdot \dots \cdot i^{2000}$$



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6. Simplify the following:

$$\sum_{n=1}^{10} i^{n+50}$$



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Exercise 2 2

1. Evaluate the following if $z = 5 - 2i$ and $w = -1 + 3i$

$$z + w$$



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2. Evaluate the following if $z = 5 - 2i$ and $w = -1 + 3i$

$$z - iw$$



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3. Evaluate the following if $z = 5 - 2i$ and $w = -1 + 3i$

$$2z + 3w$$



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4. Evaluate the following if $z = 5 - 2i$ and $w = -1 + 3i$

zw



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5. Evaluate the following if $z = 5 - 2i$ and $w = -1 + 3i$

$$z^2 + 2zw + w^2$$



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6. Evaluate the following if $z = 5 - 2i$ and $w = -1 + 3i$

$$(z + w)^2$$



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7. Given the complex number $z = 2 + 3i$, represent the complex numbers in Argand diagram.

z , iz , and $z + iz$



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8. Given the complex number $z = 2 + 3i$, represent the complex numbers in Argand diagram.

z , $-iz$, and $z - iz$.



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9. Find the values of the real numbers x and y , if the complex numbers

$(3 - i)x - (2 - i)y + 2i + 5$ and $2x + (-1 + 2i)y + 3 + 2i$ are equal



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Exercise 2 3

1. If $z_1 = 1 - 3i$, $z_2 = -4i$ and $z_3 = 5$, show that

$$(z_1 + z_2) + z_3 = z_1 + (z_2 + z_3)$$



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2. If $z_1 = 1 - 3i$, $z_2 = -4i$ and $z_3 = 5$, show that

$$(z_1 z_2) z_3 = z_1 (z_2 z_3)$$



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3. If $z_1 = 3$, $z_2 = -7i$, and $z_3 = 5 + 4i$, show that

$$z_1(z_2 + z_3) = z_1 z_2 + z_1 z_3$$



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4. If $z_1 = 3$, $z_2 = -7i$, and $z_3 = 5 + 4i$, show that

$$(z_1 + z_2) z_3 = z_1 z_3 + z_2 z_3$$



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5. If $z_1 = 2 + 5i$, $z_2 = -3 - 4i$, and $z_3 = 1 + i$, find the additive and multiplicative inverse of z_1 , z_2 and z_3 .



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Exercise 2 4

1. Write in the rectangular form

$$\overline{(5 + 9i)} + \overline{(2 - 4i)}$$



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2. Write in the rectangular form

$$\frac{10 - 5i}{6 + 2i}$$



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3. Write in the rectangular form

$$\overline{3i} + \frac{1}{2 - i}$$



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4. If $z = x + iy$, find in rectangular form.

$$\operatorname{Re}\left(\frac{1}{z}\right)$$



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5. If $z = x + iy$, find in rectangular form.

$$\operatorname{Re}(iz)$$



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6. If $z = x + iy$, find in rectangular form.

$$\operatorname{Im}(3z + 4\bar{z} - 4i)$$



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7. If $z_1 = 2 - i$ and $z_2 = -4 + 3i$, find the inverse of

$$z_1 z_2 \text{ and } \frac{z_1}{z_2}.$$



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8. The complex numbers u , v and w are related by

$\frac{1}{u} = \frac{1}{v} + \frac{1}{w}$. If $v = 3 - 4i$ and $w = 4 + 3i$, find u in rectangular form.

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9. Prove the following properties:

z is real if and only if $z = \bar{z}$

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10. Prove the following properties:

$$\operatorname{Re}(z) = \frac{z + \bar{z}}{2} \text{ and } \operatorname{Im}(z) = \frac{z - \bar{z}}{2i}$$



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11. Find the least value of the positive integer n for

$$\text{which } (\sqrt{3} + i)^n$$

real



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12. Find the least value of the positive integer n for

$$\text{which } (\sqrt{3} + i)^n$$

purely imaginary.



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13. Show that

$$(2 + i\sqrt{3})^{10} - (2 - i\sqrt{3})^{10} \text{ is purely imaginary.}$$



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14. Show that

$$\left(\frac{19 - 7i}{9 + i}\right)^{12} + \left(\frac{20 - 5i}{7 - 6i}\right)^{12} \text{ is real.}$$



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Exercise 2 5

1. Find the modulus of the complex number

$$\frac{2i}{3 + 4i}$$



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2. Find the modulus of the complex number

$$\frac{2 - i}{1 + i} + \frac{1 - 2i}{1 - i}$$



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3. Find the modulus of the complex number

$$(1 - i)^{10}$$



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4. Find the modulus of the complex number

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



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5. For any two complex number z_1 and z_2 , such that

$|z_1| = |z_2| = 1$ and $z_1 z_2 \neq -1$, then show that

$$\frac{z_1 + z_2}{1 + z_1 z_2}$$
 is real number.



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6. Which one of the points $10 - 8i$, $11 + 6i$ is closest to $1 + i$.



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7. If $|z| = 3$, show that $7 \leq |z + 6 - 8i| \leq 13$.



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8. If $|z| = 1$, show that $2 \leq |z^3 - 3| \leq 4$.



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9. If $\left|z = \frac{2}{z}\right| = 2$. show that the greatest and least value of $|z|$ are $\sqrt{3} + 1$ and $\sqrt{3} - 1$ respectively.



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10. If z_1, z_2 , and z_3 are three complex numbers such that

$$|z_1| = 1, \quad |z_2| = 2, \quad |z_3| = 3 \text{ and } |z_1 + z_2 + z_3| = 1,$$

show that $|9z_1z_2 + 4z_1z_3 + z_2z_3| = 6$.



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11. If the area of the triangle formed by the vertices z , iz , and $z + iz$ is 50 square units, find the value of $|z|$.



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12. Show that the equation $z^3 + 2\bar{z} = 0$ has five solutions.



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13. Find the square roots of

(i) $4 + 3i$



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14. Find the square roots of

$$-6 + 8i$$



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15. Find the square roots of

$$-5 - 12i.$$



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Exercise 2 6

1. If $z = x + iy$ is a complex number such that $\left| \frac{z - 4i}{z + 4i} \right| = 1$
show that the locus of z is real axis.



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2. If $z = x + iy$ is complex number such that $\operatorname{Im}\left(\frac{2z + 1}{iz + 1}\right) = 0$, show that the locus of z is

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



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3. Obtain the Cartesian form of the locus of $z = x + iy$ in each of cases:

$$[\operatorname{Re}(iz)]^2 = 3$$



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4. Obtain the Cartesian form of the locus of $z = x + iy$ in each of cases:

$$\operatorname{Im}[1 - i) z + 1] = 0$$



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5. Obtain the Cartesian form of the locus of $z = x + iy$ in each of cases:

$$|z + i| = |z - 1|$$



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6. Obtain the Cartesian form of the locus of $z = x + iy$ in each of cases:

$$\bar{z} = z^{-1}$$



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7. Show that the equations represent a circle, and , find its centre and radius.

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



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8. Show that the equations represent a circle, and , find its centre and radius.

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



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9. Show that the equations represent a circle, and , find its centre and radius.

$$|3z - 6 + 12i| = 8$$



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10. Obtain the Cartesian equation for the locus of $z = x + iy$ in each of the cases:

$$|z - 4| = 16$$



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11. Obtain the Cartesian equation for the locus of $z = x + iy$ in each of the cases:

$$|z - 4|^2 - |z - 1|^2 = 16$$



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Exercise 2 7

1. Write in polar form of the complex numbers.

$$2 + i2\sqrt{3}$$



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2. Write in polar form of the complex numbers.

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



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3. Write in polar form of the complex numbers.

$$-2 - 2i$$



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4. Write in polar form of the complex numbers.

$$\frac{i - 1}{\cos \frac{\pi}{3} + i \sin \frac{\pi}{3}}$$



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5. Find the rectangular form of the complex numbers.

$$\left(\cos \frac{\pi}{6} + i \sin \frac{\pi}{6} \right) \left(\cos \frac{\pi}{12} + i \sin \frac{\pi}{12} \right)$$



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6. Find the rectangular form of the complex numbers.

$$\frac{\cos \frac{\pi}{6} - i \sin \frac{\pi}{6}}{2 \left(\cos \frac{\pi}{3} + i \sin \frac{\pi}{3} \right)}$$



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7. Given $(x_1 + iy_1)(x_2 + iy_2)\dots(x_n + iy_n) = a + ib$,
show that

$$(x_1^2 + y_1^2)(x_2^2 + y_2^2)(x_3^2 + y_3^2)\dots(x_n^2 + y_n^2) = a^2 + b^2$$



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8. Given $(x_1 + iy_1)(x_2 + iy_2)\dots(x_n + iy_n) = a + ib$,
show that

$$\sum_{r=1}^n \tan^{-1} \frac{y_r}{x_r} = \tan^{-1} \left(\frac{b}{a} \right) + 2k\pi, \quad k \in \mathbb{Z}$$



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9. If $\frac{1+z}{1-z} = \cos 2\theta + i \sin 2\theta$, show that $z = i \tan \theta$.



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10. If $\cos \alpha + \cos \beta + \cos \gamma = \sin \alpha + \sin \beta + \sin \gamma = 0$,
, show that

$\cos 3\alpha + \cos 3\beta + \cos \gamma = 3 \cos(\alpha + \beta + \gamma)$ and



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11. If $\cos \alpha + \cos \beta + \cos \gamma = \sin \alpha + \sin \beta + \sin \gamma = 0$,
show that

$\sin 3\alpha + \sin 3\beta + \sin 3\gamma = 3 \sin(\alpha + \beta + \gamma)$



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12. If $z = x + iy$ and $\arg\left(\frac{z-i}{z+2}\right) = \frac{\pi}{4}$. Show that $x^2 + y^2 + 3x - 3y + 2 = 0$.



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Exercise 2 8

1. If $\omega \pm 1$ is a cube root of unity, show that
- $$\frac{a + b\omega + c\omega^2}{b + c\omega + a\omega^2} + \frac{a + b\omega + c\omega^2}{c + a\omega + b\omega^2} = -1$$



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



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3. Find the value of $\left(\frac{1 + \sin \frac{\pi}{10} + i \cos \frac{\pi}{10}}{1 + \sin \frac{\pi}{10} - i \cos \frac{\pi}{10}}\right)^{10}$.



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4. If $2 \cos \alpha = x + \frac{1}{x}$ and $2 \cos \beta = y + \frac{1}{y}$, show that

$$\frac{x}{y} + \frac{y}{x} = 2 \cos(\alpha - \beta)$$



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5. If $2 \cos \alpha = x + \frac{1}{x}$ and $2 \cos \beta = y + \frac{1}{y}$, show that

$$xy - \frac{1}{xy} = 2i \sin(\alpha - \beta)$$



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6. If $2 \cos \alpha = x + \frac{1}{x}$ and $2 \cos \beta = y + \frac{1}{y}$, show that

$$\frac{x^m}{y^n} - \frac{y^n}{x^m} = 2i \sin(m\alpha - n\beta)$$



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7. If $2 \cos \alpha = x + \frac{1}{x}$ and $2 \cos \beta = y + \frac{1}{y}$, show that

$$x^m y^n + \frac{1}{x^m y^n} = 2 \cos(m\alpha + n\beta)$$



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8. Solve the equation $z^3 + 27 = 0$



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9. If $\omega \neq 1$ is a cube root of unity, show that the roots of the equation $(z - 1)^3 + 8 = 0$ are $-1, 1 - 2\omega, 1 - 2\omega^2$



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10. Find the value of $\sum_{k=1}^8 \left(\cos \frac{2k\pi}{9} + i \frac{\sin 2k\pi}{9} \right)$



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11. If $\omega \pm 1$ is a cube root of unity, show that

$$(1 - \omega + \omega^2)^6 + (1 + \omega - \omega^2)^6 = 128$$



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12. If $\omega \pm 1$ is a cube root of unity, show that

$$(1 + \omega)(1 + \omega^2)(1 + \omega^4)(1 + \omega^8) \dots (1 + \omega^{2^{11}}) = 1$$



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13. If $z = 2 - 2i$, find the rotation of z by θ radians in the counter clockwise direction about the origin when

$$\theta = \frac{\pi}{3}$$



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14. If $z = 2 - 2i$, find the rotation of z by θ radians in the counter clockwise direction about the origin when

$$\theta = \frac{2\pi}{3}$$



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15. If $z = 2 - 2i$, find the rotation of z by θ radians in the counter clockwise direction about the origin when

$$\theta = \frac{3\pi}{2}$$



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16. Prove that the values of $4\sqrt{-1}$ are $\pm \frac{1}{\sqrt{2}}(1 \pm i)$.



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Exercise 2 9

1. $i^n + i^{n+1} + i^{n+2} + i^{n+3}$

A. 0

B. 1

C. -1

D. i

Answer:



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2. The value of $\sum_{i=1}^{13} (n^n + i^{n-1})$ is

A. $1 + i$

B. i

C. 1

D. 0

Answer: A



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3. The area of the triangle formed by the complex numbers z , iz , and $z + iz$ in the Argand's diagram is

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

B. $|z|^2$

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

D. $2|z|^2$

Answer: A::B



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4. The conjugate of a complex number is $\frac{1}{i - 2}$. Then, the complex number is

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

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

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

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

Answer: A::B



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5. If $z = \frac{(\sqrt{3} + i)^3(3i + 4)^2}{(8 + 6i)^2}$, then $|z|$ is equal to

A. 0

B. 1

C. 2

D. 3

Answer: B



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6. If z is non zero complex number, such that $2i z^2 = \bar{z}$,

then $|z|$ is

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

B. 1

C. 2

D. 3

Answer: A::B



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7. If $|z-2 + i| \leq 2$, then the greatest value of $|z|$ is

A. $\sqrt{3} - 2$

B. $\sqrt{3} + 2$

C. $\sqrt{5} - 2$

D. $\sqrt{5} + 2$

Answer: B



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8. If $|z - \frac{3}{z}| = 2$, then the least value of $|z|$ is

A. 1

B. 2

C. 3

D. 5

Answer: A



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9. If $|z| = 1$, then the value of $\frac{1+z}{1+\bar{z}}$.

A. z

B. \bar{z}

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

D. 1

Answer:



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

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

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

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

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

Answer: B::C



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11. If $|z_1| = 1$,

$|z_2| = 2$, $|z_3| = 3$ and $|9z_1z_2 + 4z_1z_3 + z_2$

$z_3 = 12|$, then the value of $|z_1 + z_2 + z_3|$ is

A. 1

B. 2

C. 3

D. 4

Answer: B



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12. If z is a complex number such that $z \in \mathbb{C} \setminus \mathbb{R}$, and $z + \frac{1}{z} \in \mathbb{R}$, then $|z|$ is

A. 0

B. 1

C. 2

D. 3

Answer: A



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13. z_1, z_2 , and z_3 are complex numbers such that $z_1 + z_2 + z_3 = 0$ and $|z_1| = |z_2| = |z_3| = 1$ then $z_1^2 + z_2^2 + z_3^2$

A. 3

B. 2

C. 1

D. 0

Answer:



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14. If $\frac{z - 1}{z + 1}$ is purely imaginary, then $|z|$ is

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

B. 1

C. 2

D. 3

Answer: A



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15. If $z = x + iy$ is a complex number such that $|z + 2| = |z - 2|$, then the locus of z is

A. real axis

B. imaginary axis

C. ellipse

D. circle

Answer: A



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16. The principal argument of $\frac{3}{-1+i}$ is

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

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

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

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

Answer: C::D



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

A. -110°

B. -70°

C. 70°

D. 110°

Answer: A



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18. If $(1 + i)(1 + 2i)(1 + 3i) \dots (1 + ni) = x + iy$, then 2.5.10...

$(1 + n^2)$ is

A. 1

B. i

C. $x^2 + y^2$

D. $1 + n^2$

Answer: B



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19. If $\omega \neq 1$ is a cubic root of unit and $(1 + \omega)^7 = A + B\omega$,
then (A, B) equals

A. (1,0)

B. (-1,1)

C. (0,1)

D. (1,1)

Answer: A



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20. The principal argument of the complex number

$$\frac{(1 + i\sqrt{3})^2}{4i(1 - i\sqrt{3})} \text{ is}$$

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

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

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

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

Answer: B



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21. If α and β are the roots of $x^2 + x + 1 = 0$, then

$\alpha^{2020} + \beta^{2020}$ is

A. -2

B. -1

C. 1

D. 2

Answer: A



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22. The product of all four values of $\left(\cos \frac{\pi}{3} + i \sin \frac{\pi}{3}\right)^{\frac{3}{4}}$ is

A. -2

B. -1

C. 1

D. 2

Answer: A



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23. If $\omega \neq 1$ is a cubit root unity and $\begin{vmatrix} 1 & 1 & 1 \\ 1 & -\omega^2 - 1 & \omega^2 \\ 1 & \omega^2 & \omega^7 \end{vmatrix}$
= 3 k, then k is equal to

A. 1

B. -1

C. $\sqrt{3}i$

D. $-\sqrt{3}i$

Answer: C



[Next](#)



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24. The value of $\left(\frac{1 + \sqrt{3}i}{1 - \sqrt{3}i} \right)^{10}$ is

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

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

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

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

Answer: B::C



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25. If $\omega = cis \frac{2\pi}{3}$, then number of distinct roots of

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

A. 1

B. 2

C. 3

D. 4

Answer: A



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Additional Questions 1 Mark

1. The value of $(1 + i)(1 + i^2)(1 + i^3)(1 + i^4)$ is

A. 2

B. 0

C. 1

D. i

Answer:



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2. If $\sqrt{a + ib} = x + iy$, then possible value of $\sqrt{a - ib}$ is

A. $x^2 + y^2$

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

C. $x + iy$

D. $x - iy$

Answer:



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3. If $i^2 = -1$, then $i^1 + i^2 + i^3 + \dots +$ up to 1000 terms
is equal to

A. 1

B. -1

C. i

D. 0

Answer:



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4. If $z = \cos \frac{\pi}{4} + i \sin \frac{\pi}{6}$, then

A. $|z| = 1, \arg(z) = \frac{\pi}{4}$

B. $|z| = 1, \arg(z) = \frac{\pi}{6}$

C. $|z| = \frac{\sqrt{3}}{2}, \arg(z) = \frac{5\pi}{24}$

D. $|z| = \frac{\sqrt{3}}{2}, \arg(z) = \tan^{-1} \left(\frac{1}{\sqrt{2}} \right)$

Answer: A::B::C



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5. If $a = \cos \theta + i \sin \theta$, then $\frac{1+a}{1-a}$

A. $\cot \frac{\theta}{2}$

B. $\cot \theta$

C. $i \cot \frac{\theta}{2}$

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

Answer: A::B



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6. The principal value of the amplitude of $(1+i)$ is

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

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

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

D. π

Answer: D



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7. The least positive integer n such that $\left(\frac{2i}{1+i}\right)^n$ is a positive integer is

A. 16

B. 8

C. 4

D. 2

Answer:



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8. If $a = 1 + i$, then a^2 equals

A. $1 - i$

B. $2i$

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

D. $i-1$

Answer: B



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9. If $z = \frac{1}{(2 + 3i)^2}$ then $|z| =$

A. $\frac{1}{13}$

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

C. $\frac{1}{12}$

D. none of these

Answer: A::C



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10. If $z = 1 - \cos \theta + i \sin \theta$, then $|z| =$

A. $2 \sin \frac{\theta}{2}$

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

C. $2 \left| \sin \frac{\theta}{2} \right|$

D. $2 \left| \cos \frac{\theta}{2} \right|$

Answer: A::B



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11. If $z = \frac{1}{1 - \cos \theta - i \sin \theta}$, the $\operatorname{Re}(z) =$

A. 0

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

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

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

Answer: A::B



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12. If $x + iy = \frac{3 + 5i}{7 - 6i}$, then $y =$

A. $\frac{9}{85}$

B. $-\frac{9}{85}$

C. $\frac{53}{85}$

D. none of these

Answer: C



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13. The amplitude of $\frac{1}{i}$ is equal to

A. 0

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

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

D. π

Answer: B



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14. The value of $(1 + i)^4 + (1 - i)^4$ is

A. 8

B. 4

C. -8

D. -4

Answer:



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15. The complex number z which satisfies the condition

$$\left| \frac{i+z}{i-z} \right| = 1 \text{ lies on}$$

A. circle $x^2 + y^2 = 1$

B. x - axis

C. y- axis

D. the lines $x + y = 1$

Answer: A



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16. If $z = a + ib$ lies in III quadrant then $\frac{\bar{z}}{z}$ also lies in the III quadrant if

A. $a > b > 0$

B. $a < b < 0$

C. $b < a < 0$

D. $b > a > 0$

Answer: A::B



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$$17. \frac{1 + e^{-i\theta}}{1 + e^{i\theta}} =$$

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

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

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

D. $\sin \theta + i \cos \theta$

Answer: A::C



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18. If $z^n = \cos \frac{n\pi}{3} + i \sin \frac{n\pi}{3}$, then z_1, z_2, \dots, z_6 is

A. 1

B. -1

C. i

D. $-i$

Answer: A



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19. If $x = \cos \theta + i\sin \theta$, then the value of $x^n + \frac{1}{x^n}$ is

A. $2 \cos n\theta$

B. $2 \sin n\theta$

C. $2i \sin n\theta$

D. $2i \cos n\theta$

Answer: A::B::C



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20. If ω is the cube root of unity, then the value of $(1 - \omega)(1 - \omega^2)(1 - \omega^4)(1 - \omega^8)$ is

A. 9

B. - 9

C. 16

D. 32

Answer:



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Additional Questions Fill In The Blanks

1. The points represented by $3 - 3i$, $4 - 2i$, $3 - i$ and $2 - 2i$ form _____ in the argand plane

A. collinear points

B. Vertices of a parallelogram

C. Vertices of a rectangle

D. Vertices of square

Answer: A::C



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2. $(1 + i)^3 = \underline{\hspace{2cm}}$

A. $3 + 3i$

B. $1 + 3i$

C. $3 - 3i$

D. 2i - 2

Answer: D



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3.
$$\frac{(\cos \theta + i \sin \theta)^6}{(\cos \theta - i \sin \theta)^5} = \text{_____}$$

A. $\cos 11\theta - i \sin 11\theta$

B. $\cos 11\theta + i \sin 11\theta$

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

D. $\cos \frac{6\theta}{5} + i \sin \frac{6\theta}{5}$

Answer: A::C



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4. If $a = \cos \alpha + i \sin \alpha$, $b = -\cos \beta + i \sin \beta$ then

$$\left(ab - \frac{1}{ab} \right) \text{ is } \text{_____}$$

A. $-2i \sin(\alpha - \beta)$

B. $2i \sin(\alpha - \beta)$

C. $2 \cos(\alpha - \beta)$

D. $-2 \cos(\alpha - \beta)$

Answer: A::B



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5. The conjugate of $\frac{1+2i}{1-(1-i)^2}$ is _____

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

B. $\frac{5}{1-(1-i)^2}$

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

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

Answer: A::B



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6. The modular of $\frac{(-1+i)(1-i)}{1+i\sqrt{3}}$ is _____

A. $\sqrt{2}$

B. 2

C. 1

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

Answer: A



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7. The value of
$$\frac{(\cos 45^\circ + i\sin 45^\circ)^2 (\cos 30^\circ - i\sin 30^\circ)}{\cos 30^\circ + i\sin 30^\circ}$$
 is

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

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

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

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

Answer: B::C



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8. If $x = \cos \theta + i \sin \theta$, then the value of $x^n + \frac{1}{x^n}$ is

A. $2 \cos n\theta$

B. $2i \sin n\theta$

C. $2^n \cos \theta$

D. $2^n i \sin \theta$

Answer: A::B::C



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9. If z_1, z_2, z_3 are the vertices of a parallelogram, then the fourth vertex z_4 opposite to z_2 is _____

A. $z_1 + z_3 - z_2$

B. $z_1 + z_2 - z_3$

C. $z_1 + z_2 + z_3$

D. $z_1 - z_2 - z_3$

Answer: A::B



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10. If $X_r = \cos\left(\frac{\pi}{2^r}\right) + i \sin\left(\frac{\pi}{2^r}\right)$ then $x_1, x_2, \dots, X_\infty$ is

A. $-\infty$

B. -2

C. -1

D. 0

Answer: A



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Additional Questions iii Choose The Incorrect The Statements

1. Which of the following is not true?

A. $\arg(iz) = \frac{\pi}{2} + \arg z$

B. $\arg(z) + \arg(z) = 0$

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

D. $\arg\left(\frac{1}{2}\right) + \arg(z) = 0$

Answer: A::B



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2. If $|z_1| = |z_2|$ and $\arg z_1 + \arg z_2 = 0$, then which of the following not true.

A. $z_1 + z_2 = 0$

B. $z_1 = \overline{z_2}$

C. $z_1 + \overline{z_2} = 0$

D. $z_1 = z_2$

Answer: A::B



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3. Which of the following is incorrect.?

A. $\operatorname{Re}(z) \leq |z|$

B. $\ln(z) \leq |z|$

C. $z\bar{z} = |z|^2$

D. $\operatorname{Re}(z) \geq |z|$

Answer:



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4. Which of the following is incorrect?

A. the number of distinct roots is n

B. The roots are in G.P. with common ratios is $\left(\frac{2\pi}{n}\right)$

C. The arguments are in A.P. with common difference

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

D. Product of the roots is 0 and the sum of the roots

is ± 1

Answer: A::C::D



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5. Which of the following is incorrect?

A. $|z_1 + z_2| \leq |z_1| + |z_2|$

B. $|z_1 - z_2| \leq |z_1| - |z_2|$

C. $|z_1 - z_2| \geq |z_1| - |z_2|$

D. $|z_1 + z_2| \geq |z_1| + |z_2|$

Answer: A::B



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Additional Questions Iv Choose The Odd Man Out

1. $i^{-1} =$

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

B. i

C. $-i$

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

Answer:



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2. When $z = x + iy$, then iz is

A. $x - iy$

B. $i(x + iy)$

C. $-y + ix$

D. Rotation of z by 90° in the counter clockwise direction

Answer:



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3. $(1+3i)(1-3i)$

A. $(1)^2 - (3i)^2$

B. $1 + 9$

C. 10

D. -8

Answer:



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4. If $z = x + iy$, then $z \bar{z} =$

A. $(x + iy)(x - iy)$

B. $|z|^2$

C. $x^2 + y^2$

D. $|z|$

Answer:



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5. The principle argument of a complex number.

A. $\theta = \alpha$

B. $\theta = -\alpha$

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

D. $\theta = \alpha - \pi$

Answer: A::B



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6. Application of De Moivre's theorem.

- A. $(\sin \theta + i \cos \theta)^n = \sin n\theta + i \cos n\theta$
- B. $(\cos \theta + i \sin \theta)^n = \cos n\theta + i \sin n\theta$
- C. $(\cos \theta + i \sin \theta)^{-n} = \cos n\theta - i \sin n\theta$
- D. $(\cos \theta - i \sin \theta)^{-n} = \cos n\theta + i \sin n\theta$

Answer: A::C



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Additional Questions 2 Marks

1. If z_1 and z_2 are two complex numbers, such that $|z_1| = |z_2|$, then is it necessary that $z_1 = z_2$?



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2. Find $\operatorname{Re}(z)$ and $\operatorname{im}(z)$ if $z = 5i^{11} + 7i^3$



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



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4. If z_1 and z_2 are $1 - i$, $-2 + 4i$ then find $\text{Im} \left(\frac{z_1 z_2}{\bar{z}_1} \right)$.



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5. If $z = \left(\frac{\sqrt{3}}{2} + \frac{i}{2} \right)^{107} + \left(\frac{\sqrt{3}}{2} - \frac{i}{2} \right)^{107}$, then show that $\text{Im}(z) = 0$



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6. Find the modulus of the complex number i^{25}



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7. If $1, \omega, \omega^2$ are the cube roots of unity show that
 $(1 + \omega^2)^3 - (1 + \omega)^3 = 0$



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8. Find the argument of -2



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9. Find the modulus of $(1 + 3i)^3$



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10. Find the values of the real numbers x and y if $3x + (2x - 3y) i = 6 + 3i^9$



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Additional Questions 3 Marks

1. Explain the falacy:



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2. Find the circle roots of -27



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3. Find the principal value of $-2i$



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4. Show that $\left| \frac{z - 3}{z + 3} \right| = 2$ represent a circle



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5. Show that the complex numbers $3 + 2i$, $5i$, $-3 + 2i$, and $-i$ form a square.



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6. If the complex number $2 + i$ and $1 - 2i$ are equidistant from $x + iy$ then show that $x + 3y = 0$



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7. Find the locus of z if $\operatorname{Re} \left(\frac{z+1}{z-i} \right) = 0$ where $z = x + iy$



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8. Find the locus of z if $|3z - 5| = 3|z + 1|$ where $z = x + iy$



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9. Find the locus of z if $\operatorname{Re} \left(\frac{\bar{z} + 1}{\bar{z} - i} \right) = 0$.



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10. If $\frac{(a+i)^2}{2a-i} = p + iq$, show that $p^2 + q^2 = \frac{(a^2+1)^2}{4a^2+1}$



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Additional Questions 5 Marks

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

$$(1 + 5\omega^2 + \omega^4)(1 + 5\omega + \omega^2)(5 + \omega + \omega^5) = 64.$$



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



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3. Verify that

$$2 \arg(-1) \neq \arg(-1)^2$$



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4. Verify that

$$\arg(1+i) + \arg(1-i) = \arg[(1+i)(1-i)]$$



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5. Find all the roots $(2 - 2i)^{\frac{1}{3}}$ and also find the product of its roots.



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6. Find the radius and centre of the circle $z\bar{z} - (2 + 3i)z - (2 - 3i)\bar{z} + 9 = 0$ where z is a complex number



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