MATHS

BOOKS - FULL MARKS MATHS (TAMIL ENGLISH)

COMPLEX NUMBERS

Example Questions Solved

1. Simplify the following :

(i)

$i^7 \quad (ii) i^{1729} \quad (iii) i^{-1924} + i^{2018} \quad (iv) \sum_{n=1}^{102} i^n \quad (v) i i^2 i^3 \ldots . . i^{40}$

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2. 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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3. Write $\dfrac{3+4i}{5-12i}$ in the $x+iy$ form and hence find real and imaginary parts.

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4. Simplify $\left(\dfrac{1+i}{1-i}\right)^3-\left(\dfrac{1-i}{1+i}\right)^3$.

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5. If $\dfrac{z+3}{z-5i}=\dfrac{1+4i}{2}$ find the complex number z.

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6. If $z_1=3-2i$ and $z_2=6+4i$, find $\dfrac{z_1}{z_2}$ in the rectangular form.

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7. Find z^{-1}, if $z=(2+3i)(1-i)$

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8. Show that $\left(\frac{19+9i}{5-3i}\right)^{15}-\left(\frac{8+i}{1+2i}\right)^{15}$ is purely imaginary

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9. If $z_1=3+4i,\ z_2=5-12i \text{ and } z_3=6+8i,$ find $|z_1|, |z_2|, |z_3|, |z_1+z_2|, |z_2-z_3|, \text{ and } |z_1+z_3|.$

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10. Find the following $\left|\frac{2+i}{-1+2i}\right|$

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11. Which one of the points $i, -2+i, 2$ and 3 is farthest from the origin?

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12. If z_1, z_2 and z_3 are complex numbers such that $|z_1| = |z_2| = |z_3| = |z_1 + z_2 + z_3| = 1,$ find the value of $\left|\frac{1}{z_1} + \frac{1}{z_2} + \frac{1}{z_3}\right|.$

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13. If $|z| = 2$, show that $3 \leq |z + 3 + 4i| \leq 7.$

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14. Show that the points $1, \frac{-1}{2}+i\frac{\sqrt{3}}{2}$, and $\frac{-1}{2}-i\frac{\sqrt{3}}{2}$ are the vertices of an equilateral triangle.

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15. Let z_1 and z_2 be two complex numbers such that z_1z_2 and z_1+z_2 are real then

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16. Show that the equation $z^2=\bar{z}$ has four solutions.

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

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18. Given the complex number $z = 3 + 2i$, represent the complex number z, iz and $z + iz$ in one Argand diagram. Show that these complex numbers form the veritices of an isosceles right triangle .

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19. Show that $|3z - 5 + i| = 4$ represent a circle, and, find its centre and radius .

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20. Show that $|z + 2 - i| < 2$ represents interior points of a circle find its centre and radius.

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21. Obtain the Cartesian form of the locus of z in each of the following cases.

(i) $|z| = |z - i|$ $(ii)|2z - 3 - i| = 3$

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22. Find the modulus and principal argument of the following complex numbers .

$1 - i\sqrt{3}$

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23. Find the modulus and principal argument of the following complex numbers .

$1 + i\sqrt{3}$

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24. Find the principal argument arg z, when $z = \frac{-2}{1 + i\sqrt{3}}$

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25. Find the product $\frac{3}{2}\left(\frac{\cos(\pi)}{3} + i\frac{\sin(\pi)}{3}\right).6\left(\frac{\cos(5\pi)}{6} + i\frac{\sin(5\pi)}{6}\right)$

in rectangular form.

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26. Find $\frac{2\left(cos\frac{9\pi}{4} + isin\frac{9\pi}{4}\right)}{4\left(cos\left(\frac{-3\pi}{2}\right) + i\sin\left(\frac{-3\pi}{2}\right)\right)}$ in rectangular form.

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27. If z = x + iy and arg $\left(\frac{z-1}{z+1}\right) = \frac{\pi}{2}$, show that $x^2 + y^2 - 1 = 0$.

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28. If $z = (\cos\theta + i\sin\theta)$, show that $z^n + (1)/(z^n) = 2\cos n\theta$ and

z^(n)-(1)(z^(n))=2isinntheta

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29. Simplify $\left(sin\frac{\pi}{6} + icos\frac{\pi}{6}\right)^{18}$.

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30. Simplify $\left(\frac{1+\cos 2\theta + i\sin 2\theta}{1+\cos 2\theta - i\sin 2\theta}\right)^{30}$

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31. Simplify (i) $(1+i)^{18}$ $(ii)\left(-\sqrt{3}+3i\right)^{31}$

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32. Find the cube roots of unity.

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33. Find the fourth roots of unity.

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34. Solve the equation $z^3 + 8i = 0$, where $z \in \mathbb{C}$.

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35. Express the following in the standard form $a + ib$.

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

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36. Suppose z_1, z_2 and z_3 are the vertices of an equilateral triangle inscribed in the circle |z| = 2. If $z_1 = 1 + i\sqrt{3}$ then find z_2 and z_3.

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Additional Questions Solved

1. Evaluate the following:

(i) i^{135} $(ii) i^{19}$ $(iii) i^{-999}$ $(iv) \left(-\sqrt{-1}\right)^{4n+2}, n \in N.$

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2. Show that :

(i) $\left\{i^{19} + \left(\frac{1}{i}\right)^{25}\right\}^2 = -4$ $(ii) \left\{i^{17} - \left(\frac{1}{i}\right)^{34}\right\}^2 = 2i$

(iii) $\left\{i^{18} + \left(\frac{1}{i}\right)^{24}\right\}^3 = 0$ $(iv) i^n + i^{n+1} + i^{n+2} + i^{n+3} = 0,$ for all $n \in N.$

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

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4. Find the real values of x and y, if

$(3x-7)+2iy=-5y+(5+x)i$

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5. For what values of x and y the numbers $-3+ix^2y$ and x^2+y+4i and complex conjugate to each other.

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6. Given $x = 2 - 3i$ and $y = 4 + i$.

Find

$(i) xy \quad (ii) x + y \quad (iii) x - y \quad (iv) \frac{x}{y} \quad (v) \frac{\bar{x}}{y} \quad (vi) (x - y)^2$

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7. If $z_1 = 4 - 7i$, $z_2 = 2 + 3i$ and $z_3 = 1 + i$ show that

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

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8. Given $z_1 = 1 + i$, $z_2 = 4 - 3i$ and $z_3 = 2 + 5i$ verify that.

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

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9. Given $z_1 = 4 - 7i$ and $z_2 = 5 + 6i$ find the additive and multiplicative inverse of $z_1 + z_2$ and $z_1 - z_2$.

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10. Express the following in the standard form $a + ib$.

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

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11. Find the least positive integer n such that $\left(\frac{1+i}{1-i}\right)^n = 1.$

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12. Find x and y for which of the following is satisfied.

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

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13. Find the modulus and argument of the following complex numbers and convert them in polar form.

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

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14. Find the square roots of $-15-8i$

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15. Express the following in the standard form $a+ib$.

$$\frac{i^4+i^9+i^{16}}{3-2i^8-i^{10}-i^5}$$

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16. Find the modulus or the absolute value of $\frac{(1+3i)(1-2i)}{(3+4i)}$

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17. Find the modulus and principal argument of the following complex numbers .

$1-i\sqrt{3}$

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18. Show that the points represented by the complex numbers $7+9i$, $-3+7i, 3+3i$ from a right angled triangle on the Argand diagram.

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19. Find the square root of $(-7+24i)$.

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20. If the imaginary part of $\frac{2z+1}{iz+1}$ is -2, then show that the locus of the point representing z in the argand plane is straight line.

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21. If the real part of $\frac{\bar{z}+2}{\bar{z}-1}$ is 4, then show that locus of the point representing z in the complex plane is a circle.

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

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23. If $arg(z-1)=\frac{\pi}{6}$ and $arg(z+1)=2\frac{\pi}{3}$, then prove that $|z|=1$.

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24. P represents the variable complex number z. Find the locus of P, if

$$Im\left(\frac{2z+1}{iz+1}\right) = -2.$$

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25. P represents the variable complex number z find the locus of z if :

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

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26. Write the following complex numbers in the polar form :

$1 - i$

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27. Find the modulus and principal argument of $(1+i)$ and hence express it in the polar form.

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28. Express the following complex numbers in the polar form.

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

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29. Express the following complex numbers in the polar form : $2+\sqrt{3}i$

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30. Find the modulus and principal argument of the following complex numbers .

$-1+i\sqrt{3}$

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31. Express the following complex numbers in the polar form : $-1-i$

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32. Express the following complex numbers in the polar form : $1-i$

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33. Evaluate i^{50}

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34. Evaluate i^{59}

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35. Prove that : $(1+i)^{4n}$ and $(1+i)^{4n+2}$ are real and purely imaginary respectively.

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36. If $x=\cos\alpha+i\sin\alpha, y=\cos\beta+i\sin\beta,$ prove that $x^m y^n+\frac{1}{x^m y^n}=2\cos(m\alpha+n\beta).$

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37. If $a=\cos 2\alpha+i\sin 2\alpha, b=\cos 2\beta+i\sin 2\beta$ and $c=\cos 2\gamma+i\sin 2\gamma.$

Prove that .

$$\sqrt{abc}+\frac{1}{\sqrt{abc}}=2\cos(\alpha+\beta+\gamma)$$

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38. Solve : $x^4 + 4 = 0$

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39. If $x = a + b, y = a\omega + b\omega^2, z = a\omega^2 + b\omega$, show that

$(i) xyz = a^3 + b^3$

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40. $\left(\frac{1-i}{1+i}\right)^{100} = a + ib$ then (a,b) is ....

A. $(2, -1)$

B. $(1, 0)$

C. $(0, 1)$

D. $(-1, 2)$

Answer: B

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

A. $(0, -2)$

B. $(-2, 0)$

C. $(0, 2)$

D. $(2, 0)$

Answer: A

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42. Evaluate i^{60}

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43. Fill in the blanks of the following :

For any two complex numbers z_1, z_2 and any real number a, b,

$|az_1 - bz_2|^2 + |bz_1| + az_2\ |^2\ = \ldots\ldots\ldots\ldots$

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44. Multiplicative inverse of $1 + i$ is ....

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45. $arg(z) + arg(\bar{z})(z \neq 0)$ is ....

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46. If $|z| = 4$ and $arg(z) = \frac{5\pi}{6}$, then z = ...

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47. If

$a = \cos 2\alpha + i \sin 2\alpha, b = \cos 2\beta + i \sin 2\beta$ and $c = \cos 2\gamma + i \sin 2\gamma$.

Prove that .

$$\frac{a^2 b^2 + c^2}{abc} = 2 \cos 2(\alpha + \beta - \gamma)$$

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48. If $p + iq = \frac{a + ib}{a - ib}$ then $p^2 + q^2$ = ...

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49. Evaluate i^{78}

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50. If $a = \cos \alpha - i \sin \alpha, b = \cos \beta - i \sin \beta, c = \cos \gamma - i \sin \gamma$, then $\left(\frac{a^2 c^2 - b^2}{abc}\right)$ is ....

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51. If $z_1 = 4 + 5i$ and $z_2 = -3 + 2i$ that $\frac{z_1}{z_2}$ is :

A. $\frac{2}{13} - \frac{22}{13}i$

B. $\frac{-2}{13} + \frac{22}{13}i$

C. $\frac{-2}{13} - \frac{23}{13}i$

D. $\frac{2}{13} + \frac{22}{13}i$

Answer: C

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52. The conjugate of $i^{13} + i^{14} + i^{15} + i^{16}$ is ....

A. 1

B. -1

C. 0

D. $-i$

Answer: C

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53. If $-i+2$ is one root of the equation $ax^2-bx+c=0$, then the other root is ....

A. $-i-2$

B. $i-2$

C. $2+i$

D. $2i+i$

Answer: C

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54. The equation having $4 + 3i$ and 4 - 3i as root is ....

A. $x^2 + 8x + 25 = 0$

B. $x^2 + 8x - 25 = 0$

C. $x^2 - 8x + 25 = 0$

D. $x^2 - 8x - 25 = 0$

Answer: C

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55. If $2 - i$ is one root of the equation $ax^2 + bx + c = 0,$ and a, b, c are rational numbers, then the other root is ....

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56. If $-i + 3$ is a root of $x^2 - 6x + k = 0$. Then the value of k is :

A. 5

B. $\sqrt{5}$

C. $\sqrt{10}$

D. 10

Answer: D

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

A. -16

B. 0

C. -32

D. 32

Answer: A

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

A. 9

B. -9

C. 16

D. 32

Answer: A

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

A. $|z|=1$

B. $|z|>1$

C. $|z| < 1$

D. None of these

Answer: A

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Exercise 2 1

1. Simplify the following:

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

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2. $i^{1948} - i^{-1869}$

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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:

$$i\, i^{2} i^{3} \ldots\ldots i^{2000}$$

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

z, iz, and z + iz

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

$z_1(z_2 + z_3) = z_1z_2 + z_1z_3$

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3. 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

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

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

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

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3. If $z_1 = 2 - i$ and $z_2 = -4$ + 3i, find the inverse of $z_1 z_2$ and $\frac{z_1}{z_2}$.

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4. 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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5. Prove the following properties:

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

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6. Express the following complex numbers in the polar form.

$$\frac{2+6\sqrt{3}i}{5+\sqrt{3}i}$$

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7. Show that

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

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Exercise 2 5

1. Find the modulus of the complex number

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

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

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

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

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6. 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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7. If $z_1, z_2,$ and z_3 are three complex numbers such that $|z_1|=1, \quad |z_2|=2, \quad |z_3|=3$ and $|z_1+z_2+z_3|=1,$ show that $|9z_1z_2+4z_1z_3+z_2z_3|=6.$

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

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10. Find the square roots of

(i) 4 + 3i

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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 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:

|z + i| = |z - 1|

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

$|z - 2 - i| = 3$

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

$|z - 4| = 16$

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Exercise 2 7

1. Write in polar form of the complex numbers.

$3 - i\sqrt{3}$

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2. 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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3. Given $(x_1+iy_1)(x_2+iy_2)\ldots(x_n+iy_n)$ = a + ib, show that

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

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

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

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

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6. 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 α = x + $\frac{1}{x}$ and 2 cos β = y + $\frac{1}{y}$, show that

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

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5. Solve the equation z^3+27 = 0

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6. If $\omega \ne 1$ 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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7. 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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8. If $\omega \pm$ 1 is a cube root of unity, show that

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

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9. 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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10. 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: A

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

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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: B

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

A. 0

B. 1

C. 2

D. 3

Answer: C

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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

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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: D

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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: A

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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: A

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11. If $|z_1|$ = 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. 1

B. 2

C. 3

D. 4

Answer: B

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

A. 0

B. 1

C. 2

D. 3

Answer: B

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13. $z_1, z_3,$ and z_3 are complex numbers such that $z_1 + z_2 + z_3 = 0$ and $|z_1| = |z_2| = |z_3|$ = 1 then $z_1^2 + z_2^2 + z_3^3$

A. 3

B. 2

C. 1

D. 0

Answer: A

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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: B

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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: B

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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

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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)....(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: D

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

A. $(1, 0)$

B. $(-1, 1)$

C. $(0, 1)$

D. $(1, 1)$

Answer: D

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

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

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

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

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

Answer: D

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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: B

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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: C

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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: D

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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: A

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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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