MATHS

NCERT - NCERT MATHEMATICS (ENGLISH)

COMPLEX NUMBERS AND QUADRATIC EQUATIONS

Solved Examples

1. Convert the complex number $\frac{-16}{1+i\sqrt{3}}$ into polar form.

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2. Solve $x^2+2=0$.

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

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4. Find the multiplicative inverse of $2-3i$.

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5. Express the following in the form $a+ib$(i) $\dfrac{5+\sqrt{2i}}{1-\sqrt{2i}}$ (ii) i^{-35}

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6. Represent the complex number $z=1+i\sqrt{3}$ in the polar form.

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7. If $4x + i(3x - y) = 3 + i(-6)$, where x and y are real numbers, then findthe values of x and y.

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8. Express the following in the form of $a + bi$:(i) $(-5i)\left(\frac{1}{8}i\right)$ (ii) $(-i)(2i)\left(-\frac{1}{8}i\right)^3$

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9. Express $(5 - 3i)^3$ in the form $a + ib$.

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10. Convert the complex number $z = \frac{i - 1}{\frac{\cos\pi}{3} + i\frac{\sin\pi}{3}}$ in the polar form.

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11. Find real θ such that $\frac{3+2i\sin\theta}{1-2i\sin\theta}$ is purely real.

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12. If $x+iy=\frac{a+ib}{a-ib}$, prove that $x^2+y^2=1$.

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13. Find the modulus and argument of the complex numbers : (i) $\frac{1+i}{1-i}$ (ii) $\frac{1}{1+i}$

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14. Find the conjugate of $\frac{(3-2i)(2+3i)}{(1+2i)(2-i)}$.

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15. Solve: $\sqrt{5}x^2 + x + \sqrt{5} = 0$

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16. Solve $x^2 + x + 1 = 0$.

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17. Find the square root of $-7 - 24i$

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Exercise 5 2

1. Convert of the complex number in the polar form: $\sqrt{3} + i$

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2. Convert of the complex number in the polar form: $1 - i$

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3. Convert of the complex number in the polar form: i

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4. Convert of the complex number in the polar form: $-1 - i$

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5. Find the modulus and the arguments of the complex number $z = -1 - i\sqrt{3}$

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6. Find the modulus and the arguments of the complex number $z = -\sqrt{3} + i$

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7. Convert of the complex number in the polar form: $-1 + i$

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8. Convert of the complex number in the polar form: -3

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Exercise 5 1

1. Express of the complex number in the form $a + ib$.

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

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2. Express of the complex number in the form $a + ib$.

$(1 - i)^4$

A. -4+i

B. 4i

C. 4

D. -4

Answer: D

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3. Express of the complex number in the form $a + ib$.

i^{-39}

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4. Express of the complex number in the form $a + ib$.

$i + i$

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5. Express of the complex number in the form $a + ib$.

$(5i)\left(-\frac{3}{5}i\right)$

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6. Express of the complex number in the form $a + ib$.

$\left[\left(\frac{1}{3} + i\frac{7}{3}\right) + \left(4 + i\frac{1}{3}\right)\right] - \left(-\frac{4}{3} + i\right)$

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7. Express of the complex number in the form $a + ib$.

$\left(\frac{1}{5} + i\frac{2}{5}\right) - \left(4 + i\frac{5}{2}\right)$

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8. Express of the complex number in the form $a + ib$.

$(1 - i) - (-1 + i6)$

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9. Express of the complex number in the form $a + ib$.

$3(7 + i7) + i(7 + i7)$

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10. Express of the complex number in the form $a + ib$.

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

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11. Find the multiplicative inverse of the complex number.

$4 - 3i$

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12. Find the multiplicative inverse of the complex number.

$\sqrt{5} + 3i$

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13. Find the multiplicative inverse of the complex number.

i

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14. Express the following expression in the form of $a + ib$

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

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Miscellaneous Exercise

1. If $x - iy = \sqrt{\frac{a - ib}{c - id}}$ prove that $x^2 + y^2 = \frac{a^2 + b^2}{c^2 + d^2}$

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2. Find the number of non-zero integral solutions of the equation $|1 - i|^x = 2^x$.

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3. If

$(a + ib)(c + id)(e + \text{if})(g + ih) = A$

, then show that $(a^2 + b^2)(c^2 + d^2)(e^2 + f^2)(g^2 + h^2) = A^2 + B^2$

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4. Let $z_1 = 2 - i, z_2 = -2 + i$. Find

(i) Re $\left(\frac{z_1 z_2}{\bar{z}_1}\right)$

(ii) Im $\left(\frac{1}{z_1 \bar{z}_1}\right)$

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

B. $-\frac{2}{5}$

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

D. -2

Answer: B

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5. Find the modulus and argument of the complex number $\frac{1+2i}{1-3i}$.

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6. If $z_1 = 2 - i, z_2 = 1 + i$, find $\left|\frac{z_1 + z_2 + 1}{z_1 - z_2 + i}\right|$

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7. If $a + ib = \frac{(x+i)^2}{2x^2+1}$, prove that $a^2 + b^2 = \frac{\left(x^2+1\right)^2}{\left(2x^2+1\right)^2}$

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8. If $\alpha$and $\beta$are different complex numbers with $|\beta| = 1$, then find $\left|\frac{\beta - \alpha}{1 - \overline{\alpha}\beta}\right|$.

A. 0

B. 1

C. 2

D. None of these

Answer: B

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9. Find the real numbers x and y if $(x - iy)(3 + 5i)$ is the conjugate of $-6 - 24i$.

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10. Find the modulus of $\frac{1+i}{1-i} - \frac{1-i}{1+i}$.

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11. If $(x + iy)^3 = u + iv$, then show that $\frac{u}{x} + \frac{v}{y} = 4(x^2 - y^2)$.

A. 1

B. 2

C. 3

D. 4

Answer: D

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12. Convert the following in the polar form :

(i) $\frac{1+7i}{(2-i)^2}$

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

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13. Solve the equation :$x^2 - 2x + \frac{3}{2} = 0$

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14. Solve the equation : $3x^2 - 4x + \frac{20}{3} = 0$

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15. Evaluate : $\left[i^{18} + \left(\frac{1}{i}\right)^{25}\right]^3$

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16. Reduce $\left(\frac{1}{1-4i} - \frac{2}{1+i}\right)\left(\frac{3-4i}{5+i}\right)$ to the standard form.

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17. For any two complex numbers z_1 and z_2, prove that $Re(z_1 z_2) = Re(z_1)Re(z_2) - Im(z_1)Im(z_2)$.

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18. Solve the equation :$21x^2 - 28x + 10 = 0$

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19. Solve the equation :$27x^2 - 10x + 1 = 0$

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20. If $\left(\frac{1+i}{1-i}\right)^m = 1$, then find the least integral value of m.

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Exercise 5 3

1. Solve the equation: $x^2 + \frac{x}{\sqrt{2}} + 1 = 0$

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2. Solve the equation: $x^2 + x + \frac{1}{\sqrt{2}} = 0$

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3. Solve the equation: $\sqrt{3}x^2 - \sqrt{2}x + 3\sqrt{3} = 0$

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4. Solve the equation $-x^2 + x - 2 = 0$

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5. Solve the equation: $\sqrt{2}x^2 + x + \sqrt{2} = 0$

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6. Solve the equation: $x^2 - x + 2 = 0$

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7. Solve the equation: $x^2 + 3 = 0$

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8. Solve the equation:$x^2 + 3x + 9 = 0$

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9. Solve the equation: $2x^2 + x + 1 = 0$

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10. Solve the equation:$x^2 + 3x + 5 = 0$

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Exercise 5 4

1. Find the square roots of the following:$-i$

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2. Find the square roots of the following: i

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3. Find the square roots of the following:$1+i$

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4. Find the square roots of the following:$15-8i$

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5. Find the square roots of the following: $-8-6i$

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6. Find the square roots of the following: $1-i$

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