



# MATHS

## NCERT - NCERT

### MATHEMATICS(HINGLISH)

# COMPLEX NUMBERS AND QUADRATIC EQUATIONS

## 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  $a + ib$  
$$\frac{(3 + i\sqrt{5})(3 - i\sqrt{5})}{(\sqrt{3} + \sqrt{2}i) - (\sqrt{3} - i\sqrt{2})}$$



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**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  $(-\sqrt{3} + \sqrt{-2})(2\sqrt{3} - i)$  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  $a + ib(i)$

$$\frac{5 + \sqrt{2}i}{1 - \sqrt{2}i} \quad (\text{ii}) \quad i^{-35}$$

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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 find the values of  $x$  and  $y$ .



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8. Express the following in the form of  $a + bi$ :(i)

$$(-5i) \left( \frac{1}{8}i \right) \quad \text{(ii)} \quad (-i)(2i) \left( -\frac{1}{8}i \right)^3$$



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



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10. Convert the complex number

$$z = \frac{i - 1}{\cos\left(\frac{\pi}{3}\right) + i \sin\left(\frac{\pi}{3}\right)} \text{ in the polar form.}$$



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11. Find real  $\theta$  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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**Miscellaneous Exercise**

1. If  $x + iy = \sqrt{\frac{a + ib}{c + id}}$  prove that

$$(x^2 + y^2)^2 = \frac{a^2 + b^2}{c^2 + d^2}$$



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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

$$(a + ib)(c + id)(e + if)(g + ih) = A + iB$$

, 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

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

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

$$a^2 + b^2 = \frac{(x^2 + 1)^2}{(2x^2 + 1)^2}$$



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8. If  $\alpha$  and  $\beta$  are different complex numbers with

$|\beta| = 1$ , then find  $\left| \frac{\beta - \alpha}{1 - \bar{\alpha}\beta} \right|$ .

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 Find  $p$  if

$$\frac{u}{x} + \frac{v}{y} = p(x^2 - y^2).$$

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

$$\operatorname{Re}(z_1 z_2) = \operatorname{Re}(z_1)\operatorname{Re}(z_2) - \operatorname{Im}(z_1)\operatorname{Im}(z_2).$$



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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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