



MATHS

NCERT - NCERT MATHEMATICS (GUJRATI)

COMPLEX NUMBERS AND QUADRATIC EQUATIONS

Examples

1. 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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2. 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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3. Express $(5 - 3i)^3$ in the form $a+ib$.



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



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



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6. Express the following in the form $a+ib$.

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



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



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



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



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



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



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Miscellaneous Examples

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



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2. Find the modulus and arguments of the complex numbers.

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



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3. If $z = x + iy$ and $x + iy = \frac{a + ib}{a - ib}$ then
 $x^2 + y^2 = 1.$



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4. Find real θ such that

$$\frac{3 + 2i \sin \theta}{1 - 2i \sin \theta} \text{ is purely real.}$$



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5. Convert the complex number

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



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Exercise 5 1

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

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



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

$$i^9 + i^{19}$$



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

$$i^{-39}$$



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

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



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

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



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

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



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

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



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

$$(1 - i)^4$$



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

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



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

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



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11. Find the multiplicative inverses of each of the complex numbers

$$4-3i$$



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12. Find the multiplicative inverses of each of the complex numbers

$$\sqrt{5} + 3i$$



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13. Find the multiplicative inverses of each of the complex numbers

$$-i$$



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

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



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Exercise 5 2

1. Find modulus and argument of the complex numbers

$$z = -1 - i\sqrt{3}$$



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2. Find modulus and argument of the complex numbers

$$z = -\sqrt{3} + i$$



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

$$1-i$$



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4. Convert each of the complex number in the polar form:

$$-1 + i$$



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5. Convert each of the complex number in the polar form:

$$-1 - i$$



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6. Convert each of the complex number in the polar form:

$$-3$$



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7. Convert each of the complex number in the polar form:

$$\sqrt{3} + i$$



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8. Convert each of the complex number in the polar form:

i



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Exercise 5 3

1. Solve the following: $x^2 + 3 = 0$



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$$2. \quad 2x^2 + x + 1 = 0$$



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$$3. \quad x^2 + 3x + 9 = 0$$



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$$4. \quad -x^2 + x - 2 = 0$$



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$$5. x^2 + 3x + 5 = 0$$



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$$6. -x^2 + x - 2 = 0$$



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$$7. \sqrt{2}x^2 + x + \sqrt{2} = 0$$



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$$8. \sqrt{3}x^2 - \sqrt{2}x + 3\sqrt{3} = 0$$



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$$9. x^2 + x + \frac{1}{\sqrt{2}} = 0$$



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$$10. \sqrt{2}x^2 + x + \sqrt{2} = 0$$



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Miscellaneous Exercises On Chapter 5

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



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Miscellaneous Exercises On Chapter 6

1. 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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Miscellaneous Exercises On Chapter 7

1. 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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Miscellaneous Exercises On Chapter 8

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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Miscellaneous Exercises On Chapter 9

1. Convert the following in the polar form:

$$(i) \frac{1 + 7i}{(2 - i)^2}, (ii) \frac{1 + 3i}{1 - 2i}$$



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Miscellaneous Exercises On Chapter 10

1. Solve:

$$3x^2 - 4x + \frac{20}{3} = 0$$



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Miscellaneous Exercises On Chapter 11

1. $x^2 - 2x + \frac{3}{2} = 0$



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Miscellaneous Exercises On Chapter 12

$$1.27x^2 - 10x + 1 = 0$$



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Miscellaneous Exercises On Chapter 13

$$1.21x^2 - 28x + 10 = 0$$



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Miscellaneous Exercises On Chapter 14

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



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Miscellaneous Exercises On Chapter 15

1. 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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Miscellaneous Exercises On Chapter 16

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

(i) $\left(\operatorname{Re} \frac{z_1 z_2}{\bar{z}_1} \right)$, (ii) $\operatorname{Im} \left(\frac{1}{z_1 \bar{z}_1} \right)$



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Miscellaneous Exercises On Chapter 17

1. Find the modulus and the arguments of the following complex numbers :

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



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Miscellaneous Exercises On Chapter 18

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



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Miscellaneous Exercises On Chapter 19

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



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Miscellaneous Exercises On Chapter 20

1. If $(x + iy)^3 = u + iv$, then show that

$$\frac{u}{x} + \frac{v}{y} = 4(x^2 - y^2)$$



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Miscellaneous Exercises On Chapter 21

1. If α and β are different complex numbers with

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



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Miscellaneous Exercises On Chapter 22

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



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Miscellaneous Exercises On Chapter 23

1. 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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Miscellaneous Exercises On Chapter 24

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



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