HOW TO TEACH
MATH MCQs

M. MAQSOOD ALI

Graph of sinx

a
b
c
d

For Class XI

Chapter 2

COMPLEX NUMBERS

Complex numbers are written as

(i) $a + ib$

(ii) (a, b)

where a and b are real numbers.

a =real part   and b =imaginary part.

ADDITION

i) $(a + ib) + (c + id) = (a + c) + i(b + d)$

ii) $(a, b) + (c, d) = (a + c, b + d)$

MCQ- 1:

$(3 + 5i) + (8 + 16i) =$?

    (a) $(11, 11)$ (b) $3 + 16i$ (c) $11 + 21i$ (d) $5 + 5i$

Solution:

$$(3 + 5i) + (8 + 16i)$$

$$= 3 + 8 + 5i + 16i$$

$$= 11 + 21i$$

The answer is (c).

MCQ- 2:

$(12, -8) + (-3, 20) =$?

    (a) $(9, 12)$ (b) $15 - 28i$ (c) $15 + 28i$ (d) $9 - 12i$

Solution:

$$(12, -8) + (-3, 20)$$

$$= (12 - 3, -8 + 20)$$

$$= (9, 12)$$

The answer is (b).

SUBTRACTION

i) $(a + ib) - (c + id) = (a - c) + i(b - d)$

ii) $(a, b) - (c, d) = (a - c, b - d)$

MCQ-3:

$(10 + 2i) - (16 - 5i) =?$

(a) $26 - 3i$ (b) $(-6, -7)$ (c) $6 - 3i$ (d) $-6 + 7i$

Solution:

$$(10 + 2i) - (16 - 5i)$$

$$= (10 - 16) + (2 + 5)i$$

$$= -6 + 7i$$

The answer is (d).

MCQ-4:

$(13, -5) - (8, 12) =?$

(a) $21 + 7i$ (b) $(5, -17)$ (c) $5 + 7i$ (d) $21 - 17i$

Solution:

$$(13, -5) - (8, 12)$$

$$= (13 - 8, -5 - 12)$$

$$= (5, -17)$$

The answer is (b).

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MULTIPLICATION

i) $(a, b) . (c, d) = (ac - bd, bc + ad)$

ii) $(a + ib) . (c + id) = (ac - bd) + i(bc + ad)$

Shortcut:

Step-1	**Step-2**
Real part	**Imaginary part**

a b

c d

$ac - bd$

a b

c d

$bc + ad$

Combined Step-1 and Step-2:

a b

c d

$(ac - bd , bc + ad)$

MCQ-5:

$(5 + 2i) . (9 + 4i) = ?$

    (a) $(45 , 8)$ (b) $(20 , 18)$ (c) $(37 , 38)$ (d) $(24 , 14)$

Solution:

5   2

9   4

$$(5 \times 9 - 2 \times 4 , 2 \times 9 + 5 \times 4)$$
$$= (45 - 8 , 18 + 20)$$
$$= (37 , 38)$$

The answer is (c).

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MCQ-6:

$(6, -3).(7, 8) =?$

      (a) $(66, 27)$ (b) $(42, -24)$ (c) $(48, -21)$ (d) $(30, 26)$

Solution:
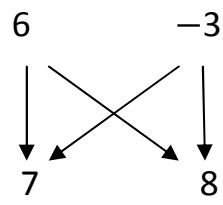
$$(6 \times 7 - (-3) \times 8, \; -3 \times 7 + 6 \times 8)$$

$$= (42 + 24, -21 + 48)$$

$$= (66, 27)$$

The answer is (a).

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DIVISION

i) $(a + i\,b) \div (c + i\,d) = \dfrac{ac + bd}{c^2 + d^2} + \dfrac{bc - ad}{c^2 + d^2}\,i$

ii) $(a, b) \div (c, d) = \left(\dfrac{ac + bd}{c^2 + d^2}, \dfrac{bc - ad}{c^2 + d^2}\right)$

Shortcut:

$$\left(\dfrac{ac + bd}{c^2 + d^2}, \dfrac{bc - ad}{c^2 + d^2}\right)$$

MCQ-7:

$(3 + 5i) \div (2 + 7i) = ?$

(a) $\left(\dfrac{3}{2}, \dfrac{5}{7}\right)$ (b) $\left(\dfrac{7}{24}, \dfrac{16}{3}\right)$ (c) $\left(\dfrac{41}{53}, \dfrac{-11}{53}\right)$ (d) $\left(\dfrac{23}{53}, -2\right)$

Solution:

$$\left(\dfrac{3 \times 2 + 5 \times 7}{2^2 + 7^2}, \dfrac{5 \times 2 - 3 \times 7}{2^2 + 7^2}\right)$$

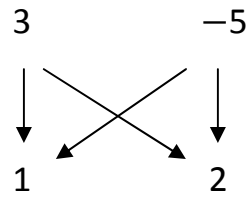$$= \left(\dfrac{6 + 35}{4 + 49}, \dfrac{10 - 21}{4 + 49}\right)$$

$$= \left(\dfrac{41}{53}, \dfrac{-11}{53}\right)$$

The answer is (c).

MCQ-8:

$(3, -5) \div (1, 2) =?$

(a) $\left(\dfrac{2}{5}, \dfrac{-8}{5}\right)$ (b) $\left(\dfrac{-13}{12}, \dfrac{7}{6}\right)$ (c) $\left(\dfrac{23}{12}, \dfrac{-1}{6}\right)$ (d) $\left(\dfrac{-7}{5}, \dfrac{-11}{5}\right)$

Solution:

$$\left(\frac{3 \times 1 + (-5) \times 2}{1^2 + 2^2}, \frac{-5 \times 1 - 3 \times 2}{1^2 + 2^2}\right)$$

$$= \left(\frac{3-10}{1+4}, \frac{-5-6}{1+4}\right)$$

$$= \left(\frac{-7}{5}, \frac{-11}{5}\right)$$

The answer is (d).

FORMULAE

(i) $(a + ib)(a - ib) = a^2 + b^2$

(ii) $(a + ib)^2 = a^2 - b^2 + 2abi$

(iii) $(a - ib)^2 = a^2 - b^2 - 2abi$

EXERCISE-2.1

(1) $(3, -5) + (2, 8) =?$

    (a) $(11, -3)$ (b) $(5, 3)$ (c) $(6, -40)$ (d) $(1, -13)$

(2) $(8, -3) - (-2, 6) =?$

    (a) $(6, 3)$ (b) $(10, 3)$ (c) $(10, -9)$ (d) $(-6, -3)$

(3) $(5 + 3i) - (2 - 6i) = ?$

    (a) $3 - 3i$ (b) $3 + 9i$ (c) $7 - 3i$ (d) $3 - 7i$

(4)   What is the imaginary part of the number $(2i + 5)(5 - 2i)$?

    (a) 0 (b) 2 (c) -10 (d) -2

(10) What is the real part of $\dfrac{2-i}{2+i}$?

   (a) 2   (b) 1   (c) $\dfrac{-4}{5}$ (d) $\dfrac{3}{5}$

(11) What is the imaginary part of $\dfrac{4i+6}{3i}$?

   (a) 2   (b) -2 (c) $\dfrac{4}{3}$ (d) $\dfrac{2}{i}$

(12) $(4+3i)(4-3i) =$?

   (a) 5   (b)$16-9i$ (c) 25   (d) 7

(13) What is the real part of the complex number $(3-2i)^2$?

   (a) -12 (b) 5   (c) 13   (d) 3

ADDITIVE INVERSE

Additive inverse of $(a, b) = (-a, -b)$

Examples:

1) Additive inverse of $3 - 5i = -3 + 5i$

2) Additive inverse of $(-8, 6) = (8, -6)$

MULTIPLICATIVE INVERSE

Multiplicative inverse of $(a, b) = \left(\dfrac{a}{a^2+b^2}, \dfrac{-b}{a^2+b^2}\right)$

MCQ-9:

What is the multiplicative inverse of $3 + 5i$?

(a) $\dfrac{3}{34} - \dfrac{5}{34}i$ (b) $\dfrac{3}{26} + \dfrac{7}{26}i$ (c) $\dfrac{9}{34} + \dfrac{6}{17}i$ (d) $\dfrac{5}{26} - \dfrac{5}{26}i$

Solution:

$$\text{Multiplicative inverse of } a + bi = \frac{a}{a^2+b^2} + \frac{-b}{a^2+b^2}i$$

$$\text{Multiplicative inverse of } (3 + 5i) = \frac{3}{3^2+5^2} + \frac{-5}{3^2+5^2}i$$

$$= \frac{3}{34} - \frac{5}{34}i$$

The answer is (a).

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EXERCISE-2.2

(1)   What is the conjugate of $3i - 5$?

    (a) $-5 + 3i$ (b) $3i + 5$ (c) $-5 - 3i$ (d) $5 - 3i$

(2)   What is the conjugate of complex number $(3, -8)$?

    (a) $(3, 8)$ (b) $(-3, -8)$ (c) $(-3, 8)$ (d) $(-8, 3)$

(3)   What is the conjugate of $2 + 3i$?

    (a) $-2 - 3i$ (b) $\sqrt{13}$ (c) $-2 + 3i$ (d) $2 - 3i$

(4)   What is the magnitude of the complex number $3 - i$?

    (a) 3 (b) $2\sqrt{2}$ (c) $\sqrt{10}$ (d) $\sqrt{2}$

(5)   What is the value of $|(4 - 3i)(8 + 6i)|$?

    (a) $10\sqrt{7}$ (b) 50 (c) 6 (d) None

(6)   What is the value of $\left|\dfrac{25 + 8i}{8 - 25i}\right|$?

    (a) $4\sqrt{5}$ (b) 8 (c) 5 (d) 1

(7)   What is the magnitude of $\dfrac{(2 + i)(1 + 3i)}{i}$?

    (a) $\sqrt{15}$ (b) -8 (c) 5 (d) $5\sqrt{2}$

(8)   What is the magnitude of the conjugate of $2 - i$?

    (a) $\sqrt{3}$ (b) $-\sqrt{5}$ (c) $2 + i$ (d) $\sqrt{5}$

CONJUGATE OF COMPLEX NUMBERS

i) Conjugate of $a + ib = a - ib$

ii) Conjugate of $(a, b) = (a, -b)$

iii) Conjugate of $z = a + ib$:

$$\bar{z} = a - ib$$

Examples:

i) Conjugate of $3 + 5i = 3 - 5i$

ii) Conjugate of $8 - 9i = 8 + 9i$

iii) Conjugate of $6i = -6i$

iv) Conjugate of $(-3, -7) = (-3, 7)$

MODULUS OF COMPLEX NUMBERS

i) Modulus of $z = a + ib$

$$|z| = \sqrt{a^2 + b^2}$$

ii) $|a + ib| = \sqrt{a^2 + b^2}$

iii) Modulus of $a + ib = \sqrt{a^2 + b^2}$

MCQ-10:

What is the modulus of $3 - 4i$?

    (a) 4   (b) 5   (c) 1   (d) 9

Solution:

Modulus of $a + ib = \sqrt{a^2 + b^2}$

Modulus of $3 - 4i = \sqrt{3^2 + (-4)^2}$

$$= \sqrt{9 + 16}$$
$$= \sqrt{25}$$
$$= 5$$

The answer is (b).

Properties:

i) $|z_1.z_2| = |z_1|.|z_2|$

ii) $\left|\dfrac{z_1}{z_2}\right| = \dfrac{|z_1|}{|z_2|}$

MCQ-11:

$|(4 + 2i)(2 − 4i)(4 + 3i)| =?$

  (a) 52   (b) 84   (c) 100   (d) 124

Solution:

$$|(4 + 2i)(2 − 4i)(4 + 3i)|$$

Note: Do not multiply the complex numbers $4 + 2i, 2 − 4i$ and $4 + 3i$. Using property $|z_1.z_2| = |z_1|.|z_2|$ calculate the modulus of each complex number and than multiply them.

$$= |4 + 2i|.|2 − 4i|.|4 + 3i|$$
$$= \sqrt{4^2 + 2^2}.\sqrt{2^2 + (−4)^2}.\sqrt{4^2 + 3^2}$$

  (a) 224   (b) 148   (c) 268   (d) 130

Solution:

$$|(3 + 2i)(2 − 3i)(−6 + 8i)|$$

Note: Do not multiply the complex numbers $3 + 2i, 2 − 3i$ and $− 6 + 8i$. Using property $|z_1.z_2| = |z_1|.|z_2|$ calculate the modulus of each complex number and then multiply them.

$$= |3 + 2i| \cdot |2 - 3i| \cdot |-6 + 8i|$$
$$= \sqrt{3^2 + (2)^2} \cdot \sqrt{2^2 + (-3)^2} \cdot \sqrt{(-6)^2 + 8^2}$$
$$= \sqrt{9 + 4} \cdot \sqrt{4 + 9} \cdot \sqrt{36 + 64}$$
$$= \sqrt{13} \cdot \sqrt{13} \cdot \sqrt{100}$$
$$= 130$$

The answer is (d).

MCQ-13:

$$\left| \frac{(7 - i)(i + 7)}{3 - 4i} \right| = ?$$

    (a) 8   (b) 10   (c) 24   (d) 18

Solution:

$$\left| \frac{(7 - i)(i + 7)}{3 - 4i} \right|$$

$$= \frac{|7 - i| \cdot |i + 7|}{|3 - 4i|}$$

$$= \frac{\sqrt{7^2 + (-1)^2} \cdot \sqrt{1^2 + 7^2}}{\sqrt{3^2 + (-4)^2}}$$

$$= \frac{\sqrt{49 + 1} \cdot \sqrt{1 + 49}}{\sqrt{9 + 16}}$$

$$= \frac{\sqrt{50} \cdot \sqrt{50}}{\sqrt{25}}$$

$$= \frac{50}{5}$$

$$= 10$$

The answer is (b).

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MCQ-14:

$\left|\dfrac{2-4i}{i-2}\right| = ?$

    (a) 2   (b) 8   (c) 6   (d) 14

Solution:

$$\left|\dfrac{2-4i}{i-2}\right|$$

$$= \dfrac{|2-4i|}{|i-2|}$$

$$= \dfrac{\sqrt{2^2+(-4)^2}}{\sqrt{1^2+(-2)^2}}$$

$$= \dfrac{\sqrt{4+16}}{\sqrt{1+4}}$$

$$= \dfrac{\sqrt{20}}{\sqrt{5}}$$

$$= \sqrt{\dfrac{20}{5}}$$

$$= \sqrt{4}$$

$$= 2$$

The answer is (a).

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EXERCISE-2.3

(1) What is the additive inverse of complex numbers $a + ib$?

   (a) $a - ib$ (b) 0 (c) $-a + ib$ (d) $-a - ib$

(2) What is the additive inverse of $5 - 3i$?

   (a) 0 (b) $-5 - 3i$ (c) $-5 + 3i$ (d) $5 + 3i$

(3) What is the multiplicative inverse of $a + ib$?

   (a) $\dfrac{a+ib}{a^2+b^2}$ (b) $\dfrac{-a-ib}{a^2+b^2}$ (c) $\dfrac{-a+ib}{a^2+b^2}$ (d) $\dfrac{a-ib}{a^2+b^2}$

(4) What is the multiplicative inverse of $2 + 5i$?

   (a) $\dfrac{2+5i}{29}$ (b) $\dfrac{2-5i}{29}$ (c) $\dfrac{-2-5i}{29}$ (d) $\dfrac{-2+5i}{29}$

(5) What is the multiplicative inverse of $3 - i$?

   (a) $\dfrac{3+i}{10}$ (b) $\dfrac{-3+i}{8}$ (c) $\dfrac{-3-i}{10}$ (d) $\dfrac{-3+i}{10}$

(6) What is the identity element with respect to multiplication of complex number $(2, 8)$?

   (a) $(-2, -8)$ (b) $(-2, 8)$ (c) $(0,\ 1)$ (d) $(1, 0\ )$

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SOLUTION OF THE EQUATIONS

Mostly equations involving complex numbers are solved by comparing the real and imaginary parts.

MCQ-15:

What are the values of x and y for the equation

$$(x + 5) + i(2 - y) = 7 + 10i$$

(a) 6 , 4   (b) -3 , 8   (c) 5 , 9   (d) 2 , $- 8$

Solution:

$$(x + 5) + i(2 - y) = 7 + 10i$$

$$x + 5 = 7 \; , \quad 2 - y = 10$$

$$x = 7 - 5 \; , \quad y = 2 - 10$$

$$x = 2 \quad , \quad y = -8$$

The answer is (d).

MCQ-16:

What is the value of x for equation $x + 5 + 9yi = 3y + 6i$?

(a) 6   (b) -2 (c) -8 (d) -3

Solution:

$$x + 5 + 9yi = 3y + 6i$$

The answer is (d).

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EXERCISE-2.4

(1) What is the value of x if $2x + iy = (5 + i)^2$

 (a) 13   (b) 24   (c) 12   (d) 5

(2) What is the value of b if $(a + ib)^2 = 4b + 10ai$

 (a) 10   (b) 5   (c) 2   (d) None

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VALUE OF i^n

The value of i^n ($n \in \mathbb{Z}^+$) can be found directly by using the following methods.

Case-1: n is even:

$i^n = +1$ or -1

If n is exactly divisible by 4, than $i^n = +1$

If n is not exactly divisible by 4 but divisible by 2, than $i^n = -1$

Case-1: n is odd:

$i^n = +i$ or $-i$

If $(n-1)$ is exactly divisible by 4, than $i^n = +i$

If $(n-1)$ is not exactly divisible by 4 but divisible by 2, than $i^n = -i$

MCQ-17:

$i^{24} =?$

    (a) 1   (b) -1 (c) i (d) $-i$

Solution:

> 24 is exactly divisible by 4.

$$i^{24} = 1$$

Note: $i^{24} = (i^2)^{12} = (-1)^{12} = 1$

The answer is (a).

MCQ-18:

$i^{18} =?$

    (a) 1   (b) -1 (c) i (d) $-i$

Solution:

> 18 is not exactly divisible by 4 but divisible by 2.

$$i^{18} = -1$$

Note: $i^{18} = (i^2)^9 = (-1)^9 = -1$

The answer is (b).

MCQ-19:

$$i^{37} = ?$$

(a) 1   (b) -1 (c) i (d) $-i$

Solution:

$37 - 1 = 36$ is exactly divisible by 4.

$$i^{37} = i$$

Note: $i^{37} = i^{36}.i = (i^2)^{18}.i = (-1)^{18}.i = i$

The answer is (c).

MCQ-20:

$i^{23} = ?$

(a) 1   (b) -1 (c) i (d) $-i$

Solution:

$23 - 1 = 22$ is not exactly divisible by 4, but divisible by 2.

$$i^{23} = -i$$

Note: $i^{23} = i^{22}.i = (i^2)^{11}.i = (-1)^{11} = -i$

The answer is (d).

EXERCISE-2.5

(1) $i^5 = ?$

    (a) -1 (b) 1   (c) i (d) $-i$

(2) $2i^7 = ?$

    (a) $-2i$ (b) $2i$ (c) $-128i$ (d) -2

(3) $(2i)^6 = ?$

    (a) -64 (b) $64i$ (c) 64   (d) $-64i$

(4) $i^{13} + i^{19} = ?$

    (a) i (b) $-i$ (c) 0   (d) 1

(5) $i^{12} + i^{10} = ?$

    (a) i (b) $-i$ (c) 0   (d) 1

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