

Complex Numbers and Quadratic Equations

Assertion Reason Questions

Direction: In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R).

Choose the correct answer out of the following choices.

- (a) Both (A) and (R) are true and (R) is the correct explanation of (A).
- (b) Both (A) and (R) are true but (R) is not the correct explanation of (A).
- (c) (A) is true but (R) is false.
- (d) (A) is false but (R) is true.

1. Assertion (A): Simplest form of i^{35} is $-i$.

Reason (R): Additive inverse of $(1 - i)$ is equal to $-1 + i$.

Ans. (A) is false but (R) is true.

Explanation: $i^{35} = \frac{1}{i^{-35}} = \frac{1}{(i^2)^{17}i}$

$$= \frac{1}{-i} \times \frac{i}{i} = \frac{i}{-i^2} = i$$

$\therefore$ Additive inverse of z is $-z$.

So, additive inverse of $(1 - i)$ is $-1 + i$.

2. Assertion (A): If $z_1 = 2 + 3i$ and $z_2 = 3 - 2i$ then

$$z_1 - z_2 = -1 + 5i.$$

Reason(R): If $z_1 = (a + ib)$ and $z_2 = (c + id)$

then $z_1 - z_2 = (a - c) + i(b - d)$.

Ans. (a) Both (A) and (R) are true and (R) is the correct explanation of (A).

Explanation: Given $z_1 = 2 + 3i$ and $z_2 = 3 - 2i$

then

We know that, if $z_1 = (a + ib)$ and $z_2 = (c + id)$,

then,

$$Z_1 - Z_2 = (ac) + i(b-d)$$

$$Z_1 - Z_2 = (2+3i)-(3-2i)$$

$$Z_1 - Z_2 = 2 + 3i - 3 + 2i$$

$$Z_1 - Z_2 = -1 + 5i$$

On comparing it with $a + ib$, we get

$$b = -8$$

Given,

$$(1-i)^3 = 1^3 - i^3 - 3 \times 1 \times i(1-i)$$

$$= 1 - i^2 - 3i + 3i^2$$

$$= 1 + i - 3i - 3$$

$$= -2 - 2i$$

$$z = -2 - 2i$$

On comparing it with $a + ib$, we get

$$a = -2 \text{ and } b = -2$$

3. Assertion (A): Multiplicative inverse of $2 - 3i$ is $2 + 3i$.

Reason (R): If $z = 3 + 4i$ then $z = 3 - 4i$.

Ans. (A) is false but (R) is true.

Explanation: Multiplicative inverse of $z = z^{-1}$

$$\text{Multiplicative inverse of } z = \frac{1}{z}$$

$$\text{Putting } z = 2 - 3i$$

$$\begin{aligned} \text{Multiplicative inverse of } 2 - 3i &= \frac{1}{2 - 3i} \\ &= \frac{1}{(2 - 3i)} \times \frac{(2 + 3i)}{(2 + 3i)} \end{aligned}$$

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

$$[\text{Using } (a + b)(a - b) = a^2 - b^2]$$

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

$$= \frac{2 + 3i}{4 - 9i^2}$$

Putting $i^2 = -1$

$$= \frac{2+3i}{4-9 \times -1}$$

$$= \frac{2+3i}{4+9}$$

$$= \frac{2+3i}{13}$$

$$= \frac{2}{13} + \frac{3i}{13}$$

Hence, Multiplicative inverse = $\frac{2}{13} + \frac{3i}{13}$.

$$z = a + ib$$

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

$$z = 3 + 4i$$

then $\bar{z} = 3 - 4i$