

Chapter 5: Complex Numbers and Quadratic Equations

Exercise 5.3

NCERT · Class 11 · Maths

Questions

Question 1

$$x^2 + 3 = 0$$

Solution

Given the quadratic equation,

$$x^2 + 3 = 0$$

On comparing it with $ax^2 + bx + c = 0$, we have

$$a = 1, b = 0, \text{ and } c = 3$$

So, the discriminant of the given equation will be

$$D = b^2 - 4ac = 0^2 - 4 \times 1 \times 3 = -12$$

Hence, the required solutions are:

$$\begin{aligned} x &= \frac{-b \pm \sqrt{D}}{2a} = \frac{\pm \sqrt{-12}}{2 \times 1} = \frac{\pm \sqrt{12} i}{2} \quad [\sqrt{-1} = i] \\ \therefore x &= \frac{\pm 2\sqrt{3} i}{2} = \pm \sqrt{3} i \end{aligned}$$

Question 2

$$2x^2 + x + 1 = 0$$

Solution

Given the quadratic equation,

$$2x^2 + x + 1 = 0$$

On comparing it with $ax^2 + bx + c = 0$, we have

$$a = 2, b = 1, \text{ and } c = 1$$

So, the discriminant of the given equation will be

$$D = b^2 - 4ac = 1^2 - 4 \times 2 \times 1 = 1 - 8 = -7$$

Hence, the required solutions are:

$$x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-1 \pm \sqrt{-7}}{2 \times 2} = \frac{-1 \pm \sqrt{7}i}{4} \quad \left[\sqrt{-1} = i \right]$$

Question 3

$$x^2 + 3x + 9 = 0$$

Solution

Given the quadratic equation,

$$x^2 + 3x + 9 = 0$$

On comparing it with $ax^2 + bx + c = 0$, we have

$$a = 1, b = 3, \text{ and } c = 9$$

So, the discriminant of the given equation will be

$$D = b^2 - 4ac = 3^2 - 4 \times 1 \times 9 = 9 - 36 = -27$$

Hence, the required solutions are:

$$x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-3 \pm \sqrt{-27}}{2(1)} = \frac{-3 \pm 3\sqrt{-3}}{2} = \frac{-3 \pm 3\sqrt{3}i}{2} \quad \left[\sqrt{-1} = i \right]$$

Question 4

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

Solution

Given the quadratic equation,

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

On comparing it with $ax^2 + bx + c = 0$, we have

$$a = -1, b = 1, \text{ and } c = -2$$

So, the discriminant of the given equation will be

$$D = b^2 - 4ac = 1^2 - 4 \times (-1) \times (-2) = 1 - 8 = -7$$

Hence, the required solutions are:

$$x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-1 \pm \sqrt{-7}}{2 \times (-1)} = \frac{-1 \pm \sqrt{7}i}{-2} \quad \left[\sqrt{-1} = i \right]$$

Question 5

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

Solution

Given the quadratic equation,

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

On comparing it with $ax^2 + bx + c = 0$, we have

$$a = 1, b = 3, \text{ and } c = 5$$

So, the discriminant of the given equation will be

$$D = b^2 - 4ac = 3^2 - 4 \times 1 \times 5 = 9 - 20 = -11$$

Hence, the required solutions are:

$$x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-3 \pm \sqrt{-11}}{2 \times 1} = \frac{-3 \pm \sqrt{11}i}{2} \quad \left[\sqrt{-1} = i \right]$$

Question 6

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

Solution

Given the quadratic equation,

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

On comparing it with $ax^2 + bx + c = 0$, we have

$$a = 1, b = -1, \text{ and } c = 2$$

So, the discriminant of the given equation is

$$D = b^2 - 4ac = (-1)^2 - 4 \times 1 \times 2 = 1 - 8 = -7$$

Hence, the required solutions are

$$x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-(-1) \pm \sqrt{-7}}{2 \times 1} = \frac{1 \pm \sqrt{7}i}{2} \quad \left[\sqrt{-1} = i \right]$$

Question 7

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

Solution

Given the quadratic equation,

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

On comparing it with $ax^2 + bx + c = 0$, we have

$$a = \sqrt{2}, b = 1, \text{ and } c = \sqrt{2}$$

So, the discriminant of the given equation is

$$D = b^2 - 4ac = (1)^2 - 4 \times \sqrt{2} \times \sqrt{2} = 1 - 8 = -7$$

Hence, the required solutions are:

$$x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-1 \pm \sqrt{-7}}{2 \times \sqrt{2}} = \frac{-1 \pm \sqrt{7}i}{2\sqrt{2}} \quad \left[\sqrt{-1} = i \right]$$

Question 8

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

Solution

Given the quadratic equation,

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

On comparing it with $ax^2 + bx + c = 0$, we have

$$a = \sqrt{3}, b = -\sqrt{2}, \text{ and } c = 3\sqrt{3}$$

So, the discriminant of the given equation is

$$D = b^2 - 4ac = (-\sqrt{2})^2 - 4 \times \sqrt{3} \times 3\sqrt{3} = 2 - 36 = -34$$

Hence, the required solutions are:

$$x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-(-\sqrt{2}) \pm \sqrt{-34}}{2 \times \sqrt{3}} = \frac{\sqrt{2} \pm \sqrt{34}i}{2\sqrt{3}} \quad \left[\sqrt{-1} = i \right]$$

Question 9

$$x^2 + x + 1/\sqrt{2} = 0$$

Solution

Given the quadratic equation,

$$x^2 + x + 1/\sqrt{2} = 0$$

It can be rewritten as,

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

On comparing it with $ax^2 + bx + c = 0$, we have

$$a = \sqrt{2}, b = \sqrt{2}, \text{ and } c = 1$$

So, the discriminant of the given equation is

$$D = b^2 - 4ac = (\sqrt{2})^2 - 4 \times \sqrt{2} \times 1 = 2 - 4\sqrt{2} = 2(1 - 2\sqrt{2})$$

Hence, the required solutions are:

$$\begin{aligned} x &= \frac{-b \pm \sqrt{D}}{2a} = \frac{-\sqrt{2} \pm \sqrt{2-4\sqrt{2}}}{2 \times \sqrt{2}} = \frac{-\sqrt{2} \pm \sqrt{2(1-2\sqrt{2})}}{2\sqrt{2}} \\ &= \left(\frac{-\sqrt{2} \pm \sqrt{2}(\sqrt{2\sqrt{2}-1})i}{2\sqrt{2}} \right) \quad [\sqrt{-1} = i] \\ &= \frac{-1 \pm (\sqrt{2\sqrt{2}-1})i}{2} \end{aligned}$$

Question 10

$$x^2 + x/\sqrt{2} + 1 = 0$$

Solution

Given the quadratic equation,

$$x^2 + x/\sqrt{2} + 1 = 0$$

It can be rewritten as,

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

On comparing it with $ax^2 + bx + c = 0$, we have

$$a = \sqrt{2}, b = 1, \text{ and } c = \sqrt{2}$$

So, the discriminant of the given equation is

$$D = b^2 - 4ac = (1)^2 - 4 \times \sqrt{2} \times \sqrt{2} = 1 - 8 = -7$$

Hence, the required solutions are:

$$x = \frac{-b \pm \sqrt{D}}{2a} = \frac{-1 \pm \sqrt{-7}}{2\sqrt{2}} = \frac{-1 \pm \sqrt{7}i}{2\sqrt{2}} \quad [\sqrt{-1} = i]$$