

Mathematics

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(Chapter – 5) (Complex Numbers and Quadratic Equations)
(Class – XI)

Exercise 5.3

Question 1:

Solve the equation $x^2 + 3 = 0$

Answer 1:

The given quadratic equation is $x^2 + 3 = 0$

On comparing the given equation with $ax^2 + bx + c = 0$,
we obtain $a = 1$, $b = 0$, and $c = 3$

Therefore, the discriminant of the given equation is

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

Therefore, the required solutions are

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

Question 2:

Solve the equation $2x^2 + x + 1 = 0$

Answer 2:

The given quadratic equation is $2x^2 + x + 1 = 0$

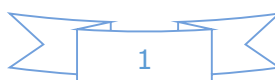
On comparing the given equation with $ax^2 + bx + c = 0$,
we obtain $a = 2$, $b = 1$, and $c = 1$

Therefore, the discriminant of the given equation is

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

Therefore, the required solutions are

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



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Question 3:

Solve the equation $x^2 + 3x + 9 = 0$

Answer 3:

The given quadratic equation is $x^2 + 3x + 9 = 0$

On comparing the given equation with $ax^2 + bx + c = 0$,
we obtain $a = 1$, $b = 3$, and $c = 9$

Therefore, the discriminant of the given equation is

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

Therefore, the required solutions are

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

Question 4:

Solve the equation $-x^2 + x - 2 = 0$

Answer 4:

The given quadratic equation is $-x^2 + x - 2 = 0$

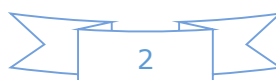
On comparing the given equation with $ax^2 + bx + c = 0$,
we obtain $a = -1$, $b = 1$, and $c = -2$

Therefore, the discriminant of the given equation is

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

Therefore, the required solutions are

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



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Question 5:

Solve the equation $x^2 + 3x + 5 = 0$

Answer 5:

The given quadratic equation is $x^2 + 3x + 5 = 0$

On comparing the given equation with $ax^2 + bx + c = 0$, we obtain $a = 1$, $b = 3$, and $c = 5$

Therefore, the discriminant of the given equation is

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

Therefore, the required solutions are

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

Question 6:

Solve the equation $x^2 - x + 2 = 0$

Answer 6:

The given quadratic equation is $x^2 - x + 2 = 0$

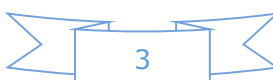
On comparing the given equation with $ax^2 + bx + c = 0$, we obtain $a = 1$, $b = -1$, and $c = 2$

Therefore, the discriminant of the given equation is

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

Therefore, the required solutions are

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



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Question 7:

Solve the equation $\sqrt{2}x^2 + x + \sqrt{2} = 0$

Answer 7:

The given quadratic equation is $\sqrt{2}x^2 + x + \sqrt{2} = 0$

On comparing the given equation with $ax^2 + bx + c = 0$, we obtain

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

Therefore, the discriminant of the given equation is

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

Therefore, the required solutions are

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

Question 8:

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

Answer 8:

The given quadratic equation is $\sqrt{3}x^2 - \sqrt{2}x + 3\sqrt{3} = 0$

On comparing the given equation with $ax^2 + bx + c = 0$, we obtain

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

Therefore, the discriminant of the given equation is

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

Therefore, the required solutions are

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

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Question 9:

Solve the equation $x^2 + x + \frac{1}{\sqrt{2}} = 0$

Answer 9:

The given quadratic equation is $x^2 + x + \frac{1}{\sqrt{2}} = 0$

This equation can also be written as $\sqrt{2}x^2 + \sqrt{2}x + 1 = 0$

On comparing this equation with $ax^2 + bx + c = 0$, we obtain

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

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

Therefore, the required solutions are

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

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Question 10:

Solve the equation $x^2 + \frac{x}{\sqrt{2}} + 1 = 0$

Answer 10:

The given quadratic equation is $x^2 + \frac{x}{\sqrt{2}} + 1 = 0$

This equation can also be written as $\sqrt{2}x^2 + x + \sqrt{2} = 0$

On comparing this equation with $ax^2 + bx + c = 0$, we obtain

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

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

Therefore, the required solutions are

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