RD Sharma Solutions Class 11 Maths Chapter 14 Ex 14.1

Quadratic Equations Ex 14.1 Q1

$$x^2 + 1 = 0$$

$$\Rightarrow \quad x^2 + i^2 = 0 \qquad \left[\because i^2 = -1\right]$$

$$\Rightarrow \quad (x + i)(x - i) = 0 \qquad \left[a^2 - b^2 = (a + b)(a - b)\right]$$

$$\Rightarrow \quad x = i, -i$$

Quadratic Equations Ex 14.1 Q2

$$9x^2 + 4 = 0$$

$$\Rightarrow \quad (3x)^2 - (2i)^2 = 0 \qquad \left[\because i^2 = -1\right]$$
$$\Rightarrow \quad (3x + 2i)(3x - 2i) = 0$$
$$\Rightarrow \quad 3x + 2i = 0 \quad \text{or} \quad 3x - 2i = 0$$
$$\Rightarrow \quad x = \frac{-2}{3}i \quad \text{or} \quad x = \frac{2}{3}i$$
$$\therefore \quad x = \frac{-2}{3}i, \frac{2}{3}i$$

Quadratic Equations Ex 14.1 Q3

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

Now, completing the squares, we get

$$(x + 1)^2 + 4 = 0$$
$$\Rightarrow \quad (x + 1)^2 - 2i^2 = 0$$
$$\Rightarrow \quad (x + 1 + 2i)(x + 1 - 2i) = 0$$
$$\Rightarrow \quad (x + 1 + 2i) = 0 \qquad or \qquad (x + 1 - 2i) = 0$$
$$\therefore \quad x = -1 - 2i, \quad -1 + 2i$$

Quadratic Equations Ex 14.1 Q4

$$4x^2 - 12x + 25 = 0$$

Now, completing the squares, we get

$$(2x - 3)^2 + 16 = 0$$
$$\Rightarrow \quad (2x - 3)^2 - 4i^2 = 0$$
$$\Rightarrow \quad (2x - 3 + 4i)(2x - 3 - 4i) = 0$$
$$\Rightarrow \quad (2x - 3 + 4i) = 0 \qquad or \qquad (2x - 3 - 4i) = 0$$
$$\therefore \quad x = \frac{3}{2} + 2i, \quad \frac{3}{2} - 2i$$

Quadratic Equations Ex 14.1 Q5

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

Now, completing the squares, we get

$$\left(x + \frac{1}{2}\right)^2 + \frac{3}{4} = 0$$

$$\Rightarrow \quad \left(x + \frac{1}{2}\right)^2 - \left(\frac{\sqrt{3}}{2}i\right)^2 = 0$$

$$\Rightarrow \quad \left(x + \frac{1}{2} + \frac{\sqrt{3}}{2}i\right)\left(x + \frac{1}{2} - \frac{\sqrt{3}}{2}i\right) = 0$$

$$\Rightarrow \quad \left(x + \frac{1}{2} + \frac{\sqrt{3}}{2}i\right) = 0 \qquad or \qquad \left(x + \frac{1}{2} - \frac{\sqrt{3}}{2}i\right) = 0$$

$$\therefore \; x = \frac{-1}{2} + \frac{\sqrt{3}}{2}i, \quad \frac{-1}{2} - \frac{\sqrt{3}}{2}i$$

Quadratic Equations Ex 14.1 Q6

$$4x^2 + 1 = 0$$

$$\Rightarrow \quad (2x)^2 - i^2 = 0 \quad \left[\because i^2 = -1\right]$$

$$\Rightarrow \quad (2x + i)(2x - i) = 0$$

$$\Rightarrow \text{ either } 2x + i = 0 \quad \text{or} \quad 2x - i = 0$$

$$\Rightarrow \quad x = \frac{-i}{2} \qquad \text{or} \quad x = \frac{i}{2}$$

$$\therefore \; x = \frac{-i}{2}, \frac{i}{2}$$

Quadratic Equations Ex 14.1 Q7

$$x^2 - 4x + 7 = 0$$

We will apply discriminant rule,

$$x = \frac{-b \pm \sqrt{D}}{2a} \ldots\ldots\ldots\ldots (A)$$

where $D = b^2 - 4ac = (-4)^2 - 4.1.7 = -12$

from (A)

$$x = -\frac{(-4) \pm \sqrt{-12}}{2}$$

$$= \frac{4 \pm 2\sqrt{3}i}{2}$$

$$= 2 \pm \sqrt{3}i$$

$$\therefore \quad x = 2 + \sqrt{3}i, \; 2 - \sqrt{3}i$$

Quadratic Equations Ex 14.1 Q8

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

We will apply discriminant rule,

$$x = \frac{-b \pm \sqrt{D}}{2a} \quad \ldots\ldots\ldots\ldots (A)$$

where $D = b^2 - 4ac$

$= 2^2 - 4.1.2$

$= 4 - 8$

$= -4$

from (A)

$$x = \frac{-2 \pm \sqrt{-4}}{2}$$

$$= \frac{-2 \pm 2i}{2}$$

$$= -1 \pm i$$

$\therefore \quad x = -1 + i, \quad -1 - i$

Quadratic Equations Ex 14.1 Q9

$$5x^2 - 6x + 2 = 0$$

We will apply discriminant rule,

$$x = \frac{-b \pm \sqrt{D}}{2a} \quad \ldots\ldots\ldots\ldots (A)$$

where $D = b^2 - 4ac$

$= (-6)^2 - 4.5.2$

$= 36 - 40$

$= -4$

from (A)

$$x = \frac{-(-6) \pm \sqrt{-4}}{2.5}$$

$$= \frac{6 \pm 2i}{10}$$

$$= \frac{3 \pm i}{5}$$

$\therefore \quad x = \frac{3}{5} + \frac{i}{5}, \quad \frac{3}{5} - \frac{i}{5}$

Quadratic Equations Ex 14.1 Q10

$21x^2 + 9x + 1 = 0$

Comparing the given equation with the general form

$ax^2 + bx + c = 0$, we get $a = 21, b = 9, c = 1$

Substituting a and b in,

$$\alpha = \frac{-b + \sqrt{b^2 - 4ac}}{2a} \text{ and } \beta = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

$$\alpha = \frac{-9 + \sqrt{81 - 84}}{42} \text{ and } \beta = \frac{-9 - \sqrt{81 - 84}}{42}$$

$$\Rightarrow \alpha = \frac{-9 + \sqrt{-3}}{42} \text{ and } \beta = \frac{-9 - \sqrt{-3}}{42}$$

$$\Rightarrow \alpha = \frac{-9 + i\sqrt{3}}{42} \text{ and } \beta = \frac{-9 - i\sqrt{3}}{42}$$

The roots are $x = \frac{-9}{42} \pm \frac{i\sqrt{3}}{42}$

Quadratic Equations Ex 14.1 Q11

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

We will apply discriminant rule,

$$x = \frac{-b \pm \sqrt{D}}{2a} \quad \ldots\ldots\ldots\ldots (A)$$

where $D = b^2 - 4ac$

$$= (-1)^2 - 4.1.1$$
$$= 1 - 4$$
$$= -3$$

from (A)

$$\therefore \quad x = \frac{-(-1) \pm \sqrt{-3}}{2}$$

$$= \frac{1 \pm \sqrt{3}i}{2}$$

$$\therefore \quad x = \frac{1}{2} + \frac{\sqrt{3}}{2}i, \quad \frac{1}{2} - \frac{\sqrt{3}}{2}i$$

Quadratic Equations Ex 14.1 Q12

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

We will apply discriminant rule,

$$x = \frac{-b \pm \sqrt{D}}{2a} \quad \ldots\ldots\ldots\ldots (A)$$

where $D = b^2 - 4ac$

$$= 1^2 - 4.1.1$$
$$= 1 - 4$$
$$= -3$$

from (A)

$$x = \frac{-1 \pm \sqrt{-3}}{2}$$

$$= \frac{-1 \pm \sqrt{3}i}{2}$$

$$\therefore \quad x = \frac{-1}{2} + \frac{\sqrt{3}}{2}i, \quad \frac{-1}{2} - \frac{\sqrt{3}}{2}i$$

Quadratic Equations Ex 14.1 Q13

$$17x^2 - 8x + 1 = 0$$

We will apply discriminant rule,

$$x = \frac{-b \pm \sqrt{D}}{2a} \quad \ldots\ldots\ldots\ldots (A)$$

where $D = b^2 - 4ac$

$$= (-8)^2 - 4.17.1$$
$$= 64 - 68$$
$$= -4$$

from (A)

$$x = \frac{-(-8) \pm \sqrt{-4}}{2.17}$$

$$= \frac{8 \pm 2i}{34}$$

$$= \frac{4 \pm i}{17}$$

$$\therefore \quad x = \frac{4}{17} + \frac{i}{17}, \quad \frac{4}{17} - \frac{i}{17}$$

Quadratic Equations Ex 14.1 Q14

$$27x^2 - 10x + 1 = 0$$

We will apply discriminant rule,

$$x = \frac{-b \pm \sqrt{D}}{2a} \ldots\ldots\ldots\ldots (A)$$

where $D = b^2 - 4ac$

$$= (-10)^2 - 4.27.1$$
$$= 100 - 108$$
$$= -8$$

from (A)

$$x = \frac{-(-10) \pm \sqrt{-8}}{54}$$

$$= \frac{10 \pm 2\sqrt{2}i}{54}$$

$$= \frac{5 \pm \sqrt{2}i}{27}$$

$$\therefore \quad x = \frac{5}{27} + \frac{\sqrt{2}i}{27}, \quad \frac{5}{27} - \frac{\sqrt{2}}{27}i$$

Quadratic Equations Ex 14.1 Q15

$$17x^2 + 28x + 12 = 0$$

We will apply discriminant rule,

$$x = \frac{-b \pm \sqrt{D}}{2a} \ldots\ldots\ldots\ldots (A)$$

where $D = b^2 - 4ac$

$$= (28)^2 - 4.17.12$$
$$= 784 - 816$$
$$= -32$$

from (A)

$$x = \frac{-28 \pm \sqrt{-32}}{2.17}$$

$$= \frac{-28 \pm 4\sqrt{2}i}{34}$$

$$\therefore \quad x = \frac{-14 \pm 2\sqrt{2}i}{17}$$

Quadratic Equations Ex 14.1 Q16

$$21x^2 - 28x + 10 = 0$$

We will apply discriminant rule,

$$x = \frac{-b \pm \sqrt{D}}{2a} \quad \ldots\ldots\ldots\ldots (A)$$

where $D = b^2 - 4ac$

$$= (-28)^2 - 4.21.10$$
$$= 784 - 840$$
$$= -56$$

from (A)

$$x = \frac{-(-28) \pm \sqrt{-56}}{2.21}$$

$$= \frac{28 \pm 2\sqrt{14}i}{42}$$

$$\therefore \quad x = \frac{2}{3} \pm \frac{\sqrt{14}}{21}i$$

Quadratic Equations Ex 14.1 Q17

$$8x^2 - 9x + 3 = 0$$

We will apply discriminant rule,

$$x = \frac{-b \pm \sqrt{D}}{2a} \quad \ldots\ldots\ldots\ldots (A)$$

where $D = b^2 - 4ac$

$$= (-9)^2 - 4.8.3$$
$$= 81 - 96$$
$$= -15$$

from (A)

$$x = \frac{-b \pm \sqrt{D}}{2a}$$

$$= \frac{-(-9) \pm \sqrt{-15}}{2.8}$$

$$= \frac{9 \pm \sqrt{15}i}{16}$$

Thus

$$\therefore \quad x = \frac{9 \pm \sqrt{15}i}{16}$$

Quadratic Equations Ex 14.1 Q18

$$13x^2 + 7x + 1 = 0$$

We will apply discriminant rule,

$$x = \frac{-b \pm \sqrt{D}}{2a} \ldots\ldots\ldots\ldots (A)$$

where $D = b^2 - 4ac$

$= 7^2 - 4.13.1$

$= 49 - 52$

$= -3$

Thus, from (A)

$$x = \frac{-7 \pm \sqrt{-3}}{2.13}$$

$$= \frac{-7 \pm \sqrt{3}i}{26}$$

Thus

$$\therefore \quad x = \frac{-7}{26} \pm \frac{\sqrt{3}}{26} i$$

Quadratic Equations Ex 14.1 Q19

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

We will apply discriminant rule,

$$x = \frac{-b \pm \sqrt{D}}{2a} \ldots\ldots\ldots\ldots (A)$$

where $D = b^2 - 4ac$

$= 1^2 - 4.2.1$

$= 1 - 8$

$= -7$

Thus, from (A)

$$x = \frac{-1 \pm \sqrt{-7}}{2.2}$$

$$= \frac{-1 \pm \sqrt{7}i}{4}$$

Thus

$$\therefore \quad x = \frac{-1}{4} \pm \frac{\sqrt{7}}{4} i$$

Quadratic Equations Ex 14.1 Q20

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

We will apply discriminant rule,

$$x = \frac{-b \pm \sqrt{D}}{2a} \quad \ldots\ldots\ldots\ldots (A)$$

where $D = b^2 - 4ac$

$$= \left(-\sqrt{2}\right)^2 - 4.\sqrt{3}.3\sqrt{3}$$
$$= 2 - 36$$
$$= -34$$

from (A)

$$x = \frac{-\left(-\sqrt{2}\right) \pm \sqrt{-34}}{2.\sqrt{3}}$$

$$= \frac{\sqrt{2} \pm \sqrt{34}i}{2\sqrt{3}}$$

Thus

$$\therefore \quad x = \frac{\sqrt{2} \pm \sqrt{34}i}{2\sqrt{3}}$$

Quadratic Equations Ex 14.1 Q21

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

We will apply discriminant rule,

$$x = \frac{-b \pm \sqrt{D}}{2a} \quad \ldots\ldots\ldots\ldots (A)$$

where $D = b^2 - 4ac$

$$= 1^2 - 4.\sqrt{2}.\sqrt{2}$$
$$= 1 - 8$$
$$= -7$$

from (A)

$$x = \frac{-1 \pm \sqrt{-7}}{2.\sqrt{2}}$$

$$= \frac{-1 \pm \sqrt{7}i}{2\sqrt{2}}$$

Thus

$$\therefore \quad x = \frac{-1 \pm \sqrt{7}i}{2\sqrt{2}}$$

Quadratic Equations Ex 14.1 Q22

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

We will apply discriminant rule,

$$x = \frac{-b \pm \sqrt{D}}{2a} \ldots\ldots\ldots\ldots (A)$$

where $D = b^2 - 4ac$

$$= 1^2 - 4.1\frac{1}{\sqrt{2}}$$

$$= 1 - 2\sqrt{2}$$

from (A)

$$x = \frac{-1 \pm \sqrt{-\left(2\sqrt{2} - 1\right)}}{2}$$

$$= \frac{-1 \pm \sqrt{2\sqrt{2} - 1}i}{2}$$

Thus,

$$\therefore \quad x = \frac{-1 \pm \sqrt{2\sqrt{2} - 1}i}{2}$$

Quadratic Equations Ex 14.1 Q23

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

We will apply discriminant rule,

$$x = \frac{-b \pm \sqrt{D}}{2a} \ldots\ldots\ldots\ldots (A)$$

$$D = b^2 - 4ac$$

$$= 1^2 - 4.\sqrt{2}.\sqrt{2}$$

$$= 1 - 8$$

$$= -7$$

from (A)

$$x = \frac{-1 \pm \sqrt{-7}}{2\sqrt{2}}$$

$$= \frac{-1 \pm \sqrt{7}i}{2\sqrt{2}}$$

Thus,

$$\therefore \quad x = \frac{-1 \pm \sqrt{7}i}{2\sqrt{2}}$$

Quadratic Equations Ex 14.1 Q24

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

We will apply discriminant rule,

$$x = \frac{-b \pm \sqrt{D}}{2a} \ldots\ldots\ldots\ldots (A)$$

where $D = b^2 - 4ac$

$= 1^2 - 4.\sqrt{5}.\sqrt{5}$

$= 1 - 20$

$= -19$

from (A)

$$x = \frac{-1 \pm \sqrt{-19}}{2.\sqrt{5}}$$

$$= \frac{-1 \pm \sqrt{19}i}{2\sqrt{5}}$$

Thus,

$$\therefore \quad x = \frac{-1 \pm \sqrt{19}i}{2\sqrt{5}}$$

Quadratic Equations Ex 14.1 Q25

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

We will apply discriminant rule,

$$x = \frac{-b \pm \sqrt{D}}{2a} \ldots\ldots\ldots\ldots (A)$$

where $D = b^2 - 4ac$

$= 1^2 - 4.(-1).(-2)$

$= 1 - 8$

$= -7$

from (A)

$$x = \frac{-1 \pm \sqrt{-7}}{2.(-1)}$$

$$= \frac{-1 \pm \sqrt{7}i}{-2}$$

Thus,

$$\therefore \quad x = \frac{-1 \pm \sqrt{7}i}{-2}$$

Quadratic Equations Ex 14.1 Q26

We will apply discriminate rule,

$$x=\frac{-b\pm\sqrt{D}}{2a} \qquad \text{.....(A)}$$

Where $D=b^2-4ac$

$$=(-2)^2-4(1)\left(\frac{3}{2}\right)$$

$$=4-6$$

$$=-2$$

From (A)

$$x=\frac{-(-2)\pm\sqrt{-2}}{2(1)}$$

$$=\frac{2\pm i\sqrt{2}}{2}$$

$$=1\pm\frac{i}{\sqrt{2}}$$

Thus,

$$\therefore x=1\pm\frac{i}{\sqrt{2}}$$

Quadratic Equations Ex 14.1 Q27

We will apply discriminate rule,

$$x=\frac{-b\pm\sqrt{D}}{2a} \qquad \text{.....(A)}$$

Where $D=b^2-4ac$

$$=(-4)^2-4(3)\left(\frac{20}{3}\right)$$

$$=16-80$$

$$=-64$$

From (A)

$$x=\frac{-(-4)\pm\sqrt{-64}}{2(3)}$$

$$=\frac{4\pm i8}{6}$$

$$=\frac{2}{3}\pm\frac{4i}{3}$$

Thus,

$$\therefore x=\frac{2}{3}\pm\frac{4i}{3}$$