RD Sharma Solutions Class 11 Maths Chapter 14 Ex 14.2

Quadratic Equations Ex 14.2 Q1(i)

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

$\Rightarrow \quad x^2 + 10ix + 21i^2 = 0 \qquad \left[\because i^2 = -1\right]$

$\Rightarrow \quad x^2 + 7ix + 3ix + 21i^2 = 0$

$\Rightarrow \quad x(x + 7i) + 3i(x + 7i) = 0$

$\Rightarrow \quad (x + 3i)(x + 7i) = 0$

$\therefore \quad x = -3i, -7i$

Quadratic Equations Ex 14.2 Q1(ii)

$x^2 + (1 - 2i)x - 2i = 0$

$\Rightarrow \quad x^2 + x - 2i - 2i = 0$

$\Rightarrow \quad x(x + 1) - 2i(x + 1) = 0$

$\Rightarrow \quad (x - 2i)(x + 1) = 0$

$\Rightarrow \quad x = 2i, -1$

Quadratic Equations Ex 14.2 Q1(iii)

$x^2 - (2\sqrt{3} + 3i)x + 6\sqrt{3i} = 0$

$\Rightarrow \quad x^2 - 2\sqrt{3}x - 3ix + 6\sqrt{3}i = 0$

$\Rightarrow \quad x(x - 2\sqrt{3}) - 3i(x - 2\sqrt{3}) = 0$

$\Rightarrow \quad (x - 3i)(x - 2\sqrt{3}) = 0$

$\Rightarrow \quad x = 3i, 2\sqrt{3}$

Quadratic Equations Ex 14.2 Q1(iv)

$6x^2 - 17ix - 12 = 0$

$\Rightarrow \quad 6x^2 - 17ix + 12i^2 = 0 \qquad \left[\because i^2 = -1\right]$

$\Rightarrow \quad 6x^2 - 9ix - 8ix + 12i^2 = 0$

$\Rightarrow \quad 3x(2x - 3i) - 4i(2x - 3i) = 0$

$\Rightarrow \quad (3x - 4i)(2x - 3i) = 0$

$\Rightarrow \quad x = \frac{4}{3}i \quad \text{or} \quad \frac{3}{2}i$

Quadratic Equations Ex 14.2 Q2(i)

$$x^2 - \left(3\sqrt{2} + 2i\right)x + 6\sqrt{2i} = 0$$

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

$$\Rightarrow \quad x = 2i \quad \text{or} \quad 3\sqrt{2}$$

Quadratic Equations Ex 14.2 Q2(ii)

$$x^2 - (5 - i)x + (18 + i) = 0$$

$$\Rightarrow \quad x^2 - 5x - ix + 18 + i = 0$$
$$\Rightarrow \quad x^2 - (3 - 4i)x - (2 + 3i)x + (18 + i) = 0$$
$$\Rightarrow \quad x\left(x - (3 - 4i)\right) - (2 + 3i)\left(x - (3 - 4i)\right) = 0$$
$$\Rightarrow \quad \left(x - (2 + 3i)\right)\left(x - (3 - 4i)\right) = 0$$

$$\Rightarrow \quad x = 2 + 3i \quad \text{or} \quad 3 - 4i$$

Quadratic Equations Ex 14.2 Q2(iii)

$$(2 + i)x^2 - (5 - i)x + 2(1 - i) = 0$$

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

$$\Rightarrow \quad x = 1 - i \quad \text{or} \quad x = \frac{2 \times 2 - i}{(2 + i)(2 - i)}$$

$$\text{or } x = \frac{4 - 2i}{4 + 1} = \frac{4}{5} - \frac{2}{5}i$$

Thus,

$$x = 1 - i, \qquad \frac{4}{5} - \frac{2}{5}i$$

Quadratic Equations Ex 14.2 Q2(iv)

$x^2 - (2+i)x - (1-7i) = 0$

$\Rightarrow \quad x^2 - (2+i)x - (1-7i) = 0$

$\Rightarrow \quad x^2 - (3-i)x + (1-2i)x - (1-7i) = 0$

$\Rightarrow \quad x(x-(3-i)) + (1-2i)(x-(3-i)) = 0$

$\Rightarrow \quad [x+(1-2i)][x-(3-i)] = 0$

$\Rightarrow \quad x = -1+2i, \quad 3-i$

Quadratic Equations Ex 14.2 Q2(v)

$ix^2 - 4x - 4i = 0$

$\Rightarrow \quad ix^2 + 4i^2x + 4i^3 = 0 \quad [\because \ i^2 = -1]$

$\Rightarrow \quad x^2 + 4ix + 4i^2 = 0$

$\Rightarrow \quad x^2 + 2ix + 2ix + 4i^2 = 0$

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

$\Rightarrow \quad (x+2i)(x+2i)$

$\therefore \quad x = -2i, \quad -2i$

Quadratic Equations Ex 14.2 Q2(vi)

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

$\Rightarrow \quad x^2 + 4ix + 4i^2 = 0 \quad [\because \ i^2 = -1]$

$\Rightarrow \quad x^2 + 2ix + 2ix + 4i^2 = 0$

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

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

$\Rightarrow \quad x = -2i, -2i$

Quadratic Equations Ex 14.2 Q2(vii)

$2x^2+\sqrt{15}ix-i=0$

Comparing the given equation with the general form

$ax^2+bx+c=0$, we get $a=2, b=\sqrt{15}i, c=-i$

Substituting a and b in,

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

$$\alpha=\frac{-\sqrt{15}i+\sqrt{-15+8i}}{4} \text{ and } \beta=\frac{-\sqrt{15}i-\sqrt{-15+8i}}{4}$$

Let $\sqrt{-15+8i}=a+bi$

$\Rightarrow -15+8i=(a+bi)^2$

$\Rightarrow -15+8i=a^2-b^2+2abi$

$\Rightarrow a^2-b^2=-15$ and $2abi=8i$

Now $(a^2+b^2)^2=(a^2-b^2)^2+4a^2b^2$

$\Rightarrow (a^2+b^2)^2=(-15)^2+64=289$

$\Rightarrow a^2+b^2=17$

Solving $a^2-b^2=-15$ and $a^2+b^2=17$, we get

$a^2=1$ and $b^2=16$

$\Rightarrow a=\pm 1$ and $b=\pm 4$

$\Rightarrow a = \pm 1$ and $b = \pm 4$

$\Rightarrow a = 1, b = 4$ or $a = -1, b = -4$

$\therefore \sqrt{-15+8i} = 1+4i, -1-4i$

When $\sqrt{-15+8i} = 1+4i$

$$\alpha = \frac{-\sqrt{15}i + 1 + 4i}{4} = \frac{1+\left(4-\sqrt{15}\right)i}{4}$$

and $$\beta = \frac{-\sqrt{15}i - (1+4i)}{4} = \frac{-1-\left(4+\sqrt{15}\right)i}{4}$$

When $\sqrt{-15+8i} = -1-4i$

$$\alpha = \frac{-\sqrt{15}i - 1 - 4i}{4} = \frac{-1-\left(4+\sqrt{15}\right)i}{4}$$

and $$\beta = \frac{-\sqrt{15}i - (-1-4i)}{4} = \frac{1+\left(4-\sqrt{15}\right)i}{4}$$

Quadratic Equations Ex 14.2 Q2(viii)

$$\begin{aligned} x^2 - x + (1+i) &= 0 \\ x^2 - x + (1+i) &= 0 \\ x^2 - ix - (1-i)x + i(1-i) &= 0 \\ (x-i)(x-(1-i)) &= 0 \\ x &= i, 1-i \end{aligned}$$

Quadratic Equations Ex 14.2 Q2(ix)

We will apply discriminate rule on $ax^2+bx+c=0$,

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$$

Now,

$ix^2-x+12i=0$

$$x=\frac{-(-1)\pm\sqrt{(-1)^2-4(i)(12i)}}{2i}$$

$$=\frac{1\pm\sqrt{1+48}}{2i}$$

$$=\frac{1\pm\sqrt{49}}{2i}$$

$$=\frac{1\pm7}{2i}$$

$$=\frac{8}{2i},\frac{-6}{2i}$$

$$=\frac{4}{i},-\frac{3}{i}$$

$$=-4i,\ 3i$$

Quadratic Equations Ex 14.2 Q2(x)

We will apply discriminate rule on $ax^2+bx+c=0$,

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$$

Now,

$x^2-\left(3\sqrt{2}-2i\right)x-\sqrt{2}i=0$

$$x=\frac{\left(3\sqrt{2}-2i\right)\pm\sqrt{\left[-\left(3\sqrt{2}-2i\right)\right]^2-4(1)\left(-\sqrt{2}i\right)}}{2(1)}$$

$$=\frac{\left(3\sqrt{2}-2i\right)\pm\sqrt{\left(3\sqrt{2}-2i\right)^2+4\sqrt{2}i}}{2}$$

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

Quadratic Equations Ex 14.2 Q2(xi)

$$x^2-\left(\sqrt{2}+i\right)x+\sqrt{2}i=0$$
$$x^2-\sqrt{2}x-ix+\sqrt{2}i=0$$
$$x\left(x-\sqrt{2}\right)-i\left(x-\sqrt{2}\right)=0$$
$$(x-i)\left(x-\sqrt{2}\right)=0$$
$$x=i,\sqrt{2}$$

Quadratic Equations Ex 14.2 Q2(xii)

$$2x^2-(3+7i)x+(9i-3)=0$$
$$2x^2-3x-7ix+(9i-3)=0$$
$$(2x-3-i)(x-3i)=0$$
$$\left(x-\frac{3+i}{2}\right)(x-3i)=0$$
$$x=\frac{3+i}{2},3i$$