## EXERCISE : 5.3

Solve each of the following equations:

**QNo 1** $x^2+3=0$

**Sol:** $x^2+3=0$

Comparing with $ax^2+bx+c=0$ ; $a=1$, $b=0$, $c=3$

$D = b^2-4ac$

$= (0)^2-4\times1\times3 = 0-12 = -12<0$

$\therefore$ Roots of Eqn will be complex.

Using Quadratic Formula

$$x = \frac{-b\pm\sqrt{b^2-4ac}}{2a} = \frac{-0\pm\sqrt{-12}}{2\times1} = \frac{\pm\sqrt{4\times3}\sqrt{-1}}{2} = \frac{\pm2\sqrt{3}\,i}{2} = \pm\sqrt{3}\,i$$

**QNo.2** $2x^2+x+1=0$

**Sol.** Given eqn. is $2x^2+x+1=0$

Comparing with $ax^2+bx+c=0$

$a=2$, $b=1$, $c=1$

Discriminant $D = b^2-4ac = (1)^2-4\times2\times1 = 1-8 = -7<0$

$$\therefore \quad x = \frac{-b\pm\sqrt{b^2-4ac}}{2a} = \frac{-1\pm\sqrt{-7}}{2\times2} = \frac{-1\pm\sqrt{7}\sqrt{-1}}{4}$$

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

$\therefore$ Roots are $\frac{-1+\sqrt{7}\,i}{4}$, $\frac{-1-\sqrt{7}}{4}i$

**QNo.3** $x^2+3x+9=0$

**Sol.** Given eqn is $x^2+3x+9=0$

Comparing with $ax^2+bx+c=0$ ; $a=1$, $b=3$, $c=9$

$D = b^2-4ac = (3)^2-4\times1\times9 = 9-36 = -27$

$$\therefore \quad x = \frac{-b\pm\sqrt{b^2-4ac}}{2a} = \frac{-3\pm\sqrt{-27}}{2\times1} = \frac{-3\pm\sqrt{27}\sqrt{-1}}{2}$$

$$= \frac{-3\pm3\sqrt{3}\,i}{2} = \frac{-3+3\sqrt{3}\,i}{2}, \frac{-3-3\sqrt{3}\,i}{2}.$$

**Q No 4** $-x^2+x-2=0$

**Sol.**: Here $D = (1)^2 - 4(-1)(-2) = 1-8 = -7$

$\therefore$ Roots are $x = \dfrac{-1 \pm \sqrt{-7}}{2(-1)} = \dfrac{-1 \pm \sqrt{7}\sqrt{-1}}{-2} = \dfrac{-1 \pm \sqrt{7}\,i}{-2}$

$= \dfrac{-1(1 \mp \sqrt{7}\,i)}{(-1)(2)} = \dfrac{1-\sqrt{7}\,i}{2}, \dfrac{1+\sqrt{7}\,i}{2}.$

**Q No 5.** $x^2+3x+5=0$

**Sol.** Here $D = b^2-4ac = (3)^2 - 4\times1\times5 = 9-20 = -11.$

$\therefore$ Roots are $x = \dfrac{-3 \pm \sqrt{-11}}{2\times1} = \dfrac{-3 \pm \sqrt{11}\,i}{2}$

$= \dfrac{-3+\sqrt{11}\,i}{2}, \dfrac{-3-\sqrt{11}\,i}{2}.$

**Q No 6** $x^2-x+2=0$

Here $D = b^2-4ac = (-1)^2 - 4\times1\times2 = 1-8 = -7$

$\therefore$ Roots of given equation are

$x = \dfrac{-(-1) \pm \sqrt{-7}}{2} = \dfrac{1 \pm \sqrt{7}\,i}{2}$

$= \dfrac{1+\sqrt{7}\,i}{2}, \dfrac{1-\sqrt{7}\,i}{2}.$

**Q No 7**: $\sqrt{2}\,x^2+x+\sqrt{2}=0$

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

$\therefore$ Roots of given equations are

$x = \dfrac{-1 \pm \sqrt{-7}}{2\sqrt{2}} = \dfrac{-1 \pm \sqrt{7}\,i}{2\sqrt{2}}.$

$= \dfrac{-1+\sqrt{7}\,i}{2\sqrt{2}}, \dfrac{-1-\sqrt{7}\,i}{2\sqrt{2}}.$

**Q No 8.** $\sqrt{3}\,x^2 - \sqrt{2}\,x + 3\sqrt{3} = 0$

**Sol.** Here $D = b^2 - 4ac = (-\sqrt{2})^2 - 4 \times \sqrt{3} \times 3\sqrt{3} = 2 - 36 = -34 < 0$

Roots of Given quadratic equation are

$$x = \frac{-(-\sqrt{2}) \pm \sqrt{-34}}{2\sqrt{3}} = \frac{\sqrt{2} \pm \sqrt{34}\,i}{2\sqrt{3}}$$

$$= \frac{\sqrt{2} + \sqrt{34}\,i}{2\sqrt{3}}, \quad \frac{\sqrt{2} - \sqrt{34}\,i}{2\sqrt{3}}.$$

**Q No. 9** $x^2 + x + \frac{1}{\sqrt{2}} = 0$

**Sol.** Given quadratic eqn is $x^2 + x + \frac{1}{\sqrt{2}} = 0$

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

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

$\therefore$ Roots of given quadratic equation are

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

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

$$= \frac{-1 + \sqrt{2\sqrt{2}-1}\,i}{2}, \quad \frac{-1 - \sqrt{2\sqrt{2}-1}\,i}{2}.$$

Q.No 10 : $x^2 + \frac{x}{\sqrt{2}} + 1 = 0$

Sol. Given eqn is $x^2 + \frac{x}{\sqrt{2}} + 1 = 0$

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

Here $D = (+1)^2 - 4 \times \sqrt{2} \times \sqrt{2} = 1 - 8 = -7 < 0$

$\therefore$ Complex roots of given quadratic equation are

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

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

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

$$= \frac{-1 + \sqrt{7}\,i}{2\sqrt{2}}, \quad \frac{-1 - \sqrt{7}\,i}{2\sqrt{2}}.$$

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