CBSE Class–11 Mathematics

NCERT Solutions

Chapter - 5 Complex Numbers and Quadratic Equations

Exercise 5.3

Solve each of the following equations:

1. $x^2+3=0$

Ans. Given: $x^2+3=0$

$\Rightarrow x^2=-3$

$\Rightarrow x=\pm\sqrt{-3}$

$\Rightarrow x=\pm\sqrt{3}i$

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

Ans. Given: $2x^2+x+1=0$

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

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

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

$=\dfrac{-1\pm\sqrt{(1)^2-4\times2\times1}}{2\times2}$

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

Therefore, $x=\dfrac{-1+\sqrt{7}i}{4}$ and $x=\dfrac{-1-\sqrt{7}i}{4}$

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

Ans. Given: $x^2+3x+9=0$

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

$a=1, b=3$ and $c=9$

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

$$=\frac{-3\pm\sqrt{(3)^2-4\times1\times9}}{2\times1}$$

$$=\frac{-3\pm\sqrt{-27}}{2}=\frac{-3\pm\sqrt{27}i}{2}$$

Therefore, $x=\frac{-3+\sqrt{27}i}{2}$ and $x=\frac{-3-\sqrt{27}i}{2}$

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

Ans. Given: $-x^2+x-2=0$

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

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

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

$$=\frac{-1\pm\sqrt{(1)^2-4\times(-1)\times(-2)}}{2\times(-1)}$$

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

Therefore, $x=\frac{-1+\sqrt{7}i}{-2}$ and $x=\frac{-1-\sqrt{7}i}{-2}$

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

Ans. Given: $x^2+3x+5=0$

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

$a=1, b=3$ and $c=5$

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

$=\frac{-3\pm\sqrt{(3)^2-4\times1\times5}}{2\times1}$

$=\frac{-3\pm\sqrt{-11}}{2}=\frac{-3\pm\sqrt{11}i}{2}$

Therefore, $x=\frac{-3+\sqrt{11}i}{2}$ and $x=\frac{-3-\sqrt{11}i}{2}$

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

Ans. Given: $x^2-x+2=0$

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

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

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

$= \frac{-(-1) \pm \sqrt{(-1)^2 - 4 \times 1 \times 2}}{2 \times 1}$

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

Therefore, $x = \frac{1 + \sqrt{7}i}{2}$ and $x = \frac{1 - \sqrt{7}i}{2}$

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

Ans. Given: $\sqrt{2}x^2 + x + \sqrt{2} = 0$

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

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

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

$= \frac{-1 \pm \sqrt{(1)^2 - 4 \times \sqrt{2} \times \sqrt{2}}}{2 \times \sqrt{2}}$

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

Therefore, $x = \frac{-1 + \sqrt{7}i}{2\sqrt{2}}$ and $x = \frac{-1 - \sqrt{7}i}{2\sqrt{2}}$

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

Ans. Given: $\sqrt{3}x^2 - \sqrt{2}x + 3\sqrt{3} = 0$

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

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

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

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

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

Therefore, $x = \frac{\sqrt{2} + \sqrt{34}i}{2\sqrt{3}}$ and $x = \frac{\sqrt{2} - \sqrt{34}i}{2\sqrt{3}}$

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

Ans. Given: $x^2 + x + \frac{1}{\sqrt{2}} = 0$

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

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

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

$= \frac{-1 \pm \sqrt{(1)^2 - 4 \times 1 \times \frac{1}{\sqrt{2}}}}{2 \times 1}$

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

Therefore, $x = \frac{-1 + \sqrt{2\sqrt{2} - 1}i}{2}$ and $x = \frac{-1 - \sqrt{2\sqrt{2} - 1}i}{2}$

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

Ans. Given: $x^2+\frac{x}{\sqrt{2}}+1=0$

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

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

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

$=\frac{\frac{-1}{\sqrt{2}}\pm\sqrt{\left(\frac{1}{\sqrt{2}}\right)^2-4\times1\times1}}{2\times1}$

$=\frac{-\frac{1}{\sqrt{2}}\pm\sqrt{\frac{1}{2}-4}}{2}=\frac{-\frac{1}{\sqrt{2}}\pm\sqrt{\frac{-7}{2}}}{2}$

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

Therefore, $x=\frac{-1+\sqrt{7}i}{2\sqrt{2}}$ and $x=\frac{-1-\sqrt{7}i}{2\sqrt{2}}$