RD SHARMA
Solutions
Class 10 Maths
Chapter 8
Ex 8.4

By using the method of completing the square, find the roots of the following quadratic equations: (1) $x^2 - 4\sqrt{2}x + 6 = 0$

Soln:

$x^2 - 4\sqrt{2}x + 6 = 0$

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

$(x - 2\sqrt{2})^2 = (2\sqrt{2})^2 - 6$

$= (x - 2\sqrt{2})^2 = (4 \times 2) - 6$

$= (x - 2\sqrt{2})^2 = 8 - 6$

$= (x - 2\sqrt{2})^2 = 2$

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

$= (x - 2\sqrt{2}) = \sqrt{2}$ or $(x - 2\sqrt{2}) = -\sqrt{2}$

$x = \sqrt{2} + 2\sqrt{2}$ or $x = -\sqrt{2} + 2\sqrt{2}$

$= x = 3\sqrt{2}$ or $x = \sqrt{2}$

So, the roots for the given equation are :

$x = 3\sqrt{2}$ or $x = \sqrt{2}$

(2) $2x^2 - 7x + 3 = 0$

Soln:

$2x^2 - 7x + 3 = 0$ $\quad 2(x^2 - \frac{7x}{2} + \frac{3}{2}) = 0$ $\quad x^2 - 2 \times \frac{7}{2} \times \frac{1}{2} \times x + \frac{3}{2} = 0$

$x^2 - 2 \times \frac{7}{4} \times x + (\frac{7}{4})^2 - (\frac{7}{4})^2 + \frac{3}{2} = 0$

$x^2 - 2 \times \frac{7}{4} \times x + (\frac{7}{4})^2 - (\frac{49}{16}) + \frac{3}{2} = 0$

$(x - \frac{7}{4})^2 - \frac{49}{16} + \frac{3}{2} = 0$ $\quad (x - \frac{7}{4})^2 = \frac{49}{16} - \frac{3}{2}$ $\quad (x - \frac{7}{4})^2 = \frac{49-26}{16}$

$(x - \frac{7}{4})^2 = \frac{25}{16}$ $\quad (x - \frac{7}{4})^2 = (\frac{5}{4})^2$ $\quad x - \frac{7}{4} = \pm\frac{5}{4}$

$x - \frac{7}{4} = \frac{5}{4}$ or $x - \frac{7}{4} = -\frac{5}{4}$

x=74+54$x = \frac{7}{4} + \frac{5}{4}$ or x=74–54$x = \frac{7}{4} - \frac{5}{4}$

x=124$x = \frac{12}{4}$ or x=24$x = \frac{2}{4}$

x = 3 or x = 1/2

(3) 3x^2+11x+10=0$3x^2 + 11x + 10 = 0$

Soln: 3x^2+11x+10=0$3x^2 + 11x + 10 = 0$

x^2+ 11x3 + 103 =0$x^2 + \frac{11x}{3} + \frac{10}{3} = 0$ x^2+2× 12 × 11x3 + 103 =0
$x^2 + 2 \times \frac{1}{2} \times \frac{11x}{3} + \frac{10}{3} = 0$ x^2+2× 11x6 +(116)^2–(116)^2+ 103 =0
$x^2 + 2 \times \frac{11x}{6} + (\frac{11}{6})^2 - (\frac{11}{6})^2 + \frac{10}{3} = 0$ (x+ 116)^2=(116)^2– 103
$(x + \frac{11}{6})^2 = (\frac{11}{6})^2 - \frac{10}{3}$ (x+ 116)^2= 12136 – 103$(x + \frac{11}{6})^2 = \frac{121}{36} - \frac{10}{3}$ (x+ 116)^2= 121–12036
$(x + \frac{11}{6})^2 = \frac{121-120}{36}$ (x+ 116)^2= 136$(x + \frac{11}{6})^2 = \frac{1}{36}$ (x+ 116)^2=(16)^2
$(x + \frac{11}{6})^2 = (\frac{1}{6})^2$ x+ 116 =± 16$x + \frac{11}{6} = \pm\frac{1}{6}$

x+ 116 = 16$x + \frac{11}{6} = \frac{1}{6}$ or x+ 116 =– 16$x + \frac{11}{6} = -\frac{1}{6}$

x= 16 – 116$x = \frac{1}{6} - \frac{11}{6}$ or x=–16 – 116$x = \frac{-1}{6} - \frac{11}{6}$

x=–106$x = \frac{-10}{6}$ or x=–126$x = \frac{-12}{6}$ = – 2

x = – 5/3 or x = – 2

(4) 2x^2+x–4=0$2x^2 + x - 4 = 0$

Soln: 2x^2+x–4=0$2x^2 + x - 4 = 0$

2(x^2+ x2 – 42)=0$2(x^2 + \frac{x}{2} - \frac{4}{2}) = 0$ x^2+2× 12 × 12 ×x–2=0
$x^2 + 2 \times \frac{1}{2} \times \frac{1}{2} \times x - 2 = 0$ x^2+2× 14 ×x+(14)^2–(14)^2–2=0
$x^2 + 2 \times \frac{1}{4} \times x + (\frac{1}{4})^2 - (\frac{1}{4})^2 - 2 = 0$ (x+ 14)^2=(14)^2+2$(x + \frac{1}{4})^2 = (\frac{1}{4})^2 + 2$

(x+ 14)^2$(x + \frac{1}{4})^2$ = (14)^2+2$(\frac{1}{4})^2 + 2$

(x+ 14)^2$(x + \frac{1}{4})^2$ = 116 +2$\frac{1}{16} + 2$

(x+ 14)^2$(x + \frac{1}{4})^2$ = 1+2×1616 $\frac{1+2\times16}{16}$

$(x+\frac{1}{4})^2 = \frac{1+32}{16}$

$(x+\frac{1}{4})^2 = \frac{33}{16}$

$(x+\frac{1}{4}) = \pm\sqrt{\frac{33}{16}}$

$(x+\frac{1}{4}) = \sqrt{\frac{33}{16}}$ or $(x+\frac{1}{4}) = -\sqrt{\frac{33}{16}}$

$x = \frac{\sqrt{33}}{4} - \frac{1}{4}$ or $x = -\frac{\sqrt{33}}{4} - \frac{1}{4}$

$x = \frac{\sqrt{33}-1}{4}$ or $x = \frac{-\sqrt{33}-1}{4}$

So, $x = \frac{\sqrt{33}-1}{4}$ or $x = \frac{-\sqrt{33}-1}{4}$

Are the two roots of the given equation.

(5) $2x^2+x+4=0$

Soln: $2x^2+x+4=0$

$x^2 + \frac{x}{2} + 2 = 0$ $x^2 + 2 \times \frac{1}{2} \times \frac{1}{2} \times x + 2 = 0$ $x^2 + 2 \times \frac{1}{4} \times x + (\frac{1}{4})^2 - (\frac{1}{4})^2 + 2 = 0$ $x^2 + 2 \times \frac{1}{4} \times x + (\frac{1}{4})^2 = (\frac{1}{4})^2 - 2$ $(x+\frac{1}{4})^2 = \frac{1}{16} - 2$

$(x+\frac{1}{4})^2 = \frac{1-32}{16}$

$(x+\frac{1}{4})^2 = \frac{-31}{16}$

$(x+\frac{1}{4} = \pm\sqrt{\frac{-31}{16}}$

$(x+\frac{1}{4} = \frac{\sqrt{-31}}{4}$ or

$(x+\frac{1}{4} = \frac{-\sqrt{-31}}{4}$

$x = \frac{\sqrt{-31}-1}{4}$ or $x = \frac{-\sqrt{-31}-1}{4}$

Since, $\sqrt{-31}$ is not a real number,

Therefore, the equation doesn't have real roots.

(6) $\mathbf{4x^2+4\sqrt{3}x+3=0}$ $4x^2+4\sqrt{3}x+3=0$

Soln: $4x^2+4\sqrt{3}x+3=0$ $4x^2+4\sqrt{3}x+3=0$

$x^2+4\sqrt{3}x4+34=0$ $x^2+\frac{4\sqrt{3}x}{4}+\frac{3}{4}=0$ $x^2+2\times 12\times\sqrt{3}\times x+34=0$
$x^2+2\times\frac{1}{2}\times\sqrt{3}\times x+\frac{3}{4}=0$ $x^2+2\times\sqrt{3}2\times x+(\sqrt{3}2)^2-(\sqrt{3}2)^2+34=0$
$x^2+2\times\frac{\sqrt{3}}{2}\times x+(\frac{\sqrt{3}}{2})^2-(\frac{\sqrt{3}}{2})^2+\frac{3}{4}=0$ $(x+\sqrt{3}2)^2-34+34=0$ $(x+\frac{\sqrt{3}}{2})^2-\frac{3}{4}+\frac{3}{4}=0$

$(x+\sqrt{3}2)^2$ $(x+\frac{\sqrt{3}}{2})^2$ $=0$

$(x+\sqrt{3}2)$ $(x+\frac{\sqrt{3}}{2})$ $=0$ and $(x+\sqrt{3}2)$ $(x+\frac{\sqrt{3}}{2})$ $=0$

$x=-\sqrt{3}2$ $x=\frac{-\sqrt{3}}{2}$ and $x=-\sqrt{3}2$ $x=\frac{-\sqrt{3}}{2}$

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

Are the real roots of the given equation.

(7) $\mathbf{\sqrt{2}x^2-3x-2\sqrt{2}=0}$ $\sqrt{2}x^2-3x-2\sqrt{2}=0$

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

$x^2-3x\sqrt{2}-2\sqrt{2}\sqrt{2}=0$ $x^2-\frac{3x}{\sqrt{2}}-\frac{2\sqrt{2}}{\sqrt{2}}=0$ $x^2-3x\sqrt{2}-2=0$ $x^2-\frac{3x}{\sqrt{2}}-2=0$ $x^2-2\times 12\times 3x\sqrt{2}-2=0$
$x^2-2\times\frac{1}{2}\times\frac{3x}{\sqrt{2}}-2=0$ $x^2-2\times 3x2\sqrt{2}+(32\sqrt{2})^2-(32\sqrt{2})^2-2=0$
$x^2-2\times\frac{3x}{2\sqrt{2}}+(\frac{3}{2\sqrt{2}})^2-(\frac{3}{2\sqrt{2}})^2-2=0$ $(x-32\sqrt{2})^2=98+2$ $(x-\frac{3}{2\sqrt{2}})^2=\frac{9}{8}+2$ $(x-32\sqrt{2})^2=9+168$
$(x-\frac{3}{2\sqrt{2}})^2=\frac{9+16}{8}$ $(x-32\sqrt{2})^2=258$ $(x-\frac{3}{2\sqrt{2}})^2=\frac{25}{8}$

(8) $\mathbf{\sqrt{3}x^2+10x+7\sqrt{3}=0}$ $\sqrt{3}x^2+10x+7\sqrt{3}=0$

Soln: $\sqrt{3}x^2+10x+7\sqrt{3}=0$ $\sqrt{3}x^2+10x+7\sqrt{3}=0$

$x^2+ 10x\sqrt{3} + 7\sqrt{3}\sqrt{3} =0$ $x^2+\frac{10x}{\sqrt{3}}+\frac{7\sqrt{3}}{\sqrt{3}}=0$ $x^2+2\times 12 \times 10x\sqrt{3} +7=0$

$x^2+2\times\frac{1}{2}\times\frac{10x}{\sqrt{3}}+7=0$ $(x+ 5\sqrt{3})^2= 253-7$ $(x+\frac{5}{\sqrt{3}})^2=\frac{25}{3}-7$ $(x+ 5\sqrt{3})^2= 25-213$

$(x+\frac{5}{\sqrt{3}})^2=\frac{25-21}{3}$ $(x+ 5\sqrt{3})^2= 43$ $(x+\frac{5}{\sqrt{3}})^2=\frac{4}{3}$ $x+ 5\sqrt{3} =\pm\sqrt{43}$

$x+\frac{5}{\sqrt{3}}=\pm\sqrt{\frac{4}{3}}$ $x+ 5\sqrt{3} =+ 2\sqrt{3}$ or $x+ 5\sqrt{3} =- 2\sqrt{3}$ $x+\frac{5}{\sqrt{3}}=+\frac{2}{\sqrt{3}}$ or $x+\frac{5}{\sqrt{3}}=-\frac{2}{\sqrt{3}}$ $x= -3\sqrt{3}$ or $x= -7\sqrt{3}$

$x=\frac{-3}{\sqrt{3}}$ or $x=\frac{-7}{\sqrt{3}}$ $x=-\sqrt{3}$ and $x= -7\sqrt{3}$ $x=-\sqrt{3}$ and $x=\frac{-7}{\sqrt{3}}$

(9) $x^2-(\sqrt{2}+1)x+\sqrt{2}=0$ $x^2-(\sqrt{2}+1)x+\sqrt{2}=0$

Soln: $x^2-(\sqrt{2}+1)x+\sqrt{2}=0$ $x^2-(\sqrt{2}+1)x+\sqrt{2}=0$

$x^2-2\times 12 (\sqrt{2}+1)x+\sqrt{2}=0$ $x^2-2\times\frac{1}{2}(\sqrt{2}+1)x+\sqrt{2}=0$ $x^2-2\times \sqrt{2}+12\, x+(\sqrt{2}+12)^2-$
$(\sqrt{2}+12)^2+\sqrt{2}=0$ $x^2-2\times\frac{\sqrt{2}+1}{2}x+(\frac{\sqrt{2}+1}{2})^2-(\frac{\sqrt{2}+1}{2})^2+\sqrt{2}=0$ $(x- \sqrt{2}+12)^2=(\sqrt{2}+12)^2-\sqrt{2}$
$(x-\frac{\sqrt{2}+1}{2})^2=(\frac{\sqrt{2}+1}{2})^2-\sqrt{2}$

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

$(x- \sqrt{2}+12)^2$ $(x-\frac{\sqrt{2}+1}{2})^2 = (3+2\sqrt{2}-4\sqrt{2})4$ $\frac{(3+2\sqrt{2}-4\sqrt{2})}{4}$

$(x- \sqrt{2}+12)^2$ $(x-\frac{\sqrt{2}+1}{2})^2 = (3-2\sqrt{2})4$ $\frac{(3-2\sqrt{2})}{4}$

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

$(x- \sqrt{2}+12)^2$ $(x-\frac{\sqrt{2}+1}{2})^2 = (\sqrt{2})^2+1-2\sqrt{2}(2)^2$ $\frac{(\sqrt{2})^2+1-2\sqrt{2}}{(2)^2}$

$(x- \sqrt{2}+12)^2$ $(x-\frac{\sqrt{2}+1}{2})^2 = (\sqrt{2}-1)^2(2)^2$ $\frac{(\sqrt{2}-1)^2}{(2)^2}$

$(x- \sqrt{2}+12)^2$ $(x-\frac{\sqrt{2}+1}{2})^2 = (\sqrt{2}-12)^2$ $(\frac{\sqrt{2}-1}{2})^2$

$x- \sqrt{2}+12$ $x-\frac{\sqrt{2}+1}{2} = \pm\pm (\sqrt{2}-12)$ $(\frac{\sqrt{2}-1}{2})$

$x- \sqrt{2}+12$ $x-\frac{\sqrt{2}+1}{2} = (\sqrt{2}-12)$ $(\frac{\sqrt{2}-1}{2})$

Or $x- \sqrt{2}+12$ $x-\frac{\sqrt{2}+1}{2} = (-\sqrt{2}-12)$ $(\frac{-\sqrt{2}-1}{2})$

$x= \sqrt{2}+12$ $x=\frac{\sqrt{2}+1}{2} + (\sqrt{2}-12)$ $(\frac{\sqrt{2}-1}{2})$

Or $x = \sqrt{2}+12$ $x = \frac{\sqrt{2}+1}{2}$ + $(-\sqrt{2}-12)(\frac{-\sqrt{2}-1}{2})$

$x = 2\sqrt{2}2$ or $x = 22$ $x = \frac{2\sqrt{2}}{2}$ or $x = \frac{2}{2}$

$x = \sqrt{2}$ $x = \sqrt{2}$ or $x = 1$.

(10) $x^2 - 4ax + 4a^2 - b^2 = 0$

Soln: $x^2 - 4ax + 4a^2 - b^2 = 0$

$x^2 - 2(2a).x + (2a)^2 - b^2 = 0$

$(x - 2a)^2 = b^2$

$x - 2a = \pm\pm\ b$

$x - 2a = b$ or $x - 2a = -b$

$x = 2a + b$ or $x = 2a - b$

Therefore, $x = 2a + b$ or $x = 2a - b$ are the two roots of the given equation.