



-I Solve by using factrization method.

Q.1. $x^2 - 4x - 12 = 0$

Sol. $x^2 - 6x + 2x - 12 = 0$

$$(x^2 - 6x) + (2x - 12) = 0$$

$$x(x - 6) + 2(x - 6) = 0$$

$$(x - 6)(x + 2) = 0$$

If $x - 6 = 0$

then $x = 6$

and if $x + 2 = 0$

then $x = -2$

$$\text{S. S.} = \{6, -2\}$$

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

Sol. $x^2 - x - 5x + 5 = 0$

$$(x^2 - x) - (5x - 5) = 0$$

$$x(x - 1) - 5(x - 1) = 0$$

$$(x - 1)(x - 5) = 0$$

If $x - 1 = 0$

then $x = 1$

and if $x - 5 = 0$

then $x = 5$

$$\text{S.S.} = \{1, 5\}$$

Q.3.

$$x^2 = 8 - 7x$$

Sol.

$$x^2 + 7x - 8 = 0$$

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

$$(x^2 + 8x) - (x + 8) = 0$$

$$x(x + 8) - 1(x + 8) = 0$$

$$(x + 8)(x - 1) = 0$$

If $x + 8 = 0$

then $x = -8$

and if $x - 1 = 0$

then $x = 1$

$$\text{Solution set} = \{-8, 1\}$$

Q.4.

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

Sol.

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

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

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

$$x^2 - 2x - 3x + 6 = 0$$

$$(x^2 - 2x) - (3x - 6) = 0$$

$$x(x - 2) - 3(x - 2) = 0$$

$$(x - 2)(x - 3) = 0$$

If $x - 2 = 0$

then $x = 2$

and if $x - 3 = 0$

then $\boxed{x = 3}$

Solution set = {2, 3}

Q.5. $3x^2 - 10x + 8 = 0$

Sol. $3x^2 - 6x - 4x + 8 = 0$

$$(3x^2 - 6x) - (4x - 8) = 0$$

$$3x(x - 2) - 4(x - 2) = 0$$

$$(x - 2)(3x - 4) = 0$$

If $x - 2 = 0$

then $\boxed{x = 2}$

and if $3x - 4 = 0$

$$3x = 4$$

then $\boxed{x = \frac{4}{3}}$

Solution set = $\left\{2, \frac{4}{3}\right\}$

Q.6. $2x^2 + 15x - 8 = 0$

Sol. $2x^2 - x + 16x - 8 = 0$

$$(2x^2 - x) + (16x - 8) = 0$$

$$x(2x - 1) + 8(2x - 1) = 0$$

$$(2x - 1)(x + 8) = 0$$

If $2x - 1 = 0$

$$2x = 1$$

then

$$\boxed{x = \frac{1}{2}}$$

and if

$$x + 8 = 0$$

then

$$\boxed{x = -8}$$

$$\text{Solution set} = \left\{ \frac{1}{2}, -8 \right\}$$

Q.7.

$$\frac{x}{4}(x+1) = 3$$

Sol.

$$4\left(\frac{x}{4}\right)(x+1) = 3 \times 4 \quad (\text{Multiply by 4})$$

$$x(x+1) = 12$$

$$x^2 + x = 12$$

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

$$x^2 + 4x - 3x - 12 = 0$$

$$(x^2 + 4x) - (3x + 12) = 0$$

$$x(x+4) - 3(x+4) = 0$$

$$(x+4)(x-3) = 0$$

$$\text{If } x + 4 = 0$$

$$\text{then } \boxed{x = -4}$$

$$\text{and if } x - 3 = 0$$

$$\text{then } \boxed{x = 3}$$

$$\text{Solution set} = \{-4, 3\}$$

Q.8. $3x^2 - 8x - 3 = 0$

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

$$(3x^2 - 9x) + (x - 3) = 0$$

$$3x(x - 3) + 1(x - 3) = 0$$

$$(x - 3)(3x + 1) = 0$$

If $x - 3 = 0$

then $x = 3$

and if $3x + 1 = 0$

$$3x = -1$$

then $x = -\frac{1}{3}$

$$\text{Solution set} = \left\{ 3, -\frac{1}{3} \right\}$$

Q.9. $2x = \frac{2}{x} + 3$

Sol. (Multiply by x)

$$x(2x) = x\left(\frac{2}{x}\right) + 3(x)$$

$$2x^2 = 2 + 3x$$

$$2x^2 - 3x - 2 = 0$$

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

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

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

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

If $x - 2 = 0$

then $x = 2$

and if $2x + 1 = 0$

$$2x = -1$$

then $x = -\frac{1}{2}$

$$\text{Solution set} = \left\{ 2, -\frac{1}{2} \right\}$$

Q.10. $5x^2 - 6x - 8 = 0$

Sol. $5x^2 - 10x + 4x - 8 = 0$

$$(5x^2 - 10x) + (4x - 8) = 0$$

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

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

If $x - 2 = 0$

then $x = 2$

and if $5x + 4 = 0$

$$5x = -4$$

then $x = -\frac{4}{5}$

$$\text{Solution set} = \left\{ 2, -\frac{4}{5} \right\}$$

Q.11. $(2x + 3)(x - 2) = 0$

Sol. If $x - 2 = 0$

then $x = 2$

and if $2x + 3 = 0$

$$\begin{array}{l} 2x = -3 \\ \text{then } \boxed{x = -\frac{3}{2}} \end{array}$$

$$\text{Solution set} = \left\{ 2, -\frac{3}{2} \right\}.$$

Q.12. $(2x + 1)(5x - 4) = 0$

Sol. If $2x + 1 = 0$

$$\begin{array}{l} 2x = -1 \\ \text{then } \boxed{x = -\frac{1}{2}} \end{array}$$

and if $5x - 4 = 0$

$$\begin{array}{l} 5x = 4 \\ \text{then } \boxed{x = \frac{4}{5}} \end{array}$$

$$\text{Solution set} = \left\{ -\frac{1}{2}, \frac{4}{5} \right\}$$

Q.13. $4x(3x - 1) - 2 = (2x - 1)(5x + 1)$

Sol. $12x^2 - 4x - 2 = 10x^2 - 3x - 1$

$$12x^2 - 10x^2 - 4x + 3x - 2 + 1 = 0$$

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

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

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

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

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

If $x - 1 = 0$

then $x = 1$

and if $2x + 1 = 0$

$$2x = -1$$

then $x = -\frac{1}{2}$

$$\text{Solution set} = \left\{1, -\frac{1}{2}\right\}$$

II- Solve by completing the square method.

Q.14. $x^2 - 10x - 3 = 0$

Sol. $x^2 - 10x = 3$

$\frac{10}{2} = 5$ then add $(5)^2$ on both sides

$$x^2 - 10x + (5)^2 = 3 + (5)^2$$

$$(x - 5)^2 = 3 + 25$$

$$(x - 5)^2 = 28$$

(By taking square root on both sides)

$$x - 5 = \sqrt{28}$$

$$x - 5 = \pm 2\sqrt{7}$$

$$x = 5 \pm 2\sqrt{7}$$

Q.15. $x^2 - 6x - 3 = 0$

Sol. $x^2 - 6x = 3$

$\frac{6}{2} = 3$ then add $(3)^2$ on both sides

$$x^2 - 6x + (3)^2 = 3 + (3)^2$$

$$(x - 3)^2 = 3 + 9$$

$$(x - 3)^2 = 12$$

(By taking square root on both sides)

$$x - 3 = \pm\sqrt{12}$$

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

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

Q16. $x^2 + x - 1 = 0$

Sol.

$$\text{Adding } \left(\frac{1}{2}\right)^2 \text{ on both sides}$$

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

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

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

$$\left(x + \frac{1}{2}\right)^2 = \frac{5}{4}$$

$$x + \frac{1}{2} = \pm\sqrt{\frac{5}{4}} \quad (\text{Taking square root})$$

$$x = -\frac{1}{2} \pm \sqrt{\frac{5}{4}}$$

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

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

Q.17. $x^2 + 6x - 3 = 0$

Sol. $x^2 + 6x = 3$

$\frac{6}{2} = 3$, then $(3)^2$ adding on both sides

$$x^2 + 6x + (3)^2 = 3 + (3)^2$$

$$(x+3)^2 = 3 + 9$$

$$(x+3)^2 = 12$$

$$x+3 = \pm\sqrt{12} \text{ (Taking square root)}$$

$$x+3 = \pm 2\sqrt{3}$$

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

Q.18. $2x^2 - 4x + 1 = 0$

Sol. $2x^2 - 4x = -1$

Divided by co-efficient 2 of x .

$$x^2 - 2x = -\frac{1}{2}$$

$\frac{2}{2} = 1$, add $(1)^2$ on both sides

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

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

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

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

$$x-1 = \pm\sqrt{\frac{1}{2}} \text{ (Taking square root)}$$

thus, $x = 1 \pm \sqrt{\frac{1}{2}}$

Q19. $2x^2 - 6x + 3 = 0$

Sol. $2x^2 - 6x = -3$

Divided by co-efficient 2 of x .

$$x^2 - 3x = -\frac{3}{2}$$

Adding $\left(\frac{3}{2}\right)^2$ on both sides

$$x^2 - 3x + \left(\frac{3}{2}\right)^2 = -\frac{3}{2} + \left(\frac{3}{2}\right)^2$$

$$\left(x - \frac{3}{2}\right)^2 = -\frac{3}{2} + \frac{9}{2}$$

$$\left(x - \frac{3}{2}\right)^2 = \frac{-3+9}{2}$$

$$\left(x - \frac{3}{2}\right)^2 = \frac{6}{2}$$

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

* $x - \frac{3}{2} = \pm \sqrt{3}$ (Taking square root)

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

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

Q20. $3x^2 + 5x - 4 = 0$

Sol. $3x^2 + 5x = 4$

Divided by 3 co-efficient of x .

$$x^2 + \frac{5}{3}x = \frac{4}{3}$$

$$\frac{1}{2} \left(\frac{5}{3} \right) = \frac{5}{6}, \text{ Adding } \left(\frac{5}{6} \right)^2 \text{ on both sides}$$

$$x^2 + \frac{5}{3}x + \left(\frac{5}{6} \right)^2 = \left(\frac{5}{6} \right)^2 + \frac{4}{3}$$

$$\left(x + \frac{5}{6} \right)^2 = \frac{25}{36} + \frac{4}{3}$$

$$\left(x + \frac{5}{6} \right)^2 = \frac{25 + 48}{36}$$

$$\left(x + \frac{5}{6} \right)^2 = \frac{73}{36}$$

$$x + \frac{5}{6} = \pm \frac{\sqrt{73}}{6} \text{ (Taking square root)}$$

$$x = -\frac{5}{6} \pm \frac{\sqrt{73}}{6}$$

$$x = \frac{-5 \pm \sqrt{73}}{6}$$

Q21. $x^2 + mx + n = 0$

Sol. $x^2 + mx = -n$

$$\text{Adding } \left(\frac{m}{2} \right)^2 \text{ on both sides.}$$

$$x^2 + mx + \left(\frac{m}{2} \right)^2 = \left(\frac{m}{2} \right)^2 - n$$

$$\left(x + \frac{m}{2} \right)^2 = \frac{m^2}{4} - n$$

$$\left(x + \frac{m}{2} \right)^2 = \frac{m^2 - 4n}{4}$$

$$x + \frac{m}{2} = \pm \sqrt{\frac{m^2 - 4n}{4}} \text{ (Taking square root)}$$

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

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

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

Q22.

$$11x^2 = 6x + 21$$

Sol.

$$11x^2 - 6x = 21$$

$$x^2 - \frac{6}{11}x = \frac{21}{11} \text{ (Divided by 11)}$$

$$\left(\frac{6}{11} \times \frac{1}{2}\right)^2 = \frac{3}{11} \text{ adding } \left(\frac{3}{11}\right)^2 \text{ on both sides}$$

$$x^2 - \frac{6}{11}x + \left(\frac{3}{11}\right)^2 = \left(\frac{3}{11}\right)^2 + \frac{21}{11}$$

$$\left(x - \frac{3}{11}\right)^2 = \frac{9}{121} + \frac{21}{11}$$

$$\left(x - \frac{3}{11}\right)^2 = \frac{9 + 231}{121}$$

$$\left(x - \frac{3}{11}\right)^2 = \frac{240}{121}$$

$$x - \frac{3}{11} = \pm \sqrt{\frac{240}{121}} \text{ (Taking square root)}$$

$$x - \frac{3}{11} = \pm \sqrt{\frac{16 \times 15}{11 \times 11}}$$

$$x - \frac{3}{11} = \pm \frac{4\sqrt{15}}{11}$$

$$x = \frac{3}{11} \pm \frac{4\sqrt{15}}{11}$$

$$x = \frac{3 \pm 4\sqrt{15}}{11}$$

Q23. $2x^2 + 8x - 26 = 0$

Sol. $2x^2 + 8x = 26$

$$x^2 + 4x = 13 \text{ (Dividing by 2)}$$

$$\frac{4}{2} = 2 \text{ adding } (2)^2 \text{ on both sides.}$$

$$x^2 + 4x + (2)^2 = (2)^2 + 13$$

$$(x+2)^2 = 4 + 13$$

$$(x+2)^2 = 17$$

$$x+2 = \pm\sqrt{17} \text{ (Taking square root)}$$

$$x = -2 \pm \sqrt{17}$$

Q24. $5x^2 - 20x - 28 = 0$

Sol. $5x^2 - 20x = 28$

$$x^2 - 4x = \frac{28}{5} \text{ (Divided by 5)}$$

$$\frac{4}{2} = 2, \text{ Adding } (2)^2 \text{ on both sides.}$$

$$x^2 - 4x + (2)^2 = (2)^2 + \frac{28}{5}$$

$$(x-2)^2 = 4 + \frac{28}{5}$$

$$(x-2)^2 = \frac{20+28}{5}$$

$$(x-2)^2 = \frac{48}{5}$$

$$x - 2 = \pm \sqrt{\frac{48}{5}} \text{ (Taking square root)}$$

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

$$x = 2 \pm \frac{4\sqrt{3}}{\sqrt{5}} \text{ (Rationalize)}$$

$$x = 2 \pm 4 \frac{\sqrt{3}}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$$

$$x = 2 \pm \frac{4\sqrt{15}}{5}$$

$$x = \frac{10 \pm 4\sqrt{15}}{5} \text{ Ans.}$$

Q25. $x^2 - 11x - 26 = 0$

Sol. $x^2 - 11x = 26$

Adding $\left(\frac{11}{2}\right)^2$ on both sides.

$$x^2 - 11x + \left(\frac{11}{2}\right)^2 = \left(\frac{11}{2}\right)^2 + 26$$

$$\left(x - \frac{11}{2}\right)^2 = \frac{121}{4} + 26$$

$$\left(x - \frac{11}{2}\right)^2 = \frac{121 + 104}{4}$$

$$\left(x - \frac{11}{2}\right)^2 = \frac{225}{4}$$

$$x - \frac{11}{2} = \pm \sqrt{\frac{225}{4}} \text{ (Taking square root)}$$

$$x - \frac{11}{2} = \pm \frac{15}{2}$$

$$x = \frac{11}{2} \pm \frac{15}{2}$$

$$x = \frac{11 \pm 15}{2}$$

$$x = \frac{11+15}{2}, \frac{11-15}{2}$$

$$x = \frac{26}{2}, \frac{-4}{2}$$

$$x = 13, -2$$

$$\text{S.S.} = \{13, -2\}$$

5.3 The Quadratic Formula

If $ax^2 + bx + c = 0$ $a \neq 0$

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



Solve using quadratic formula:

Q.1. $x^2 + 5x + 6 = 0$

Sol. Here $a = 1$

$$b = -5$$

$$c = 6$$

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

Putting values of a, b, c