SOLUTION OF EXERCISE # 1.1

Exercise # 1.1

Q.1: Solve the following equations by factorization.

(i) $3x^2+7x+4=0$

Sol. $3x^2 + 7x + 4 = 0$

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

$x(3x + 4) + 1(3x + 4) = 0$

$(3x + 4)(x + 1) = 0$

Either | OR

$3x + 4 = 0$ | $x + 1 = 0$

$3x = -4$ | $x = -1$

$x = -4/3$

S.S. = $\boxed{\left\{-1, -\frac{4}{3}\right\}}$

(IA-2016), (IIA-2017)

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

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

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

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

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

Either | OR

$x - 3 = 0$ | $x - 2 = 0$

$x = 3$ | $x = 2$

S.S. = $\boxed{\{2, 3\}}$

(iii) $3x^2-1=\frac{1}{5}(1-x)$

Sol. $3x^2-1=\frac{1}{5}(1-x)$

Multipling both sides by 5, we have

$5(3x^2 - 1) = 1(1 - x)$

$15x^2 - 5 = 1 - x$

$15x^2 - 5 - 1 + x = 0$

$15x^2 + x - 6 = 0$

SOLUTION OF EXERCISE # 1.1

$15x^2 + 10x - 9x - 6 = 0$

$5x(3x + 2) - 3(3x + 2) = 0$

$(3x + 2)(5x - 3) = 0$

Either OR

$3x + 2 = 0$ | $5x - 3 = 0$

$3x = -2$ | $5x = 3$

$x = -\frac{2}{3}$ | $x = \frac{3}{5}$

$$S.S. = \boxed{\left\{-\frac{2}{3}, \frac{3}{5}\right\}}$$

(iv) $(2x+3)(x+1) = 1$ (IIA-2019)

Sol. $(2x + 3)(x + 1) = 1$

$2x^2 + 2x + 3x + 3 - 1 = 0$

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

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

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

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

Either OR

$x + 2 = 0$ | $2x + 1 = 0$

$x = -2$ | $2x = -1$

$x = -1/2$

$$S.S. = \boxed{\left\{-2, -\frac{1}{2}\right\}}$$

(v) $\frac{4}{x-1} - \frac{5}{x+2} = \frac{3}{x}$ (IIA-2017)

Sol. $\frac{4}{x-1} - \frac{5}{x+2} = \frac{3}{x}$

$\frac{4(x+2) - 5(x-1)}{(x-1)(x+2)} = \frac{3}{x}$

SOLUTION OF EXERCISE # 1.1

$$\frac{4x+8-5x+5}{x^2+2x-x-2}=\frac{3}{x}$$

$$\frac{-x+13}{x^2+x-2}=\frac{3}{x}$$

$x(-x+13)=3(x^2+x-2)$

$-x^2+13x=3x^2+3x-6$

$-x^2+13x-3x^2-3x+6=0$

$-4x^2+10x+6=0$

Dividing both sides by (–2), we have

$$\frac{-4x^2}{-2}+\frac{10x}{-2}+\frac{6}{-2}=\frac{0}{-2}$$

$2x^2-5x-3=0$

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

$2x(x-3)+1(x-3)=0$

$(x-3)(2x+1)=0$

Either | OR

$x-3=0$ | $2x+1=0$

$x=3$ | $2x=-1 \Rightarrow x=-\frac{1}{2}$

$$\text{S.S.}=\boxed{\left\{3,\ -\frac{1}{2}\right\}}$$

(vi) $\dfrac{1}{a+b+x}=\dfrac{1}{a}+\dfrac{1}{b}+\dfrac{1}{x}$ (IIA-2016), (IIA-2021)

Sol. $\dfrac{1}{a+b+x}=\dfrac{1}{a}+\dfrac{1}{b}+\dfrac{1}{x}$

$$\frac{1}{a+b+x}-\frac{1}{x}=\frac{1}{a}+\frac{1}{b}$$

$$\frac{1(x)-1(a+b+x)}{(a+b+x)x}=\frac{1(b)+1(a)}{ab}$$

SOLUTION OF EXERCISE # 1.1

$$\frac{x-a-b-x}{ax+bx+x^2}=\frac{b+a}{ab} \Rightarrow \frac{-a-b}{ax+bx+x^2}=\frac{a+b}{ab}$$

$$\frac{-(a+b)}{ax+bx+x^2}=\frac{a+b}{ab}$$

Dividing both sides by (a+b), we get

$$\frac{-1}{ax+bx+x^2}=\frac{1}{ab}$$

$$-ab=ax+bx+x^2$$

$$-ab-ax-bx-x^2=0$$

Multipling both sides by (-1), we get

$$ab+ax+bx+x^2=0$$

$$x^2+ax+bx+ab=0$$

$$x(x+a)+b(x+a)=0$$

$$(x+a)(x+b)=0$$

Either $x+a=0$, $x=-a$ OR $x+b=0$, $x=-b$

$$S.S.=\boxed{\{-a,-b\}}$$

(vii) $abx^2+(b^2-ac)x-bc=0$ **(IIA-2020)**

Sol. $abx^2+(b^2-ac)x-bc=0$

$$abx^2+b^2x-acx-bc=0$$

$$bx(ax+b)-c(ax+b)=0$$

$$(ax+b)(bx-c)=0$$

Either $ax+b=0$, $ax=-b$, $x=-\frac{b}{a}$ OR $bx-c=0$, $bx=c$, $x=\frac{c}{b}$

$$S.S.=\boxed{\left\{-\frac{b}{a},\frac{c}{a}\right\}}$$

SOLUTION OF EXERCISE # 1.1

(viii) $(a+b)x^2+(a+2b+c)x+(b+c)=0$

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

$(a+b)x^2+(a+b+b+c)x+(b+c)=0 \qquad \because 2b=b+b$

$(a+b)x^2+(a+b)x+(b+c)x+(b+c)=0$

$(a+b)x\{x+1\}+(b+c)\{x+1\}=0$

$(x+1)\left[(a+b)x+(b+c)\right]=0$

Either $x+1=0$ OR $(a+b)x+(b+c)=0$

$x=-1$ | $(a+b)x=-(b+c)$

$x=-\dfrac{b+c}{a+b}$

$$\text{S.S.}=\boxed{\left\{-1,-\frac{b+c}{a+b}\right\}}$$

(ix) $\dfrac{a}{ax-1}+\dfrac{b}{bx-1}=a+b$ **(IA-2016), (IIA-2019)**

Sol. $\dfrac{a}{ax-1}+\dfrac{b}{bx-1}=a+b$

$$\frac{a(bx-1)+b(ax-1)}{(ax-1)(bx-1)}=a+b$$

$$\frac{abx-a+abx-b}{abx^2-ax-bx+1}=a+b$$

$2abx-a-b=(a+b)(abx^2-ax-bx+1)$

$2abx-a-b=a^2bx^2-a^2x-abx+a+ab^2x^2-abx-b^2x+b$

$2abx-a-b-a^2bx^2+a^2x+abx-a-ab^2x^2+abx+b^2x-b=0$

$-a^2bx^2-ab^2x^2+a^2x+b^2x+2abx+2abx-2a-2b=0$

Multipling by (-1), we get:

$a^2bx^2+ab^2x^2-a^2x-b^2x-2abx-2abx+2a+2b=0$

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

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

SOLUTION OF EXERCISE # 1.1

$$(a+b)x\{abx-(a+b)\}-2\{abx-(a+b)\}=0$$

$$\{abx-(a+b)\}\{(a+b)x-2\}=0$$

Either OR

$abx-(a+b)=0$	$(a+b)x-2=0$
$abx=a+b$	$(a+b)x=2$
$x=\dfrac{a+b}{ab}$	$x=\dfrac{2}{a+b}$

$$S.S.=\boxed{\left\{\frac{a+b}{ab},\ \frac{2}{a+b}\right\}}$$

(x) $\dfrac{x+2}{x-1}+2\dfrac{2}{3}=\dfrac{x+3}{x-2}$

Sol. $\dfrac{x+2}{x-1}+2\dfrac{2}{3}=\dfrac{x+3}{x-2}$

$$\frac{x+2}{x-1}+\frac{8}{3}=\frac{x+3}{x-2}$$

$$\frac{3(x+2)+8(x-1)}{3(x-1)}=\frac{x+3}{x-2}$$

$$\frac{3x+6+8x-8}{3x-3}=\frac{x+3}{x-2}$$

$$\frac{11x-2}{3x-3}=\frac{x+3}{x-2}$$

$$(x-2)(11x-2)=(x+3)(3x-3)$$

$$11x^2-2x-22x+4=3x^2-3x+9x-9$$

$$11x^2-24x+4=3x^2+6x-9$$

$$11x^2-24x+4-3x^2-6x+9=0$$

$$8x^2-30x+13=0$$

$$8x^2-26x-4x+13=0$$

$$2x(4x-13)-1(4x-13)=0$$

$$(4x-13)(2x-1)=0$$

SOLUTION OF EXERCISE # 1.1

Either $4x - 13 = 0$ OR $2x - 1 = 0$

$4x = 13$ | $2x = 1$

$x = 13/4$ | $x = 1/2$

$$S.S. = \boxed{\left\{\frac{13}{4}, \frac{1}{2}\right\}}$$

Q.2: Solve the following equations by the method of completing the square.

(i) $\mathbf{x^2 - 6x + 8 = 0}$

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

$x^2 - 6x = -8$

Adding the square of one half of the coefficient of x i.e., $(3)^2$ on both sides

$x^2 - 6x + (3)^2 = -8 + (3)^2$

$(x - 3)^2 = -8 + 9$

$(x - 3)^2 = 1$

Taking square root on both sides

$\sqrt{(x-3)^2} = \pm\sqrt{1}$

$x - 3 = \pm 1$

$x = 3 \pm 1$

Either $x = 3 + 1$ OR $x = 3 - 1$

$x = 4$ | $x = 2$

$$S.S. = \boxed{\{2, 4\}}$$

(ii) $\mathbf{32 - 3x^2 = 10x}$

Sol. $32 - 3x^2 = 10x$

$-3x^2 - 10x = -32$

Multipling both sides by (-1), we get

$3x^2 + 10x = 32$

Dividing both sides by 3, we have

$$x^2 + \frac{10}{3}x = \frac{32}{3}$$

SOLUTION OF EXERCISE # 1.1

Adding the square of one half of the coefficient of x i.e.. $\left(\frac{5}{3}\right)^2$ on both sides

$$x^2+\frac{10}{3}x+\left(\frac{5}{3}\right)^2=\frac{32}{3}+\left(\frac{5}{3}\right)^2$$

$$\left(x+\frac{5}{3}\right)^2=\frac{32}{3}+\frac{25}{9}=\frac{96+25}{9}=\frac{121}{9}$$

Taking square root on both sides

$$\sqrt{\left(x+\frac{5}{3}\right)^2}=\pm\sqrt{121/9}$$

$$x+\frac{5}{3}=\pm\frac{11}{3}$$

$$x=-\frac{5}{3}\pm\frac{11}{3}$$

$$x=\frac{-5\pm 11}{3}$$

Either $x=\frac{-5+11}{3}$ OR $x=\frac{-5-11}{3}$

$x=\frac{6}{3}=2$ | $x=\frac{-16}{3}$

$$\text{S.S.}=\boxed{\left\{-\frac{16}{3},\ 2\right\}}$$

(iii) **$(x-2)(x+3)=2(x+11)$**

Sol. $(x-2)(x+3)=2(x+11)$

$x^2+3x-2x-6=2x+22$

$x^2+x-6-2x-22=0$

$x^2-x-28=0$

$x^2-x=28$

SOLUTION OF EXERCISE # 1.1

Adding the square of one half of the coefficient of x i.e., $\left(\frac{1}{2}\right)^2$ on both sides

$$x^2 - x + \left(\frac{1}{2}\right)^2 = 28 + \left(\frac{1}{2}\right)^2$$

$$\left(x - \frac{1}{2}\right)^2 = 28 + \frac{1}{4} = \frac{112+1}{4} = \frac{113}{4}$$

Taking square root on both sides

$$\sqrt{\left(x - \frac{1}{2}\right)^2} = \pm\sqrt{\frac{113}{4}}$$

$$x - \frac{1}{2} = \pm\frac{\sqrt{113}}{2} \Rightarrow x = \frac{1}{2} \pm \frac{\sqrt{113}}{2}$$

$$x = \frac{1 \pm \sqrt{113}}{2} \Rightarrow S.S. = \boxed{\left\{\frac{1 \pm \sqrt{113}}{2}\right\}}$$

(iv) $x^2 + (a+b)x + ab = 0$

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

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

Adding the square of one half of the coefficient of x i.e., $\left(\frac{a+b}{2}\right)^2$ on both sides.

$$x^2 + (a+b)x + \left(\frac{a+b}{2}\right)^2 = -ab + \left(\frac{a+b}{2}\right)^2$$

$$\left(x + \frac{a+b}{2}\right)^2 = -ab + \frac{a^2 + b^2 + 2ab}{4}$$

$$\left(x + \frac{a+b}{2}\right)^2 = \frac{-4ab + a^2 + b^2 + 2ab}{4}$$

$$\left(x + \frac{a+b}{2}\right)^2 = \frac{a^2 + b^2 - 2ab}{4}$$

SOLUTION OF EXERCISE # 1.1

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

Taking square root on both sides, we have

$$\sqrt{\left(x+\left(\frac{a+b}{2}\right)\right)^2}=\pm\sqrt{\frac{(a-b)^2}{4}}$$

$$x+\left(\frac{a+b}{2}\right)=\pm\left(\frac{a-b}{2}\right)$$

$$x=-\left(\frac{a+b}{2}\right)\pm\left(\frac{a-b}{2}\right)$$

$$x=\frac{-(a+b)\pm(a-b)}{2}$$

Either $x=\dfrac{-a-b+a-b}{2}$ OR $x=\dfrac{-a-b-a+b}{2}$

$$x=\frac{-2b}{2} \qquad\qquad x=\frac{-2a}{2}$$

$$x=-b \qquad\qquad x=-a$$

$$S.S.=\boxed{\{-a,\ -b\}}$$

(v) $x+\dfrac{1}{x}=\dfrac{10}{3}$

Sol. $x+\dfrac{1}{x}=\dfrac{10}{3}$

$$\frac{x^2+1}{x}=\frac{10}{3}$$

$$x^2+1=\frac{10}{3}x$$

$$x^2-\frac{10}{3}x=-1$$

Adding the square of one half of the coefficient of x i.e., $\left(\dfrac{5}{3}\right)^2$ on both sides

SOLUTION OF EXERCISE # 1.1

$$x^2 - \frac{10}{3}x + \left(\frac{5}{3}\right)^2 = -1 + \left(\frac{5}{3}\right)^2$$

$$\left(x - \frac{5}{3}\right)^2 = -1 + \frac{25}{9} = \frac{-9+25}{9} = \frac{16}{9}$$

Taking square root on both sides, we have

$$\sqrt{\left(x - \frac{5}{3}\right)^2} = \pm\sqrt{16/9}$$

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

$$x = \frac{5}{3} \pm \frac{4}{3}$$

$$x = \frac{5 \pm 4}{3}$$

Either $x = \frac{5+4}{3}$ OR $x = \frac{5-4}{3}$

$x = \frac{9}{3} = 3$ | $x = 1/3$

$$\text{S.S.} = \boxed{\left\{3, \frac{1}{3}\right\}}$$

(vi) $\frac{10}{x-5} + \frac{10}{x+5} = \frac{5}{6}$

Sol. $\frac{10}{x-5} + \frac{10}{x+5} = \frac{5}{6}$

$$\frac{10(x+5) + 10(x-5)}{(x-5)(x+5)} = \frac{5}{6}$$

$$\frac{10x + 50 + 10x - 50}{x^2 + 5x - 5x - 25} = \frac{5}{6}$$

SOLUTION OF EXERCISE # 1.1

$$\frac{20x}{x^2-25}=\frac{5}{6}$$

$$6(20x)=5(x^2-25)$$

$$\frac{6(20x)}{5}=x^2-25$$

$$24x=x^2-25$$

$$-x^2+24x=-25$$

Multipling both sides by (-1), we get

$$x^2-24x=25$$

Adding the square of one half of the coefficient of x i.e., $(12)^2$ on both sides

$$x^2-24x+(12)^2=25+(12)^2$$

$$(x-12)^2=25+144$$

$$(x-12)^2=169$$

Taking square root on both side

$$\sqrt{(x-12)^2}=\pm\sqrt{169}$$

$$x-12=\pm13$$

$$x=12\pm13$$

$x=12+13$ OR $x=12-13$

$x=25$ | $x=-1$

$$\text{S.S.}=\boxed{\{-1,\ 25\}}$$

(vii) $2x^2-5bx=3b^2$

Sol. $2x^2-5bx=3b^2$

Dividing both sides by 2, we have

$$\frac{2x^2}{2}-\frac{5b}{2}x=\frac{3b^2}{2}$$

$$x^2-\frac{5b}{2}x=\frac{3b^2}{2}$$

Adding the square of one half of the coefficient of x i.e. $\left(\frac{5b}{4}\right)^2$ on both sides

SOLUTION OF EXERCISE # 1.1

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

$$\left(x - \frac{5b}{4}\right)^2 = \frac{3b^2}{2} + \frac{25b^2}{16} = \frac{24b^2 + 25b^2}{16} = \frac{49b^2}{16}$$

Taking square root on both sides, we have

$$\sqrt{\left(x - \frac{5b}{4}\right)^2} = \pm\sqrt{\frac{49b^2}{16}}$$

$$x - \frac{5b}{4} = \pm\frac{7b}{4}$$

$$x = \frac{5b}{4} \pm \frac{7b}{4} \Rightarrow x = \frac{5b \pm 7b}{4}$$

Either OR

$$x = \frac{5b+7b}{4} \qquad x = \frac{5b-7b}{4}$$

$$x = \frac{12b}{4} = 3b \qquad x = \frac{-2b}{4} = -\frac{b}{2}$$

$$\text{S.S.} = \boxed{\left\{3b, -\frac{b}{2}\right\}}$$

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

Sol. $x^2 - 2ax = -a^2 + b^2$

Adding the square of one half of the coefficient of x i.e., $(a)^2$ on both sides

$$x^2 - 2ax + a^2 = -a^2 + b^2 + a^2$$

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

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

$$x - a = \pm b$$

$$x = a \pm b$$

Either $x = a + b$ OR $x = a - b$

$$\text{S.S.} = \boxed{\{(a+b), (a-b)\}}$$

SOLUTION OF EXERCISE # 1.1

Q.3: **Solve the following equations by using quadratic formula.**

(i) $2x^2 + 3x - 9 = 0$ (IIA-2021)

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

Here $a = 2,\quad b = 3,\quad c = -9$

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

$$x = \frac{-3 \pm \sqrt{(3)^2 - 4(2)(-9)}}{2(2)}$$

$$x = \frac{-3 \pm \sqrt{9 + 72}}{4}$$

$$x = \frac{-3 \pm \sqrt{81}}{4}$$

$$x = \frac{-3 \pm 9}{4}$$

Either

$$x = \frac{-3 + 9}{4}$$

$$x = \frac{6}{4} = \frac{3}{2}$$

OR

$$x = \frac{-3 - 9}{4}$$

$$x = \frac{-12}{4} = -3$$

$$\text{S.S.} = \boxed{\left\{\frac{3}{2}, -3\right\}}$$

(ii) $(x + 1)^2 = 3x + 14$

Sol. $(x + 1)^2 = 3x + 14$

$x^2 + 2x + 1 - 3x - 14 = 0$

$x^2 - x - 13 = 0$

Here $a = 1,\quad b = -1,\quad c = -13$

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

SOLUTION OF EXERCISE # 1.1

$$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-13)}}{2(1)}$$

$$x = \frac{1 \pm \sqrt{1+52}}{2}$$

$$x = \frac{1 \pm \sqrt{53}}{2} \quad \Rightarrow \quad S.S. = \boxed{\left\{\frac{1 \pm \sqrt{53}}{2}\right\}}$$

(iii) $\frac{1}{x+1} + \frac{1}{x+2} + \frac{1}{x+3} = \frac{3}{x}$ **(IA-2018), (IA-2021)**

Sol. $\frac{1}{x+1} + \frac{1}{x+2} + \frac{1}{x+3} = \frac{3}{x}$

$$\frac{1}{x+1} + \frac{1}{x+2} = \frac{3}{x} - \frac{1}{x+3}$$

$$\frac{1(x+2)+1(x+1)}{(x+1)(x+2)} = \frac{3(x+3)-1(x)}{x(x+3)}$$

$$\frac{x+2+x+1}{x^2+2x+x+2} = \frac{3x+9-x}{x^2+3x}$$

$$\frac{2x+3}{x^2+3x+2} = \frac{2x+9}{x^2+3x}$$

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

$2x^3 + 6x^2 + 3x^2 + 9x = 2x^3+6x^2+4x+9x^2+27x+18$

$2x^3 + 9x^2 + 9x = 2x^3 + 15x^2 + 31x + 18$

$\cancel{2x^3} + 9x^2 + 9x - \cancel{2x^3} - 15x^2 - 31x - 18 = 0$

$-6x^2 - 22x - 18 = 0$

Dividing both sides by (–2), we have

$3x^2 + 11x + 9 = 0$

Here $a = 3$, $b = 11$, $c = 9$

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

SOLUTION OF EXERCISE # 1.1

$$x = \frac{-11 \pm \sqrt{(11)^2 - 4(3)(9)}}{2(3)}$$

$$x = \frac{-11 \pm \sqrt{121 - 108}}{6}$$

$$x = \frac{-11 \pm \sqrt{13}}{6} \qquad S.S. = \boxed{\left\{\frac{-11 \pm \sqrt{13}}{6}\right\}}$$

(iv) $x^2 - 3\left(x + \frac{25}{4}\right) = 9x - \frac{25}{2}$ (IA-2019)

Sol. $x^2 - 3\left(x + \frac{25}{4}\right) = 9x - \frac{25}{2}$

$$x^2 - 3x - \frac{75}{4} = 9x - \frac{25}{2}$$

$$x^2 - 3x - \frac{75}{4} - 9x + \frac{25}{2} = 0$$

$$x^2 - 3x - 9x + \frac{-75 + 50}{4} = 0$$

$$x^2 - 12x - \frac{25}{4} = 0$$

Multiply both sides by 4, we get

$4x^2 - 48x - 25 = 0$

Here $a = 4$, $b = -48$, $c = -25$

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

$$x = \frac{-(-48) \pm \sqrt{(-48)^2 - 4(4)(-25)}}{2(4)}$$

$$x = \frac{48 \pm \sqrt{2304 + 400}}{8}$$

SOLUTION OF EXERCISE # 1.1

$$x = \frac{48 \pm \sqrt{2704}}{8} \Rightarrow x = \frac{48 \pm 52}{8}$$

Either | OR

$$x = \frac{48+52}{8} \quad\Big|\quad x = \frac{48-52}{8}$$

$$x = \frac{100}{8} = \frac{25}{2} \quad\Big|\quad x = \frac{-4}{8} = \frac{-1}{2}$$

$$S.S. = \boxed{\left\{\frac{25}{2}, -\frac{1}{2}\right\}}$$

(v) $x^2 + (m-n)x - 2(m-n)^2 = 0$ **(IIA-2018)**

Sol. $x^2 + (m-n)x - 2(m-n)^2 = 0$

Here $a = 1$, $b = m - n$, $c = -2(m-n)^2$

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

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

$$x = \frac{-(m-n) \pm \sqrt{(m-n)^2 + 8(m-n)^2}}{2}$$

$$x = \frac{-(m-n) \pm \sqrt{9(m-n)^2}}{2} \Rightarrow x = \frac{-(m-n) \pm 3(m-n)}{2}$$

Either | OR

$$x = \frac{-(m-n)+3(m-n)}{2} \quad\Big|\quad x = \frac{-(m-n)-3(m-n)}{2}$$

$$x = \frac{2(m-n)}{2} \quad\Big|\quad x = \frac{-4(m-n)}{2}$$

$$x = (m-n) \quad\Big|\quad x = -2(m-n)$$

$$S.S. = \boxed{\{(m-n), -2(m-n)\}}$$

(vi) $mx^2 + (1+m)x + 1 = 0$ **(IA-2017)**

Sol. $mx^2 + (1+m)x + 1 = 0$

Here $a = m$, $b = 1 + m$, $c = 1$

SOLUTION OF EXERCISE # 1.1

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

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

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

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

$$x = \frac{-(1+m) \pm \sqrt{(1-m)^2}}{2m} \qquad x = \frac{-(1+m) \pm (1-m)}{2m}$$

Either

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

$$x = \frac{-1 - m + 1 - m}{2m}$$

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

OR

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

$$x = \frac{-1 - m - 1 + m}{2m}$$

$$x = \frac{-2}{2m} = -1/m$$

$$\text{S.S.} = \boxed{\left\{-1, -\frac{1}{m}\right\}}$$

(vii) $abx^2 + (2b - 3a)x - 6 = 0$

Sol. $abx^2 + (2b - 3a)x - 6 = 0$

Here $A = ab$, $B = (2b - 3a)$, $C = -6$

$$x = \frac{-B \pm \sqrt{B^2 - 4AC}}{2A}$$

$$x = \frac{-(2b-3a) \pm \sqrt{(2b-3a)^2 - 4(ab)(-6)}}{2(ab)}$$

$$x = \frac{-(2b-3a) \pm \sqrt{(2b)^2 + (3a)^2 - 2(2b)(3a) + 24ab}}{2ab}$$

SOLUTION OF EXERCISE # 1.1

$$x = \frac{-(2b-3a)+\sqrt{(2b)^2+(3a)^2+12ab}}{2ab}$$

$$x = \frac{-(2a-3a)\pm\sqrt{(2b+3a)^2}}{2ab}$$

$$x = \frac{-(2b-3a)\pm(2b+3a)}{2ab}$$

Either

$$x = \frac{-(2b-3a)+(2b+3a)}{2ab}$$

$$x = \frac{-2b+3a+2b+3a}{2ab}$$

$$x = \frac{6a}{2ab} = \frac{3}{b}$$

OR

$$x = \frac{-(2b-3a)-(2b+3a)}{2ab}$$

$$x = \frac{-2b+3a-2b-3a}{2ab}$$

$$x = \frac{-4b}{2ab} = -\frac{2}{a}$$

$$\text{S.S.} = \boxed{\left\{\frac{3}{b}, -\frac{2}{a}\right\}}$$

(viii) $x^2 + (b-a)x - ab = 0$ **(IA-2022)**

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

Here $A = 1,\quad B = b-a,\quad C = -ab$

$$x = \frac{-B\pm\sqrt{B^2-4AC}}{2A}$$

$$x = \frac{-(b-a)\pm\sqrt{(b-a)^2-4(1)(-ab)}}{2(1)}$$

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

$$x = \frac{-(b-a)\pm\sqrt{b^2+a^2+2ab}}{2}$$

SOLUTION OF EXERCISE # 1.1

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

$$x = \frac{-(b-a) \pm (b+a)}{2}$$

Either

$$x = \frac{-(b-a)+(b+a)}{2}$$

$$x = \frac{-b+a+b+a}{2}$$

$$x = \frac{2a}{2} = a$$

OR

$$x = \frac{-(b-a)-(b+a)}{2}$$

$$x = \frac{-b+a-b-a}{2}$$

$$x = \frac{-2b}{2} = -b$$

$$S.S. = \boxed{\{a, -b\}}$$

(ix) $\dfrac{x}{x+1} + \dfrac{x+1}{x+2} + \dfrac{x+2}{x+3} = 3$

Sol. $\dfrac{x}{x+1} + \dfrac{x+1}{x+2} + \dfrac{x+2}{x+3} = 3$

$$\frac{x}{x+1} + \frac{x+1}{x+2} = 3 - \frac{x+2}{x+3}$$

$$\frac{x(x+2)+(x+1)(x+1)}{(x+1)(x+2)} = \frac{3(x+3)-1(x+2)}{(x+3)}$$

$$\frac{x^2+2x+x^2+x+x+1}{x^2+2x+x+2} = \frac{3x+9-x-2}{x+3}$$

$$\frac{2x^2+4x+1}{x^2+3x+2} = \frac{2x+7}{x+3}$$

$$(2x^2+4x+1)(x+3) = (2x+7)(x^2+3x+2)$$

$$2x^3+6x^2+4x^2+12x+x+3 = 2x^3+6x^2+4x+7x^2+21x+14$$

$$2x^3+10x^2+13x+3 = 2x^3+13x^2+25x+14$$

$$2x^3+10x^2+13x+3-2x^3-13x^2-25x-14 = 0$$

$$-3x^2-12x-11 = 0$$

$$3x^2+12x+11 = 0$$

SOLUTION OF EXERCISE # 1.1

Here $a = 3, \quad b = 12, \quad c = 11$

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

$$x = \frac{-12 \pm \sqrt{(12)^2 - 4(3)(11)}}{2(3)}$$

$$x = \frac{-12 \pm \sqrt{144 - 132}}{6}$$

$$x = \frac{-12 \pm \sqrt{12}}{6}$$

$$x = \frac{-12 \pm \sqrt{4 \times 3}}{6}$$

$$x = \frac{-12 \pm 2\sqrt{3}}{6}$$

$$x = \frac{2(-6 \pm \sqrt{3})}{6} = \frac{-6 \pm \sqrt{3}}{3} \qquad S.S. = \boxed{\left\{\frac{-6 \pm \sqrt{3}}{3}\right\}}$$

Q.4: The sum of a number and its square is 56. Find the number?

Sol. Let 'x' be a require number, then according to the given condition:

$x + x^2 = 56$

$x^2 + x - 56 = 0$

$x^2 + 8x - 7x - 56 = 0$ By factorization

$x(x + 8) - 7(x + 8) = 0$

$(x + 8)(x - 7) = 0$

Either OR

$x + 8 = 0$ | $x - 7 = 0$

$x = -8$ | $x = 7$

$$S.S. = \boxed{\{7, -8\}}$$

SOLUTION OF EXERCISE # 1.1

Q.5: The hypotenuse of a right triangle is 18 meters. If one side is 4 meters longer than the other side, what is the length of the shorter side?

Sol. Let length of shorter side = x

Then length of longer side = x+4

By Pythagoras theorem.

$(\text{base})^2 + (\text{perp})^2 = (\text{hyp})^2$

$x^2 + (x+4)^2 = (18)^2$

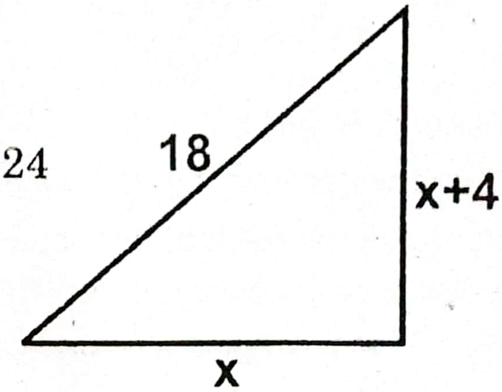
$x^2 + (x)^2 + 2(x)(4) + (4)^2 = 324$

$x^2 + x^2 + 8x + 16 - 324 = 0$

$2x^2 + 8x - 308 = 0$

$2(x^2 + 4x - 154) = 0$

$x^2 + 4x - 154 = 0$



Here: $a = 1$, $b = 4$, $c = -154$

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

$$x = \frac{-4 \pm \sqrt{(4)^2 - 4(1)(-154)}}{2(1)}$$

$$x = \frac{-4 \pm \sqrt{16 + 616}}{2}$$

$$x = \frac{-4 \pm \sqrt{632}}{2}$$

Either

$$x = \frac{-4 + \sqrt{632}}{2}$$

$x = 10.6 \Rightarrow \boxed{x = 10.6\text{m}}$

OR

$$x = \frac{-4 - \sqrt{632}}{2}$$

This is not possible, because length is always positive.