Ex 3.2

Q.12-(ii) $\frac{1}{3x} + \frac{4x}{6} = 1, \quad x \neq 0$

Sol:- $\frac{1}{3x} + \frac{4}{6}x = 1$

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

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

$1 + 2x^2 = 3x$

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

$a = 2, \; b = -3, \; c = 1.$

Using Quadratic formula

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

$$= \frac{3 \pm \sqrt{9-8}}{4}$$

$$= \frac{3 \pm \sqrt{1}}{4}$$

$$x = \frac{3+1}{4} \quad , \quad x = \frac{3-1}{4}$$

$$x = \frac{4}{4} \quad , \quad x = \frac{2}{4}$$

$$\boxed{x = 1} \qquad \boxed{x = 1/2}$$

$$S.S = \left\{\frac{1}{2}, 2\right\} \text{ Ans.}$$

(iii) $\frac{x}{x+1} + \frac{x+1}{x} = \frac{5}{2}, x \neq -1, 0.$

Sol: Taking L.C.M.

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

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

$$\frac{2x^2 + 2x + 1}{x^2 + x} = \frac{5}{2}$$

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

$4x^2+4x+2 = 5x^2+5x$

$5x^2-4x+5x-4x-2=0$

$x^2+x-2=0$

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

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

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

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

$\boxed{x=-2}$, $\boxed{x=1}$

$S.S = \{-2, 1\}$ Ans.

(iii) $\frac{1}{x+1} + \frac{2}{x+2} = \frac{7}{x+5}$, $x \neq -1, -2, -5$

Sol: Taking LCM.

$\frac{x+2+2(x+1)}{(x+1)(x+2)} = \frac{7}{x+5}$

$\frac{x+2+2x+2}{x^2+2x+x+2} = \frac{7}{x+5}$

$\frac{3x+4}{x^2+3x+2} = \frac{7}{x+5}$

$(3x+4)(x+5) = 7(x^2+3x+2)$

$3x^2+15x+4x+20 = 7x^2+21x+14$

$3x^2+19x+20 = 7x^2+21x+14$

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$7x^2 - 3x^2 + 21x - 19x + 24 - 20 = 0$

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

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

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

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

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

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

$2x = -3$, $x - 1 = 0$

$\boxed{x = \frac{-3}{2}}$, $\boxed{x \neq 1}$

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

(iii) $\frac{a}{ax-1} + \frac{b}{bx-1} = a+b$, $x \neq \frac{1}{a}, \frac{1}{b}$

Sol: $\frac{a}{ax-1} - b + \frac{b}{bx-1} - a = 0$

$\frac{a-(ax-1)b}{ax-1} + \frac{b-a(bx-1)}{bx-1} = 0$

$\frac{a-abx+b}{ax-1} + \frac{a-abx+b}{bx-1} = 0$

$a - abx + b \left(\frac{1}{ax-1} + \frac{1}{bx-1} \right) = 0$

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$a - abx + b = 0$

$a + b = abx$

$\boxed{x = \frac{a+b}{ab}}$

$\frac{1}{ax-1} + \frac{1}{bx-1} = 0$

$\frac{1}{ax-1} = -\frac{1}{bx-1}$

$bx - 1 = -(ax - 1)$

$bx - 1 = -ax + 1$

$ax + bx = 1 + 1$

$ax + bx = 2$

$x(a+b) = 2$

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

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

(v) $\frac{x+1}{x-1} + \frac{x-1}{x+1} = 2, \; x \neq 1, x \neq -1.$

Sol:

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

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

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

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

$2x^2 + 2 = 2x^2 - 2$

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$2 = -2$ (Not Possible)

S.S = { } Ans.

(vi) $3x^2+15x-2\sqrt{x^2+5x+2} = 2$

Sol: $3(x^2+5x) - 2\sqrt{x^2+5x+2} = 2$ —— i)

put $x^2+5x = y$ put in i)

$3y - 2\sqrt{y+2} = 2$

$3y - 2 = 2\sqrt{y+2}$

Taking square on b.s

$(3y-2)^2 = (2\sqrt{y+2})^2$

$(3y)^2 + (2)^2 - 2(3y)(2) = 4(y+2)$

$9y^2 + 4 - 12y = 4y + 8$

$9y^2 - 12y - 4y + 4 - 4 = 0$

$9y^2 - 16y = 0$

$y(9y-16) = 0$

$y = 0$, $9y = 16$

$y = \frac{16}{9}$

$x^2+5x = 0$, $x^2+5x = \frac{16}{9}$

$x(x+5) = 0$

$x = 0$ | $x = -5$ $9x^2+45x = 16$

$9x^2+45x-16 = 0$

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$9x^2+48x-3x-16=0$

$3x(3x+16)-1(3x+16)=0$

$(3x+16)(3x-1)=0$

$3x+16=0 \quad 3x-1=0$

$3x=-16 \quad 3x=1$

$\boxed{x=\frac{-16}{3}} \quad \boxed{x=\frac{1}{3}}$

$S.S=\left\{\frac{-16}{3}, \frac{1}{3}\right\}$ Ans.

(viii) $\sqrt{2x+8}+\sqrt{x+5}=7$ —— (i)

Sol:- Taking square on b.s

$(\sqrt{2x+8}+\sqrt{x+5})^2=7^2$

$(\sqrt{2x+8})^2+(\sqrt{x+5})^2+2(\sqrt{2x+8})(\sqrt{x+5})=49$

$2x+8+x+5+2\sqrt{(2x+8)(x+5)}=49$

$2x+8+x+5+2\sqrt{2x^2+10x+8x+40}=49$

$3x+13+2\sqrt{2x^2+18x+45}=49$

$2\sqrt{2x^2+18x+45}=49-13-3x$

$2\sqrt{2x^2+18x+45}=36-3x$

Taking square on b.s

$(2\sqrt{2x^2+18x+45})^2=(36-3x)^2$

$4(2x^2+18x+45)=(36)^2+(3x)^2-2(36)(3x)$

$8x^2+72x+160=1296+9x^2-216x$

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$9x^2 - 8x^2 - 216x - 72x + 1296 - 160 = 0$

$x^2 - 288x + 1136 = 0$

$x = \frac{-(-288) \pm \sqrt{(-288)^2 - 4(1)(1136)}}{2(1)}$

$= \frac{288 \pm \sqrt{82944 - 4544}}{2}$

$= \frac{288 \pm \sqrt{78400}}{2}$

$x = \frac{288 \pm 280}{2}$

$x = \frac{288 + 280}{2}$, $x = \frac{288 - 280}{2}$

$x = \frac{568}{2}$, $x = \frac{8}{2}$

$\boxed{x = 284}$ $\boxed{x = 4}$

Checking:-

$\sqrt{2(4) + 8} + \sqrt{4 + 5} = 7$

$\sqrt{8 + 8} + \sqrt{9} = 7$

$\sqrt{16} + \sqrt{9} = 7$

$4 + 3 = 7$

$7 = 7$ True.

Now put $x = 284$ in (1)

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$= \sqrt{2(284)+8} + \sqrt{284+5} = 7$

$\sqrt{563+8} + \sqrt{289} = 7$

$\sqrt{571} + \sqrt{289} = 7$

$\sqrt{571+289} = 7$

$\sqrt{860} = 7$

$2\sqrt{215} = 7$ (False).

S.S $= \{\ \}$ Ans.

(viii) $\sqrt{3x+4} - 2 = \sqrt{2x-4}$

Sol:- $\sqrt{3x+4} - \sqrt{2x-4} = 2$

Taking square on b.s

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

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

$3x+4+2x-4-2\sqrt{(3x+4)(2x-4)} = 4$

$5x-4 = 2\sqrt{6x^2-12x+8x-16}$

$5x-4 = 2\sqrt{6x^2-4x-16}$

Again Taking square on b.s

$(5x-4)^2 = (2\sqrt{6x^2-4x-16})^2$

$(5x)^2+(4)^2-2(5x)(4) = 4(6x^2-4x-16)$

$25x^2+16-40x = 24x^2-16x-64$

$25x^2-24x^2-40x+16x-16+64 = 0$

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$x^2-24x+80=0$

$x^2-20x-4x+80=0$

$x(x-20)\mp 4(x-20)=0$

$(x-20)(x\mp 4)=0$

$x-20=0, \quad x\mp 4=0$

$x=20, \quad x=\pm 4$ $\quad$ So $=\{20, 4\}$ Ans.

(ii) $\sqrt{x+7}+\sqrt{x+2}=\sqrt{6x+13}$ — (i)

Sol: $(\sqrt{x+7})^2+(\sqrt{x+2})^2+2(\sqrt{x+7})(\sqrt{x+2})=(\sqrt{6x+13})^2$

$x+7+x+2+2\sqrt{(x+7)(x+2)}=6x+13$

$2x+9+2\sqrt{x^2+2x+7x+14}=6x+13$

$2\sqrt{x^2+9x+14}=6x-2x+13-9$

$2\sqrt{x^2+9x+14}=4x+4$

$2\sqrt{x^2+9x+14}=2(2x+2)$

$\frac{2\sqrt{x^2+9x+14}}{2}$

$(\sqrt{x^2+9x+14})^2=(2x+2)^2$

$x^2+9x+14=4x^2+8x+4$

$4x^2-x^2+8x-9x+4-14=0$

$3x^2-x-10=0$

$3x^2-6x+5x-10=0$

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

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

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

$\boxed{x=2}$ $3x=-5$

$\boxed{x=-5/3}$ SOS $=\{-\frac{5}{3}, 2\}$ Ans

Checking:-

put $x=2$ in (i)

$\sqrt{2+7}+\sqrt{2+2}=\sqrt{6(2)+13}$

$\sqrt{9}+\sqrt{4}=\sqrt{25}$

$3+2=5$

$5=5$ True

Now put $x=\frac{-5}{3}$ in (i)

$\sqrt{\frac{-5}{3}+7}+\sqrt{\frac{-5}{3}+2}=\sqrt{2(\frac{-5}{3})+13}$

$\sqrt{\frac{16}{3}}+\sqrt{\frac{1}{3}}=\sqrt{-10+13}$

$\sqrt{\frac{16+1}{3}}=\sqrt{3}$

$=\sqrt{\frac{17}{3}}=\sqrt{3}$ (False)

SOS $=\{2\}$ Ans.

(ii) $\sqrt{x+5}-\sqrt{x-3}=2$

Sol:- $(\sqrt{x+5}-\sqrt{x-3})^2=(2)^2$

$(\sqrt{x+5})^2+(\sqrt{x-3})^2-2(\sqrt{x+5})(\sqrt{x-3})=4$

$x+5+x-3-2\sqrt{x^2-3x+5x-15}=4$

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$$2x+2-2\sqrt{x^2+2x-15}=4$$

$$2x+2-4=2\sqrt{x^2+2x-15}$$

$$2x-2=2\sqrt{x^2+2x-15}$$

$$2(x-1)=2\sqrt{x^2+2x-15}$$

$$(x-1)^2=\left(\sqrt{x^2+2x-15}\right)^2$$

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

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

$$4x-16=0$$

$$4x=16$$

$$x=\frac{16}{4}$$

$$\boxed{x=4}$$

$$SS=\{4\}\ \text{Ans.}$$

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