

## Exercise 7.1

**Q.1** Solve the following equations

(i)  $\frac{2}{3}x - \frac{1}{2}x = x + \frac{1}{6}$

**Solution:**  $\frac{2}{3}x - \frac{1}{2}x = x + \frac{1}{6}$

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

$$x = 6 \frac{(6x+1)}{6}$$

$$x = 6x + 1$$

$$-6x + x = 1$$

$$-5x = 1$$

$$x = \frac{1}{-5}$$

$$x = -\frac{1}{5}$$

To check

Substitution  $x = -\frac{1}{5}$

$$\frac{2}{3} \times \frac{-1}{5} - \frac{1}{2} \times \frac{-1}{5} = \frac{-1}{5} + \frac{1}{6}$$

$$\frac{-2}{15} + \frac{1}{10} = \frac{-6+5}{30}$$

$$\frac{-2 \times 2 + 1 \times 3}{30} = \frac{-1}{30}$$

$$\frac{-4+3}{30} = \frac{-1}{30}$$

$$\frac{-1}{30} = \frac{-1}{30}$$

**Solution Set** =  $\left\{ -\frac{1}{5} \right\}$

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

**Solution**  $\frac{x-3}{3} - \frac{x-2}{2} = -1$

**By taking L.C.M**

$$\frac{2(x-3) - 3(x-2)}{6} = -1$$

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

$$-x = -6$$

**Multiplying both sets by -1**

$$-1 \times -x = -1 \times -6$$

$$x = 6$$

To check

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

When  $x = 6$

$$\frac{6-3}{3} - \frac{6-2}{2} = -1$$

$$\frac{3}{3} - \frac{4}{2} = -1$$

$$\frac{6-12}{6} = -1$$

$$\frac{6}{6} = -1$$

$$-1 = -1$$

**Solution Set** =  $\{6\}$

(iii)  $\frac{1}{2} \left( x - \frac{1}{6} \right) + \frac{2}{3} = \frac{5}{6} + \frac{1}{3} \left( \frac{1}{2} - 3x \right)$

**Solution**  $\frac{1}{2} \left( x - \frac{1}{6} \right) + \frac{2}{3} = \frac{5}{6} + \frac{1}{3} \left( \frac{1}{2} - 3x \right)$

Taking L.C.M of brackets

$$\frac{1}{2} \left( \frac{6x-1}{6} \right) + \frac{2}{3} = \frac{5}{6} + \frac{1}{3} \left( \frac{1-6x}{2} \right)$$

$$\frac{6x-1}{12} + \frac{2}{3} = \frac{5}{6} + \frac{1-6x}{6}$$

$$\frac{6x-1+8}{12} = \frac{5+1-6x}{6}$$

$$\cancel{12}^2 (6x+7) = 6-6x$$

$$\frac{6x+7}{2} = 6-6x$$

$$6x+7 = 2(6-6x)$$

$$6x+7 = 12-12x$$

$$6x+12x = 12-7$$

$$18x = 5$$

$$x = \frac{5}{18}$$

To check

$$\frac{1}{2}\left(x - \frac{1}{6}\right) + \frac{2}{3} = \frac{5}{6} + \frac{1}{3}\left(\frac{1}{2} - 3x\right)$$

When  $x = \frac{5}{18}$

$$\frac{1}{2}\left[\frac{15}{18} - \frac{1}{6}\right] + \frac{2}{3} = \frac{5}{6} + \frac{1}{3}\left[\frac{1}{2} - 3\left(\frac{5}{18}\right)\right]$$

$$\frac{1}{2}\left[\frac{5-3}{18}\right] + \frac{2}{3} = \frac{5}{6} + \frac{1}{3}\left[\frac{1}{2} - \frac{5}{6}\right]$$

$$\frac{1}{2}\left[\frac{\cancel{2}}{18}\right] + \frac{2}{3} = \frac{5}{6} + \frac{1}{3}\left[\frac{3-5}{6}\right]$$

$$\frac{1}{\cancel{2}}\left[\frac{\cancel{2}}{18}\right] + \frac{2}{3} = \frac{5}{6} + \frac{1}{3}\left[\frac{-2^1}{6^3}\right]$$

$$\frac{1}{18} + \frac{2}{3} = \frac{5}{6} + \frac{1}{3}\left[\frac{-1}{3}\right]$$

$$\frac{1+12}{18} = \frac{5}{6} - \frac{1}{9}$$

$$\frac{13}{18} = \frac{15-2}{18}$$

$$\frac{13}{18} = \frac{13}{18}$$

**Solution Set** =  $\left\{\frac{5}{18}\right\}$

(iv)  $x + \frac{1}{3} = 2\left[x - \frac{2}{3}\right] - 6x$

**Solution**  $x + \frac{1}{3} = 2\left[x - \frac{2}{3}\right] - 6x$

$$\frac{3x+1}{3} = 2\left[\frac{3x-2}{3}\right] - 6x$$

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

Taking L.C.M of right side

$$\frac{3x+1}{3} = \frac{6x-4-18x}{3}$$

$$\frac{3x+1}{\cancel{3}} = \frac{(-12x-4)}{\cancel{3}}$$

$$3x+1 = -12x-4$$

$$3x+12x = -4-1$$

$$15x = -5$$

$$x = \frac{-5}{15}$$

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

To check

$$x + \frac{1}{3} = 2\left[x - \frac{2}{3}\right] - 6x$$

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

$$\frac{\cancel{-1}}{\cancel{3}} + \frac{1}{\cancel{3}} = 2\left[\frac{-1}{3} - \frac{2}{3}\right] - 6\left(\frac{-1}{3}\right)$$

$$0 = 2\left[\frac{-1-2}{3}\right] + \frac{\cancel{6}^2}{\cancel{3}}$$

$$0 = 2\left[\frac{-\cancel{3}}{\cancel{3}}\right] + 2$$

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

$$0 = -\cancel{2} + \cancel{2}$$

$$0 = 0$$

**Solution Set** =  $\left\{\frac{-1}{3}\right\}$

(v)  $\frac{5(x-3)}{6} - x = 1 - \frac{x}{9}$

**Solution**  $\frac{5(x-3)}{6} - x = 1 - \frac{x}{9}$

$$\frac{5x-15-6x}{6} = \frac{9-x}{9}$$

$$\frac{-15-x}{6} = \frac{9-x}{9}$$

$$9(-15-x) = 6(9-x)$$

$$-135-9x = 54-6x$$

$$-135-54 = -6x+9x$$

$$-189 = 3x$$

$$\frac{-189}{3} = x$$

$$x = -63$$

To check

$$\frac{5(x-3)}{6} - x = 1 - \frac{x}{9}$$

When  $x = -63$

$$\frac{5(-63-3)}{6} - (-63) = 1 - \frac{(-63)}{9}$$

$$\frac{5(-66)}{\cancel{6}} + 63 = 1 + 7$$

$$-55 + 63 = 8$$

$$8 = 8$$

$$\text{Solution Set} = \{-63\}$$

$$(vi) \quad \frac{x}{3x-6} = 2 - \frac{2x}{x-2}, x \neq 2$$

$$\text{Solution} \quad \frac{x}{3x-6} = 2 - \frac{2x}{x-2}, x \neq 2$$

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

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

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

$$x(x-2) = -4 \times 3(x-2)$$

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

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

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

$$x-2 = 0, \text{ or } x+12 = 0$$

$$x = 2, \text{ or } x = -12$$

$$x = 2 \text{ (Rejected because } x \neq 2 \text{)}$$

$$\text{Hence } x = -12$$

To check

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

$$\text{When } x = -12$$

$$\frac{-12}{3(-12)-6} = 2 - \frac{2(-12)}{-12-2}$$

$$\frac{-12}{-36-6} = 2 + \frac{24}{-14}$$

$$\frac{-12}{-42} = 2 - \frac{24}{14}$$

$$\frac{12}{42} = 2 - \frac{12}{7}$$

$$\frac{2}{7} = \frac{14-12}{7}$$

$$\frac{2}{7} = \frac{2}{7}$$

$$\text{Solution Set} = \{-12\}$$

$$(vii) \quad \frac{2x}{2x+5} = \frac{2}{3} - \frac{5}{4x+10}$$

$$\text{Solution} \quad \frac{2x}{2x+5} = \frac{2}{3} - \frac{5}{4x+10}$$

$$\frac{2x}{2x+5} = \frac{2(4x+10) - 3 \times 5}{3(4x+10)}$$

$$\frac{2x \times 3(4x+10)}{2x+5} = 8x + 20 - 15$$

$$\frac{6x \times 2(2x+5)}{(2x+5)} = 8x + 5$$

$$12x = 8x + 5$$

$$12x - 8x = 5$$

$$4x = 5$$

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

To check

$$\frac{2x}{2x+5} = \frac{2}{3} - \frac{5}{4x+10}$$

$$\text{When } x = \frac{5}{4}$$

$$\frac{2\left(\frac{5}{4}\right)}{2\left(\frac{5}{4}\right)+5} = \frac{2}{3} - \frac{5}{4\left(\frac{5}{4}\right)+10}$$

$$\frac{\frac{5}{2}}{\frac{5}{2}+5} = \frac{2}{3} - \frac{5}{5+10}$$

$$\frac{\frac{5}{2}}{5+10} = \frac{2}{3} - \frac{5}{15}$$

$$\frac{\frac{5}{2}}{15} = \frac{2}{3} - \frac{1}{3}$$

$$\frac{\cancel{5}}{\cancel{2}} \times \frac{\cancel{2}}{\cancel{15}^3} = \frac{2-1}{3}$$

$$\frac{1}{3} = \frac{1}{3}$$

$$\text{Solution Set} = \left\{ \frac{5}{4} \right\}$$

$$(viii) \quad \frac{2x}{x-1} + \frac{1}{3} = \frac{5}{6} + \frac{2}{x-1} \quad x \neq 1$$

$$\text{Solution} \quad \frac{2x}{x-1} + \frac{1}{3} = \frac{5}{6} + \frac{2}{x-1} \quad x \neq 1$$

$$\frac{3 \times 2x + 1(x-1)}{3(x-1)} = \frac{5(x-1) + 2 \times 6}{6(x-1)}$$

$$\frac{6x + x - 1}{3(x-1)} = \frac{5x - 5 + 12}{6(x-1)}$$

$$\frac{7x - 1}{3(x-1)} = \frac{5x - 5 + 12}{6(x-1)}$$

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

$$2(7x - 1) = 5x + 7$$

$$14x - 2 = 5x + 7$$

$$14x - 5x = 4 + 2$$

$$9x = 9$$

$$x = \frac{9}{9}$$

$$x = 1$$

No solution because  $x \neq 1$ .

$$(ix) \quad \frac{2}{x^2-1} - \frac{1}{x+1} = \frac{1}{x+1} \quad x \neq \pm 1$$

$$\text{Solution} \quad \frac{2}{x^2-1} - \frac{1}{x+1} = \frac{1}{x+1} \quad x \neq \pm 1$$

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

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

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

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

$$3 - x = x - 1$$

$$1 + 3 = x + x$$

$$4 = 2x$$

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

$$x = 2$$

To check

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

$$\frac{2}{4-1} - \frac{1}{3} = \frac{1}{3}$$

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

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

$$\frac{1}{3} = \frac{1}{3}$$

Solution Set = {2}

$$(x) \quad \frac{2}{3x+6} = \frac{1}{6} - \frac{1}{2x+4}$$

$$\text{Solution} \quad \frac{2}{3x+6} = \frac{1}{6} - \frac{1}{2x+4}$$

$$\frac{2}{3(x+2)} = \frac{1}{6} - \frac{1}{2(x+2)}$$

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

$$\frac{2 \times 6(x+2)}{3(x+2)} = x-1$$

$$4 = x-1$$

$$4+1 = x$$

$$x = 5$$

Check

$$\frac{2}{3(5)+6} = \frac{1}{6} - \frac{1}{2(5)+4}$$

$$\frac{2}{15+6} = \frac{1}{6} - \frac{1}{10+4}$$

$$\frac{2}{21} = \frac{1}{6} - \frac{1}{14}$$

$$\frac{2}{21} = \frac{7-3}{42}$$

$$\frac{2}{21} = \frac{4}{42}$$

$$\frac{2}{21} = \frac{2}{21}$$

Solution Set = {5}

**Q.2** Check each equation and check for extraneous solution, if any

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

**Solution:**  $\sqrt{3x+4} = 2$

Taking square on both side

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

$$3x+4 = 4$$

$$3x = 4 - 4$$

$$3x = 0$$

$$x = \frac{0}{3}$$

$$x = 0$$

$$x = 0$$

To check

$$\sqrt{3x+4} = 2$$

When  $x = 0$

$$\sqrt{3(0)+4} = 2$$

$$\sqrt{4} = 2$$

$$2 = 2$$

L.H.S = R.H.S

**Solution Set** = {0}

(ii)  $\sqrt[3]{2x-4} - 2 = 0$

**Solution:**  $\sqrt[3]{2x-4} - 2 = 0$

$$\sqrt[3]{2x-4} = 2$$

Taking cube on both sides

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

$$2x - 4 = 8$$

$$2x = 8 + 4$$

$$2x = 12$$

$$x = \frac{12}{2}$$

$$x = 6$$

To check

$$\sqrt[3]{2x-4} - 2 = 0$$

When  $x = 6$

$$\sqrt[3]{2x-4} - 2 = 0$$

$$\sqrt[3]{2(6)-4} - 2 = 0$$

$$\sqrt[3]{12-4} - 2 = 0$$

$$\sqrt[3]{8} - 2 = 0$$

$$\sqrt[3]{2^3} - 2 = 0$$

$$2 - 2 = 0$$

$$0 = 0$$

L.H.S = R.H.S

**Solution Set** = {6}

(iii)  $\sqrt{x-3} - 7 = 0$

**Solution:**  $\sqrt{x-3} - 7 = 0$

$$\sqrt{x-3} = 7$$

Taking square on both side

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

$$x - 3 = 49$$

$$x = 49 + 3$$

$$x = 52$$

To check

$$\sqrt{x-3} - 7 = 0$$

When  $x = 52$

$$\sqrt{52-3} - 7 = 0$$

$$\sqrt{49} - 7 = 0$$

$$7 - 7 = 0$$

$$0 = 0$$

L.H.S = R.H.S

**Solution Set** = {52}

(iv)  $2\sqrt{t+4} = 5$

**Solution:**  $2\sqrt{t+4} = 5$

Taking square on both side

$$(2\sqrt{t+4})^2 = (5)^2$$

$$4(t+4) = 25$$

$$t+4 = \frac{25}{4}$$

$$t = \frac{25}{4} - 4$$

$$t = \frac{25-16}{4}$$

$$t = \frac{9}{4}$$

To check

$$2\sqrt{t+4} = 5$$

When  $t = \frac{9}{4}$

$$2\sqrt{\frac{9}{4}+4} = 5$$

$$2\sqrt{\frac{9+16}{4}} = 5$$

$$2\sqrt{\frac{25}{4}} = 5$$

$$2 \times \frac{5}{2} = 5$$

$$5 = 5$$

L.H.S = R.H.S

$$\text{Solution Set} = \left\{ \frac{9}{4} \right\}$$

$$(v) \quad \sqrt[3]{2x+3} = \sqrt[3]{x-2}$$

$$\text{Solution: } \sqrt[3]{2x+3} = \sqrt[3]{x-2}$$

Taking cube on both sides

$$\left(\sqrt[3]{2x+3}\right)^3 = \left(\sqrt[3]{x-2}\right)^3$$

$$2x+3 = x-2$$

$$2x-x = -2-3$$

$$x = -5$$

To check

$$\sqrt[3]{2x+3} = \sqrt[3]{x-2}$$

When  $x = -5$

$$\sqrt[3]{2(-5)+3} = \sqrt[3]{-5-2}$$

$$\sqrt[3]{-10+3} = \sqrt[3]{-7}$$

$$\sqrt[3]{-7} = \sqrt[3]{-7}$$

L.H.S = R.H.S

$$\text{Solution Set} = \{-5\}$$

$$(vi) \quad \sqrt[3]{2-t} = \sqrt[3]{2t-28}$$

$$\text{Solution: } \sqrt[3]{2-t} = \sqrt[3]{2t-28}$$

Taking cube on both sides

$$\left(\sqrt[3]{2-t}\right)^3 = \left(\sqrt[3]{2t-28}\right)^3$$

$$2-t = 2t-28$$

$$2+28 = 2t+t$$

$$30 = 3t$$

$$\frac{30}{3} = t$$

$$t = 10$$

To check

$$\sqrt[3]{2-t} = \sqrt[3]{2t-28}$$

When  $t = 10$

$$\sqrt[3]{2-10} = \sqrt[3]{2(10)-28}$$

$$\sqrt[3]{-8} = \sqrt[3]{20-28}$$

$$\sqrt[3]{-8} = \sqrt[3]{-8}$$

L.H.S = R.H.S

$$\text{Solution Set} = \{10\}$$

$$(vii) \quad \sqrt{2t+6} - \sqrt{2t-5} = 0$$

$$\text{Solution: } \sqrt{2t+6} - \sqrt{2t-5} = 0$$

$$\sqrt{2t+6} = \sqrt{2t-5}$$

Taking square on both side

$$\left(\sqrt{2t+6}\right)^2 = \left(\sqrt{2t-5}\right)^2$$

$$2t+6 = 2t-5$$

$$2t-2t = -5-6$$

$$0 = -11$$

Solution is not possible

$$\text{Solution Set} = \{\} \text{ or } \phi$$

$$(viii) \quad \sqrt{\frac{x+1}{2x+5}} = 2 \quad x \neq \frac{-5}{2}$$

$$\text{Solution: } \sqrt{\frac{x+1}{2x+5}} = 2 \quad x \neq \frac{-5}{2}$$

Taking square on both side

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

$$\frac{x+1}{2x+5} = 4$$

$$x+1 = 4(2x+5)$$

$$x+1 = 8x+20$$

$$1-20 = 8x-x$$

$$-19 = 7x$$

$$\frac{-19}{7} = x$$

$$\text{Or, } x = \frac{-19}{7}$$

To check

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

$$\text{When } x = \frac{-19}{7}$$

$$\sqrt{\left(\frac{-19}{7}+1\right) \div \left[2 \times \frac{-19}{7}+5\right]} = 2$$

$$\sqrt{\frac{-19+7}{7} \div \left[\frac{-38}{7}+5\right]} = 2$$

$$\sqrt{\frac{-12}{7} \div \left[\frac{-38+35}{7}\right]} = 2$$

$$\sqrt{\frac{-12}{7} \div \frac{-3}{7}} = 2$$

$$\sqrt{\frac{-12^4}{7}} \times \frac{7}{-7} = 2$$

$$\sqrt{4} = 2$$

$$2 = 2$$

L.H.S = R.H.S

$$\text{Solution Set} = \left\{ \frac{-19}{7} \right\}$$

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