Exercise 7.1

Q.1 **Solve the following equations**

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

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

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

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

$$x = 6x + 1$$

$$-6x + x = 1$$

$$-5x = 1$$

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

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

To check

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

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

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

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

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

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

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

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

Solution $\dfrac{x - 3}{3} - \dfrac{x - 2}{2} = -1$

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

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

Taking L.C.M of brackets

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

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

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

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

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

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

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

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

$$18x = 5$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$0=0$$

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

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

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

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

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

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

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

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

$$-189=3x$$

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

$$x=-63$$

To check

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

When $x=-63$

$$\frac{5(-63-3)}{6}-(-63)=1-\frac{(-63^{7})}{\cancel{9}}$$

$$\frac{5(-66^{11})}{\cancel{6}}+63=1+7$$

$-55 + 63 = 8$

$8 = 8$

Solution Set $= \{-63\}$

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

Solution $\dfrac{x}{3x-6} = 2 - \dfrac{2x}{x-2}, x \neq 2$

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

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

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

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

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

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

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

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

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

$x = 2$ (Rejected because $x \neq 2$)

Hence $x = -12$

To check

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

When $x = -12$

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

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

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

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

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

$\dfrac{2}{7} = \dfrac{2}{7}$

Solution Set $= \{-12\}$

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

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

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

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

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

$12x = 8x + 5$

$12x - 8x = 5$

$` 4x = 5$

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

To check

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

When $x = \dfrac{5}{4}$

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

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

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

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

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

$\dfrac{1}{3} = \dfrac{1}{3}$

Solution Set $= \left\{\dfrac{5}{4}\right\}$

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

Solution $\dfrac{2x}{x-1}+\dfrac{1}{3}=\dfrac{5}{6}+\dfrac{2}{x-1}$ $x \neq 1$

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

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

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

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

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

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

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

$$9x=9$$

$$x=\dfrac{9}{9}$$

$$x=1$$

No solution because x ≠ 1.

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

Solution $\dfrac{2}{x^2-1}-\dfrac{1}{x+1}=\dfrac{1}{x+1}$ $x \neq \pm 1$

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

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

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

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

$$3-x=x-1$$

$$1+3=x+x$$

$$4=2x$$

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

$$x=2$$

To check

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

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

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

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

$$\dfrac{1}{3}=\dfrac{1}{3}$$

Solution Set $=\{2\}$

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

Solution $\dfrac{2}{3x+6}=\dfrac{1}{6}-\dfrac{1}{2x+4}$

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

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

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

$$4=x-1$$

$$4+1=x$$

$$x=5$$

Check

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

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

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

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

$$\dfrac{2}{21}=\dfrac{\cancel{4}^2}{\cancel{42}^{21}}$$

$$\dfrac{2}{21}=\dfrac{2}{21}$$

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

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

$3x+4=4$

$3x=4-4$

$3x=0$

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

$x=0$

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

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

$2x-4=8$

$2x=8+4$

$2x=12$

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

$x=6$

To check

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

When $x=6$

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

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

$\sqrt{12-4}-2=0$

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

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

$2-2=0$

$0=0$

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

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

$x-3=49$

$x=49+3$

$x=52$

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

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

$4(t+4)=25$

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

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

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

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

To check

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

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

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

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

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

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

$5 = 5$

L.H.S = R.H.S

Solution Set $= \left\{\dfrac{9}{4}\right\}$

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

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

Solution Set $= \{-5\}$

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

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

Taking cube on both sides

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

$2 - t = 2t - 28$

$2 + 28 = 2t + t$

$30 = 3t$

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

$t = 10$

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

Solution Set $= \{10\}$

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

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

Solution Set $= \{\,\}$ or ϕ

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

Solution: $\sqrt{\dfrac{x+1}{2x+5}} = 2 \qquad x \neq \dfrac{-5}{2}$

Taking square on both side

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

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

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

$x + 1 = 8x + 20$

$1 - 20 = 8x - x$

$-19 = 7x$

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

Or, $x = \dfrac{-19}{7}$

To check

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

When $x = \dfrac{-19}{7}$

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

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

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

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

$$\sqrt{\dfrac{-\cancel{12}^{\,4}}{\cancel{7}}\times\dfrac{\cancel{7}}{-\cancel{3}}}=2$$

$$\sqrt{4}=2$$

$$2=2$$

$$\text{L.H.S}=\text{R.H.S}$$

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

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Report any mistake at freeilm786@gmail.com