

EXERCISE 8.1

1. $x - 3 = 8$

$\Rightarrow x = 8 + 3$ (By transposing -3)

$\Rightarrow \boxed{x = 11}$

2. $x + 7 = 15$

$\Rightarrow x = 15 - 7$ (By transposing 7)

$\Rightarrow \boxed{x = 8}$

3. $5x = 20$

Dividing both sides by 5, we get

$\Rightarrow \frac{5x}{5} = \frac{20}{5}$

$\Rightarrow \boxed{x = 4}$

4. $2x + 6 = 10$

$\Rightarrow 2x = 10 - 6$ (By transposing 6)

$\Rightarrow 2x = 4$

$\Rightarrow \frac{2x}{2} = \frac{4}{2}$ (On dividing both sides by 2)

$\Rightarrow \boxed{x = 2}$

5. $7x - 5 = 16$

$\Rightarrow 7x = 16 + 5$ (By transposing -5)

$\Rightarrow 7x = 21$

$\Rightarrow \frac{7x}{7} = \frac{21}{7}$ (On dividing both sides by 7)

$\Rightarrow \boxed{x = 3}$

6. $\frac{3x}{2} = 18$

Multiplying both sides by 2, we get

$\frac{3x}{2} \times 2 = 18 \times 2$

$\Rightarrow 3x = 36$

$\Rightarrow \frac{3x}{3} = \frac{36}{3}$ (On dividing both sides by 3)

$\Rightarrow \boxed{x = 12}$

7. $\frac{x}{5} = 7$

$\Rightarrow \frac{x}{5} \times 5 = 7 \times 5$

(On multiplying both sides by 5)

$\Rightarrow \boxed{x = 35}$

8. $\frac{4}{7} + x = \frac{20}{7}$

$\Rightarrow x = \frac{20}{7} - \frac{4}{7}$ (By transposing $\frac{4}{7}$)

$\Rightarrow x = \frac{20 - 4}{7}$

$\Rightarrow \boxed{x = \frac{16}{7}}$

9. $7 = 2x - 5$

or $2x - 5 = 7$

$\Rightarrow 2x = 7 + 5$ (By transposing -5)

$\Rightarrow 2x = 12$

$\Rightarrow \frac{2x}{2} = \frac{12}{2}$ (On dividing both sides by 2)

$\Rightarrow \boxed{x = 6}$

10. $1.6x + 2 = 5.2$

$\Rightarrow 1.6x = 5.2 - 2$ (By transposing 2)

$\Rightarrow 1.6x = 3.2$

$\Rightarrow \frac{1.6x}{1.6} = \frac{3.2}{1.6}$ (On dividing both sides by 1.6)

$\Rightarrow \boxed{x = 2}$

11. $13 + 2a = 39$

$\Rightarrow 2a = 39 - 13$ (By transposing 13)

$\Rightarrow 2a = 26$

$\Rightarrow \frac{2a}{2} = \frac{26}{2}$ (On dividing both sides by 2)

$\Rightarrow \boxed{a = 13}$

$$\begin{aligned}
 12. \quad & 16a - 4 = 28 \\
 \Rightarrow & 16a = 28 + 4 \quad (\text{By transposing } -4) \\
 \Rightarrow & 16a = 32 \\
 \Rightarrow & \frac{16a}{16} = \frac{32}{16} \quad (\text{On dividing both sides by } 16) \\
 \Rightarrow & \boxed{a = 2}
 \end{aligned}$$

EXERCISE 8.2

$$\begin{aligned}
 1. \quad & 2x - 5 = 3x + 5 \\
 & \text{Transposing variables on L.H.S. and constant terms} \\
 & \text{on R.H.S., we get} \\
 & 2x - 3x = 5 + 5 \\
 \Rightarrow & -x = 10 \\
 \Rightarrow & \boxed{x = -10} \quad (\text{On multiplying both sides by } -1)
 \end{aligned}$$

$$\begin{aligned}
 2. \quad & 9x + 15 = 20 - x \\
 & \text{Transposing variables on L.H.S. and constant terms} \\
 & \text{on R.H.S., we get} \\
 & 9x + x = 20 - 15 \\
 \Rightarrow & 10x = 5 \\
 \Rightarrow & \frac{10x}{10} = \frac{5}{10} \quad (\text{On dividing both sides by } 10) \\
 \Rightarrow & \boxed{x = \frac{1}{2}}
 \end{aligned}$$

$$\begin{aligned}
 3. \quad & 2m - \frac{3}{5} = m + \frac{4}{5} \\
 & \text{Transposing variables on L.H.S. and constant terms} \\
 & \text{on R.H.S., we get} \\
 & 2m - m = \frac{4}{5} + \frac{3}{5} \\
 \Rightarrow & \boxed{m = \frac{7}{5}}
 \end{aligned}$$

$$\begin{aligned}
 4. \quad & 3m + 4 = 8m + 24 \\
 & \text{Transposing variables on L.H.S. and constant terms} \\
 & \text{on R.H.S., we get} \\
 & 3m - 8m = 24 - 4 \\
 \Rightarrow & -5m = 20 \\
 \Rightarrow & \frac{-5m}{5} = \frac{20}{5} \quad (\text{On dividing both sides by } 5) \\
 \Rightarrow & -m = 4 \\
 \Rightarrow & \boxed{m = -4} \quad (\text{On multiplying both sides by } -1)
 \end{aligned}$$

$$\begin{aligned}
 5. \quad & \frac{m}{2} + 6 = m - 8 \\
 & \text{Transposing variables on L.H.S. and constant terms} \\
 & \text{on R.H.S., we get}
 \end{aligned}$$

$$\begin{aligned}
 & \frac{m}{2} - m = -8 - 6 \\
 \Rightarrow & \frac{-m}{2} = -14 \\
 \Rightarrow & (-2) \left(\frac{-m}{2} \right) = (-14) \times (-2) \\
 & \quad \quad \quad (\text{On multiplying both sides by } -2) \\
 \Rightarrow & \boxed{m = 28}
 \end{aligned}$$

$$\begin{aligned}
 6. \quad & 7 - \frac{x}{3} = 4 - x \\
 & \text{Transposing variables on L.H.S. and constant terms} \\
 & \text{on R.H.S., we get}
 \end{aligned}$$

$$\begin{aligned}
 & -\frac{x}{3} + x = 4 - 7 \\
 \Rightarrow & \frac{-x + 3x}{3} = -3 \\
 \Rightarrow & \frac{2x}{3} = -3 \\
 \Rightarrow & \frac{2x}{3} \times 3 = -3 \times 3 \quad (\text{On multiplying both sides by } 3) \\
 \Rightarrow & 2x = -9 \\
 \Rightarrow & \frac{2x}{2} = \frac{-9}{2} \quad (\text{On dividing both sides by } 2) \\
 \Rightarrow & \boxed{x = \frac{-9}{2}}
 \end{aligned}$$

$$\begin{aligned}
 7. \quad & 3t + \frac{7}{5} = \frac{2}{5} + 5t \\
 \text{or} \quad & \frac{2}{5} + 5t = 3t + \frac{7}{5} \\
 & \text{Transposing variables on L.H.S. and constant terms} \\
 & \text{on R.H.S., we get}
 \end{aligned}$$

$$\begin{aligned}
 & 5t - 3t = \frac{7}{5} - \frac{2}{5} \\
 \Rightarrow & 2t = \frac{5}{5} \\
 \Rightarrow & 2t = 1 \\
 \Rightarrow & \frac{2t}{2} = \frac{1}{2} \quad (\text{On dividing both sides by } 2) \\
 \Rightarrow & \boxed{t = \frac{1}{2}}
 \end{aligned}$$

$$\begin{aligned}
 8. \quad & 3.5x - 9 = 2.4x + 13 \\
 & \text{Transposing variables on L.H.S. and constant terms} \\
 & \text{on R.H.S., we get}
 \end{aligned}$$

$$\begin{aligned}
 3.5x - 2.4x &= 13 + 9 \\
 \Rightarrow 1.1x &= 22 \\
 \Rightarrow \frac{1.1x}{1.1} &= \frac{22}{1.1} \quad (\text{On dividing both sides by 1.1}) \\
 \Rightarrow \boxed{x = 20}
 \end{aligned}$$

$$9. \quad 11x - \frac{4}{3} = 2x + \frac{5}{3}$$

Transposing variables on L.H.S. and constant terms on R.H.S., we get

$$\begin{aligned}
 11x - 2x &= \frac{5}{3} + \frac{4}{3} \\
 \Rightarrow 9x &= \frac{9}{3} \\
 \Rightarrow 9x &= 3 \\
 \Rightarrow \frac{9x}{9} &= \frac{3}{9} \quad (\text{On dividing both sides by 9}) \\
 \Rightarrow \boxed{x = \frac{1}{3}}
 \end{aligned}$$

$$10. \quad 12x - \frac{2}{7} = \frac{13}{14} - 5x$$

Transposing variables on L.H.S. and constant terms on R.H.S., we get

$$\begin{aligned}
 12x + 5x &= \frac{13}{14} + \frac{2}{7} \\
 \Rightarrow 17x &= \frac{17}{14} \\
 \Rightarrow \frac{17x}{17} &= \frac{17}{14 \times 17} \\
 &\quad (\text{On dividing both sides by 17}) \\
 \Rightarrow \boxed{x = \frac{1}{14}}
 \end{aligned}$$

EXERCISE 8.3

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

$$\begin{aligned}
 \Rightarrow 4x - 1 &= 5x + 2 \quad (\text{By cross multiplication}) \\
 \Rightarrow -1 - 2 &= 5x - 4x \quad (\text{By transposing}) \\
 \Rightarrow -3 &= x \\
 \Rightarrow \boxed{x = -3}
 \end{aligned}$$

$$\begin{aligned}
 \text{Verification: L.H.S.} &= \frac{4(-3) - 1}{5(-3) + 2} = \frac{-12 - 1}{-15 + 2} \\
 &= \frac{-13}{-13} = 1 = \text{R.H.S.}
 \end{aligned}$$

$$2. \quad \frac{3x+5}{3-2x} = \frac{5}{3}$$

$$\begin{aligned}
 \Rightarrow 3(3x+5) &= 5(3-2x) \quad (\text{By cross multiplication}) \\
 \Rightarrow 9x + 15 &= 15 - 10x \\
 \Rightarrow 9x + 10x &= 15 - 15 \quad (\text{By transposing}) \\
 \Rightarrow 19x &= 0 \\
 \Rightarrow x &= \frac{0}{19} = 0 \\
 \Rightarrow \boxed{x = 0}
 \end{aligned}$$

$$\begin{aligned}
 \text{Verification: L.H.S.} &= \frac{3(0) + 5}{3 - 2(0)} = \frac{0 + 5}{3 - 0} \\
 &= \frac{5}{3} = \text{R.H.S.}
 \end{aligned}$$

$$3. \quad \frac{2x+3}{3x+2} = \frac{9}{7}$$

$$\begin{aligned}
 \Rightarrow 7(2x+3) &= 9(3x+2) \quad (\text{By cross multiplication}) \\
 \Rightarrow 14x + 21 &= 27x + 18 \\
 \Rightarrow 21 - 18 &= 27x - 14x \quad (\text{By transposing}) \\
 \Rightarrow 13x &= 3 \\
 \Rightarrow 3 &= 13x \\
 \Rightarrow \frac{13x}{13} &= \frac{3}{13} \quad (\text{On dividing both sides by 13}) \\
 \Rightarrow \boxed{x = \frac{3}{13}}
 \end{aligned}$$

$$\begin{aligned}
 \text{Verification: L.H.S.} &= \frac{2\left(\frac{3}{13}\right) + 3}{3\left(\frac{3}{13}\right) + 2} = \frac{\frac{6}{13} + 3}{\frac{9}{13} + 2} \\
 &= \frac{\frac{6 + 39}{13}}{\frac{9 + 26}{13}} = \frac{45}{35} = \frac{9}{7} = \text{R.H.S.}
 \end{aligned}$$

$$4. \quad \frac{(3x+4) - 2x}{(2-5x) - 7x} = -\frac{9}{58}$$

$$\begin{aligned}
 \Rightarrow \frac{3x+4-2x}{2-5x-7x} &= -\frac{9}{58} \\
 \Rightarrow \frac{x+4}{2-12x} &= -\frac{9}{58} \\
 \Rightarrow 58(x+4) &= -9(2-12x) \quad (\text{By cross multiplication}) \\
 \Rightarrow 58x + 232 &= -18 + 108x
 \end{aligned}$$

$$\Rightarrow 58x - 108x = -18 - 232 \quad (\text{By transposing})$$

$$\Rightarrow -50x = -250$$

$$\Rightarrow \frac{-50x}{-50} = \frac{-250}{-50}$$

(On dividing both sides by -50)

$$\Rightarrow \boxed{x = 5}$$

$$\begin{aligned} \text{Verification: L.H.S.} &= \frac{(3 \times 5 + 4) - 2 \times 5}{(2 - 5 \times 5) - 7 \times 5} \\ &= \frac{(15 + 4) - 10}{(2 - 25) - 35} = \frac{19 - 10}{-23 - 35} \\ &= \frac{9}{-58} = -\frac{9}{58} = \text{R.H.S.} \end{aligned}$$

$$5. \frac{1}{2}(m - 1) + 5 = \frac{1}{3}(2m + 1)$$

Multiplying both sides by 6, the L.C.M. of 2 and 3, we get

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

$$\Rightarrow 3(m - 1) + 30 = 2(2m + 1)$$

$$\Rightarrow 3m - 3 + 30 = 4m + 2$$

$$-3 + 30 - 2 = 4m - 3m$$

(By transposing)

$$\Rightarrow 25 = m$$

$$\Rightarrow \boxed{m = 25}$$

$$\begin{aligned} \text{Verification: L.H.S.} &= \frac{1}{2}(25 - 1) + 5 = \frac{1}{2} \times 24 + 5 \\ &= 12 + 5 = 17 \end{aligned}$$

$$\text{R.H.S.} = \frac{1}{3}(2 \times 25 + 1) = \frac{1}{3}(50 + 1)$$

$$= \frac{1}{3} \times 51 = 17$$

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

$$6. \frac{5x}{3x + 4} = -5$$

$$\Rightarrow 5x = -5(3x + 4) \quad (\text{By cross multiplication})$$

$$5x = -15x - 20$$

$$\Rightarrow 5x + 15x = -20 \quad (\text{By transposing})$$

$$\Rightarrow 20x = -20$$

$$\Rightarrow \frac{20x}{20} = \frac{-20}{20} \quad (\text{On dividing both sides by 20})$$

$$\Rightarrow \boxed{x = -1}$$

$$\begin{aligned} \text{Verification: L.H.S.} &= \frac{5 \times (-1)}{3 \times (-1) + 4} = \frac{-5}{-3 + 4} \\ &= \frac{-5}{1} = -5 = \text{R.H.S.} \end{aligned}$$

$$7. \frac{2y}{3y + 1} = -3$$

$$\Rightarrow 2y = -3(3y + 1) \quad (\text{By cross multiplication})$$

$$\Rightarrow 2y = -9y - 3$$

$$\Rightarrow 2y + 9y = -3 \quad (\text{By transposing})$$

$$\Rightarrow 11y = -3$$

$$\Rightarrow \boxed{y = \frac{-3}{11}} \quad (\text{On dividing both sides by 11})$$

$$\begin{aligned} \text{Verification: L.H.S.} &= \frac{2\left(\frac{-3}{11}\right)}{3\left(\frac{-3}{11}\right) + 1} = \frac{\frac{-6}{11}}{\frac{-9}{11} + 1} \\ &= \frac{\frac{-6}{11}}{\frac{-9 + 11}{11}} = \frac{\frac{-6}{11}}{\frac{2}{11}} \\ &= \frac{-6}{2} = -3 = \text{R.H.S.} \end{aligned}$$

$$8. \frac{1.2x + 3}{3.2x + 6} = \frac{9}{8}$$

$$\Rightarrow 8(1.2x + 3) = 9(3.2x + 6)$$

(By cross multiplication)

$$\Rightarrow 9.6x + 24 = 28.8x + 54$$

$$\Rightarrow 24 - 54 = 28.8x - 9.6x \quad (\text{By transposing})$$

$$\Rightarrow -30 = 19.2x$$

$$\Rightarrow x = \frac{-30}{19.2}$$

(On dividing both sides by 19.2)

$$\Rightarrow x = \frac{-300}{192}$$

$$\Rightarrow \boxed{x = \frac{-25}{16}}$$

$$\begin{aligned} \text{Verification: L.H.S.} &= \frac{1.2 \times \left(\frac{-25}{16}\right) + 3}{3.2 \times \left(\frac{-25}{16}\right) + 6} = \frac{\frac{-30}{16} + 3}{\frac{-80}{16} + 6} \\ &= \frac{\frac{-30 + 48}{16}}{\frac{-80 + 96}{16}} = \frac{\frac{18}{16}}{\frac{16}{16}} \\ &= \frac{18}{16} = \frac{9}{8} = \text{R.H.S.} \end{aligned}$$

$$9. \frac{4y+8}{5y+8} = \frac{5}{6}$$

$$\Rightarrow 6(4y+8) = 5(5y+8) \quad (\text{By cross multiplication})$$

$$\Rightarrow 24y+48 = 25y+40$$

$$\Rightarrow 48-40 = 25y-24y \quad (\text{By transposing})$$

$$\Rightarrow 8 = y$$

$$\Rightarrow \boxed{y=8}$$

$$\text{Verification: L.H.S.} = \frac{4 \times 8 + 8}{5 \times 8 + 8} = \frac{32+8}{40+8}$$

$$= \frac{40}{48} = \frac{5}{6} = \text{R.H.S.}$$

$$10. \frac{x+b}{a-b} = \frac{x-b}{a+b}$$

$$\Rightarrow (x+b)(a+b) = (a-b)(x-b) \quad (\text{By cross multiplication})$$

$$\Rightarrow ax+bx+ab+b^2 = ax-ab-bx+b^2$$

$$\Rightarrow \cancel{ax} + bx - \cancel{ax} + bx = -ab + \cancel{b^2} - ab - \cancel{b^2} \quad (\text{By transposing})$$

$$\Rightarrow 2bx = -2ab$$

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

(On dividing both sides by 2b)

$$\Rightarrow \boxed{x = -a}$$

$$\text{Verification: L.H.S.} = \frac{-a+b}{a-b} = \frac{-(a-b)}{a-b} = -1$$

$$\text{R.H.S.} = \frac{-a-b}{a+b} = \frac{-(a+b)}{a+b} = -1$$

$$11. \frac{7x+4}{x+2} = -\frac{4}{3}$$

$$\Rightarrow 3(7x+4) = -4(x+2) \quad (\text{By cross multiplication})$$

$$\Rightarrow 21x+12 = -4x-8$$

$$\Rightarrow 21x+4x = -8-12 \quad (\text{By transposing})$$

$$\Rightarrow 25x = -20$$

$$\Rightarrow x = -\frac{20}{25} \quad (\text{On dividing both sides by 25})$$

$$\Rightarrow \boxed{x = -\frac{4}{5}}$$

$$\text{Verification: L.H.S.} = \frac{7\left(\frac{-4}{5}\right)+4}{\frac{-4}{5}+2} = \frac{\frac{-28}{5}+4}{\frac{-4}{5}+2}$$

$$= \frac{\frac{-28+20}{5}}{\frac{-4+10}{5}} = \frac{\frac{-8}{5}}{\frac{6}{5}}$$

$$= \frac{-8}{6} = \frac{-4}{3} = \text{R.H.S.}$$

$$12. \frac{17(2-x)}{1-7x} + \frac{5(x+12)}{7x-1} = 8$$

$$\Rightarrow \frac{34-17x}{1-7x} + \frac{5x+60}{7x-1} = 8$$

$$\Rightarrow \frac{34-17x}{1-7x} - \frac{5x+60}{1-7x} = 8$$

$$\Rightarrow \frac{34-17x-(5x+60)}{(1-7x)} = 8$$

$$\Rightarrow \frac{34-17x-5x-60}{(1-7x)} = 8$$

$$\Rightarrow \frac{-22x-26}{1-7x} = 8$$

$$\Rightarrow -22x-26 = 8(1-7x)$$

(By cross multiplication)

$$\Rightarrow -22x-26 = 8-56x$$

$$\Rightarrow -22x+56x = 8+26$$

(By transposing)

$$\Rightarrow 34x = 34$$

$$\Rightarrow \boxed{x=1}$$

(On dividing both sides by 34)

$$\text{Verification: L.H.S.} = \frac{17(2-1)}{1-7 \times 1} + \frac{5(1+12)}{7 \times 1-1}$$

$$= \frac{17 \times 1}{1-7} + \frac{5 \times 13}{7-1} = \frac{17}{-6} + \frac{65}{6}$$

$$= \frac{-17+65}{6} = \frac{48}{6} = 8 = \text{R.H.S.}$$

$$13. \frac{4x-3}{10x-9} = \frac{0.05}{0.25}$$

$$\Rightarrow \frac{4x-3}{10x-9} = \frac{5}{25} = \frac{1}{5}$$

$$\Rightarrow 5(4x-3) = 1(10x-9) \quad (\text{By cross multiplication})$$

$$\Rightarrow 20x-15 = 10x-9$$

$$\Rightarrow 20x-10x = -9+15 \quad (\text{By transposing})$$

$$\Rightarrow 10x = 6$$

$$\Rightarrow x = \frac{6}{10} = \frac{3}{5}$$

(On dividing both sides by 10)

$$\Rightarrow \boxed{x = \frac{3}{5}}$$

$$\begin{aligned} \text{Verification: L.H.S.} &= \frac{4\left(\frac{3}{5}\right) - 3}{10\left(\frac{3}{5}\right) - 9} = \frac{\frac{12}{5} - 3}{\frac{30}{5} - 9} \\ &= \frac{\frac{12}{5} - 3}{6 - 9} = \frac{\frac{12 - 15}{5}}{-3} = \frac{-3}{-3} \\ &= \frac{-3}{5(-3)} = \frac{1}{5} \end{aligned}$$

$$\text{R.H.S.} = \frac{0.05}{0.25} = \frac{5}{25} = \frac{1}{5}$$

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

$$14. \frac{3}{2x - (3 - 4x)} = \frac{1}{3}$$

$$\Rightarrow \frac{3}{2x - 3 + 4x} = \frac{1}{3}$$

$$\Rightarrow \frac{3}{6x - 3} = \frac{1}{3}$$

$$\Rightarrow 3 \times 3 = 6x - 3 \quad (\text{By cross multiplication})$$

$$\Rightarrow 9 = 6x - 3$$

$$\Rightarrow 9 + 3 = 6x \quad (\text{By transposing})$$

$$\Rightarrow 12 = 6x$$

$$\Rightarrow 6x = 12$$

$$\Rightarrow \boxed{x = 2}$$

(On dividing both sides by 6)

$$\text{Verification: L.H.S.} = \frac{3}{2 \times 2 - (3 - 4 \times 2)} = \frac{3}{4 - (3 - 8)}$$

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

$$= \frac{3}{9} = \frac{1}{3} = \text{R.H.S.}$$

$$15. \frac{5(x + 6) - 15(2 - x)}{3x - 1} = 10$$

$$\Rightarrow \frac{5x + 30 - 30 + 15x}{3x - 1} = 10$$

$$\Rightarrow \frac{20x}{3x - 1} = 10$$

$$\Rightarrow 20x = 10(3x - 1)$$

(By cross multiplication)

$$\Rightarrow 20x = 30x - 10$$

$$\Rightarrow 20x - 30x = -10$$

(By transposing)

$$\Rightarrow -10x = -10$$

$$\Rightarrow \boxed{x = 1}$$

(On dividing both sides by -10)

$$\text{Verification: L.H.S.} = \frac{5(1 + 6) - 15(2 - 1)}{3 \times 1 - 1}$$

$$= \frac{5 \times 7 - 15 \times 1}{3 - 1} = \frac{35 - 15}{2}$$

$$= \frac{20}{2} = 10 = \text{R.H.S.}$$

$$16. \frac{x - 5}{x - 3} = \frac{x - 4}{x - 6}$$

$$\Rightarrow (x - 5)(x - 6) = (x - 3)(x - 4)$$

(By cross multiplication)

$$\Rightarrow x^2 - 11x + 30 = x^2 - 7x + 12$$

(Cancelling x^2 from both sides)

$$\Rightarrow -11x + 30 = 7x + 12$$

$$\Rightarrow -11x + 7x = 12 - 30 \quad (\text{By transposing})$$

$$\Rightarrow -4x = -18$$

$$\Rightarrow x = \frac{-18}{-4} = \frac{9}{2}$$

(On dividing both sides by -4)

$$\Rightarrow \boxed{x = \frac{9}{2}}$$

$$\text{Verification: L.H.S.} = \frac{\frac{9}{2} - 5}{\frac{9}{2} - 3} = \frac{\frac{9 - 10}{2}}{\frac{9 - 6}{2}} = \frac{-\frac{1}{2}}{\frac{3}{2}} = -\frac{1}{3}$$

$$\text{R.H.S.} = \frac{\frac{9}{2} - 4}{\frac{9}{2} - 6} = \frac{\frac{9 - 8}{2}}{\frac{9 - 12}{2}} = \frac{\frac{1}{2}}{-\frac{3}{2}} = -\frac{1}{3}$$

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

$$17. \frac{2}{x + 9} = \frac{-7}{4x - 3}$$

$$\Rightarrow 2(4x - 3) = -7(x + 9)$$

(By cross multiplication)

$$\Rightarrow 8x - 6 = -7x - 63$$

$$\Rightarrow 8x + 7x = -63 + 6 \quad (\text{By transposing})$$

$$\Rightarrow 15x = -57$$

$$\Rightarrow x = \frac{-57}{15} = \frac{-19}{5}$$

(On dividing both sides by 15)

$$\Rightarrow \boxed{x = \frac{-19}{5}}$$

Verification: L.H.S. = $\frac{2}{\frac{-19}{5} + 9} = \frac{2}{\frac{-19 + 45}{5}} = \frac{2}{\frac{26}{5}}$

$$= \frac{10}{26} = \frac{5}{13}$$

R.H.S. = $\frac{-7}{4\left(\frac{-19}{5}\right) - 3} = \frac{-7}{\frac{-76}{5} - 3}$

$$= \frac{-7}{\frac{-76 - 15}{5}} = \frac{-7}{\frac{-91}{5}}$$

$$= \frac{7 \times 5}{91} = \frac{5}{13}$$

L.H.S. = R.H.S.

18. $\frac{2 + 3y}{1 + 5y} = \frac{4}{3}$

$$\Rightarrow 3(2 + 3y) = 4(1 + 5y) \quad (\text{By cross multiplication})$$

$$\Rightarrow 6 + 9y = 4 + 20y$$

$$\Rightarrow 9y - 20y = 4 - 6 \quad (\text{By transposing})$$

$$\Rightarrow -11y = -2$$

$$\Rightarrow \boxed{y = \frac{2}{11}} \quad (\text{On dividing both sides by } -11)$$

Verification: L.H.S. = $\frac{2 + 3\left(\frac{2}{11}\right)}{1 + 5\left(\frac{2}{11}\right)} = \frac{2 + \frac{6}{11}}{1 + \frac{10}{11}} = \frac{\frac{22 + 6}{11}}{\frac{11 + 10}{11}}$

$$= \frac{28}{21} = \frac{28}{21} = \frac{4}{3} = \text{R.H.S.}$$

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

$$\Rightarrow (3x - 2)(5x + 2) = (5x - 1)(3x + 1)$$

$$\Rightarrow 15x^2 + 6x - 10x - 4 = 15x^2 + 5x - 3x - 1$$

$$\Rightarrow \cancel{15x^2} - 4x - 4 = \cancel{15x^2} + 2x - 1$$

(Cancelling $15x^2$ from both sides)

$$\Rightarrow -4x - 4 = 2x - 1$$

$$\Rightarrow -4x - 2x = -1 + 4 \quad (\text{By transposing})$$

$$\Rightarrow -6x = 3$$

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

(On dividing both sides by -6)

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

Verification: L.H.S. = $\frac{3\left(\frac{-1}{2}\right) - 2}{5\left(\frac{-1}{2}\right) - 1} = \frac{\frac{-3}{2} - 2}{\frac{-5}{2} - 1}$

$$= \frac{\frac{-3 - 4}{2}}{\frac{-5 - 2}{2}} = \frac{\frac{-7}{2}}{\frac{-7}{2}} = 1$$

R.H.S. = $\frac{3\left(\frac{-1}{2}\right) + 1}{5\left(\frac{-1}{2}\right) + 2} = \frac{\frac{-3}{2} + 1}{\frac{-5}{2} + 2}$

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

L.H.S. = R.H.S.

EXERCISE 8.4

1. Let the number to be added be x . Therefore,

$$3 \times \left(\frac{-7}{4}\right) + x = \frac{3}{7}$$

$$\Rightarrow \frac{-21}{4} + x = \frac{3}{7}$$

$$\Rightarrow x = \frac{3}{7} + \frac{21}{4} \quad (\text{By transposing } \frac{21}{4})$$

$$\Rightarrow x = \frac{12 + 147}{28}$$

$$\Rightarrow x = \frac{159}{28}$$

Hence, the required number is $\frac{159}{28}$.

2. The lengths of sides of a triangle are $2x$, $2x + 3$ and $2x + 5$.

Perimeter of triangle = Sum of the lengths of sides

$$\Rightarrow 56 = 2x + 2x + 3 + 2x + 5$$

$$\Rightarrow 6x + 8 = 56$$

$$\begin{aligned} \Rightarrow 6x &= 56 - 8 && \text{(By transposing)} \\ \Rightarrow 6x &= 48 \\ \Rightarrow x &= \frac{48}{6} = 8 \\ x &= 8 \end{aligned}$$

Hence, lengths of sides of triangle are $2 \times 8 = 16$, $2 \times 8 + 3 = 19$ and $2 \times 8 + 5 = 21$.

3. Let the required number be x . Then according to the given condition,

$$\begin{aligned} 8x - 3x &= 35 \\ \Rightarrow 5x &= 35 \\ \Rightarrow x &= \frac{35}{5} = 7 \\ \Rightarrow x &= 7 \end{aligned}$$

Hence, the required number is 7.

4. Let the two numbers be $4x$ and $7x$.

$$\begin{aligned} \therefore 7x - 4x &= 9 \\ \Rightarrow 3x &= 9 \\ \Rightarrow x &= 3 \end{aligned}$$

Hence, the required numbers are $4 \times 3 = 12$, $7 \times 3 = 21$.

5. Let the required number be x .

Therefore,
according to condition,

$$\begin{aligned} \frac{x}{3} + \frac{x}{4} + \frac{x}{2} &= 169 \\ \Rightarrow \frac{4x + 3x + 6x}{12} &= 169 \\ & (\because \text{L.C.M. of 3, 4 and 2 is 12}) \\ \Rightarrow \frac{13x}{12} &= 169 \\ \Rightarrow 13x &= 169 \times 12 \\ \Rightarrow x &= \frac{169 \times 12}{13} \\ \Rightarrow x &= 13 \times 12 \\ \Rightarrow x &= 156 \end{aligned}$$

The required number is 156.

6. Let the number of boys in the class be x .

Therefore, number of girls in the class = $\frac{3x}{5}$

Total number of students in the class = $x + \frac{3x}{5}$

$$\begin{aligned} \therefore x + \frac{3x}{5} &= 96 \\ \Rightarrow \frac{5x + 3x}{5} &= 96 \\ \Rightarrow \frac{8x}{5} &= 96 \end{aligned}$$

$$\begin{aligned} \Rightarrow 8x &= 96 \times 5 \\ \Rightarrow x &= \frac{96 \times 5}{8} \\ \Rightarrow x &= 12 \times 5 = 60 \end{aligned}$$

Hence, number of boys = 60

Number of girls = $\frac{3 \times 60}{5} = 36$.

7. Let the three consecutive integers be x , $(x + 1)$ and $(x + 2)$. Therefore, according to condition,

$$\begin{aligned} x + (x + 1) + (x + 2) &= 48 \\ \Rightarrow 3x + 3 &= 48 \\ \Rightarrow 3x &= 48 - 3 && \text{(By transposing)} \\ \Rightarrow 3x &= 45 \\ \Rightarrow x &= \frac{45}{3} = 15 \\ \therefore x + 1 &= 15 + 1 = 16 \\ x + 2 &= 15 + 2 = 17 \end{aligned}$$

Hence, the required three consecutive integers are 15, 16 and 17.

8. The ratio of ages of A and $B = 5 : 7$

Let the ages of A and B be $5x$ and $7x$ respectively.

After 4 years, age of $A = (5x + 4)$ years

and age of $B = (7x + 4)$ years

According to the condition.

$$\begin{aligned} (5x + 4) + (7x + 4) &= 56 \\ \Rightarrow 12x + 8 &= 56 \\ \Rightarrow 12x &= 56 - 8 && \text{(By transposing)} \\ \Rightarrow 12x &= 48 \\ \Rightarrow x &= \frac{48}{12} = 4 \end{aligned}$$

Hence, present age of $A = 5 \times 4 = 20$ years

present age of $B = 7 \times 4 = 28$ years

9. Let the required number be x .

Then, according to the given condition,

$$\begin{aligned} 7x + 7 &= 28 \\ \Rightarrow 7x &= 28 - 7 && \text{(By transposing)} \\ \Rightarrow 7x &= 21 \\ \Rightarrow x &= \frac{21}{7} = 3 \end{aligned}$$

Hence, the required number is 3.

10. Let the present age of Ashwin be x years.

After 20 years, Ashwin's age = $(x + 20)$ years.

Now, as per condition,

$$\begin{aligned} (x + 20) &= 3x \\ \Rightarrow 3x - x &= 20 && \text{(By transposing)} \\ \Rightarrow 2x &= 20 \end{aligned}$$

$$\Rightarrow x = \frac{20}{2} = 10$$

Hence, present age of Ashwin = 10 years.

11. Let the present age of grandson be x years.

Then grandfather's age = $8x$ years.

According to the condition,

$$8x = x + 63$$

$$\Rightarrow 8x - x = 63 \quad (\text{By transposing})$$

$$\Rightarrow 7x = 63$$

$$\Rightarrow x = \frac{63}{7} = 9$$

Hence, age of grandson = 9 years

Age of grandfather $8 \times 9 = 72$ years

12. Let number of ₹1 coins in piggy bank be x . Therefore

Number of 50 p coins = $3x$

$$\begin{aligned} \therefore \text{Total amount} &= ₹1 \times x + 50 \text{ paise} \times 3x \\ &= x \text{ rupees} + 150x \text{ paise} \\ &= 100x \text{ paise} + 150x \text{ paise} \\ &= 250x \text{ paise} \end{aligned}$$

According to the condition,

$$250x \text{ paise} = ₹45$$

$$\Rightarrow 250x \text{ paise} = 4500 \text{ paise}$$

$$\Rightarrow 250x = 4500$$

$$\Rightarrow x = \frac{4500}{250} = 18$$

Hence, number of ₹1 coins = 18 and number of 50 paise coins $3 \times 18 = 54$.

13. The ratio of present ages of Aman and Naman = 4 : 5. Therefore,

Let Aman's present age = $4x$ years and

Naman's present age = $5x$ years.

After 8 years, Aman's age = $(4x + 8)$ years

Naman's age = $(5x + 8)$ years

According to the question,

$$\frac{4x + 8}{5x + 8} = \frac{5}{6}$$

$$\Rightarrow 6(4x + 8) = 5(5x + 8) \quad (\text{By cross multiplication})$$

$$\Rightarrow 24x + 48 = 25x + 40$$

$$\Rightarrow 24x - 25x = 40 - 48 \quad (\text{By transposing})$$

$$\Rightarrow -x = -8$$

$$\Rightarrow x = 8$$

Hence, Aman's present age = $4 \times 8 = 32$ years

and Naman's present age = $5 \times 8 = 40$ years

14. Let the ages of Mohan and Sohan be $5x$ and $7x$.

If Mohan is 9 years older, then his age = $5x + 9$

If Sohan is 9 years younger, then his age = $7x - 9$

According to condition,

$$\frac{5x + 9}{7x - 9} = \frac{2}{1}$$

$$\Rightarrow 5x + 9 = 2(7x - 9) \quad (\text{By cross multiplication})$$

$$\Rightarrow 5x + 9 = 14x - 18$$

$$\Rightarrow 5x - 14x = -18 - 9 \quad (\text{By transposing})$$

$$\Rightarrow -9x = -27$$

$$\Rightarrow x = 3$$

Hence, Mohan's present age = $5 \times 3 = 15$ years

Sohan's present age = $7 \times 3 = 21$ years.

15. Let son's age be x years.

Then, father's age = $3x$ years.

After 15 years,

Son's age = $(x + 15)$ years

Father's age = $(3x + 15)$ years

According to condition,

$$(3x + 15) = 2(x + 15)$$

$$\Rightarrow 3x + 15 = 2x + 30$$

$$\Rightarrow 3x - 2x = 30 - 15 \quad (\text{By transposing})$$

$$\Rightarrow x = 15$$

Hence, Son's age = 15 years

Father's age = $3 \times 15 = 45$ years.

16. Let the digit at ones place be x .

Then, digit at tens place = $3x$

The two digit number formed by these digits

$$= (3x \times 10) + x = 31x$$

And, number formed by reversing the digits

$$= 10 \times x + 3x = 13x$$

According to the question,

$$31x + 13x = 88$$

$$\Rightarrow 44x = 88$$

$$\Rightarrow x = \frac{88}{44} = 2$$

Hence, the required number = $31 \times 2 = 62$.

17. Let the digit at units place be x .

Then, digit at tens place = $2x$

Therefore, the number = $10 \times 2x + x$

$$= 20x + x$$

$$= 21x$$

The number formed by reversing the digits

$$= 10 \times x + 2x$$

$$= 12x$$

According to the question,

$$21x - 18 = 12x$$

$$\Rightarrow 21x - 12x = 18 \quad (\text{By transposing})$$

$$\Rightarrow 9x = 18$$

$$\Rightarrow x = \frac{18}{9} = 2$$

Hence, the required number = $21 \times 2 = 42$.

18. Let the digit at units place be x .

Then, digit at tens place = $3x$

$$\begin{aligned} \text{Therefore, the number} &= 10 \times 3x + x \\ &= 30x + x = 31x \end{aligned}$$

$$\begin{aligned} \text{The number formed by reversing the digits} \\ &= 10 \times x + 3x \\ &= 13x \end{aligned}$$

According to the question,

$$13x = 31x - 36$$

$$\Rightarrow 13x - 31x = -36 \quad (\text{By transposing terms})$$

$$\Rightarrow -18x = -36$$

$$\Rightarrow x = \frac{-36}{-18} = 2$$

Hence, the required number is $31 \times 2 = 62$.

19. Let the denominator of the fraction be x .

Therefore, numerator of the fraction = $x - 4$

$$\therefore \text{The fraction} = \frac{x-4}{x}$$

According to the condition,

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

$$\Rightarrow \frac{x-4-3}{x+5} = \frac{1}{4} \quad (\text{By cross multiplication})$$

$$\Rightarrow \frac{x-7}{x+5} = \frac{1}{4}$$

$$\Rightarrow 4(x-7) = x+5$$

$$\Rightarrow 4x - 28 = x + 5$$

$$\Rightarrow 4x - x = 5 + 28 \quad (\text{By transposing})$$

$$\Rightarrow 3x = 33$$

$$\Rightarrow x = 11$$

$$\text{Numerator} = 11 - 4 = 7$$

$$\text{Denominator} = 11$$

$$\text{Hence, the required fraction} = \frac{7}{11}.$$

20. Let one number be x .

Then, other number = $x + 50$.

Therefore, as per given condition,

$$\frac{x}{x+50} = \frac{2}{3}$$

$$\Rightarrow 3x = 2(x+50) \quad (\text{By cross multiplication})$$

$$\Rightarrow 3x = 2x + 100$$

$$\Rightarrow 3x - 2x = 100$$

$$\Rightarrow x = 100$$

Hence, the required numbers are 100 and 150.

21. Let the breadth of a rectangle be x .

Then, length = $x + 4$

$$\begin{aligned} \therefore \text{Area of rectangle} &= \text{length} \times \text{breadth} \\ &= (x+4) \times x \\ &= (x^2 + 4x) \text{ sq. cm.} \end{aligned}$$

If length and breadth are increased by 3 cm each, then,

$$\text{new length of rectangle} = x + 4 + 3 = (x + 7) \text{ cm}$$

$$\text{new breadth of rectangle} = (x + 3) \text{ cm.}$$

$$\begin{aligned} \text{New area of rectangle} &= (x+7) \times (x+3) \text{ sq. cm} \\ &= (x^2 + 10x + 21) \text{ sq. cm.} \end{aligned}$$

According to given condition,

$$(x^2 + 10x + 21) = (x^2 + 4x) + 81$$

$$\Rightarrow \cancel{x^2} + 10x + 21 = \cancel{x^2} + 4x + 81$$

(Cancelling x^2 from both sides)

$$\Rightarrow 10x + 21 = 4x + 81$$

$$\Rightarrow 10x - 4x = 81 - 21$$

$$\Rightarrow 6x = 60$$

$$\Rightarrow x = 10$$

Hence, breadth of rectangle = 10 cm

length of rectangle = $10 + 4 = 14$ cm.

22. Let the speed of steamer in still water be x km/hr.

Speed of steam = 2 km/hr.

\therefore Speed of steamer during downstream = $(x + 2)$ km/hr.

Speed of steamer during upstream = $(x - 2)$ km/hr.

Now, the distance covered by the steamer during downstream in 4 hours = $4 \times (x + 2)$ km.

The distance covered by the steamer during upstream in 5 hours = $5 \times (x - 2)$ km.

$$(\because \text{speed} = \frac{\text{distance}}{\text{time}})$$

\therefore Distance covered in upstream = distance covered in downstream

$$\therefore 5(x-2) = 4(x+2)$$

$$\Rightarrow 5x - 10 = 4x + 8$$

$$\Rightarrow 5x - 4x = 8 + 10 \quad (\text{By transposing terms})$$

$$\Rightarrow x = 18$$

Hence speed of steamer in still water = 18 km/hr.

MULTIPLE CHOICE QUESTION

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

$$3(3x+5) = 1(2x+1) \quad (\text{By cross multiplication})$$

$$\Rightarrow 9x + 15 = 2x + 1$$

$$\Rightarrow 9x - 2x = 1 - 15$$

$$\Rightarrow 7x = -14$$

$$\Rightarrow x = -2$$

Hence, option (a) is correct.

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

$$\Rightarrow \frac{2}{5}x = \frac{7}{5} - 1 \quad (\text{By transposing } -1)$$

$$\Rightarrow \frac{2}{5}x = \frac{2}{5}$$

$$\Rightarrow x = 1$$

Hence, option (c) is correct.

3. Let the two numbers be $2x$ and $5x$. Therefore,

$$2x + 5x = 21$$

$$\Rightarrow 7x = 21$$

$$\Rightarrow x = 3$$

\therefore The two numbers are 6 and 15.

Hence, option (c) is correct.

4. Let the number be x . Therefore,

$$4x + 8 = 5x - 2$$

$$\Rightarrow 4x - 5x = -2 - 8 \quad (\text{By transposing terms})$$

$$\Rightarrow -x = -10$$

$$\Rightarrow x = 10$$

\therefore The required number is 10.

Hence, option (b) is correct.

5. Let the number be x . Therefore,

$$5x - 7 = 2x + 8$$

$$\Rightarrow 5x - 2x = 8 + 7 \quad (\text{By transposing terms})$$

$$\Rightarrow 3x = 15$$

$$\Rightarrow x = 5$$

\therefore The required number is 5.

Hence, option (b) is correct.

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

$$\Rightarrow \frac{x-3}{5} = -1 + 2 \quad (\text{Transposing } -2)$$

$$\Rightarrow \frac{x-3}{5} = 1$$

$$\Rightarrow x - 3 = 5 \quad (\text{By cross multiplication})$$

$$\Rightarrow x = 5 + 3 \quad (\text{By transposing } -3)$$

$$\Rightarrow x = 8$$

Hence, option (c) is correct.

7. $\frac{x-3}{x+3} = \frac{5}{6}$

$$\Rightarrow 6(x-3) = 5(x+3)$$

(By cross multiplication)

$$\Rightarrow 6x - 18 = 5x + 15$$

$$\Rightarrow 6x - 5x = 15 + 18 \quad (\text{By transposing terms})$$

$$\Rightarrow x = 33$$

Hence, option (a) is correct.

8. Let the number be x . Its successor = $(x + 1)$.

Therefore,

$$x^2 + 15 = (x + 1)^2 - 6$$

$$\Rightarrow x^2 + 15 = x^2 + 2x + 1 - 6$$

(Cancelling x^2 from both sides)

$$\Rightarrow 15 = 2x - 5$$

$$2x = 15 + 5 \quad (\text{By transposing terms})$$

$$\Rightarrow 2x = 20$$

$$\Rightarrow x = 10$$

The number is 10.

Hence, option (b) is correct.

9. Let the number be x . Therefore,

$$35 - x = x - 27$$

$$x + x = 35 + 27$$

(By transposing terms)

$$\Rightarrow 2x = 62$$

$$\Rightarrow x = 31$$

The number is 31.

Hence, option (a) is correct.

10. Let present age be x years. Then age after 14 years = $(x + 14)$ years

Age four years before = $(x - 4)$ years.

Therefore,

$$3(x - 4) = x + 14$$

$$\Rightarrow 3x - 12 = x + 14$$

$$\Rightarrow 3x - x = 14 + 12$$

(By transposing terms)

$$\Rightarrow 2x = 26$$

$$\Rightarrow x = \frac{26}{2} = 13 \text{ years.}$$

Hence, option (c) is correct.

$$11. \frac{x}{2} + \frac{x}{3} - \frac{x}{4} = 14$$

$$\Rightarrow \frac{6x + 4x - 3x}{12} = 14$$

(\because L.C.M. of 2, 3 and 4 is 12)

$$\frac{7x}{12} = 14$$

$$\Rightarrow 7x = 168$$

$$\Rightarrow x = \frac{168}{7} = 24$$

Hence option (d) is correct.

$$12. \frac{x-8}{3} = \frac{x-3}{2}$$

$$\Rightarrow 2(x-8) = 3(x-3)$$

(By cross multiplication)

$$\Rightarrow 2x - 16 = 3x - 9$$

$$\Rightarrow 2x - 3x = -9 + 16$$

(By transposing terms)

$$\Rightarrow -x = 7$$

$$\Rightarrow x = -7$$

Hence, option (b) is correct.

MENTAL MATHS CORNER

Fill in the blanks:

- The equation $5x + 8 = 0$ is an example of **linear** equation.
- The value of the variable for which an equation is true is called the **solution** or **root** of the equation.
- A number which when added to three times of itself gives 20 is **5**.

\because Let the number be x . Therefore,

$$x + 3x = 20$$

$$\Rightarrow 4x = 20$$

$$\Rightarrow x = \frac{20}{4} = 5$$

$$x = 5$$

The number is 5.

- In a linear equation, the degree of variable is **1**.
- A number when multiplied by 4 exceeds itself by 24. The number is **8**.

\because Let the number be x . Therefore,

$$4x - x = 24$$

$$\Rightarrow 3x = 24$$

$$\Rightarrow x = \frac{24}{3} = 8$$

The number is 8.

- $0.4x + 0.5 = 0.3x + 0.6$, then x is **1**.

$$\because 0.4x + 0.5 = 0.3x + 0.6$$

$$\Rightarrow 0.4x - 0.3x = 0.6 - 0.5$$

(By transposing terms)

$$\Rightarrow 0.1x = 0.1$$

$$\Rightarrow x = 1$$

- The sum of two numbers which are in the ratio 5 : 7 is 120. Then the numbers are **50** and **70**.

Let the numbers be $5x$ and $7x$.

$$\because 5x + 7x = 120$$

$$\Rightarrow 12x = 120$$

$$\Rightarrow x = \frac{120}{12}$$

$$x = 10$$

\therefore The numbers are 50 and 70.

- If the value of x is 5, then $3x + 5 = 20$.

$$\because 3 \times 5 + y = 20$$

$$\Rightarrow y = 20 - 15 = 5$$

- Two consecutive natural numbers whose sum is 55 are **27** and **28**.

Let two consecutive numbers be x and $x + 1$.

$$\because x + (x + 1) = 55$$

$$\Rightarrow 2x + 1 = 55$$

$$\Rightarrow 2x = 55 - 1$$

$$\Rightarrow 2x = 54$$

$$\Rightarrow x = 27$$

$$\therefore x + 1 = 27 + 1 = 28$$

- The general form of linear equation is $ax + b = c$, where, $a \neq 0$.

REVIEW EXERCISE

- Let the first number be x .

Then the other number = $43 - x$.

Therefore,

$$x - (43 - x) = 13$$

$$\Rightarrow x - 43 + x = 13$$

$$\Rightarrow 2x - 43 = 13$$

$$\Rightarrow 2x = 13 + 43$$

$$\Rightarrow 2x = 56$$

$$\Rightarrow x = \frac{56}{2} = 28$$

Hence the required numbers are 28 and $43 - 28 = 15$.

2. Let the present ages of husband and wife be $4x$ and $3x$.

Thirty years later,

Husband's age = $(4x + 30)$ years

Wife's age = $(3x + 30)$ years

As per condition,

$$(4x + 30) = (3x + 30) + 10$$

$$\Rightarrow 4x + 30 = 3x + 40$$

$$\Rightarrow 4x - 3x = 40 - 30 \text{ (By transposing terms)}$$

$$\Rightarrow x = 10$$

\therefore Husband's present age = $4 \times 10 = 40$ years

Wife's present age = $3 \times 10 = 30$ years

3. Let the three consecutive multiples of 3 be $3x$, $(3x + 3)$, $(3x + 6)$. Then,

$$3x + (3x + 3) + (3x + 6) = 333$$

$$\Rightarrow 9x + 9 = 333$$

$$\Rightarrow 9x = 333 - 9$$

$$\Rightarrow 9x = 324$$

$$\Rightarrow x = \frac{324}{9} = 36$$

$$\Rightarrow x = 36$$

The three multiples are $3 \times 36 = 108$, $3 \times 36 + 3 = 111$ and $3 \times 36 + 6 = 114$

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

Multiply both sides by 4, the L.C.M. of 2 and 4, we get

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

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

$$\Rightarrow 6x + 12 + 16 = 10x - 8 + 5x$$

$$\Rightarrow 6x - 10x - 5x = -8 - 16 - 12$$

(By transposing)

$$\Rightarrow -9x = -36$$

$$\Rightarrow x = 4$$

To verify: L.H.S. = $\frac{3}{2}(x + 2) + 4$

$$= \frac{3}{2}(4 + 2) + 4$$

$$= \frac{3}{2} \times 6 + 4$$

$$= 3 \times 3 + 4$$

$$= 9 + 4 = 13$$

$$\begin{aligned} \text{R.H.S.} &= \frac{5x - 4}{2} + \frac{5x}{4} \\ &= \frac{5 \times 4 - 4}{2} + \frac{5 \times 4}{4} \\ &= \frac{20 - 4}{2} + \frac{20}{4} \\ &= \frac{16}{2} + 5 \\ &= 8 + 5 = 13 \end{aligned}$$

Hence L.H.S. = R.H.S.

5. $\frac{2x - (7 - 5x)}{9x - (3 + 4x)} = \frac{7}{6}$

$$\Rightarrow \frac{2x - 7 + 5x}{9x - 3 - 4x} = \frac{7}{6}$$

$$\Rightarrow \frac{7x - 7}{5x - 3} = \frac{7}{6}$$

$$\Rightarrow 6(7x - 7) = 7(5x - 3)$$

(By cross multiplication)

$$\Rightarrow 42x - 42 = 35x - 21$$

$$\Rightarrow 42x - 35x = -21 + 42 \quad \text{(By transposing)}$$

$$\Rightarrow 7x = 21$$

$$\Rightarrow x = \frac{21}{7}$$

$$\Rightarrow \boxed{x = 3}$$

6. $\frac{3}{5x} - \frac{2}{3x} = \frac{1}{10}$

$$\Rightarrow \frac{9 - 10}{15x} = \frac{1}{10}$$

$$\Rightarrow \frac{-1}{15x} = \frac{1}{10}$$

$15x = -10$ (By cross multiplication)

$$\Rightarrow x = \frac{-10}{15}$$

$$\Rightarrow \boxed{x = \frac{-2}{3}}$$

7. $(a + 3)(a - 3) - a(a + 5) = 6$

$$\Rightarrow (a^2 - 3^2) - (a^2 + 5a) = 6$$

[$\because (a + b)(a - b) = (a^2 - b^2)$]

$$\Rightarrow \cancel{a^2} - 9 - \cancel{a^2} - 5a = 6$$

$$\Rightarrow -5a - 9 = 6$$

$$\Rightarrow -5a = 6 + 9 \quad \text{(Transposing -9)}$$

$$\begin{aligned} \Rightarrow & -5a = 15 \\ \Rightarrow & a = -\frac{15}{5} = -3 \\ \therefore & \boxed{a = -3} \end{aligned}$$

8. Let the number be x . Therefore,

$$\begin{aligned} \therefore & \frac{4}{5}x = \frac{2}{3}x + 10 \\ \Rightarrow & \frac{4x}{5} - \frac{2x}{3} = 10 \quad (\text{By transposing } \frac{2x}{3}) \\ \Rightarrow & \frac{12x - 10x}{15} = 10 \\ \Rightarrow & \frac{2x}{15} = 10 \\ \Rightarrow & 2x = 150 \\ \Rightarrow & x = \frac{150}{2} = 75 \\ \therefore & \boxed{x = 75} \end{aligned}$$

Hence, the required number is 75.

9. Let three consecutive integers be x , $(x + 1)$ and $(x + 2)$. Then,

$$\begin{aligned} x + (x + 1) + (x + 2) &= 54 \\ \Rightarrow 3x + 3 &= 54 \\ \Rightarrow 3x &= 54 - 3 \quad (\text{Transposing } +3) \\ \Rightarrow 3x &= 51 \\ \Rightarrow x &= 17 \\ \therefore x + 1 &= 17 + 1 = 18 \\ &x + 2 = 17 + 2 = 19 \end{aligned}$$

Hence, required three consecutive integers are 17, 18, 19.

$$\begin{aligned} 10. \quad \frac{3x-2}{4} - \frac{2x+3}{3} &= \frac{2}{3} - x \\ \Rightarrow \frac{3x-2}{4} - \frac{2x+3}{3} + x &= \frac{2}{3} \quad (\text{By transposing } -x) \\ \Rightarrow \frac{3(3x-2) - 4(2x+3) + 12x}{12} &= \frac{2}{3} \\ &(\because \text{L.C.M. of 4 and 3 is 12}) \\ \Rightarrow \frac{9x-6-8x-12+12x}{12} &= \frac{2}{3} \\ \Rightarrow \frac{13x-18}{12} &= \frac{2}{3} \\ \Rightarrow 3(13x-18) &= 2 \times 12 \\ &(\text{By cross multiplication}) \end{aligned}$$

$$\begin{aligned} \Rightarrow 39x - 54 &= 24 \\ \Rightarrow 39x &= 24 + 54 \quad (\text{Transposing } -54) \\ \Rightarrow 39x &= 78 \\ \Rightarrow x &= \frac{78}{39} \\ \therefore & \boxed{x = 2} \end{aligned}$$

$$\begin{aligned} 11. \quad 15(a-4) - 2(a-9) + 5(a+6) &= 0 \\ \Rightarrow 15a - 60 - 2a + 18 + 5a + 30 &= 0 \\ \Rightarrow 18a - 12 &= 0 \\ \Rightarrow 18a &= 12 \quad (\text{By transposing } -12) \\ \Rightarrow a &= \frac{12}{18} \\ \therefore & \boxed{a = \frac{2}{3}} \end{aligned}$$

12. Let the two numbers be $3x$ and $5x$.

Now, as per condition,

$$\begin{aligned} \frac{3x+10}{5x+10} &= \frac{5}{7} \\ \Rightarrow 7(3x+10) &= 5(5x+10) \quad (\text{By cross multiplication}) \\ \Rightarrow 21x + 70 &= 25x + 50 \\ \Rightarrow 21x - 25x &= 50 - 70 \quad (\text{By transposing terms}) \\ \Rightarrow -4x &= -20 \\ \Rightarrow x &= \frac{-20}{-4} = 5 \end{aligned}$$

Hence, the required two numbers are $3 \times 5 = 15$ and $5 \times 5 = 25$.

HOTS QUESTIONS

1. Let three consecutive multiples of 9 be $9x$, $9(x + 1)$ and $9(x + 2)$.

$$\begin{aligned} \text{Therefore, } 9x + 9(x + 1) + 9(x + 2) &= 999 \\ \Rightarrow 9x + 9x + 9 + 9x + 18 &= 999 \\ \Rightarrow 27x + 27 &= 999 \\ \Rightarrow 27x &= 999 - 27 \quad (\text{Transposing } +27) \\ \Rightarrow 27x &= 972 \\ \Rightarrow x &= \frac{972}{27} = 36 \\ \therefore 9x &= 9 \times 36 = 324 \\ \therefore 9(x + 1) &= 9 \times (36 + 1) = 333 \\ \therefore 9(x + 2) &= 9 \times (36 + 2) = 342 \end{aligned}$$

Hence, three required consecutive multiples of 9 are 324, 333 and 342.

Puzzle

$$2. \quad \frac{1.2x + 3.2}{3.2x + 6.4} = \frac{9}{8}$$

$$\Rightarrow 8(1.2x + 3.2) = 9(3.2x + 6.4)$$

$$\Rightarrow 9.6x + 25.6 = 28.8x + 57.6$$

$$\Rightarrow 9.6x - 28.8x = 57.6 - 25.6$$

$$\Rightarrow -19.2x = 32$$

$$\Rightarrow x = \frac{-32}{19.2} = \frac{-320}{192} = -\frac{5}{3}$$

$$\therefore \boxed{x = \frac{-5}{3}}$$

3. Let number of ₹1 coins be x .
 Then number of 50 paise coins = $3x$.
 Total amount = 50 paise \times $3x$ + ₹1 \times x

$$= 150x \text{ paise} + ₹x$$

$$= 150x \text{ paise} + 100x \text{ paise}$$

$$= 250x \text{ paise}$$

$\therefore 250x \text{ paise} = ₹35 = 3500 \text{ paise}$

$$\Rightarrow 250x = 3500$$

$$\Rightarrow x = \frac{3500}{250} = 14$$

$\therefore 3x = 3 \times 14 = 42$
 Hence, number of ₹1 coins = 14
 Number of 50 paise coins = 42.

Let $\star = x$, $\star\star = y$ and $\text{flower} = z$

	C_1	C_2	C_3	C_4	
	↓	↓	↓	↓	
$R_1 \rightarrow$					89
$R_2 \rightarrow$					82
$R_3 \rightarrow$					64
	61	54	52	68	

For Rows :

$$R_1 \equiv x + y + x + z = 89 \Rightarrow 2x + y + z = 89$$

$$R_2 \equiv y + y + z + x = 82 \Rightarrow x + 2y + z = 82$$

$$R_3 \equiv z + z + z + x = 64 \Rightarrow x + 3z = 64$$

For Columns :

$$C_1 \equiv x + y + z = 61$$

$$C_2 \equiv 2y + z = 54$$

$$C_3 \equiv x + 2z = 52$$

$$C_4 \equiv 2x + z = 68$$

Now, subtracting C_4 from R_1 , we get

$$\begin{array}{r} 2x + y + z = 89 \\ - 2x + z = 68 \\ \hline y = 21 \end{array}$$

Again, subtracting C_2 from R_2 , we get

$$\begin{array}{r} x + 2y + z = 82 \\ - 2y + z = 54 \\ \hline x = 28 \end{array}$$

Putting $x = 28$ in R_3 , we get

$$3z = 64 - 28$$

$$\Rightarrow 3z = 36$$

$$\Rightarrow z = 12$$

Hence, $\star = 28$, $\star\star = 21$ and $\text{flower} = 12$.