

Chapter-9

Linear equation in one variable

WS-1

Q1: solve the following equations

$$(i) \frac{p+7}{p-6} = \frac{1}{3}$$

$$\Rightarrow 3(p+7) = 1(p-6)$$

$$\Rightarrow 3p+21 = p-6$$

$$\Rightarrow 3p-p = -6-21$$

$$\Rightarrow 2p = -27$$

$$\Rightarrow p = \frac{-27}{2}$$

Checking -

$$\text{LHS} = \frac{p+7}{p-6}$$

$$\text{put } p = \frac{-27}{2}$$

$$\text{LHS} = \frac{-27+7}{2}$$

$$\frac{-27-6}{2}$$

$$2$$

$$\text{LHS} = \frac{-27+14}{2}$$

$$2$$

$$\frac{-27-12}{2}$$

$$2$$

$$\Rightarrow \frac{12}{3} = \frac{1}{3}$$

$$\Rightarrow \frac{1}{3} = \text{RHS}$$

LHS = RHS

checked

$$(iv) \frac{2x-1}{5x} = \frac{-1}{6}$$

$$\Rightarrow 6(2x-1) = -1(5x)$$

$$\Rightarrow 12x - 6 = -5x$$

$$\Rightarrow 12x + 5x = 6$$

$$\Rightarrow 17x = 6$$

$$\Rightarrow x = \frac{6}{17}$$

Checking

$$\text{LHS} = \frac{2x-1}{5x}$$

put $x = \frac{6}{17}$ in LHS

$$\text{LHS} = \frac{2\left(\frac{6}{17}\right) - 1}{5\left(\frac{6}{17}\right)}$$

$$\text{LHS} = \frac{12 - 17}{17}$$

$$\frac{30}{17}$$

$$= \frac{12-17}{17}$$

$$\frac{30}{17}$$

$$= -\frac{5}{17}$$

$$= -\frac{5}{17}$$

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

$$\text{LHS} = \text{RHS}$$

checked

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

$$\Rightarrow 1(4x+1) = -2(3x-1)$$

$$\Rightarrow 4x+1 = -6x+2$$

$$\Rightarrow 4x+6x = 2-1$$

$$\Rightarrow 10x = 1$$

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

Checking -

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

$$\text{Put } x = \frac{1}{10} \text{ in LHS}$$

$$= \frac{4\left(\frac{1}{10}\right)+1}{3\left(\frac{1}{10}\right)-1}$$

$$= \frac{4}{10} + 1$$

$$= \frac{4}{10} + 1$$

$$\frac{3}{10} - 1$$

$$= \frac{4-10}{10}$$

$$\frac{3-10}{10}$$

$$\frac{3-10}{10}$$

$$\frac{3-10}{10}$$

$$= \frac{1 \times 2}{-7 \times 1}$$

$$= -2 = \text{RHS}$$

$$\text{LHS} = \text{RHS}$$

checked

$$(VI) \frac{4z-3}{2z+1} = \frac{5}{7}$$

$$\Rightarrow 7(4z-3) = 5(2z+1)$$

$$\Rightarrow 28z-21 = 10z+5$$

$$\Rightarrow 28z-10z = 5+21$$

$$\Rightarrow 18z = 26$$

$$\Rightarrow z = \frac{26}{18} = \frac{13}{9}$$

Checking

$$\text{LHS} = \frac{4z-3}{2z+1}$$

$$\frac{4z-3}{2z+1}$$

$$= \frac{4\left(\frac{13}{9}\right)-3}{2\left(\frac{13}{9}\right)+1}$$

$$\frac{4\left(\frac{13}{9}\right)-3}{2\left(\frac{13}{9}\right)+1}$$

$$= \frac{52-27}{18+9}$$

$$\frac{52-27}{18+9}$$

$$\frac{26}{9}$$

$$\frac{26}{9}$$

$$= \frac{52-27}{9}$$

$$\frac{26+9}{9}$$

$$= \frac{255}{357} = \frac{5}{7} = \text{RHS}$$

LHS = RHS

Checked

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

$$\Rightarrow 1(x-2) = 1(6x+1)$$

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

$$\Rightarrow -2-1 = 6x-x$$

$$\Rightarrow -3 = 5x$$

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

Checking -

$$\text{LHS} = \frac{x-2}{6x+1}$$

Put $x = \frac{-3}{5}$ in LHS

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

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

$$= \frac{-13}{-13} = 1 = \text{RHS}$$

$$\frac{-18+5}{5}$$

LHS = RHS

checked

$$= \frac{52 - 27}{9}$$

$$\frac{26 + 9}{9}$$

$$= \frac{255}{357} = \frac{5}{7} = \text{RHS}$$

$$\text{LHS} = \text{RHS}$$

Checked

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

$$\Rightarrow 1(x-2) = 1(6x+1)$$

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

$$\Rightarrow -2-1 = 6x-x$$

$$\Rightarrow -3 = 5x$$

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

Checking -

$$\text{LHS} = \frac{x-2}{6x+1}$$

$$\text{Put } x = \frac{-3}{5} \text{ in LHS}$$

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

$$= \frac{-3 - 10}{8}$$

$$\frac{-18 + 5}{8}$$

$$= \frac{-13}{8} = 1 = \text{RHS}$$

$$\text{LHS} = \text{RHS}$$

checked

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

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

$$\Rightarrow -3x = 5x - 5$$

$$\Rightarrow -3x - 5x = -5$$

$$\Rightarrow -8x = -5$$

$$\Rightarrow x = \frac{-5}{-8} = x = \frac{5}{8}$$

Checking -

$$\text{LHS} = \frac{3x}{5x-5}$$

Put $x = \frac{5}{8}$ in LHS

$$= \frac{3\left(\frac{5}{8}\right)}{5\left(\frac{5}{8}\right) - 5}$$

$$= \frac{15}{8} = \frac{15}{8}$$

$$\frac{(25-5)}{8 \cdot 1} \quad \frac{(25-40)}{8}$$

$$= \frac{15}{8} = -1$$
$$\frac{-15}{8}$$

$$= -1 = \text{RHS}$$

$$\text{LHS} = \text{RHS}$$

Checked

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

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

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

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

$$\Rightarrow x = -6$$

checking-

$$LHS = \frac{2x+3}{5}$$

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

Put $x = -6$ in LHS

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

$$\frac{1(-6)-1}{3}$$

$$= \frac{-12+3}{5}$$

~~$$-6-1$$~~

$$= \frac{-9}{5} = \frac{-21}{5}$$

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

LHS = RHS
checked

$$(x) \quad \frac{3k+5}{4k-3} = \frac{4}{9}$$

$$\Rightarrow 9(3k+5) = 4(4k-3)$$

$$\Rightarrow 27k+45 = 16k-12$$

$$\Rightarrow 27k-16k = -12-45$$

$$\Rightarrow 11k = -57$$

$$\Rightarrow k = \frac{-57}{11}$$

Checking-

$$\text{LHS} = \frac{3k+5}{4k-3} = \frac{4}{9}$$

$$\text{Put } x = \frac{-57}{11} \text{ in LHS}$$

$$= \frac{3\left(\frac{-57}{11}\right)+5}{4\left(\frac{-57}{11}\right)-3}$$

$$= \frac{-171+55}{-228-33}$$

$$= \frac{-116}{-261} = \frac{116}{261}$$

$$= \frac{-171+55}{-228-33}$$

✓

$$= \frac{-116}{-261}$$

✓

$$= \frac{+116}{+261} = \frac{4}{9} = \text{RHS}$$

LHS = RHS
Checked

Excellent ✓

22/10/22

$$\text{VIII} \quad \frac{2x - \frac{3}{4}}{\frac{3x + 4}{5}} = \frac{1}{5}$$

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

$$\Rightarrow \frac{10x - 15}{4} = \frac{3x + 4}{5}$$

$$\Rightarrow 10x - 3x = \frac{4 + 15}{5 \cdot 4}$$

$$\Rightarrow 7x = \frac{16 + 75}{20}$$

$$\Rightarrow 7x = \frac{91}{20}$$

$$\Rightarrow x = \frac{91}{20 \times 7} = \frac{13}{20}$$

Checking-

$$\text{LHS} = \frac{2x - \frac{3}{4}}{\frac{3x + 4}{5}} \quad , \quad \text{Put } x = \frac{13}{20} \text{ in LHS}$$

$$\frac{3x + 4}{5}$$

$$= \frac{2 \times \frac{13}{20} - \frac{3}{4}}{\frac{3 \left(\frac{13}{20} \right) + 4}{5}}$$

$$\frac{3 \left(\frac{13}{20} \right) + 4}{5}$$

$$\Rightarrow \frac{13-3}{10 \quad 4}$$

$$\frac{39+4}{10 \quad 5}$$

$$\Rightarrow \frac{26-15}{20}$$

$$\frac{39+16}{20}$$

$$\Rightarrow \frac{11}{555} = RHS$$

LHS = RHS

Checked

$$(IX) \frac{3x+1}{4} = \frac{7}{4} \frac{x+1}{5}$$

$$\Rightarrow 4 \left(\frac{3x+1}{4} \right) = 7 \left(\frac{x+1}{5} \right)$$

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

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

$$\Rightarrow -4x = \frac{7-20}{5}$$

$$\Rightarrow +4x = \frac{+13}{5}$$

$$\Rightarrow x = \frac{13}{5 \times 4} = \frac{13}{20}$$

Checking-

$$\text{LHS} = \frac{3x+1}{4} \quad , \text{ put } x = \frac{13}{20}$$

$$\frac{x+1}{5}$$

$$= \frac{3 \times 13 + 1}{4 \times 20} = \frac{39 + 1}{80}$$

$$\frac{13 + 1}{20 \times 5}$$

$$\frac{13 + 1}{20 \times 5}$$

$$= \frac{39 + 80}{80} = \frac{49}{80}$$

$$\frac{13 + 4}{20}$$

$$\frac{17}{20}$$

$$= \frac{7}{4} = \text{RHS}$$

$$\text{LHS} = \text{RHS}$$

Checked

$$(X1) \frac{0.5x-4}{2.4x+6} = -\frac{5}{3}$$

$$\Rightarrow 3(0.5x-4) = -5(2.4x+6)$$

$$\Rightarrow 1.5x-12 = -12x-30$$

$$\Rightarrow 1.5x+12x = -30+12$$

$$\Rightarrow 13.5x = -18$$

$$\Rightarrow x = \frac{-18}{13.5}$$

$$\Rightarrow x = \frac{180}{135} \times \frac{1}{3} = \frac{4}{3}$$

checking-

$$\text{LHS} = \frac{0.5x-4}{2.4x+6}, \text{ put } x = \frac{4}{3}$$

$$= \frac{0.5\left(\frac{4}{3}\right)-4}{0.8 \times \frac{4}{3} + 6} = \frac{-2-4}{3+6} = \frac{-6}{9} = -\frac{2}{3}$$

$$= \frac{-2-12}{3} = \frac{-14}{3} = -\frac{5}{3}$$

$$\frac{-9.6+18}{3} = \frac{27.6}{3}$$

$$= -\frac{5}{3}$$

$$\text{LHS} = \text{RHS}$$

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

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

$$\Rightarrow \frac{2}{5x-2} = \frac{1}{2}$$

$$\Rightarrow 5x-2 = 4$$

$$\Rightarrow 5x = 4+2$$

$$\Rightarrow 5x = 6$$

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

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

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

$$= \left(\frac{1-12}{1}\right) + \left(\frac{1+12}{1}\right) = \left(\frac{5-12}{5}\right) + \left(\frac{5+12}{5}\right)$$

$$\left(\frac{24+1}{5}\right) + \left(\frac{6-3}{5}\right) \quad \left(\frac{24+5}{5}\right) + \left(\frac{6-15}{5}\right)$$

$$= \frac{-7}{5} + \frac{17}{5} = \frac{-7+17}{5} = \frac{10}{5} = \frac{2}{1} = \frac{1}{2} = \text{RHS}$$

$$\frac{29}{5} + \frac{-9}{5}$$

$$\frac{29}{5} + \frac{-9}{5}$$

LHS = RHS

checked

$$(XIV) \frac{x^2 - (x+2)(x+3)}{7x+1} = \frac{2}{3}$$

$$\Rightarrow \frac{x^2 - [x^2 + 5x + 6]}{7x+1} = \frac{2}{3}$$

$$\Rightarrow \frac{x^2 - x^2 - 5x - 6}{7x+1} = \frac{2}{3}$$

$$\Rightarrow \frac{-5x - 6}{7x+1} = \frac{2}{3}$$

$$\Rightarrow 2(7x+1) = 3(-5x-6)$$

$$\Rightarrow 14x + 2 = -15x - 18$$

$$\Rightarrow 14x + 15x = -18 - 2$$

$$\Rightarrow 29x = -20$$

$$\Rightarrow x = \frac{-20}{29}$$

Checking-

$$\frac{x^2 - (x+2)(x+3)}{7x+1}$$

$$\text{Put } x = \frac{-20}{29}$$

$$\frac{\left(\frac{-20}{29}\right)^2 - \left(\frac{-20}{29} + 2\right)\left(\frac{-20}{29} + 3\right)}{7\left(\frac{-20}{29}\right) + 1}$$

$$= \frac{\left(\frac{-20}{29}\right)^2 - \left[\left(\frac{-20}{29}\right)^2 + 5\left(\frac{-20}{29}\right) + 6\right]}{7\left(\frac{-20}{29}\right) + 1}$$

$$= \frac{\left(\frac{-20}{29}\right)^2 - \left(\frac{-20}{29}\right)^2 - 5\left(\frac{-20}{29}\right) + 6}{-140 + 1}$$

$$\frac{-140 + 1}{29}$$

$$= \frac{100 - 6}{29}$$

$$= \frac{100 - 174}{29}$$

$$\frac{-140 + 29}{29}$$

$$\frac{-111}{29}$$

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

$$= \text{LHS} = \text{RHS}$$

$$\text{ii) } \frac{x-2}{3 \cdot 5} = \frac{16}{\frac{3-2x}{4} \cdot 15}$$

$$\Rightarrow 15 \left(\frac{x-2}{3 \cdot 5} \right) = 16 \left(\frac{3-2x}{4 \cdot 1} \right)$$

$$\Rightarrow 5x - 6 = 12 - 32x$$

$$\Rightarrow 5x + 32x = 12 + 6$$

$$\Rightarrow 37x = 18$$

$$\Rightarrow x = \frac{18}{37}$$

Checking

$$\text{LHS} = \frac{x}{3} - \frac{2}{5}$$

$$\text{Put } x = \frac{18}{37}$$

$$\frac{3 - 2x}{4}$$

$$= \frac{18}{37} \times \frac{1}{3} - \frac{2}{5}$$

$$\frac{3 - 2 \times \frac{18}{37}}{4}$$

$$= \frac{6}{37} - \frac{2}{5}$$

$$\frac{3 - 36}{4 \times 37}$$

Q2: Find the positive value

$$(i) \frac{3 - x^2}{8 + x^2} = -\frac{3}{4}$$

$$\Rightarrow 4(3 - x^2) = -3(8 + x^2)$$

$$\Rightarrow 12 - 4x^2 = -24 + (-3x^2)$$

$$\Rightarrow -4x^2 + 3x^2 = -24 + 12$$

$$\Rightarrow -x^2 = -12$$

$$\Rightarrow x = 6$$

$$(ii) \frac{y^2+6}{8y^2+3} = \frac{1}{5}$$

$$\Rightarrow 5(y^2+6) = 1(8y^2+3)$$

$$\Rightarrow 5y^2+30 = 8y^2+3$$

$$\Rightarrow 30-3 = 8y^2-5y^2$$

$$\Rightarrow 27 = 3y^2$$

$$\Rightarrow \frac{27}{3} = y^2$$

$$\Rightarrow y = 9$$

$$(iii) \frac{x^2-9}{5+x^2} = \frac{5}{9}$$

$$\Rightarrow 9(x^2-9) = 5(5+x^2)$$

$$\Rightarrow 9x^2-81 = 25+5x^2$$

$$\Rightarrow 9x^2-5x^2 = 25+81$$

$$\Rightarrow 4x^2 = 106$$

$$\Rightarrow x^2 = \frac{106}{4} = 26.5$$

$$\Rightarrow x = \sqrt{\frac{106}{4}}$$

$$(iv) \frac{y^2+4}{3y^2+7} = \frac{1}{2}$$

$$\Rightarrow 2(y^2+4) = 1(3y^2+7)$$

$$\Rightarrow 2y^2+8 = 3y^2+7$$

$$\Rightarrow 8-7 = 3y^2-2y^2$$

$$\Rightarrow 1 = y^2$$

$$\Rightarrow y = 1$$

Q1: Let present ages of a & b be $7x$ yrs and $5x$ yrs respectively

10 years later

Age of A = $(7x+10)$ yrs

Age of B = $(5x+10)$ yrs

$$\frac{7x+10}{5x+10} = \frac{9}{7}$$

$$\Rightarrow 7(7x+10) = 9(5x+10)$$

$$\Rightarrow 49x + 70 = 45x + 90$$

$$\Rightarrow 49x - 45x = 90 - 70$$

$$\Rightarrow 4x = 20$$

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

So present age A of $7x = 7 \times 5 = 35$ yrs

present age of B = $5x = 5 \times 5$

Q2: Let digit at ones place be x and digit at tens place be $8-x$

$$\begin{aligned} \text{Original no.} &= 10 \times \text{Tens place} + \text{ones place} \\ &= 10(8-x) + x \\ &= 80 - 10x + x \\ &= 80 - 9x \quad \text{--- (1)} \end{aligned}$$

On reversing the digits -

ones place = $8-x$

Tens place = x

$$\begin{aligned} \text{New no.} &= 10(x) + 8 - x \\ &= 10x + 8 - x \end{aligned}$$

$$\text{New no.} = 9x + 8 \quad \text{--- (2)}$$

ATQ New no. - Original no. = 18

$$\Rightarrow 9x + 8 - (80 - 9x) = 18$$

$$\Rightarrow 9x + 8 - 80 + 9x = 18$$

$$\Rightarrow 18x - 72 = 18$$

$$\Rightarrow 18x = 18 + 72$$

$$\Rightarrow 18x = 90$$

$$\Rightarrow x = \frac{90}{18} = 5$$

$$\Rightarrow x = 5$$

So ones place = 5

Tens place = 8 - 5 = 3

$$\begin{aligned} \text{Original no.} &= 10 \times 3 + 5 \\ &= 30 + 5 \\ &= 35 \end{aligned}$$

and new no. = 53

So nos are 35, 53

Q4: Let's tens digit be x therefore ones digit = $2x$

$$\begin{aligned} \text{Original no.} &= 10 \times \text{Tens place} + \text{Ones place} \\ &= 10x + 2x \end{aligned}$$

$$\text{original no.} = 12x$$

On reversing the digits ones place = x
Tens place = $2x$

$$\begin{aligned}\text{New no.} &= 10(2x) + x \\ &= 20x + x \\ &= 21x\end{aligned}$$

$$\text{ATQ} = \text{Original no.} + \text{New no.} = 99$$

$$\Rightarrow 12x + 21x = 99$$

$$\Rightarrow 33x = 99$$

$$\Rightarrow x = 3$$

So tens place = 3

$$\text{ones place} = 2 \times 3 = 6$$

$$\begin{aligned}\text{So original no. is } 10 \times 3 + 6 \\ = 36\end{aligned}$$

Q5: Let ones place be x and tens place is $11-x$

$$\begin{aligned}\text{Original no.} &= 10 \times \text{Tens place} + \text{ones place} \\ &= 10(11-x) + x \\ &= 110 - 10x + x \\ &= 110 - 9x\end{aligned}$$

On interchanging the digits

$$\text{ones place} = 11-x$$

$$\text{Tens place} = x$$

$$\begin{aligned}\text{New no.} &= 10 + 11-x \\ &= 9x + 11\end{aligned}$$

ATQ

New no. - Original no. = 27

$$\Rightarrow 9x + 11 - (110 - 9x) = 27$$

$$\Rightarrow 9x + 11 - 110 + 9x = 27$$

$$\Rightarrow 18x - 99 = 27$$

$$\Rightarrow 18x = 126$$

$$\Rightarrow x = \frac{126}{18} = 7$$

So ones place = 7

Tens place = $11 - 7$
= 4

So original no. = $10 \times 4 + 7$
= 47

Q6: Let three consecutive multiples of 7 be $7x, 7x+7, 7x+14$

ATQ

$$\Rightarrow 7x + 7x + 7 + 7x + 14 = 777$$

$$\Rightarrow 21x + 21 = 777$$

$$\Rightarrow 21x = 756$$

$$\Rightarrow x = \frac{756}{21} = 36$$

So req. multiples are

$$7x = 7 \times 36 = 252$$

$$7x + 7 = 252 + 7 = 259$$

$$7x + 14 = 252 + 14 = 266$$

Q8: Let num. be x so deno be $x+7$

Original fraction = $\frac{x}{x+7}$

ATQ

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

$$\Rightarrow 5(x-3) = 1(x+7+2)$$

$$\Rightarrow 5x - 15 = x + 9$$

$$\Rightarrow 5x - x = +9 + 15$$

$$\Rightarrow 4x = 24$$

$$\Rightarrow x = \frac{24}{4} = 6$$

So fraction is $\frac{x}{x+7}$

$$= \frac{6}{6+7}$$

$$= \frac{6}{13}$$

Q9: Let num. be $3x$ & deno. be $4x$

$$\text{So fraction} = \frac{3x}{4x+3} = \frac{3}{5}$$

$$\Rightarrow 5(3x) = 3(4x+3)$$

$$\Rightarrow 15x = 12x + 9$$

$$\Rightarrow 15x - 12x = 9$$

$$\Rightarrow 3x = 9$$

$$\Rightarrow x = 3$$

So fraction is $\frac{3 \times 3}{4 \times 3}$

$$= \frac{9}{12}$$

Q10: Speed of stream = 3 km/hr

Let speed of motorboat in still water be x km/hr

Case of downstream

Net speed = $(x+3)$ km/hr

time = 4 hr

Distance = $S \times T$

$$= 4(x+3) \text{ km}$$
$$= 4x + 12 \text{ --- (1)}$$

Case of upstream

Net speed = $(x-3)$ km/hr

Time = 5 hrs

Distance = $S \times T$

$$= 5(x-3) \text{ km}$$

Distance = $5x - 15$ km --- (2)

Since distance is same in both the cases so equating (1) & (2)

$$\Rightarrow 5x - 15 = 4x + 12$$

$$\Rightarrow 5x - 4x = 12 + 15$$

$$\Rightarrow x = 27$$

So speed of motorboat in still water is 27 km/hr

Q11: Speed of water = 3 km/hr

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

Case of downstream

Net speed = $(x+3)$ km/hr

Time 15 hrs

Distance = $S \times T$

$$= 15(x+3)$$
$$= (15x+45) \text{ km} - \textcircled{1}$$

Case of upstream

$$\text{Net speed} = (x-3) \text{ km/hr}$$

$$\text{Time} = 20 \text{ hrs}$$

$$D = S \times T$$

$$\text{Distance} = 20(x-3)$$
$$= 20x - 60 - \textcircled{2}$$

Since distance is same in both the cases so equating $\textcircled{1}$ & $\textcircled{2}$

$$\Rightarrow 20x - 60 = 15x + 45$$

$$\Rightarrow 20x - 15x = 45 + 60$$

$$\Rightarrow 5x = 105$$

$$\Rightarrow x = \frac{105}{5} = 21$$

Put $x = 21$ in equation $\textcircled{1}$

$$\text{Distance} = 15x + 45$$
$$= 15 \times 21 + 45$$
$$= 315 + 45$$
$$= 360 \text{ km}$$

Q12: Distance between two towns = 300 km

Let speed of 1st car be x km/hr

Speed of 2nd car be $(x+7)$ km/hr

For first car -

$$T = 2 \text{ hr}$$

$$S = x \text{ km/hr}$$

$$= 2x \text{ km}$$

For second car —

$$T = 2 \text{ hrs}$$

$$S = (x + 7) \text{ km/hr}$$

$$D = 2(x + 7) = (2x + 14) \text{ km/hr}$$

Distance between cars after 2 hrs = 34 km

ATQ

$$\Rightarrow 2x + 2x + 14 + 34 = 300$$

$$\Rightarrow 4x + 48 = 300$$

$$\Rightarrow 4x = 300 - 48$$

$$\Rightarrow 4x = 252$$

$$\Rightarrow x = \frac{252}{4} = 63$$

So speed of 1st car 63 km/hr

2nd car $63 + 7 = 70$ km/hr

Q15: Let the 2 positive integers be $2x$ & $5x$

ATQ

$$\Rightarrow 5x - 2x = 30$$

$$\Rightarrow 3x = 30$$

$$\Rightarrow x = \frac{30}{3} = 10$$

\Rightarrow So req. integers are

$$2 \times 10 = 20$$

$$5 \times 10 = 50$$

Q16: Let the two positive integers be $2x$ & $3x$

ATQ

$$\Rightarrow 2x + 3x = 105$$

$$\Rightarrow 5x = 105$$

$$\Rightarrow x = 21$$

So integers are 42, 63

Q13: Let breadth of rectangle be x cm

So length = $(x+18)$ cm

$$\begin{aligned} \text{Original area} &= l \times b \\ &= x(x+18) \\ &= (x^2+18x) \text{ cm}^2 \end{aligned}$$

When length and breadth are increased by 6

$$\begin{aligned} \text{New length} &= x+18+6 \\ &= (x+24) \text{ cm} \end{aligned}$$

$$\text{New Breadth} = (x+6) \text{ cm}$$

$$\begin{aligned} \text{New area} &= (x+24)(x+6) \\ &= (x^2+30x+144) \text{ cm}^2 \end{aligned}$$

ATQ

$$\text{New area} - \text{Original area} = 168$$

$$\Rightarrow (x^2+30x+144) - (x^2+18x) = 168$$

$$\Rightarrow x^2+30x+144 - x^2 - 18x = 168$$

$$\Rightarrow 12x = 168 - 144$$

$$\Rightarrow x = \frac{24}{12} = 2$$

$$\Rightarrow x = 2 \quad \Rightarrow x = 2$$

So breadth = 2 cm

Length = $2+18$

$$= 20 \text{ cm}$$

Q14: Let breadth of rectangle be x cm

So length is $(x+3)$ cm

$$\begin{aligned} \text{Original area} &= l \times b \\ &= x(x+3) \\ &= (x^2+3x) \text{ cm} \end{aligned}$$

New length = $(x+12)$ cm

New Breadth = $(x-5)$ cm

$$\begin{aligned} \text{New area} &= l \times b \\ &= (x+12)(x-5) \\ &= x^2 - 7x - 60 \end{aligned}$$

ATQ

New area = Original area

$$\Rightarrow x^2 + 7x - 60 = x^2 + 3x$$

$$\Rightarrow 7x - 3x = 60$$

$$\Rightarrow 4x = 60$$

$$\Rightarrow x = \frac{60}{4} = 15$$

So breadth is 15 cm

Length is $15 + 3 = 18$ cm

Q17: Let no. of ₹1 coin be $5x$ and no. of ₹2 coin be $6x$

Money formed by ₹1 coins = $1 \times 5x = ₹5x$

Money formed by ₹2 coins = $2 \times 6x = 12x$

ATQ Total money

$$5x + 12x = 85$$

$$\Rightarrow 17x = 85$$

$$\Rightarrow x = \frac{85}{17} = 5$$

So ₹2 coins are $6x = 6 \times 5 = 30$

Q18: Let no. of ₹1 coins be x & no. of ₹2 coins be $\frac{1}{3}x$

Money formed by ₹1 coin = $1 \times x = ₹x$

Money formed by ₹2 coin = $2 \times \frac{1}{3}x = \frac{2x}{3}$

ATQ Total money = ₹115

$$= x + \frac{2x}{3} = 115$$

$$\Rightarrow \frac{3x + 2x}{3} = 115$$

$$\Rightarrow 5x = 115 \times 3$$

$$\Rightarrow x = \frac{115 \times 3}{5}$$

$$\Rightarrow x = 69$$

So ₹ 2 coin value $\frac{1}{3}x = \frac{1}{3} \times 69 = 23$

Value Based Questions

Q1: Let req. distance be x km

case I

when speed = 24 km/hr

$$\text{Time taken} = \frac{D}{S} = \frac{x}{24} \text{ hr}$$

case II

when speed = 30 km/hr

$$\text{Time taken} = \frac{D}{S} = \frac{x}{30} \text{ hr}$$

ATQ

$$\frac{x}{24} - \frac{x}{30} = \frac{9}{60}$$

$$9 \text{ min} = \frac{9}{60} \text{ hrs}$$

$$\Rightarrow \frac{5x - 4x}{120} = \frac{9}{60}$$

$$\Rightarrow \frac{x}{120} = \frac{9}{60}$$

$$\Rightarrow x = \frac{9 \times 120^2}{60} = 18 \text{ km}$$

So req. distance is 18 km

(ii) No it may cause accident.

Q2: Let no. of prizes of discipline be x , therefore no. of prizes for politeness be $\frac{5}{6}x$, no. of prizes for punctuality $\frac{4}{5}$ (Prizes of politeness)

$$= \frac{4}{5} \times \frac{5}{6} x = \frac{2}{3} x$$

Total no. of prizes = 15 ~~ATQ~~

ATQ-

$$\frac{x}{1} + \frac{5x}{6} + \frac{2x}{3} = 15$$

$$\Rightarrow \frac{6x + 5x + 4x}{6} = 15$$

$$\Rightarrow \frac{15x}{6} = 15$$

$$\Rightarrow 15x = 90$$

$$\Rightarrow x = 6$$

So prizes for discipline = 6

$$\begin{aligned} \text{prizes for politeness} &= \frac{5}{6} \times x = \frac{5}{6} \times 6 \\ &= 5 \end{aligned}$$

$$\begin{aligned} \text{prizes for punctuality} &= \frac{2}{3} x = \frac{2}{3} \times 6 \\ &= 4 \end{aligned}$$

(ii) Honesty, Responsible, Sharing etc

Brain Teasers

Q1 (A) Tick

$$a) \frac{5x-4}{3} = \frac{2x}{5}, (2x-7)$$

$$\Rightarrow \frac{25x-20}{3} = \frac{2x}{5}$$

$$\Rightarrow \frac{25x-6x}{15} = 4$$

$$\Rightarrow 19x = 60$$

$$\Rightarrow x = \frac{60}{19}$$

$$\therefore 2x-7$$

$$= 2\left(\frac{60}{19}\right) - 7$$

$$= \frac{120}{19} - 7$$

$$= \frac{120-133}{19} = \frac{-13}{19}$$

b) let two parts of 351 be $2x$ & $7x$

ATQ

$$2x + 7x = 351$$

$$\Rightarrow 9x = 351$$

$$\Rightarrow x = \frac{351}{9} = 39$$

$$\text{So parts are } 2 \times 39 = 78$$

$$7 \times 39 = 273$$

$$\text{So } 78 \times 273 =$$

d)

$$e) \text{ Breadth of rectangle} = 3\frac{3}{4} \text{ cm} = \frac{11}{4}$$

Let length be x

ATQ

$$2(l+b) = lb$$

$$\Rightarrow 2\left(\frac{x+11}{4}\right) = \frac{11x}{4}$$

$$\Rightarrow 2\left(\frac{4x+11}{4}\right) = \frac{11x}{4}$$

$$\Rightarrow 8x + 22 = 11x$$

$$\Rightarrow 8x - 11x = -22$$

$$\Rightarrow +3x = +22$$

$$\Rightarrow x = \frac{22}{3} \text{ cm}$$

B) a) Let the req. no. be x

ATQ

$$\frac{x+30}{5} = \frac{x-30}{4}$$

$$\Rightarrow \frac{x}{5} - \frac{x}{4} = -30 - 30$$

$$\Rightarrow \frac{4x - 5x}{20} = -60$$

$$\Rightarrow \frac{-x}{20} = -60$$

$$\Rightarrow x = 1200$$

b) Total no. of flowers = 30

Let no. of flowers offered in the temple be x

no. of flowers left = $30 - x$

ATQ

$$\frac{30-x}{30} = \frac{2}{5}$$

$$\Rightarrow 30-x = \frac{2}{5} \times 306$$

$$\Rightarrow 30-x = 12$$

$$\Rightarrow -x = -18$$

$$\Rightarrow x = 18$$

$$e) \text{ Total no. of chocolates} = 100$$

$$\text{No. of chocolates left} = 10$$

$$\text{No. of chocolates distributed} = 90$$

Since two chocolates are given to teacher = 2

$$\text{so no. of chocolates given to students} = 88$$

Let there are x students & each get 2 chocolate

$$2x = 88$$

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

so there are 44 students

Q2: solve -

$$(v) \frac{3z-1}{7} = \frac{-3}{14} = \frac{1}{7}$$

$$\frac{z-1}{4}$$

$$\Rightarrow \frac{3z-1}{7} = \frac{1}{7} + \frac{3}{14}$$

$$\frac{z-1}{4}$$

$$\Rightarrow \frac{3z-1}{7} = \frac{5}{14}$$

$$\frac{z-1}{4}$$

$$\Rightarrow 14 \left(\frac{3z-1}{7} \right) = 5 \left(\frac{z-1}{4} \right)$$

$$\Rightarrow 6z-7 = 5z - \frac{5}{4} \quad \Rightarrow 6z-5z = 7 - \frac{5}{4}$$

$$z = \frac{23}{4}$$

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

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

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

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

$$\Rightarrow x+3 = 8 \quad \Rightarrow x = 8-3$$

$$\Rightarrow x = 5$$

$$Q3: (ii) \quad \frac{3z^2 + 7}{4 + z^2} = 2$$

$$\Rightarrow 3z^2 + 7 = 2(4 + z^2)$$

$$\Rightarrow 3z^2 + 7 = 8 + 2z^2$$

$$\Rightarrow 3z^2 - 2z^2 = 8 - 7$$

$$\Rightarrow z^2 = 1 \quad \Rightarrow z = 1$$

Q9: Let speed of stream (water) be x km/hr
Speed of boat in still water = 35 km/hr
Downstream
net speed $(x + 35)$ km/hr
 $D = 60$ km

$$T = \frac{1}{2} \text{ hr} = \frac{3}{2} \text{ hr}$$

$$\text{Speed} = \frac{D}{T}$$

$$\Rightarrow x + 35 = \frac{60 \times 2}{3}$$

$$\Rightarrow x + 35 = 40$$

$$\Rightarrow x = 40 - 35 \quad \Rightarrow x = 5$$

So speed of stream is 5 km/hr

Q10: Let in fig. a right angled triangle ABC

In which $AB = 4x$ cm, $AC = 3x$ cm

By using pythagoras theorem

$$BC^2 = AB^2 + AC^2$$

$$BC^2 = (4x)^2 + (3x)^2$$

$$BC^2 = 16x^2 + 9x^2$$

$$BC^2 = 25x^2$$

$$BC = 5x$$

BCDE is a rectangle

$$\text{length } (l) = 5x \text{ cm}$$

$$\text{Breadth } (b) = \frac{4 \times 5x}{8} = 4x \text{ cm}$$

Perimeter of rectangle = 180 cm

$$2(l+b) = 180$$

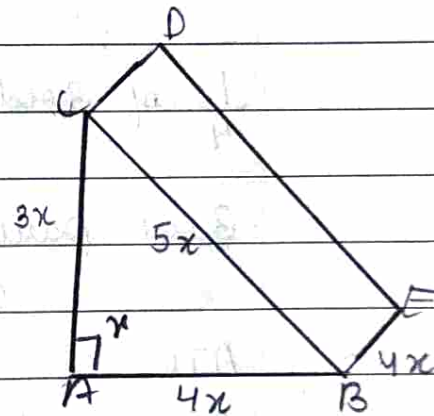
$$2(5x+4x) = 180$$

$$9x = \frac{180}{2}$$

$$x = 10$$

So shortest side of triangle is $3x$

$$= 3 \times 10 = 30$$



Q11: Given no. = 243

$$\frac{1}{2} \text{ of 1st part} = x$$

$$\text{1st part} = 2x$$

$$\frac{1}{3} \text{ of 2nd part} = x$$

$$\text{2nd part} = 3x$$

$$\frac{1}{4} \text{ of 3rd part} = x$$

$$\text{3rd part} = 4x$$

ATQ

$$2x + 3x + 4x = 243$$

$$9x = 243$$

$$x = \frac{243}{9} = 27$$

$$\text{1st part} = 2x = 2 \times 27 = 54$$

$$\text{2nd part} = 3x = 3 \times 27 = 81$$

$$\text{3rd part} = 4x = 4 \times 27 = 108$$

HOTS

Q1: Let avg. no. be x

ATQ

$$x = \left[\left(\frac{x}{3} + \frac{x}{3} + \frac{x}{6} \right) \div 3 \right] + 6$$

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

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

$$x = \frac{x}{3} + 6$$

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

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

$$2x = 18$$

$$x = 9$$

So avg. no. is 9

$$\text{Q2: } \frac{x^2 - 3x - 28}{x^2 - 49} = \frac{3}{17}, \quad x \neq \pm 7$$

$$\Rightarrow \frac{x^2 - 7x + 4x - 28}{x^2 - 7^2} = \frac{3}{17}$$

$$\Rightarrow \frac{x(x-7) + 4(x-7)}{(x+7)(x-7)} = \frac{3}{17}$$

$$\Rightarrow \frac{\cancel{x-7}(x+4)}{(x+7)\cancel{x-7}} = \frac{3}{17}$$

$$\Rightarrow \frac{x+4}{x+7} = \frac{3}{17}$$

$$\Rightarrow 17x + 68 = 3x + 21$$

$$\Rightarrow 17x - 3x = 21 - 68$$

$$\Rightarrow 14x = -47$$

$$\Rightarrow x = \frac{-47}{14}$$

$$\text{B d) } \frac{x^2 - 9}{x+3} = \frac{4}{7}$$

WS-2

Q2: Let present age of son be x yrs
2 years before

$$\text{Age of son} = (x-2) \text{ yrs}$$

$$\begin{aligned} \text{Age of father} &= 3(x-2) \text{ yrs} \\ &= 3x-6 \text{ yrs} \end{aligned}$$

$$\begin{aligned} \text{Present age of father} &= 3x-6+2 \\ &= (3x-4) \text{ yrs} \end{aligned}$$

2 years hence

$$\text{Age of son} = (x+2) \text{ yrs}$$

$$\begin{aligned} \text{Age of father} &= 3x-4+2 \\ &= (3x-2) \text{ yrs} \end{aligned}$$

ATQ

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

$$6x-4 = 5x+10$$

$$6x-5x = 10+4$$

$$1x = 14$$

$$x = 14$$

$$\begin{aligned}
 \text{So present age of son} &= 14 \\
 \text{Present age of father} &= 3x - 4 \\
 &= 3 \times 14 - 4 \\
 &= 42 - 4 \\
 &= 38 \text{ yrs}
 \end{aligned}$$

Brain Teasers

Q4: Let age of daughter 5 years ago be x yrs
 Age of mother 5 years ago be $7x$ yrs

$$\begin{aligned}
 \text{So present age of daughter} &= (x + 5) \text{ yrs} \\
 \text{Present age of mother} &= (7x + 5) \text{ yrs}
 \end{aligned}$$

5 years hence

$$\begin{aligned}
 \text{Age of daughter} &= x + 5 + 5 = (x + 10) \text{ yrs} \\
 \text{Age of mother} &= (7x + 5 + 5) \\
 &= (7x + 10) \text{ yrs}
 \end{aligned}$$

ATQ

$$\begin{aligned}
 7x + 10 &= 3(x + 10) \\
 \Rightarrow 7x + 10 &= 3x + 30 \\
 \Rightarrow 7x - 3x &= 30 - 10 \\
 \Rightarrow 4x &= 20 \\
 \Rightarrow x &= \frac{20}{4} = 5
 \end{aligned}$$

$$\begin{aligned}
 \text{So present age of daughter} &= x + 5 \\
 &= 5 + 5 \\
 &= 10 \text{ yrs}
 \end{aligned}$$

$$\begin{aligned} \text{Present age of mother} &= 7x + 5 \\ &= 7 \times 5 + 5 \\ &= 40 \text{ yrs} \end{aligned}$$

Brain Teasers

Q2: Solve

$$(i) \frac{2z+7}{3z+8} = \frac{1}{4}$$

$$\Rightarrow 4(2z+7) = 1(3z+8)$$

$$\Rightarrow 8z+28 = 3z+8$$

$$\Rightarrow 8z-3z = 8-28$$

$$\Rightarrow 5z = -20$$

$$\Rightarrow z = \frac{-20}{5} \quad z = -4$$

$$(ii) \frac{3+2y}{2+5y} = \frac{7}{12}$$

$$\Rightarrow 12(3+2y) = 7(2+5y)$$

$$\Rightarrow 36+24y = 14+35y$$

$$\Rightarrow 24y-35y = 14-36$$

$$\Rightarrow -11y = -22$$

$$\Rightarrow y = \frac{22}{11} \quad \Rightarrow y = 2$$

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

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

$$\Rightarrow 4x-2 = 1+5x$$

$$\Rightarrow 4x-5x = 1+2$$

$$\Rightarrow -x = 3$$

$$\Rightarrow x = -3$$

$$(iv) \frac{5k-7}{3k-9} = \frac{-6}{7}$$

$$\Rightarrow 7(5k-7) = -6(3k-9)$$

$$\Rightarrow 35k-49 = -18k+54$$

$$\Rightarrow 35k+18k = 54+49$$

$$\Rightarrow 53k = 103$$

$$\Rightarrow k = \frac{103}{53}$$

$$(VI) \frac{p-2}{5} = \frac{5}{p+\frac{2}{5}}$$

$$\Rightarrow 1\left(\frac{p-2}{5}\right) = 5\left(p+\frac{2}{5}\right)$$

$$\Rightarrow p - \frac{2}{5} = 5p + 2$$

$$\Rightarrow p - 5p = 2 + \frac{2}{5}$$

$$\Rightarrow -4p = \frac{10+2}{5}$$

$$\Rightarrow -4p = \frac{12}{5}$$

$$\Rightarrow p = \frac{12}{5 \times (-4)} = \frac{-12}{20} = \frac{-3}{5}$$

Q3: Find the positive value

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

$$\Rightarrow 5(1-x^2) = -4(1+x^2)$$

$$\Rightarrow 5 - 5x^2 = -4 - 4x^2$$

$$\Rightarrow -5x^2 - 4x^2 = -4 - 5$$

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

$$\Rightarrow +x^2 = +9$$

$$\Rightarrow x = 3$$

Q5: Let digit at tens place be x & digit at ones place be $4x$

$$\begin{aligned} \text{Original no.} &= 10x + 4x = 14x \\ &= 14x \end{aligned}$$

On reversing the digits =

$$\text{Digit at tens place} = 4x$$

$$\text{Digit at ones place} = x$$

$$\text{New no.} = 10 \times 4x + 1 \times x$$

$$= 40x + x = 41x$$

ATQ

$$14x = 41x = 54$$

$$\Rightarrow 41x - 14x = 54$$

$$\Rightarrow 27x = 54$$

$$\Rightarrow x = \frac{54}{27}$$

$$27$$

$$\Rightarrow x = 2$$

original no.

$$= 14 \times 2$$

$$= 28$$

Q6: Sum of digits of 2 digit no. = 10

Let digit at ones place be x & digit at tens place be $(10-x)$

$$\begin{aligned} \text{Original no.} &= 10(10-x) + x \\ &= 100 - 10x + x \end{aligned}$$

$$= 100 - 9x$$

$$= -9x + 100$$

On interchanging the digits -

$$\text{Digit at ones place} = (10-x)$$

$$\text{Digit at tens place} = x$$

$$\text{New no.} = 1(10-x) + 10x$$

$$= 10-x+10x$$

$$= 9x+10$$

ATQ

$$-9x+100+36 = 9x+10$$

$$\Rightarrow -9x+136 = 9x+10$$

$$\Rightarrow -9x-9x = 10-136$$

$$\Rightarrow -18x = -126$$

$$\Rightarrow x = \frac{126}{18} = 7$$

$$181$$

Original no. -

$$= -9 \times 7 + 100$$

$$= -63 + 100$$

$$= 37$$

Q7: Let 2 consecutive multiples of 6 = $6x, 6(x+1)$

ATQ

$$6x + 6(x+1) = 66$$

$$\Rightarrow 6x + 6x + 6 = 66$$

$$\Rightarrow 12x = 66 - 6$$

$$\Rightarrow 12x = 60$$

$$\Rightarrow x = \frac{60}{12}$$

$$5$$

$$\Rightarrow x = 5$$

2 consecutive multiples of 6 are

$$= 6 \times 5 = 30$$

$$= 6(5+1) = 36$$

Q8: Let denominator be x & numerator be $x-3$

$$\text{Rational no.} = \frac{x-3}{x}$$

on increasing numerator by 1
and increasing denominator by 3

$$\text{New rational no.} = \frac{x-3+1}{x+3}$$

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

ATQ

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

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

$$\Rightarrow 2x-4 = 1x+3$$

$$\Rightarrow 2x-x = 3+4$$

$$\Rightarrow x = 7$$

denominator be x & numerator be $x-3$

denominator = 7 & numerator 4