

Chapter 7. Linear Equations

Ex 7.1

Answer 1.

(i) $5x-2=18$; $x=4$

We know a value is a solution of the equation if it satisfies the equation.

i.e., x_1 is a solution if $f(x_1)=0$

Here, $x_1=4$. Put in $5x-2=18$

we get LHS=RHS.

Thus, $x=4$ is a solution of the equation $5x-2=18$

(ii) $2x-5=3x$; $x=3$

Can be written as: $x=-5$, which is not satisfied by $x=3$.

Thus, $x=3$ is not a solution of $2x-5=3x$.

(iii) $3x+8=x-7$; $x=3$

Can be written as: $2x+15=0$

Putting, $x=3$, we get LHS=RHS.

Thus, $x=3$ is a solution of the equation $3x+8=x-7$

(iv) $2\frac{1}{2}x + 3\frac{1}{2}x = 56 - 2x$; $x = 7$

Simplifying, we get:

$$\Rightarrow \frac{5}{2}x + \frac{7}{2}x = 56 - 2x$$

$$\Rightarrow \frac{12}{2}x + 2x = 56$$

$$\Rightarrow 8x = 56$$

$$\Rightarrow x = 7$$

Put $x=7$ in above gives, LHS=RHS.

Thus, $x=7$ is a solution of the equation $2\frac{1}{2}x + 3\frac{1}{2}x = 56 - 2x$; $x = 7$

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

Simplifying, we get:

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

$$\Rightarrow 3x+2 = 8$$

$$\Rightarrow 3x = 6$$

$$\Rightarrow x = 2$$

Thus, $x=2$ is a solution of the equation $\frac{3x-1}{4} + \frac{3}{4} = 2$; $x = 2$

Answer 2.

(i) $3x+8=35$

Collecting like terms, $3x=27$

$\Rightarrow x=9.$

(ii) $8x-21=3x-11$

Collecting like terms,

$8x-3x=21-11$

$\Rightarrow 5x=10$

$\Rightarrow x=2$

(iii) $2x-(3x-4)=3x-4$

Collecting like terms,

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

$\Rightarrow -4x=-8$

$\Rightarrow x=2$

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

Collecting like terms,

$\Rightarrow x=4\sqrt{2}+4=4(\sqrt{2}+1)$

(v) $15y-20=2y+6$

Collecting like terms,

$13y=26$

$\Rightarrow y=2$

(vi) $5x+10-4x+6=12x+20-3x+12$

Collecting like terms,

$\Rightarrow x+16=9x+32$

$\Rightarrow 8x=-16$

$\Rightarrow x=-2$

$$(vii)(a+2)(2a+5)=2(a+1)^2+13$$

Collecting like terms,

$$\Rightarrow a(2a+5)+2(2a+5)=2a^2+2+4a+13$$

$$\Rightarrow 2a^2+5a+4a+10-(2a^2+4a+15)=0$$

$$\Rightarrow 5a+10-15=0$$

$$\Rightarrow a=1 \text{ is the unknown.}$$

$$(viii) (6p+9)^2+(8p-7)^2=(10p+3)^2-71$$

$$(6p+9)^2+(8p-7)^2=(10p+3)^2-71$$

$$[36p^2+81+2(6p)(9)]+[64p^2+49-2(8p)(7)]=100p^2+9+2(10p)(3)-71$$

$$\Rightarrow 100p^2+130+2 \times 54p-2 \times 56p=100p^2+9+71+60p$$

Collecting like terms ,

$$\Rightarrow 130+71-9=60p+4p$$

$$\Rightarrow 192=64p$$

$$\Rightarrow p=3$$

$$(ix) (3x-1)^2+(4x+1)^2=(5x+1)^2+5$$

Opening squares, we get:

$$[9x^2+1+2(3x)(1)]+[16x^2+1+2(4x)(1)]=[25x^2+1+2(5x)(1)]+5$$

$$\Rightarrow 25x^2+2+8x+6x=25x^2+6+10x$$

$$\Rightarrow 4x=4$$

$$\Rightarrow x=1$$

$$(x) 3(3x-4)-2(4x-5)=6$$

Simplifying by Collecting like terms,

$$9x-8x=6+12-10$$

$$\Rightarrow x=8$$

Answer 3A.

$$\frac{4x}{27} = \frac{8}{9}$$

$$\therefore (4x)(9) = (8)(27)$$

$$\therefore x = \frac{8 \times 27}{4 \times 9}$$

$$\therefore x = \frac{2 \times 3}{1 \times 1}$$

$$\therefore x = 6$$

Answer 3B.

$$\frac{1.5y}{3} = \frac{7}{2}$$

$$\therefore (1.5y)(2) = (7)(3)$$

$$\therefore y = \frac{7 \times 3}{1.5 \times 2}$$

$$\therefore y = \frac{70 \times 3}{15 \times 2}$$

$$\therefore y = 7$$

Answer 3C.

$$-\frac{3.4m}{2.7} = \frac{10.2}{9}$$

$$\therefore (-3.4m)(9) = (10.2)(2.7)$$

$$\therefore y = -\frac{10.2 \times 2.7}{3.4 \times 9}$$

$$\therefore y = -\frac{102 \times 27}{34 \times 9 \times 10}$$

$$\therefore y = -\frac{3 \times 3}{1 \times 1 \times 10}$$

$$\therefore y = -0.9$$

Answer 3D.

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

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

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

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

$$\Rightarrow \frac{p}{4} = -3$$

$$\Rightarrow p = (-3)(4)$$

$$\Rightarrow p = -12$$

Answer 3E.

$$\frac{9y}{4} - \frac{5y}{3} = \frac{1}{5}$$

$$\Rightarrow \frac{27y - 20y}{12} = \frac{1}{5}$$

$$\Rightarrow \frac{7y}{12} = \frac{1}{5}$$

$$\Rightarrow (7y)(5) = 12$$

$$\Rightarrow y = \frac{12}{7 \times 5}$$

$$\Rightarrow y = \frac{12}{35}$$

Answer 3F.

$$\frac{x}{2} + \frac{x}{4} + \frac{x}{8} = 7$$

$$\Rightarrow \frac{4x + 2x + x}{8} = 7$$

$$\Rightarrow \frac{7x}{8} = 7$$

$$\Rightarrow 7x = (7)(8)$$

$$\Rightarrow x = \frac{7 \times 8}{7}$$

$$\Rightarrow x = 8$$

Answer 3G.

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

$$\therefore \frac{4m - 3m}{6} = 1$$

$$\therefore 4m - 3m = 6$$

$$\therefore m = 6$$

Answer 3H.

$$\frac{2(2x - 1)}{9} - \frac{x - 1}{2} = 0$$

$$\Rightarrow \frac{4x - 2}{9} - \frac{x - 1}{2} = 0$$

$$\Rightarrow \frac{4x - 2}{9} = \frac{x - 1}{2}$$

$$\Rightarrow 2(4x - 2) = 9(x - 1)$$

$$\Rightarrow 8x - 4 = 9x - 9$$

$$\Rightarrow x = 5$$

Answer 3I.

$$\frac{4}{5}x - 21 = \frac{3}{4}x - 20$$

$$\Rightarrow \frac{4}{5}x - \frac{3}{4}x = 21 - 20$$

$$\Rightarrow \frac{16x}{20} - \frac{15x}{20} = 21 - 20$$

$$\Rightarrow \frac{16x - 15x}{20} = 1$$

$$\Rightarrow 16x - 15x = 20$$

$$\Rightarrow x = 20$$

Answer 3J.

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

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

Take the LCM of all the denominators, that is, 2 and 3 which is 6.

Multiply throughout by the LCM

$$\Rightarrow 3(a-1) - 2(a+1) + 6a = 30$$

$$\Rightarrow 3a - 3 - 2a - 2 + 6a = 30$$

$$\Rightarrow 7a = 35$$

$$\Rightarrow a = 5$$

Answer 4A.

$$\frac{5}{x} - 11 = \frac{2}{x} + 16, x \neq 0$$

$$\Rightarrow \frac{5}{x} - \frac{2}{x} = 11 + 16$$

$$\Rightarrow \frac{5-2}{x} = 27$$

$$\Rightarrow \frac{3}{x} = 27$$

$$\Rightarrow x = \frac{3}{27}$$

$$\Rightarrow x = \frac{1}{9}$$

Answer 4B.

$$11 - \frac{3}{x} = \frac{5}{x} + 3$$

$$\Rightarrow 11 - 3 = \frac{5}{x} + \frac{3}{x}$$

$$\Rightarrow \frac{5}{x} + \frac{3}{x} = 11 - 3$$

$$\Rightarrow \frac{5+3}{x} = 8$$

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

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

$$\Rightarrow x = 1$$

Answer 4C.

$$\frac{5}{3x-2} - \frac{1}{8} = 0, x \neq 0, x \neq \frac{2}{3}$$

$$\Rightarrow \frac{5}{3x-2} = \frac{1}{8}$$

$$\Rightarrow 40 = 3x - 2$$

$$\Rightarrow 3x = 42$$

$$\Rightarrow x = 14$$

Answer 4D.

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

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

$$\Rightarrow \frac{1}{x-1} = \frac{10}{15} - \frac{12}{15}$$

$$\Rightarrow \frac{1}{x-1} = \frac{-2}{15}$$

$$\Rightarrow 15 = -2(x-1)$$

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

$$\Rightarrow 2x = -13$$

$$\Rightarrow x = \frac{-13}{2}$$

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

Answer 4E.

$$\frac{7}{x-2} - \frac{5}{3} = 3, x \neq 2$$

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

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

$$\Rightarrow \frac{7}{x-2} = \frac{14}{3}$$

$$\Rightarrow 21 = 14(x-2)$$

$$\Rightarrow 21 = 14x - 28$$

$$\Rightarrow 49 = 14x$$

$$\Rightarrow x = \frac{49}{14}$$

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

Answer 4F.

$$\frac{2x+3}{x+7} = \frac{5}{8}, x \neq -7$$

$$\Rightarrow 8(2x+3) = 5(x+7)$$

$$\Rightarrow 16x + 24 = 5x + 35$$

$$\Rightarrow 11x = 11$$

$$\Rightarrow x = 1$$

Answer 4G.

$$\frac{3x-5}{7x-5} = \frac{1}{9}, x \neq \frac{5}{7}$$

$$\Rightarrow 9(3x-5) = 7x-5$$

$$\Rightarrow 27x - 45 = 7x - 5$$

$$\Rightarrow 20x = 40$$

$$\Rightarrow x = 2$$

Answer 4H.

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

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

LCM of all the denominators in the equation is $(x-1)(x+1)$.

Multiply throughout by the LCM.

$$3(x-1) - (x-6) = 12(x+1)$$

$$\Rightarrow 3x - 3 - x + 6 = 12x + 12$$

$$\Rightarrow 3x - 12x - x = 12 - 6 + 3$$

$$\Rightarrow -10x = 9$$

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

Answer 4I.

$$\frac{x+13}{x^2-1} + \frac{5}{x+1} = \frac{7}{x+1}$$

$$\Rightarrow \frac{x+13}{(x-1)(x+1)} + \frac{5}{x+1} = \frac{7}{x+1}$$

LCM of all the denominators in the equation is $(x-1)(x+1)$.

Multiply throughout by the LCM.

$$x+13+5(x-1) = 7(x-1)$$

$$\Rightarrow x+13+5x-5 = 7x-7$$

$$\Rightarrow 13-5+7 = 7x-5x-x$$

$$\Rightarrow x = 15$$

Answer 4J.

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

$$\Rightarrow (6x+7)(2x+3) = (4x+5)(3x+2)$$

$$\Rightarrow 6x(2x+3) + 7(2x+3) = 4x(3x+2) + 5(3x+2)$$

$$\Rightarrow 12x^2 + 18x + 14x + 21 = 12x^2 + 8x + 15x + 10$$

$$\Rightarrow 18x + 14x + 21 = 8x + 15x + 10$$

$$\Rightarrow 18x - 8x + 14x - 15x = 10 - 21$$

$$\Rightarrow 9x = -11$$

$$\Rightarrow x = -\frac{11}{9}$$

Answer 4K.

$$\begin{aligned}2\frac{1}{5} - \frac{x-2}{3} &= \frac{x-1}{3} \\ \Rightarrow \frac{11}{5} - \frac{x-2}{3} &= \frac{x-1}{3} \\ \Rightarrow \frac{11}{5} &= \frac{x-1}{3} + \frac{x-2}{3} \\ \Rightarrow \frac{11}{5} &= \frac{x-1+x-2}{3} \\ \Rightarrow \frac{11}{5} &= \frac{2x-3}{3} \\ \Rightarrow 10x - 15 &= 33 \\ \Rightarrow 10x &= 48 \\ \Rightarrow x &= 4.8\end{aligned}$$

Answer 4L.

$$\begin{aligned}\frac{1}{2}\left(y - \frac{1}{3}\right) + \frac{1}{4}\left(2y + \frac{1}{5}\right) &= \frac{3}{4}\left(y - \frac{1}{12}\right) \\ \Rightarrow \frac{y}{2} - \frac{1}{6} + \frac{y}{2} + \frac{1}{20} &= \frac{3y}{4} - \frac{1}{16} \\ \Rightarrow \frac{y}{2} + \frac{y}{2} - \frac{3y}{4} &= -\frac{1}{16} + \frac{1}{6} - \frac{1}{20} \\ \Rightarrow y - \frac{3y}{4} &= -\frac{1}{16} + \frac{1}{6} - \frac{1}{20} \\ \Rightarrow \frac{4y - 3y}{4} &= -\frac{-15 + 40 - 12}{240} \\ \Rightarrow \frac{y}{4} &= \frac{13}{240} \\ \Rightarrow y &= \frac{13}{240} \times 4 \\ \Rightarrow y &= \frac{13}{60}\end{aligned}$$

Answer 4M.

$$\begin{aligned}
2 + \frac{3x-2}{3x+2} &= \frac{3x+2}{x+1} \\
\Rightarrow 2 &= \frac{3x+2}{x+1} - \frac{3x-2}{3x+2} \\
\Rightarrow 2 &= \frac{(3x+2)(3x+2) - (3x-2)(x+1)}{(x+1)(3x+2)} \\
\Rightarrow 2(x+1)(3x+2) &= (3x+2)(3x+2) - (3x-2)(x+1) \\
\Rightarrow 2[3x^2 + 2x + 3x + 2] &= [9x^2 + 6x + 6x + 4] - [3x^2 + 3x - 2x - 2] \\
\Rightarrow 6x^2 + 4x + 6x + 4 &= 9x^2 + 6x + 6x + 4 - 3x^2 - 3x + 2x + 2 \\
\Rightarrow 4x &= 6x - 3x + 2x + 2 \\
\Rightarrow -x &= 2 \\
\Rightarrow x &= -2
\end{aligned}$$

Answer 4N.

$$\begin{aligned}
\frac{7x-1}{4} - \frac{1}{3} \left(2x - \frac{1-x}{2} \right) &= 5\frac{1}{3} \\
\Rightarrow \frac{7x-1}{4} - \frac{2x}{3} + \frac{1-x}{6} &= \frac{16}{3}
\end{aligned}$$

LCM of all the denominators is 12.

Multiply the equation throughout by the LCM.

$$\begin{aligned}
\Rightarrow \frac{3(7x-1)}{12} - \frac{4(2x)}{12} + \frac{2(1-x)}{12} &= 16(4) \\
\Rightarrow \frac{21x-3}{12} - \frac{8x}{12} + \frac{2-2x}{12} &= 64 \\
\Rightarrow 21x-3-8x+2-2x &= 64 \\
\Rightarrow 11x &= 64+3-2 \\
\Rightarrow 11x &= 65 \\
\Rightarrow x &= \frac{65}{11}
\end{aligned}$$

Answer 5A.

$$\begin{aligned}
\sqrt{x-5} &= 3 \\
\text{Squaring both sides} \\
\Rightarrow x-5 &= (3)^2 \\
\Rightarrow x-5 &= 9 \\
\Rightarrow x &= 9+5 \\
\Rightarrow x &= 14
\end{aligned}$$

Answer 5B.

$$7 - \frac{1}{\sqrt{y}} = 0$$

$$\Rightarrow 7 = \frac{1}{\sqrt{y}}$$

Squaring both sides

$$\Rightarrow (7)^2 = \frac{1}{y}$$

$$\Rightarrow 49 = \frac{1}{y}$$

$$\Rightarrow y = \frac{1}{49}$$

Answer 5C.

$$\frac{1}{5} = \frac{3\sqrt{x}}{3}$$

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

Squaring both sides

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

$$\Rightarrow x = \frac{1}{25}$$

Answer 5D.

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

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

$$\Rightarrow 4\left(\frac{x-3}{x+5}\right) = \frac{1}{9}$$

$$\Rightarrow \frac{4x-12}{x+5} = \frac{1}{9}$$

$$\Rightarrow 9(4x-12) = x+5$$

$$\Rightarrow 36x - 108 = x + 5$$

$$\Rightarrow 35x = 113$$

$$\Rightarrow x = \frac{113}{35}$$

Answer 6.

$$\frac{2}{m} \times 1\frac{1}{5} = \frac{3}{7} \text{ of } 2\frac{1}{2}$$

$$\text{means } \frac{2}{m} \times 1\frac{1}{5} = \frac{3}{7} \times 2\frac{1}{2}$$

$$\Rightarrow \frac{2}{m} \times \frac{6}{5} = \frac{3}{7} \times \frac{5}{2}$$

$$\Rightarrow \frac{12}{5m} = \frac{15}{14}$$

$$\Rightarrow (12)(14) = (15)(5m)$$

$$\Rightarrow \frac{12 \times 14}{15 \times 5} = m$$

$$\Rightarrow m = \frac{56}{25}$$

Answer 7.

$$(i) a(x-2a)+b(x-2b)=4ab$$

On simplyfying, we get :

$$\Rightarrow xa - 2a^2 + bx - 2b^2 = 4ab$$

$\Rightarrow$ On Collecting like terms, we get :

$$\Rightarrow x(a+b) = 4ab + 2(a^2 + b^2)$$

$$\Rightarrow x = \frac{2(a^2 + b^2 + 2ab)}{(a+b)} = \frac{2(a+b)^2}{(a+b)} = 2(a+b)$$

$$(ii) a(x-b)-b(x-a)=a^2-b^2$$

On simplyfying, we get :

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

$$\Rightarrow (a-b)x = a^2 - b^2$$

$$\Rightarrow x = (a+b)$$

$$(iii) a(x-b)-x(x-2b)=x+5(x-b)$$

On simplyfying, we get :

$$\Rightarrow ax - ab - x + 2b = x + 5x - 5b$$

$$\Rightarrow -ab + 2b + 5b = 6x + x - ax$$

$$\Rightarrow (7-a)b = (7-a)x$$

$$\Rightarrow x = b$$

$$(iv) 8x + a(x - b) = 10(ax - b)$$

$$\Rightarrow 8x + ax - ab - 10ax + 10b = 0$$

$$\Rightarrow 8x - 9ax = ab - 10b$$

$$\Rightarrow x(8 - 9a) = b(a - 10)$$

$$\Rightarrow x = \frac{b(a - 10)}{(8 - 9a)}$$

$$(v) a(2x - b) - b(3x - a) + a(x + 1) = b(x + 5)$$

On simplifying, we get :

$$2ax - ab - 3bx + ab + ax + a = bx + 5b$$

$$\Rightarrow 3ax - 4bx = 5b - a$$

$$\Rightarrow x(3a - 4b) = 5b - a$$

$$\Rightarrow x = \frac{5b - a}{(3a - 4b)}$$

Answer 8.

$$7(3 - 4x) = 1$$

$$\Rightarrow 21 - 28x = 1$$

$$\Rightarrow 20 = 28x$$

$$\Rightarrow x = \frac{20}{28}$$

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

$$\begin{aligned} 2x^2 + 7x + 6 &= 2\left(\frac{5}{7}\right)^2 + 7\left(\frac{5}{7}\right) + 6 \\ &= 2\left(\frac{25}{49}\right) + 7\left(\frac{5}{7}\right) + 6 \\ &= \frac{50}{49} + 5 + 6 \\ &= \frac{50}{49} + 11 \\ &= \frac{50 + 539}{49} \\ &= \frac{589}{49} \end{aligned}$$

Answer 9.

$$\text{Given } a = \frac{2x-3}{5}, b = \frac{3x-2}{3}$$

Consider,

$$2(3a-b)+1=0$$

Substituting the expressions for a and b in the equation, we get

$$2 \left[3 \left(\frac{2x-3}{5} \right) - \frac{3x-2}{3} \right] + 1 = 0$$

$$\Rightarrow 2 \left[\frac{6x-9}{5} - \frac{3x-2}{3} \right] + 1 = 0$$

$$\Rightarrow 2 \left[\frac{3(6x-9) - 5(3x-2)}{15} \right] + 1 = 0$$

$$\Rightarrow 2 \left[\frac{18x-27-15x+10}{15} \right] + 1 = 0$$

$$\Rightarrow 2 \left[\frac{3x-7}{15} \right] + 1 = 0$$

$$\Rightarrow 2 \left[\frac{3x-7}{15} \right] = -1$$

$$\Rightarrow 3x-7 = -1 \left(\frac{15}{2} \right)$$

$$\Rightarrow 3x-7 = -\frac{15}{2}$$

$$\Rightarrow 3x = -\frac{15}{2} + 7$$

$$\Rightarrow 3x = \frac{-15+14}{2}$$

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

Answer 10.

$$x = p + 1 \text{ and}$$

$$2.5 + \frac{2p+1}{3} = 1.5(2x-1)$$

$$\Rightarrow 2.5 + \frac{2p+1}{3} = 1.5[2(p+1)-1]$$

$$\Rightarrow 2.5 + \frac{2p+1}{3} = 3(p+1)-1.5$$

$$\Rightarrow 2.5 + \frac{2p+1}{3} = 3p+3-1.5$$

$$\Rightarrow 2.5 + \frac{2p+1}{3} = 3p+1.5$$

$$\Rightarrow \frac{2p+1}{3} - 3p = 1.5 - 2.5$$

$$\Rightarrow \frac{2p+1-9p}{3} = -1$$

$$\Rightarrow 2p+1-9p = -3$$

$$\Rightarrow -7p = -3-1$$

$$\Rightarrow -7p = -4$$

$$\Rightarrow p = \frac{4}{7}$$

Answer 11.

$$\text{We first solve } \frac{4m-3}{2} - \frac{3m-1}{5} = \frac{3}{2} \text{ for } m :$$

Taking LCM,

$$\frac{5(4m-3) - 2(3m-1)}{10} = \frac{3}{2}$$

$$\Rightarrow \frac{20m - 6m - 15 + 2}{10} = \frac{3}{2}$$

$$\Rightarrow \frac{14m - 13}{10} = \frac{3}{2}$$

$\Rightarrow$ On Cross - multiplying, we get :

$$2(14m - 13) = 30$$

$$\Rightarrow 14m - 13 = 15$$

$$\Rightarrow m = 2$$

Now, given $m = x - 3$

$$\Rightarrow 2 = x - 3$$

$$\Rightarrow x = 5$$

Answer 12.

Given $x = 3$ is a solution of $ax^2 + (a - 4)x + 1 = a$

$\Rightarrow x = 3$ must satisfy the equation.

$$\Rightarrow 9a + (a - 4)3 + 1 - a = 0$$

$$\Rightarrow 9a + 3a - 12 + 1 - a = 0$$

$$\Rightarrow 11a - 11 = 0$$

$$\Rightarrow a = 1$$

Answer 13.

$$\frac{a}{b} = \frac{3}{2} \text{ (Given)}$$

$\Rightarrow$ On Cross - multiplying, we get :

$$2a = 3b \text{ --- (1)}$$

$$\text{Also, } a = 2x - 5, 3b = 3x + 1 \text{ -----(2)}$$

From (1) and (2),

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

$$\Rightarrow 4x - 10 - 3x - 1 = 0$$

$$\Rightarrow x = 11$$

Answer 14.

$$\frac{1}{x} - \frac{2}{3b} + 1 = 0$$

Taking LCM,

$$\Rightarrow \frac{3b - 2x + 3bx}{3bx} = 0$$

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

$$\Rightarrow x = \frac{3b}{2 - 3b} \text{ ----- (1)}$$

$$\text{Solving } \frac{2x + 4}{8} - \frac{3 - 2x}{12} = \frac{x - 3}{6} \text{ for } x :$$

$$\Rightarrow \frac{x + 2}{4} - \frac{(3 - 2x)}{12} - \left(\frac{x - 3}{6} \right) = 0$$

Taking LCM,

$$\frac{3(x + 2) - (3 - 2x) - 2(x - 3)}{12} = 0$$

$$\Rightarrow 3x + 6 - 3 + 2x - 2x + 6 = 0$$

$$\Rightarrow 3x = -9$$

$$\Rightarrow x = -3 \text{ ----- (2)}$$

From (1) and (2),

$$\Rightarrow \frac{3b}{2 - 3b} = -3$$

Crossmultiplying,

$$\Rightarrow 3b = -6 + 9b$$

$$\Rightarrow -6b = -6$$

$$\Rightarrow b = 1$$

Answer 15.

$$x + \frac{6}{a} = 11$$

$$\Rightarrow \frac{ax + 6}{a} = 11$$

On Cross - multiplying, we get :

$$ax + 6 = 11a$$

$$\Rightarrow x = \frac{11a - 6}{a} \text{ ----- (1)}$$

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

$$\Rightarrow \frac{13}{3} - \frac{3x - 4}{5} = \frac{x - 7}{3}$$

$$\Rightarrow \frac{13 \times 5 - 3(3x - 4)}{15} = \frac{x - 7}{3}$$

$$\Rightarrow \frac{65 - 9x + 12}{5} = x - 7$$

Crossmultiplying,

$$5(x - 7) = 77 - 9x$$

$$\Rightarrow 5x + 9x = 77 + 35$$

$$\Rightarrow 14x = 112$$

$$\Rightarrow x = \frac{112}{14} = 8 \text{ ----- (2)}$$

From, (1) and (2),

$$\frac{11a - 6}{a} = 8$$

$$\Rightarrow 8a = 11a - 6$$

$$\Rightarrow 6 = 3a \text{ or } a = 2$$

Answer 16.

$$\text{Given } m(x - 1) = 40 \Rightarrow x - 1 = \frac{40}{m}$$

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

$$\frac{(x - 1)}{2} = 1 + \frac{x - 1 + 1 + 1}{3} \quad \dots \text{(Adding and subtracting 1 in the RHS)}$$

$$\Rightarrow \frac{\left(\frac{40}{m}\right)}{2} = 1 + \frac{\left(\frac{40}{m}\right) + 2}{3}$$

$$\Rightarrow \frac{40}{2m} = 1 + \frac{40 + 2m}{3}$$

$$\Rightarrow \frac{40}{2m} = 1 + \frac{40 + 2m}{3m}$$

$$\Rightarrow \frac{40}{2m} = \frac{3m + 40 + 2m}{3m}$$

$$\Rightarrow \frac{40}{2m} = \frac{5m + 40}{3m}$$

$$\Rightarrow 40(3m) = 2m(5m + 40)$$

$$\Rightarrow 120m = 10m^2 + 80m$$

$$\Rightarrow 10m^2 + 80m - 120m = 0$$

$$\Rightarrow 10m^2 = 40m$$

$$\Rightarrow m = 4$$

Ex 7.2

Answer 1.

We are to find that value of x for which the two expressions are equal:

$$\text{i.e, } \frac{x}{5} + 2 = \frac{x}{3} - 4$$

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

$$\Rightarrow \text{Taking LCM, } \frac{3x - 5x}{15} = -6$$

$$\Rightarrow \frac{-2x}{15} = -6$$

On Cross – multiplying, we get :

$$2x = 15 \times 6$$

$$\Rightarrow x = 45$$

Answer 2.

Given that:

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

$$\text{Taking LCM, } \frac{5(x + 7) - 3(3x - 2)}{15} = 3$$

$\Rightarrow$ On simplyfying and Cross – multiplying, we get :

$$5x - 9x + 35 + 6 = 15 \times 3$$

$$\Rightarrow -4x + 41 = 45 \Rightarrow -4x = 4$$

$$\Rightarrow x = -1$$

Answer 3.

We have to find the value of x which makes the two expressions equal:

$$10(3x+12)= 3(9x+50)$$

$$\Rightarrow 30x-27x=150-120$$

$$\Rightarrow 3x=30$$

$$\Rightarrow x=10$$

Answer 4.

$$\text{Given: } 15(x+1)+10(x+2)+6(x+3) = 270.$$

$\Rightarrow$ Collecting like terms, we get :

$$(15x + 10x + 6x) + (15 + 20 + 18) - (270) = 0$$

$$\Rightarrow 31x = 217$$

$$\Rightarrow x = 7$$

Answer 5.

We know that the sum of all angles of a triangle are 180° (By angle sum property)

$$\text{Thus, we get : } (3x - 5)^\circ + (3x + 5)^\circ + 6x^\circ = 180^\circ$$

$\Rightarrow$ Collecting like terms, we get :

$$(12x)^\circ + (5 - 5)^\circ = 180^\circ$$

$$\Rightarrow x = \frac{180}{12}^\circ = 15^\circ.$$

Thus, the angles of the triangle are respectively :

$$(3x - 5)^\circ = (3 \times 15 - 5)^\circ = 40^\circ$$

$$(3x + 5)^\circ = (3 \times 15 + 5)^\circ = 50^\circ$$

$$\text{And } 6x^\circ = 6 \times 15^\circ = 90^\circ$$

Since one of the angles is 90° , the type of triangle formed is right angled.

Answer 6.

We know that the sum of all angles of a quadrilateral are 360°

(By angle sum property of a quadrilateral)

Thus,

$$(2x - 4)^\circ + (5x - 10)^\circ + (4x - 8)^\circ + (7x - 14)^\circ = 360^\circ$$

$\Rightarrow$ Collecting like terms, we get :

$$(2x + 5x + 4x + 7x) + (-4 - 10 - 8 - 14)^\circ = 360^\circ$$

$$\Rightarrow 18x - 36^\circ - 360^\circ = 0$$

$$\Rightarrow x = \frac{396^\circ}{18} = 22^\circ$$

Answer 7.

We know that the sum of all angles of a triangle are 180°

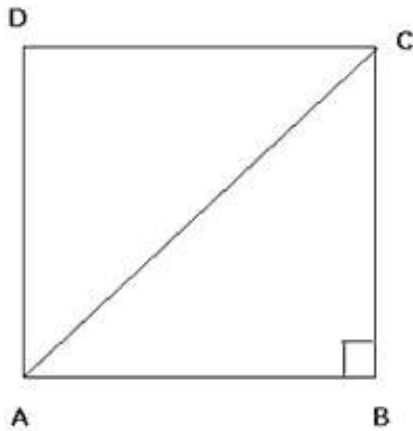
$$\text{Thus, } 2(x+6)^\circ + 3(x-1)^\circ + 6(x+1)^\circ = 180^\circ$$

$\Rightarrow$ Collecting like terms, we get :

$$(2x + 3x + 6x)^\circ + (12 + 6 - 3)^\circ = 180^\circ$$

$$\Rightarrow 11x^\circ = 180^\circ - 15^\circ = 165^\circ$$

$$\Rightarrow x = 15^\circ$$

Answer 8.

By pythagoras theorem, In rt $\triangle ABC$:

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

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

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

$$\Rightarrow \left[\frac{(x+1)^2}{2} \right] = \left[\frac{(9+x^2-6x)}{2} \right]$$

$$\Rightarrow (x^2 + 1 + 2x) - (9 + x^2 - 6x) = 0$$

$$\Rightarrow 8x - 8 = 0$$

$$\Rightarrow x = 1 \text{ unit.}$$

Answer 9.

Let the three consecutive natural numbers be x , $x+1$ and $x+2$.

$$\text{Then, sum} = x + x + 1 + x + 2 = 216$$

$$\Rightarrow 3x + 3 = 216$$

$$\Rightarrow 3x = 213$$

$$x = 71$$

$$\Rightarrow x+1 = 72, x+2 = 73$$

Thus, the 3 natural numbers are: 71, 72 and 73.

Answer 10.

Let the three consecutive odd natural numbers be $2n+1$, $2n+3$, $2n+5$

Then, $\text{sum} = 2n+1+2n+3+2n+5 = 99$

$$\Rightarrow 6n+9=99$$

$$\Rightarrow 6n=90$$

$$n=15$$

$$\Rightarrow 2n+1=31, 2n+3=33, 2n+5=35$$

Thus, the 3 natural numbers are: 31, 33, 35.

Answer 11.

Let the number be x .

Then As per the ques,

$$x + \frac{x}{2} = 60$$

$$\Rightarrow \frac{3x}{2} = 60$$

Crossmultiplying,

$$x = \frac{120}{3} = 40$$

Answer 12.

Let the number be x .

Then As per the ques,

$$2x-15=25$$

$$2x-15=25$$

$$\Rightarrow 2x=40$$

$$x=20$$

Answer 13.

Let the two nos be x and y

Then, as per the question,

$$\text{Their Sum} = x+y=50$$

$$\text{Their difference} = x-y=10$$

Then, adding the two equations, $2x=60$

$$x=30, y=20$$

Answer 14.

Let the two nos be x and y

Then, as per the question,

$$x - 21 = 71 - x$$

$$\Rightarrow 2x = 92 \Rightarrow x = 46$$

Answer 15.

Let the two parts be x and y.

$$\text{Then, } x + y = 300$$

Also, one part is less than the other by 48.

$$\Rightarrow \frac{1}{2}(300 - x) - x = 48$$

$$\Rightarrow 300 - 3x = 96$$

$$\Rightarrow x = \frac{204}{3} = 68$$

$$\text{Then, } y = 300 - 68 = 232$$

Answer 16.

Let the two consecutive even numbers be $2n$ and $2n+1$.

Then As per the question,

$$2n + (2n + 2) = 38$$

$$\Rightarrow 4n = 36 \text{ or } n = 9$$

Thus, numbers are $2n = 18$ and $2n + 1 = 20$.

Answer 17.

Let the complementary angles be

$$\angle 1 + \angle 2 = 90^\circ$$

Then, as per question, Also, $\angle 1 - \angle 2 = 14^\circ$

Solving, the equation:

$$\angle 1 = 52^\circ \text{ and } \angle 2 = 38^\circ$$

Answer 18.

Let the supplementary angles be

$$\angle 1 + \angle 2 = 180^\circ$$

$$\Rightarrow (7x+6) + (2x-15) = 180^\circ$$

$$\Rightarrow 9x = 180^\circ + 15^\circ - 6^\circ = 189^\circ$$

$$\Rightarrow \frac{189}{9} = 21^\circ$$

Thus, the measure of the angles are: $(7x+6)^\circ$

and $(2x-15)^\circ$.

$= 153^\circ$ and 27°

Answer 19.

We know that, sum of the measure of the angles of a triangle is 180° .

$$9x - 5 + 7x + 5 + 20x = 180^\circ$$

$$\Rightarrow 36x = 180$$

$$\Rightarrow x = \frac{180}{36}$$

$$\Rightarrow x = 5$$

To show that the triangle is isosceles, we can show that at least two angles of the triangle are equal.

$$9x - 5 = 9(5) - 5 = 40$$

$$7x + 5 = 7(5) + 5 = 40$$

So, the triangle is an isosceles triangle.

Answer 20.

Sum of angles of a quadrilateral = 360°

$$\Rightarrow x^\circ + (3x - 40)^\circ + 2x^\circ + (4x + 30)^\circ = 360^\circ$$

$$\Rightarrow 10x^\circ - 10^\circ = 360^\circ$$

$$\Rightarrow x = 37^\circ$$

Therefore, the measures of the angles are 37° , $(3 \times 37 - 40)^\circ$, $2 \times 37^\circ$ and $(4 \times 37 + 20)^\circ$

i.e 37° , 71° , 74° and 168° .

Answer 21.

Let the two numbers be x and y .

Then Given, $x+y=150$ and $x:y=2:3$

$$\text{Then, the number } x = \frac{2}{2+3} \text{ of } 150 = \frac{2 \times 150}{5} = 60$$

$$\text{And } y = \frac{3}{2+3} \text{ of } 150 = \frac{3 \times 150}{5} = 90$$

Answer 22.

Let the two numbers be x and y

Then, $x:y=11:13$

The smaller number =

$$\frac{11}{11+13} \text{ of } (x+y) = 286 \text{ (Given)}$$

$$\Rightarrow \frac{11}{24} \times (x+y) = 286$$

$$\Rightarrow (x+y) = \frac{286 \times 24}{11} = 624$$

The bigger number =

$$\frac{13}{11+13} \text{ of } (624)$$

$$\Rightarrow \frac{13}{24} \times (624) = 338$$

Answer 23.

Let the two consecutive even natural numbers be $2x$ and $2x + 2$.

As per the given condition,

$$(2x + 2)^2 - (2x)^2 = 68$$

$$\Rightarrow 4x^2 + 8x + 4 - 4x^2 = 68$$

$$\Rightarrow 8x + 4 = 68$$

$$\Rightarrow 8x = 64$$

$$\Rightarrow x = \frac{64}{8}$$

$$\Rightarrow x = 8$$

$$2x = 2(8) = 16 \text{ and } 2x + 2 = 2(8) + 2 = 16 + 2 = 18$$

Hence, the numbers are 16 and 18.

Answer 24.

Let the two consecutive odd natural numbers be $2n+1$ and $2n+3$, where n is a natural number.

$$\text{Given, } (2n+3)^2 + (2n+1)^2 = 650$$

$$\Rightarrow (4n^2 + 9 + 12n) + (4n^2 + 1 + 4n) = 650$$

$$\Rightarrow 8n^2 + 10 + 16n = 650$$

$$\Rightarrow 8n^2 + 16n - 640 = 0$$

$$\Rightarrow n^2 + 2n - 80 = 0$$

$$\Rightarrow n^2 + 10n - 8n - 80 = 0$$

$$\Rightarrow n(n+10) - 8(n+10) = 0$$

$$\Rightarrow (n-8)(n+10) = 0$$

Thus, $n=8$ as $n=-10$ is not possible.

Thus, the two consecutive odd natural numbers are 17 and 19

Answer 25.

Let the two consecutive even natural numbers be $2x + 1$ and $2x + 3$.

As per the given condition,

$$(2x + 3)^2 - (2x + 1)^2 = 72$$

$$\Rightarrow 4x^2 + 12x + 9 - [4x^2 + 4x + 1] = 72$$

$$\Rightarrow 4x^2 + 12x + 9 - 4x^2 - 4x - 1 = 72$$

$$\Rightarrow 12x + 9 - 4x - 1 = 72$$

$$\Rightarrow 8x = 64$$

$$\Rightarrow x = \frac{64}{8}$$

$$\Rightarrow x = 8$$

$$2x + 1 = 2(8) + 1 = 16 + 1 = 17 \text{ and } 2x + 3 = 2(8) + 3 = 16 + 3 = 19$$

Hence, the numbers are 17 and 19.

Answer 26.

Let the fraction be $\frac{x}{y}$.

Given, The denominator of a fraction is 18 more than the numerator.

$$\text{i.e., } x = y - 18$$

$$\text{or } y - x = 18 \text{ --- (1)}$$

Also, If 1 is added to both the numerator and denominator, the value of the fraction equals the value of fraction obtained by adding 8 to the numerator and 15 to the denominator.

$$\Rightarrow \frac{x + 1}{y + 1} = \frac{x + 8}{y + 15}$$

$$\Rightarrow \frac{x + 1 - (y + 1)}{y + 1} = \frac{x + 8 - (y + 15)}{y + 15}$$

$$\Rightarrow \frac{x - y}{y + 1} = \frac{x - y - 7}{y + 15}$$

$$\Rightarrow \frac{-18}{y+1} = \frac{-18-7}{y+15}$$

$$\Rightarrow \frac{18}{y+1} = \frac{25}{y+15}$$

$$\Rightarrow 18y + 18 \times 15 = 25y + 25$$

$$\Rightarrow 7y = 245$$

$$\Rightarrow y = 35.$$

$$\text{Hence, } x = y - 18 = 35 - 18 = 17$$

The fraction is $\frac{17}{35}$

Answer 27.

Let the units place be x and tens place be y .

Then, the two-digit number is $10y+x$.

Given, the digit at the ten's place is 4 times the digit at the unit's place.

$$\Rightarrow y=4x \text{---(1)}$$

Also, sum of the digits and the number is 92.

$$\Rightarrow x+y+(10y+x)=92$$

$$\Rightarrow 11y+2x=92 \text{---(2)}$$

Solving (1) and (2), we get:

$$11 \times 4x + 2x = 92$$

$$46x = 92$$

$$\Rightarrow x = 2$$

$$\text{So, } y = 8$$

Then, the two-digit number is $10 \times 8 + 2 = 82$

Answer 28.

Let the units place be x and tens place be y .

Then, the two-digit number is $10y+x$.

Given, $x:y=3:2$ ---(1)

If the digits are reversed,

The reversed number is $10x+y$.

The original number is $10y+x$.

Given the resulting number with reversed digits is 27 more than the original number.

$$\Rightarrow 10x+y-27=10y+x$$

$$\Rightarrow 9x-9y-27=0$$

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

Using (2) in (1), gives:

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

$$\Rightarrow 2y+6=3y$$

$$\Rightarrow y=6$$

$$\text{Thus, } x = y + 3 = 9$$

$$\text{The number is } 10y + x = 10 \times 6 + 9 = 69$$

Ex 7.3**Answer 1.**

Let the distance covered by walking = x km.

Then, the distance covered on the motorcycle = $(95-x)$ km

Speed when walking = 5 km/hr.

$$\text{Time taken} = \frac{x}{5} \text{ hrs}$$

Speed on motorcycle = 40 km/h

$$\text{Time taken on motorcycle} = \frac{95-x}{40} \text{ hrs}$$

As the total time is 3 hours.

Thus, we get:

$$\frac{x}{5} + \frac{95-x}{40} = 3$$

Taking LCM, we get :

$$\Rightarrow \frac{8x + 95 - x}{40} = 3$$

$$\Rightarrow 7x + 95 = 120$$

$$\Rightarrow 7x = 25$$

$$\Rightarrow x = 3\frac{5}{7} \text{ km.}$$

Then, the distance covered on the motorcycle = $(95-x)$ km

$$= (95 - 3\frac{5}{7}) \text{ km} = 91\frac{2}{7} \text{ km.}$$

Answer 2.

Let the speed of Anand be x km/hr.

Then Speed of Sonu = $(x+4)$ km/hr.

In 5 hours, Anand travels = $5x$ km

In 5 hours, Sonu travels = $5(x+4)$ km

Distance between two places = 660 km

The total distance travelled by Anand and Sonu will be same as the distance between two places

$$\text{ATQ, } 5x + 5(x+4) = 660$$

$$\Rightarrow 10x + 20 = 660$$

$$\Rightarrow 10x = 640$$

$$\Rightarrow x = 64 \text{ km/hr}$$

Speed of Anand = 64 km/hr

Speed of Sonu = $64 + 4 = 68$ km/hr

Answer 3.

Let the distance of the market from his home = x km.

Speed = 4 km/h

$$\text{Time taken} = \frac{x}{4} \text{ hrs}$$

Also, distance of the market to home = x km.

Speed = 3 km/h

$$\text{Time taken} = \frac{x}{3} \text{ hrs}$$

As per the condition, he took 30 minutes more in returning from the market.

$$\frac{x}{3} - \frac{x}{4} = \frac{30}{60}$$

$$\Rightarrow \frac{4x - 3x}{12} = \frac{1}{2}$$

$$\Rightarrow \frac{x}{12} = \frac{1}{2}$$

$$\Rightarrow x = 6 \text{ km.}$$

Answer 4.

Distance = 30 km.

Let the speed of A be x km/hr.

And, the speed of B be y km/hr.

Then, time taken by A = $\left(\frac{30}{x}\right)$ hrs.

Also, time taken by B = $\left(\frac{30}{y}\right)$ hrs.

As per given ques, A takes 4 hours more than B in walking 30 km.

$$\Rightarrow \left(\frac{30}{x}\right) = 4 + \left(\frac{30}{y}\right) \text{ --- (1)}$$

Also, If A doubles his speed, he will take 1 hr less than B.

$$\Rightarrow \left(\frac{30}{2x}\right) + 1 = \left(\frac{30}{y}\right) \text{ --- (2)}$$

Using (2) in (1), gives :

$$\left(\frac{30}{x}\right) = 4 + \left(\frac{30}{2x}\right) + 1$$

$$\Rightarrow \left(\frac{30}{x}\right) - \left(\frac{15}{x}\right) = 5$$

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

$$\Rightarrow x = 3 \text{ km/hr.}$$

From (1),

$$\Rightarrow \left(\frac{30}{3}\right) = 4 + \left(\frac{30}{y}\right)$$

$$\Rightarrow 6 = \left(\frac{30}{y}\right)$$

$$\Rightarrow y = 5 \text{ km/hr.}$$

Thus, the speed of A is 3 km/hr.

And, the speed of B is 5 km/hr.

Answer 5.

Let the total time taken by the motorcyclist to reach his destination = x hrs

Speed = 24km/h

Also, the distance of his destination from the start = Speed $\times$ time

Speed = 30km/h

Given, driving at 24km/hr, a person reaches his destination 5 minutes late.

Therefore, time taken by him in reaching the destination = $\left(x + \frac{5}{60}\right)$ hr

And driving at 30km/hr, he will reach 4 minutes early to the destination.

Therefore, time taken by him in reaching the destination = $\left(x - \frac{4}{60}\right)$ hr

We, know that distance between the start and destination will remain the same

$$\therefore 24\left(x + \frac{5}{60}\right) = 30\left(x - \frac{4}{60}\right)$$

$$\Rightarrow 24(60x + 5) = 30(60x - 4)$$

$$\Rightarrow 1440x + 120 = 1800x - 120$$

$$\Rightarrow 360x = 240$$

$$\Rightarrow x = \frac{240}{360} = \frac{2}{3}$$

$$\text{Therefore, the distance of his destination} = 30\left(\frac{2}{3} - \frac{4}{60}\right) \text{ km} = 30\left(\frac{40 - 4}{60}\right) = 18 \text{ km}$$

Answer 6.

Let the total time taken by the boy from home to his school be = x hrs

Speed = 4km/h

Also, the distance of his office to home = Speed $\times$ time

Speed = 3km/h

Given, Walking at 4km/hr, a boy reaches his school 10 minutes early.

Therefore, time taken by him in reaching the school = $\left(x - \frac{10}{60}\right)$ hr

And walking at 3km/hr, he will reach 10 minutes late to the school.

Therefore, time taken by him in reaching the school = $\left(x + \frac{10}{60}\right)$ hr

We, know that distance between the home and school will remain the same

$$\therefore 4\left(x - \frac{10}{60}\right) = 3\left(x + \frac{10}{60}\right)$$

$$\Rightarrow 4(60x - 10) = 3(60x + 10)$$

$$\Rightarrow 240x - 40 = 180x + 30$$

$$\Rightarrow 60x = 70$$

$$\Rightarrow x = \frac{70}{60} = \frac{7}{6} \text{ hr}$$

Therefore, the distance between house and school =

$$4\left(\frac{7}{6} + \frac{10}{60}\right) \text{ km} = 4\left(\frac{7}{6} + \frac{1}{6}\right) \text{ km} = 4 \text{ km}$$

Answer 7.

Let the average speed of the air plane = x km/hr.

Then, the average speed of the other air plane = $(x+40)$ km/hr

As the planes are moving in opposite directions we will add the average speed of the plane to get the total speed = $x+x+40 = (2x+40)$ km/hr

Distance between the airplanes = 3400 km.

After 5 hours they are 3400 km apart

$$\therefore 5 = \frac{3400}{2x+40}$$

$$\Rightarrow 10x + 200 = 3400$$

$$\Rightarrow 10x = 3200$$

$$\Rightarrow x = 320 \text{ km/hr}$$

Therefore, the average speed of the plane = 320 km/hr

And average speed of the other plane = $(320+40) = 360$ km/hr

Answer 8.

Let the distance between the two ports = x km.

Given, the speed of the stream is 2 km/h

Let the speed of man in still water = y km/h.

Relative speed upstream = $(y-2)$ km/h

Relative speed downstream = $(y+2)$ km/h

Then, time taken to go upstream = $\frac{x}{y-2}$ hrs

Then, time taken to go downstream = $\frac{x}{y+2}$ hrs

Also, given steamer goes in down stream from one port to another in 4 hours.

$$\Rightarrow \frac{x}{y+2} = 4$$

$$\Rightarrow x = 4y + 8 \text{ --- (1)}$$

Also, It covers the same distance in upstream in 5 hours

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

$$\Rightarrow x = 5y - 10 \text{ --- (2)}$$

Solving, (1) and (2), we get:

$$4y + 8 = 5y - 10$$

$$\Rightarrow y = 18 \text{ km/hr.}$$

$$x = (4 \times 18 + 8) \text{ km} = (72 + 8) \text{ km} = 80 \text{ km}$$

Answer 9.

Distance travelled downstream = 20 km.

Distance travelled upstream = 12 km.

Given, The speed of a boat in still water is 8km/h.

Let the speed of the stream = x km/hr.

Relative speed upstream = (8-x) km/hr

Relative speed downstream = (8+x) km/hr

Time taken to go upstream = $\frac{12}{8-x}$ hrs

Time taken to go downstream = $\frac{20}{8+x}$ hrs

As per given condition, boat takes the same time in going 20km in downstream as it takes in going 12 km upstream.

$$\Rightarrow \frac{12}{8-x} = \frac{20}{8+x}$$

$$12(8+x) = 20(8-x)$$

$$\Rightarrow 12 \times 8 + 12x = 20 \times 8 - 20x$$

$$\Rightarrow 8(20-12) = 32x$$

$$\Rightarrow 64 = 32x$$

$$\Rightarrow x = 2 \text{ km/hr}$$

Thus, the speed of the stream = 2 km/hr.

Answer 10.

The average speed of speeding car is 80 km/h.

The average speed of police car is 100 km/h.

As the police car and the speeding car is moving in the same direction so

Therefore their average speed would be subtracted to get the total speed =

$$100\text{km/hr} - 80\text{ km/hr} = 20\text{ km/hr}$$

Therefore the car will travel 20km in 1 hour i.e 20km in 60 minutes

$$\text{So, the time taken by car to travel 1km} = \frac{60}{20} = 3\text{ minutes}$$

So, time taken by car to cover a distance of 5 km as the speeding car is 5 km

$$\text{ahead} = \frac{60}{20} \times 5 = 15\text{ minutes}$$

Answer 11.

Let Jayeeta's age be x years and Shweta's age be $6x$ years.

15 years hence, means after 15 years.

As per the given condition,

$$6x + 15 = 3(x + 15)$$

$$\Rightarrow 6x + 15 = 3x + 45$$

$$\Rightarrow 3x = 30$$

$$\Rightarrow x = 10$$

Jayeeta's age = x years = 10 years

Shweta's age = $6x = 6(10) = 60$ years

Hence, Jayeeta's age is 10 years and Shweta's age is 60 years.

Answer 12.

Let the common multiple be x .

So, P's age be $7x$ years and Q's age be $5x$ years.

10 years hence, means after 10 years.

As per the given condition,

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

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

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

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

$$\Rightarrow 4x = 20$$

$$\Rightarrow x = 5$$

$$\text{P's age} = 7x \text{ years} = 7(5) = 35 \text{ years}$$

$$\text{Q's age} = 5x = 5(5) = 25 \text{ years}$$

Hence, P's age is 35 years and Q's age is 25 years.

Answer 13.

Let the son's age be x years, so the man's age is $2x$ years.

As per the given condition,

$$\frac{2x + 8}{x + 8} = \frac{7}{4}$$

$$\Rightarrow 4(2x + 8) = 7(x + 8)$$

$$\Rightarrow 8x + 32 = 7x + 56$$

$$\Rightarrow 8x - 7x = 56 - 32$$

$$\Rightarrow x = 24$$

$$\text{Son's age} = x \text{ years} = 24 \text{ years}$$

$$\text{Man's age} = 2x \text{ years} = 2(24) = 48 \text{ years}$$

Hence, son's age is 24 years and man's age is 48 years.

Ex 7.4

Answer 1.

Let the breadth of the rectangle be x cm.

So, the length of the rectangle = $(30 + x)$ cm

As per the given condition,

Perimeter of the rectangle = 180

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

$$\Rightarrow 2(30 + x + x) = 180$$

$$\Rightarrow 2(30 + 2x) = 180$$

$$\Rightarrow 60 + 4x = 180$$

$$\Rightarrow 4x = 180 - 60$$

$$\Rightarrow 4x = 120$$

$$\Rightarrow x = 30$$

breadth = x cm = 30 cm

length = $(30 + x)$ cm = $(30 + 30)$ cm = 60 cm

Hence, the breadth is 30 cm and the length is 60 cm.

Answer 2.

Let the breadth of the rectangle be x cm.

Perimeter of the rectangle = 80

$$\Rightarrow 2(l + x) = 80$$

$$\Rightarrow l + x = 40$$

$$\Rightarrow l = 40 - x$$

So, the area = $lb = x(40 - x) = 40x - x^2$

breadth = $(x + 2)$ m

length = $(40 - x - 2)$ m = $(38 - x)$ m

So, area = $(38 - x)(x + 2) = 38x + 76 - x^2 - 2x = -x^2 + 36x + 76$

As per the given condition,

$$-x^2 + 36x + 76 - (40x - x^2) = 36$$

$$\Rightarrow -x^2 + 36x + 76 - 40x + x^2 = 36$$

$$\Rightarrow 36x + 76 - 40x = 36$$

$$\Rightarrow -4x = -40$$

$$\Rightarrow x = 10$$

So, breadth = 10 m and length = $40 - x = 30$ m

Hence, the breadth is 10 m and the length is 30 m.

Answer 3.

Let the base of the triangle be x cm.

So, each of its equal sides $= (x + 4)$ cm

As per the given condition,

perimeter of the triangle $= 29$ cm

$$\Rightarrow x + x + 4 + x + 4 = 29$$

$$\Rightarrow 3x = 21$$

$$\Rightarrow x = 7 \text{ cm}$$

$$\text{So, } x + 4 = 7 + 4 = 11 \text{ cm}$$

Hence, the sides are 7 cm, 11 cm and 11 cm.

Answer 4.

Let the breadth of the rectangle be x cm.

Perimeter of the rectangle $= 100$

$$\Rightarrow 2(l + x) = 100$$

$$\Rightarrow l + x = 50$$

$$\Rightarrow l = 50 - x$$

$$\text{So, the area} = lb = x(50 - x) = 50x - x^2$$

$$\text{breadth} = (x + 3) \text{ m}$$

$$\text{length} = (50 - x - 2) \text{ m} = (48 - x) \text{ m}$$

$$\text{So, area} = (48 - x)(x + 3) = 48x + 144 - x^2 - 3x = -x^2 + 45x + 144$$

As per the given condition,

$$-x^2 + 45x + 144 - (50x - x^2) = 44$$

$$\Rightarrow -x^2 + 45x + 144 - 50x + x^2 = 44$$

$$\Rightarrow -5x = -100$$

$$\Rightarrow x = 20$$

$$\text{So, breadth} = 20 \text{ m and length} = 50 - x = 30 \text{ m}$$

Hence, the breadth is 20 m and the length is 30 m.

Answer 5.

Let the number of days in which B alone can do the work be x days.

So, B can do $\frac{1}{x}$ part of the work in a day.

Given that the number of days in which A alone can do the work is 10 days.

So, A can do $\frac{1}{10}$ part of the work in a day.

Together they can complete the work in 6 days.

So, together they can do $\frac{1}{6}$ part of the work in a day.

As per the given condition,

$$\frac{1}{x} + \frac{1}{10} = \frac{1}{6}$$

$$\Rightarrow \frac{10+x}{10x} = \frac{1}{6}$$

$$\Rightarrow 6(10+x) = 10x$$

$$\Rightarrow 60 + 6x = 10x$$

$$\Rightarrow 4x = 60$$

$$\Rightarrow x = 15$$

Hence, B can complete the work in 15 days.

Answer 6.

Let the number of days in which B alone can do the work be x days.

So, B can do $\frac{1}{x}$ part of the work in a day.

Given that the number of days in which A alone can do the work is 10 days.

So, A can do $\frac{1}{12}$ part of the work in a day.

Together they can complete the work in 6 days.

So, together they can do $\frac{1}{4}$ part of the work in a day.

As per the given condition,

$$\frac{1}{x} + \frac{1}{12} = \frac{1}{4}$$

$$\Rightarrow \frac{12+x}{12x} = \frac{1}{4}$$

$$\Rightarrow 4(12+x) = 12x$$

$$\Rightarrow 48 + 4x = 12x$$

$$\Rightarrow 8x = 48$$

$$\Rightarrow x = 6$$

Hence, B can complete the work in 6 days.

Answer 7.

Let the time taken by the second tap be x hours.

So, the second tap can fill $\frac{1}{x}$ part of the tank in an hour.

Given that the time taken by the first tap to fill the tank is 12 hours.

So, the first tap can fill $\frac{1}{12}$ part of the tank in an hour.

Together they can fill the tank in 6 hours 40 minutes

$$= \left(6 + \frac{40}{60}\right) \text{ hours}$$

$$= \left(6 + \frac{2}{3}\right) \text{ hours} = \frac{20}{3} \text{ hours}$$

So, together they can fill $\frac{3}{20}$ part of the tank in an hour.

As per the given condition,

$$\frac{1}{x} + \frac{1}{12} = \frac{3}{20}$$

$$\Rightarrow \frac{12+x}{12x} = \frac{3}{20}$$

$$\Rightarrow 20(12+x) = 36x$$

$$\Rightarrow 240 + 20x = 36x$$

$$\Rightarrow 16x = 240$$

$$\Rightarrow x = 15$$

Hence, the time taken by the second tap is 15 hours.

Answer 8.

Let the number be x .

As per the given condition,

$$x + 15\% \text{ of } x = 2921$$

$$\Rightarrow x + \frac{15}{100}x = 2921$$

$$\Rightarrow x + \frac{15x}{100} = 2921$$

$$\Rightarrow \frac{115x}{100} = 2921$$

$$\Rightarrow 115x = 292100$$

$$\Rightarrow x = 2540$$

Hence, the number is 2540.

Answer 9.

Let the number be x .

As per the given condition,

$$x - 12\% \text{ of } x = 1584$$

$$\Rightarrow x - \frac{12}{100} \times x = 1584$$

$$\Rightarrow x - \frac{12x}{100} = 1584$$

$$\Rightarrow \frac{88x}{100} = 1584$$

$$\Rightarrow 88x = 158400$$

$$\Rightarrow x = 1800$$

Hence, the number is 1800.

Answer 10.

Let the one number be x .

So, the other number is $99 - x$

As per the given condition,

$$99 - x = 20\% \text{ of } x + x$$

$$\Rightarrow 99 - x = \frac{20}{100} \times x + x$$

$$\Rightarrow 99 = \frac{20x}{100} + 2x$$

$$\Rightarrow 99 = \frac{220x}{100}$$

$$\Rightarrow x = \frac{99 \times 100}{220}$$

$$\Rightarrow x = 45$$

$$\text{and } 99 - x = 99 - 45 = 54$$

Hence, the numbers are 45 and 54.

Answer 11.

Let the number of normal hours of work be x hours.

So, in a week the number of overtime work hours = $(56 - x)$ hours

So, for x hours of normal work, the worker is paid Rs. $20x$

and for $(56 - x)$ hours of overtime work the worker gets

paid Rs. $40(56 - x) = \text{Rs.}(2240 - 40x)$

As per the given condition,

$$2240 - 40x + 20x = 1440$$

$$\Rightarrow 2240 - 20x = 1440$$

$$\Rightarrow -20x = -800$$

$$\Rightarrow x = \frac{800}{20}$$

$$\Rightarrow x = 40$$

Hence, the number of hours of normal work is 40 hours.

Answer 12.

Let the number of games that he won be x .

So, the number of games that he lost is $100 - x$.

As per the given condition,

$$50x - 20(100 - x) = 800$$

$$\Rightarrow 50x - 2000 + 20x = 800$$

$$\Rightarrow 50x + 20x = 2800$$

$$\Rightarrow 70x = 2800$$

$$\Rightarrow x = \frac{2800}{70}$$

$$\Rightarrow x = 40$$

Hence, he won 40 games.

Answer 13.

Let the number of times he hit the mark be x .

So, the number of times he misses it be $100 - x$.

As per the given condition,

$$50x - 20(100 - x) = 100$$

$$\Rightarrow 50x - 2000 + 20x = 100$$

$$\Rightarrow 50x + 20x = 2100$$

$$\Rightarrow 70x = 2100$$

$$\Rightarrow x = \frac{2100}{70}$$

$$\Rightarrow x = 30$$

Hence, he hit the mark 30 times.

Answer 14.

Let the number of benches in the class = x

Number of students sitting in one bench = 4

Number of benches left = 3

Total number of students = $4(x - 3)$

Number of students sitting in one bench = 3

Number of students left = 3

Total number of students = $3x + 3$

Since the total number of students is the same,

$$\text{so } 4(x - 3) = 3x + 3$$

$$\Rightarrow 4x - 12 = 3x + 3$$

$$\Rightarrow x = 15$$

Therefore, the number of benches = 15

Number of students = $4(x - 3) = 4(15 - 3) = 4(12) = 48$

Answer 15.

Let the CP be Rs. x and the profit is 6%.

$$\therefore \text{SP} = \left(1 + \frac{6}{100}\right) \text{ of Rs. } x = \text{Rs. } \frac{53x}{50}$$

If he buys the article at 4% less, then

$$\text{CP} = \left(1 - \frac{4}{100}\right) \text{ of Rs. } x = \text{Rs. } \frac{24x}{50}$$

New profit = 12%

$$\begin{aligned} \therefore \text{New SP} &= \left(1 + \frac{12}{100}\right) \text{ of Rs. } \frac{24x}{50} \\ &= \text{Rs. } \left(\frac{28}{25} \times \frac{24x}{50}\right) \end{aligned}$$

As per the given condition,

$$\text{Rs. } \left(\frac{28}{25} \times \frac{24x}{50}\right) = \text{Rs. } \frac{53x}{50} + \text{Rs. } 7.60$$

$$\Rightarrow \frac{672}{625}x = \frac{53x}{50} + \frac{76}{10}$$

$$\Rightarrow \frac{672}{625}x - \frac{53x}{50} = \frac{76}{10}$$

$$\Rightarrow (2 \times 672 - 25 \times 53)x = 125 \times 76$$

$$\Rightarrow 19x = 125 \times 76$$

$$\Rightarrow x = 500$$

Hence, the CP of the article is Rs. 500.

Answer 16.

Let the amount he invested at 12% interest be Rs. x and the amount he invested at 14% interest be Rs. $(35000 - x)$.

As per the given condition,

$$\frac{12x}{100} + \frac{14(35000 - x)}{100} = 4460 \quad \dots \left[\text{Using SI} = \frac{\text{PNR}}{100} \right]$$

$$\Rightarrow \frac{12x}{100} + \frac{490000 - 14x}{100} = 4460$$

$$\Rightarrow \frac{12x + 490000 - 14x}{100} = 4460$$

$$\Rightarrow 490000 - 2x = 446000$$

$$\Rightarrow -2x = -44000$$

$$\Rightarrow x = 22000$$

$$\text{and } 35000 - x = 35000 - 22000 = \text{Rs. } 13000$$

Hence, the amount he invested at 12% is Rs. 22000

and the amount he invested at 14% is Rs. 13000.

Answer 17.

Let the quantity of cashew kernels be x kg in 700 g $\left(\text{that is, } \frac{700}{1000} \text{ kg}\right)$

and the quantity of dry grapes by $\left(\frac{700}{1000} - x\right)$ kg $= (0.7 - x)$ kg

Since the cashew kernels cost Rs. 96 per kg,

so x kg of cashew kernels cost Rs. $96x$

Since the dry grapes cost Rs. 112 per kg,

so $(0.7 - x)$ kg cost Rs. $112(0.7 - x)$

As per the given condition,

$$112(0.7 - x) + 96x = 72$$

$$\Rightarrow 78.4 - 112x + 96x = 72$$

$$\Rightarrow -16x = -6.4$$

$$\Rightarrow x = 0.4$$

$$0.7 - x = 0.7 - 0.4 = 0.3 \text{ kg}$$

So, the quantity of cashew kernels is $0.4 \text{ kg} = 400 \text{ g}$

and the quantity of dry grapes is 300 g .

Answer 18.

Let the amount of water be x litres.

Volume of acid in the solution $= 33\frac{1}{3}\%$ of 12 litres

$$= \frac{100}{3}\% \times 12$$

$$= \frac{100}{300} \times 12$$

$$= 4 \text{ litres}$$

Concentration of acid in $(12 + x)$ litres of solution $= 20\%$

$$\Rightarrow \frac{4}{12 + x} = \frac{20}{100}$$

$$\Rightarrow \frac{4}{12 + x} = \frac{1}{5}$$

$$\Rightarrow 12 + x = 20$$

$$\Rightarrow x = 8 \text{ litres}$$

Hence, 8 litres of water should be added.

Answer 19.

Let the amount of property be x .

$$\text{Daughter's share} = x - \frac{1}{2}x - \frac{1}{3}x$$

As per the given condition,

$$x - \frac{1}{2}x - \frac{1}{3}x = 15000$$

$$\Rightarrow \frac{6x - 3x - 2x}{6} = 15000$$

$$\Rightarrow \frac{x}{6} = 15000$$

$$\Rightarrow x = 90000$$

$$\frac{1}{2}x = \frac{90000}{2} = 45000$$

Hence, the amount of property he left was Rs. 90000
and the amount his wife got was Rs. 45000.

Ex 7.5

Answer 1.

Let the Age of B be x years.

Then, the age of A becomes $6x$ years.

After 15 years,

Age of A after 15 years $= 6x + 15$

Age of B after 15 years $= x + 15$

Given, 15 years hence A will be three times as old as B.

$$\Rightarrow 6x + 15 = 3(x + 15)$$

$$\Rightarrow 6x + 15 = 3x + 45$$

$$\Rightarrow 3x = 30$$

$$\Rightarrow x = 10 \text{ years.}$$

Thus, the Age of B be 10 years.

Then, the age of A becomes 60 years.

Answer 2.

Given, the present ages of A and B are in the ratio 7:5.

$\therefore$ Their present ages are $7x : 5x$.

After 10 years, their ages will be :

$(7x + 10)$ and $(5x + 10)$ respectively.

New ratio of their ages $= 9 : 7$

As per given conditions,

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

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

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

$$\Rightarrow 4x = 20$$

$$\Rightarrow x = 5 \text{ years.}$$

Thus, the present ages of A and B are 35 and 25 respectively.

Answer 3.

Let the present age of the son be x years.

Then, the father's age = $2x$ years.

After 8 years, their ages will be $(x+8)$ years and $(2x+8)$ years resp.

Given, After 8 years, the ratio of their ages will be 7:4.

As per given conditions,

$$\begin{aligned}\frac{(x+8)}{(2x+8)} &= \frac{4}{7} \\ \Rightarrow 7x + 56 &= 8x + 32 \\ \Rightarrow x &= 24 \text{ years.}\end{aligned}$$

Thus, the present age of the son is 24 years.

Then, the father's age = 48 years.

Answer 4.

Let the age of the son be x years.

Then, the man's age = $3x$ years.

After 10 years, their ages become

$(x+10)$ and $(3x+10)$ respectively.

As per given conditions,

$$\begin{aligned}\frac{(x+10)}{(3x+10)} &= \frac{1}{2} \\ \Rightarrow 2x + 20 &= 3x + 10 \\ \Rightarrow x &= 10 \text{ years}\end{aligned}$$

Thus, the present age of the son is 10 years.

Then, the man's age = 30 years.

Answer 5.

Given, The difference between the ages of two brothers is 10 years

So, let their ages be x and $(x-10)$ years respectively.

Their ages 15 years ago are,

$(x-15)$ and $(x-25)$ respectively.

Also, given 15 years ago their ages were in the ratio 2:1.

As per given conditions,

$$\frac{(x-15)}{(x-25)} = \frac{2}{1}$$

$$\Rightarrow x - 15 = 2x - 50$$

$$\Rightarrow x = 50 - 15 = 35 \text{ years.}$$

Thus, their present ages are $x=35$ years and 20 years respectively.

Also, their ages 15 years hence are,

$(x+15)$ and $x+5$ respectively = 50 and 40 years.

Thus, the ratio of their ages 15 years hence

$$\frac{(x+15)}{(x)} = \frac{50}{40} = \frac{5}{4}$$

Answer 6.

Given, present age of boy is one-third as that of his father.

So, let the present age of the son be x years.

Then, present age of father is $3x$ years.

Twelve years hence, their ages become, $(x+12)$ and $(3x+12)$ respectively.

As per given conditions,

$$\frac{(x+12)}{(3x+12)} = \frac{1}{2}$$

$$\Rightarrow 2x + 24 = 3x + 12$$

$$\Rightarrow x = 12 \text{ years}$$

Thus, the present age of the son is 12 years.

Then, present age of father is 36 years.

Answer 7.

Let the present age of the son be x years.

Then, the man's present age = y years.

5 years ago, their ages were

$(x-5)$ and $(y-5)$ respectively.

As per given conditions,

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

$$\Rightarrow 7x - 35 = y - 5$$

$$\Rightarrow 7x - y = 30 \text{ --- (1)}$$

Also, 5 years hence, their ages are

$(x+5)$ and $(y+5)$ resp.

Given, The age of the man will be 3 times the age of his son in 5 years from now.

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

$$\Rightarrow y - 3x = 10 \text{ --- (2)}$$

Adding (1) and (2), we get :

$$4x = 40$$

$$\Rightarrow x = 10 \text{ years.}$$

$$\Rightarrow y = 3x + 10 = 30 + 10$$

$$= 40 \text{ years.}$$

Thus, the present age of the son is 10 years.

Then, the man's age = 40 years.

Answer 8.

Let the present age of the son be x years.

Then, the man's age = $2x$ years.

20 years ago, their ages will be $(x-20)$ years and $(2x-20)$ years resp.

Given, Twenty years ago, son was six times his son's age.

As per given conditions,

$$\frac{(x-20)}{(2x-20)} = \frac{1}{6}$$

$$\Rightarrow 6x - 120 = 2x - 20$$

$$\Rightarrow 4x = 100$$

$$\Rightarrow x = 25 \text{ years.}$$

$$\Rightarrow y = 50 \text{ years.}$$

Thus, the present age of the son is 25 years.

Then, the man's age = 50 years.

Answer 3.

Let the breadth of the rectangle be x cm.

Then, length is $(x+30)$ cm.

Given, The perimeter of the rectangle is 180 cm.

$$\Rightarrow 2(\text{length} \times \text{breadth}) = 180 \text{ cm}$$

$$\Rightarrow 2(x + x + 30) \text{ cm} = 180 \text{ cm}$$

$$\Rightarrow 2x + 30 = 90 \text{ cm}$$

$$\Rightarrow 2x = 60 \text{ cm}$$

$$\Rightarrow x = 30 \text{ cm}$$

Thus, the breadth of the rectangle is 30 cm.

Then, length is 60 cm.

Answer 10.

Let the length of the rectangular field be x m and breadth be y m.

Given, the perimeter of a rectangular field is 80m.

$$\Rightarrow 2(x+y) = 80 \text{ m}$$

$$\Rightarrow x+y = 40 \text{ m} \text{ -----(1)}$$

Original area = $xy \text{ m}^2$

New increased length = $(x+2) \text{ m}$

New decreased breadth = $(y-2) \text{ m}$

Then, new area = $(x+2)(y-2) \text{ m}^2$

Also, given the breadth is increased by 2 m and the length is decreased by 2 m, the area of the field increases by 36 m^2

$$\Rightarrow (x+2)(y-2) \text{ m}^2 = (xy+36) \text{ m}^2$$

$$\Rightarrow (xy+2y-2x-4) \text{ m}^2 = (xy+36) \text{ m}^2$$

$$\Rightarrow 2(y-x) = 40 \text{ m}^2$$

$$\Rightarrow (y-x) = 20 \text{ -----(2)}$$

Solving (1) and (2), we get:

$$y = 30 \text{ m and } x = 10 \text{ m.}$$

Thus, the length of the rectangular field is 10 m and breadth is 30m.

Answer 11.

Let the length of the rectangle be $(x+3) \text{ cm}$ and breadth be $x \text{ cm}$.

Given, the perimeter of a rectangular field is 18m.

$$\Rightarrow 2(x+x+3) = 18 \text{ m}$$

$$\Rightarrow 2(2x+3) = 18 \text{ m}$$

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

$$\Rightarrow 2x = 6$$

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

Thus, the length of the rectangle is 6 cm and breadth is 3cm.

Answer 12.

Let the length of the rectangular field be x m and breadth be y m.

Given, the perimeter of a rectangular field is 140m.

$$\Rightarrow 2(x+y)=140 \text{ m}$$

$$\Rightarrow x+y=70 \text{ m} \text{ ----- (1)}$$

Original area= $xy \text{ m}^2$

New increased length= $(x+2) \text{ m}$

New decreased breadth= $(y-3) \text{ m}$

Then, new area= $(x+2)(y-3) \text{ m}^2$

Also, given the length of the field is increased by 2 m and the breadth decreased by 3m, the area is decreased by 66 m^2

$$\Rightarrow (x+2)(y-3) \text{ m}^2 = (xy-66) \text{ m}^2$$

$$\Rightarrow (xy+2y-3x-6) \text{ m}^2 = (xy-66) \text{ m}^2$$

$$\Rightarrow 2y-3x = -60$$

$$\Rightarrow (2y-3x) = -60 \text{ ---- (2)}$$

Solving (1) and (2), we get:

$x = 40 \text{ m}$ and $y = 30 \text{ m}$.

Thus, the length of the rectangular field is 40 m and breadth is 30 m.

Answer 13.

Let the base of the isosceles triangle be x cm long.

Then, the equal sides are $(x+4)$ cm.

Given, the perimeter of the triangle is 29 cm

$$\Rightarrow 2(x+4) + x = 29 \text{ cm}$$

$$3x + 8 = 29 \text{ cm}$$

$$\Rightarrow 3x = 21$$

$$\Rightarrow x = 7 \text{ cm}$$

Thus, the base of the isosceles triangle is 7 cm long.

Then, the equal sides are 11 cm.

Answer 14.

Let the length of the rectangle be x

$$\text{breadth} = x - 2$$

$$\text{perimeter} = 2(\text{length} + \text{breadth})$$

$$\therefore 2(x + x - 2) = 14$$

$$\Rightarrow 2x - 2 = 7$$

$$\Rightarrow x = 4.5$$

$$\therefore \text{breadth} = 4.5 - 2 = 2.5$$

Answer 15.

Let the length of the rectangular field be x m and breadth be y m.

Given, the perimeter of a rectangular field is 80m.

$$\Rightarrow 2(x+y) = 100 \text{ m}$$

$$\Rightarrow x+y = 50 \text{ m} \text{ ----- (1)}$$

Original area = $xy \text{ m}^2$

New increased length = $(x-2) \text{ m}$

New decreased breadth = $(y+3) \text{ m}$

Then, new area = $(x-2)(y+3) \text{ m}^2$

Also, its length is decreased by 2m and breadth increased by 3 m, the area of the field is increased by 44 m^2

$$\Rightarrow (x-2)(y+3) \text{ m}^2 = (xy+44) \text{ m}^2$$

$$\Rightarrow (xy-2y+3x-6) \text{ m}^2 = (xy+44) \text{ m}^2$$

$$\Rightarrow 3x-2y = 50 \text{ ---- (2)}$$

Solving (1) and (2), we get:

$$y = 20 \text{ m and } x = 30 \text{ m.}$$

Thus, the length of the rectangular field is 30 m and breadth is 20m.

Answer 16.

Let the breadth of the rectangle be x m.

Then, the length = $(x+3)$ m.

Then, Area of the room = $x(x+3)$ m²

If both the length and breadth, are increased by 1m, then:

Increased length = $(x+4)$ m.

Increased Breadth = $(x+1)$ m.

Given, If both the length and breadth, are increased by 1m, then the area of the room is increased by 18 cm²

$$\Rightarrow (x+1)(x+4) = x(x+3) + 18$$

$$\Rightarrow (x^2 + x + 4x + 4) = x^2 + 3x + 18$$

$$\Rightarrow 5x - 3x = 18 - 4 = 14$$

$$\Rightarrow 2x = 14$$

$$\Rightarrow x = 7 \text{ cm}$$

Thus, the breadth of the rectangle is 7 m.

Then, the length = 10 m.

Answer 17.

Number of days A takes alone to complete the work=10 Days.

$$\therefore \text{Amount of work done by A in 1 day} = \frac{1}{10}$$

Let the number of Days B working alone = x

$$\therefore \text{Amount of work done by B in 1 day} = \frac{1}{x}$$

No of Days they take working together=6 Days

$$\therefore \text{Amount of work done by both in 1 day} = \frac{1}{6}$$

$$\Rightarrow \frac{1}{10} + \frac{1}{x} = \frac{1}{6}$$

$$\Rightarrow \frac{1}{x} = \frac{1}{6} - \frac{1}{10}$$

$$= \frac{5-3}{30} = \frac{2}{30} = \frac{1}{15}$$

$$\Rightarrow x = 15 \text{ days}$$

Thus, the number of Days B working alone = 15 days

Answer 18.

Number of days A takes alone to complete the work = 12 Days.

$$\therefore \text{Amount of work done by A in 1 day} = \frac{1}{12}$$

Let the number of Days B working alone = x

$$\therefore \text{Amount of work done by B in 1 day} = \frac{1}{x}$$

No of Days they take working together = 4 Days

$$\therefore \text{Amount of work done by both in 1 day} = \frac{1}{4}$$

$$\Rightarrow \frac{1}{12} + \frac{1}{x} = \frac{1}{4}$$

$$\Rightarrow \frac{1}{x} = \frac{1}{4} - \frac{1}{12}$$

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

$$\Rightarrow x = 6 \text{ days}$$

Thus, the number of Days B working alone = 6 days

Answer 19.

Number of hours A takes alone to fill the tank = 12 hrs.

$$\therefore \text{Amount of water filled by tap A in 1 hr} = \frac{1}{12}$$

Number of hours tap B takes alone to fill the tank = x

$$\therefore \text{Amount of water filled by tap B in 1 hr} = \frac{1}{x}$$

No of hours Tap A and B take together to fill the tank = 6 hrs and 40 minutes

$$= 6 \text{ hr} + \frac{40}{60} \text{ hrs}$$

$$= 6 \text{ hr} + \frac{2}{3} \text{ hrs}$$

$$\therefore \text{Amount of work done by both Tap A and B in 1 hr} = \frac{1}{4}$$

$$\Rightarrow \frac{1}{12} + \frac{1}{x} = \frac{1}{4}$$

$$\Rightarrow \frac{1}{x} = \frac{1}{4} - \frac{1}{12}$$

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

$$\Rightarrow x = 6 \text{ days}$$

Thus, the number of Days B working alone = 6 days

Answer 20.

Time taken by Tap A to empty the tank = 6 hours

Amount of work done by tap A in 1 hour = $\frac{1}{6}$

Let B takes x hour to empty the tank alone.

Amount of work done by tap B in 1 hour = $\frac{1}{x}$

$\therefore$ Amount of work done by (A+B) in 1 hour = $\frac{1}{x} + \frac{1}{6}$

Tap A along with Tap B together can empty the tank in $3\frac{3}{7}$ hours = $\frac{24}{7}$ hours

$\therefore$ In 1 hour amount of work done by A and B = $\frac{1}{\frac{24}{7}} = \frac{7}{24}$

Now, according to the question

$$\frac{1}{x} + \frac{1}{6} = \frac{7}{24}$$

$$\Rightarrow \frac{1}{x} = \frac{7}{24} - \frac{1}{6} = \frac{7-4}{24} = \frac{3}{24} = \frac{1}{8}$$

$$\Rightarrow x = 8 \text{ hrs}$$

Ex 7.6**Answer 1.**

Let the number be x .

Therefore,

$$x + \frac{8}{100} \times x = 1620$$

$$\Rightarrow \frac{100x + 8x}{100} = 1620$$

$$\Rightarrow 108x = 1620 \times 100$$

$$\Rightarrow x = \frac{1620 \times 100}{108}$$

$$\Rightarrow x = 1500$$

Hence, 1500 is the number.

Answer 2.

Let the number be x .

Therefore,

$$x + \frac{15}{100} \times x = 2921$$

$$\Rightarrow \frac{100x + 15x}{100} = 2921$$

$$\Rightarrow 115x = 2921 \times 100$$

$$\Rightarrow x = \frac{2921 \times 100}{115}$$

$$\Rightarrow x = 2540$$

Hence, 2540 is the number.

Answer 3.

Let the number be x.

Therefore,

$$x - \frac{12}{100} \times x = 1584$$

$$\Rightarrow \frac{100x - 12x}{100} = 1584$$

$$\Rightarrow 88x = 1584 \times 100$$

$$\Rightarrow x = \frac{1584 \times 100}{88}$$

$$\Rightarrow x = 1800$$

Hence, 1800 is the number.

Answer 4.

Let the number be x.

Therefore,

$$x - \frac{18}{100} \times x = 1599$$

$$\Rightarrow \frac{100x - 18x}{100} = 1599$$

$$\Rightarrow 82x = 1599 \times 100$$

$$\Rightarrow x = \frac{1599 \times 100}{82}$$

$$\Rightarrow x = 1950$$

Hence, 1950 is the number.

Answer 5.

Let normal working hours be x and overtime working hours be y .

$$x + y = 56$$

$$y = 56 - x \dots\dots(i)$$

Also given, total amount received = Rs 1440

$$20x + 40y = 1440$$

$$\Rightarrow x + 2y = 72 \dots\dots(ii)$$

Substituting (i) in (ii)

$$x + 2(56 - x) = 72$$

$$\Rightarrow x + 112 - 2x = 72$$

$$\Rightarrow x - 2x = 72 - 112$$

$$\Rightarrow x = 40$$

Normal working hours = 40 hrs

Answer 6.

Let working days be x and non-working days be y .

$$x + y = 30$$

$$y = 30 - x \dots\dots(i)$$

Also given, amount paid to him = Rs 1000

$$60x - 20y = 1000$$

$$\Rightarrow 3x - y = 50 \dots\dots(ii)$$

Substituting (i) in (ii)

$$3x - (30 - x) = 50$$

$$\Rightarrow 3x - 30 + x = 50$$

$$\Rightarrow 4x = 80$$

$$\Rightarrow x = 20$$

Working days = 20

Answer 7.

Let number of games won be x and number of games lost be y .

$$x + y = 100$$

$$y = 100 - x \dots\dots(i)$$

Also given, Rs gained = Rs 800

$$50x - 20y = 800$$

$$\Rightarrow 5x - 2y = 80 \dots\dots(ii)$$

Substituting (i) in (ii)

$$5x - 2(100 - x) = 80$$

$$\Rightarrow 5x - 200 + 2x = 80$$

$$\Rightarrow 7x = 280$$

$$\Rightarrow x = 40$$

Number of games won = 40

Answer 8.

Let the wife work for x hrs.

Since the husband works twice as much as his wife,

Therefore husband works for $2x$ hrs.

Total numbers of hours worked = 60

$$\Rightarrow x + 2x = 60$$

$$\Rightarrow 3x = 60$$

$$\Rightarrow x = 20$$

$$\Rightarrow 2x = 40$$

Therefore, wife works for 20 hrs and husband works for 40 hrs

Answer 9.

Let the marksman hit x times and miss y times

Therefore, $x - y = 100 \Rightarrow y = x - 100 \dots\dots (i)$

Also given, Amount earned = Rs 29 = (29×100) paise = 2900 paise

Therefore,

$$50x - 20y = 2900$$

$$5x - 2y = 290 \quad \dots\dots (ii)$$

Substituting (i) in (ii)

$$5x - 2(x - 100) = 290$$

$$5x - 2x + 200 = 290$$

$$3x = 90$$

$$x = 30$$

Therefore, marksman hits 30 times and misses 70 times.

Answer 10.

Let the number of students be x and number of benches be y .

(i) When 4 students sit on one bench:

Number of benches occupied = $y-3$

$$\Rightarrow x = 4(y-3) \quad \dots\dots (i)$$

(ii) When 3 students sit on one bench:

3 students are left standing

$$\Rightarrow x-3 = 3y \Rightarrow x = 3y + 3 \quad \dots\dots (ii)$$

From (i) and (ii)

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

$$4y - 12 = 3y + 3$$

$$y = 15$$

$$\text{But } x = 4(y-3) \quad (\text{from (i)})$$

$$\Rightarrow x = 4(15-3)$$

$$\Rightarrow x = 48$$

Therefore, Number of students in the class = 48

Answer 11.

Let the number of students be x and number of seats be y .

(i) When 2 students sit on one seat:

Number of seats occupied = $y - 7$

$$\Rightarrow x = 2(y - 7) \dots\dots(i)$$

(ii) When 1 student sit on one seat:

9 students are left standing

$$\Rightarrow x - 9 = y \Rightarrow x = y + 9 \dots\dots(ii)$$

From (i) and (ii)

$$2(y - 7) = y + 9$$

$$2y - 14 = y + 9$$

$$y = 23$$

Therefore, Number of seats in the class = 23

Answer 12.

Let s be the selling price and c be the cost price.

$$\frac{s - c}{c} = 6\%$$

$$\Rightarrow s - c = 0.06c$$

$$\Rightarrow s = 1.06c \dots\dots(i)$$

If he bought at 4% less cost price = $c - 4\%c = 0.96c$

and sold at Rs 7.60 higher $\Rightarrow$ selling price = $s + 7.60$

Therefore,

$$\frac{s + 7.60 - 0.96c}{0.96c} = 12\%$$

$$\Rightarrow \frac{s + 7.60 - 0.96c}{0.96c} = 0.12 \dots\dots(ii)$$

Substituting (i) in (ii)

$$\Rightarrow \frac{(1.06c) + 7.60 - 0.96c}{0.96c} = 0.12$$

$$\Rightarrow \frac{0.1c + 7.60}{0.96c} = 0.12$$

$$\Rightarrow 0.1c + 7.60 = 0.12 \times 0.96c$$

$$\Rightarrow 0.1c + 7.60 = 0.1152c$$

$$\Rightarrow 0.0152c = 7.60$$

$$\Rightarrow c = 500$$

Therefore, his cost price is Rs 500.

Answer 13.

Let x and y be the cost price of first and second article respectively and z be the selling price of both.

Therefore, $x + y = 410$ (i)

For first article: profit = 15%

$$\frac{z - x}{x} = 0.15$$

$$\Rightarrow z - x = 0.15x$$

$$\Rightarrow z = 1.15x \text{(ii)}$$

For second article: loss = 10%

$$\frac{y - z}{y} = 0.10$$

$$\Rightarrow y - z = 0.10y$$

$$\Rightarrow z = 0.9y \text{(iii)}$$

Selling prices of both are equal, therefore

$$0.9y = 1.15x$$

$$y = \frac{1.15x}{0.9} \text{(iv)}$$

Substituting (iv) in (i)

$$x + \frac{1.15x}{0.9} = 410$$

$$\Rightarrow 0.9x + 1.15x = 410 \times 0.9$$

$$\Rightarrow 2.05x = 369$$

$$\Rightarrow x = 180$$

Substituting value of x in (i)

$$180 + y = 410$$

$$\Rightarrow y = 410 - 180 = 230$$

Therefore, cost price of two articles = Rs 180 and Rs 230

Answer 14.

Let investment at 12% be x and at 14% be y.

$$\text{Then, } x + y = 35000 \quad \Rightarrow y = 35000 - x \quad \dots\dots (i)$$

$$\text{And } 0.12x + 0.14y = 4460 \quad \dots\dots(ii)$$

Substituting (i) in (ii)

$$0.12x + 0.14(35000 - x) = 4460$$

$$\Rightarrow 0.12x + 4900 - 0.14x = 4460$$

$$\Rightarrow 0.02x = 440$$

$$\Rightarrow x = 22000$$

Substituting value of x in (i)

$$\Rightarrow y = 35000 - 22000$$

$$\Rightarrow y = 13000$$

Therefore, he invested Rs 22000 at 12% and Rs 13000 at 14%

Answer 15.

Let quantities of cashew kernels and dry grapes be x and y respectively.

$$\text{Therefore, } x + y = 700g \quad \Rightarrow y = 700 - x \quad \dots\dots(i)$$

$$\text{Cost of cashew kernels} = \text{Rs } 96/\text{kg} \Rightarrow 0.096/g$$

$$\text{Cost of dry grapes} = \text{Rs } 112/\text{kg} \Rightarrow 0.112/g$$

$$\text{Cost of dry fruit pack} = \text{Rs } 72$$

Therefore,

$$0.096x + 0.112y = 72 \dots\dots(ii)$$

Substituting (i) in (ii)

$$0.096x + 0.112(700 - x) = 72$$

$$\Rightarrow 0.096x + 78.4 - 0.112x = 72$$

$$\Rightarrow 0.016x = 6.4$$

$$\Rightarrow x = 400$$

Substituting value of x in (i)

$$400 + y = 700 \Rightarrow y = 300$$

Therefore, cashew kernels = 400g and dry grapes = 300g

Answer 16.

$$\text{Total number of votes polled} = 9791$$

$$\text{Number of invalid votes} = 116$$

$$\text{Number of valid votes} = 9791 - 116 = 9675$$

$$\text{Number of votes received by successful candidate} = \frac{5}{9} \times 9675 = 5375 \dots(i)$$

$$\text{Number of votes received by opponent candidate} = \frac{4}{9} \times 9675 = 4300 \dots(ii)$$

Subtracting (ii) from (i)

$$5375 - 4300 = 1075$$

Therefore, the successful candidate won by 1075 votes.

Answer 17.

Let x be the water added

Then,

$$12(33.33\%) = 20\%(x + 12)$$

$$\Rightarrow 12 \times 0.3333 = 0.2(x + 12)$$

$$\Rightarrow 3.999 = 0.2x + 2.4$$

$$\Rightarrow 0.2x = 1.596$$

$$\Rightarrow x = 7.95 \text{ t} \approx 8 \text{ t}$$

Approximately, 8 litres of water must be added.

Answer 18.

Quantity of solution = 90 kg

$$\text{Quantity of salt} = 90 \text{ kg} \times \frac{10}{100} = 9 \text{ kg}$$

Let x kg of water be evaporated.

Therefore,

$$\frac{9}{90 - x} = \frac{20}{100}$$

$$\Rightarrow 900 = 1800 - 20x$$

$$\Rightarrow 20x = 900$$

$$\Rightarrow x = 45$$

Therefore, 45 kg of water must be evaporated.

Answer 19.

Let x Kg of Rs. 50 per kg tea should be added with 35 kg of tea costing Rs.60/kg.

Total weight of tea after mixing = $(x + 35)$ Kg

Selling price of $(x + 35)$ Kg = $(x + 35)$ 57 Rs.

But here SP = CP

C.P. of the tea = Rs $(50x + 35 \times 60)$

$$\Rightarrow (x+35) 57 = 50x + 2100$$

$$\Rightarrow 57x + 1995 = 50x + 2100$$

$$\Rightarrow 7x = 105$$

$$\Rightarrow x = 15 \text{ kg}$$

Therefore, 15 Kg of Rs. 50 per kg should be added.

Answer 20.

Let x be the total money left by the man.

$$\text{Share of wife} = \frac{1}{2}x$$

$$\text{Share of son} = \frac{1}{3}x$$

$$\text{Share of daughter} = x - \frac{1}{2}x - \frac{1}{3}x = 0.166667x$$

But daughter's share = Rs 15000

$$\Rightarrow 0.166667x = \text{Rs}15000$$

$$\Rightarrow x = \text{Rs}90000$$

$$\text{Share of wife} = \frac{1}{2}x = \frac{1}{2} \times \text{Rs}90000 = \text{Rs}45000$$

Therefore, Man left Rs 90000 and wife's share is Rs 45000