

Linear Equations in One Variable

Ex.A

Linear equation in one variable is an equation which can be written in the form of $ax + b = 0$, where a and b are real-number constants and $a \neq 0$.

Ex.

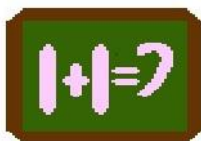
$$x + 7 = 12$$

Equation is a mathematical sentence indicating that two expressions are equal. The symbol "=" is used to indicate equality.

Ex.

$2x + 5 = 9$ is a conditional equation
since its truth or falsity depends on
the value of x

$2 + 9 = 11$ is identity equation since both of its
sides are identical to the same
number 11.



Solution Set of a Linear Equation

Example

$$4x + 2 = 10$$

this statement is either true or false

If $x = 1$, then $4x + 2 = 10$

is false because $4(1) + 2$ is $\neq 10$

If $x = 2$, then $4x + 2 = 10$

is true because $4(2) + 2 = 10$

ONE STEP SUBTRACTION EXAMPLE

The Opposite of Subtraction is Addition

$$\begin{array}{r} x - 120 = 80 \\ +120 \quad +120 \\ \hline x = 200 \checkmark \end{array}$$

The value which makes the equation true is 200.

$x - 4 = 7$	Original problem
$x - 4 = 7$	We want to remove the minus 4.
$x - 4 + 4 = 7 + 4$	The opposite of minus 4 is plus 4, so I added 4 to BOTH sides of the equation.
$x = 11$	$-4 + 4 = 0$, so x remains on the left and $7 + 4 = 11$; therefore $x = 11$
Check: $x - 4 = 7$ $11 - 4 = 7$	This is a correct statement, so my answer is $x = 11$ is correct!

Solving simple two-step equations

To solve an equation, find the value that makes the equation true.

Solve $2x + 3 = 13$

This means: $x \xrightarrow{\times 2} \xrightarrow{+ 3} = 13$

To solve, we reverse the process:

$x \xrightarrow{\times 2} \xrightarrow{+ 3} 13$				
$x \xrightarrow{- 2} \xrightarrow{- 3} 13$				
$2x + 3 = 13$				
$2x = 10$	$- 3$			
$x = 5$	$\div 2$			

Use the opposite (inverse) operation and undo in reverse order.

We have solved the equation when we get to a single value of x (here, $x = 5$).

Solve $4x + 6 = 14$

$4x + 6 = 14$	
$4x = 8$	$- 6$
$x = 2$	$\div 4$

Solve $3x - 8 = 19$

$3x - 8 = 19$	
$3x = 27$	$+ 8$
$x = 9$	$\div 3$

Q1

Answer :

$$\begin{aligned}
 3x - 5 &= 0 \\
 \Rightarrow 3x &= 5 && \text{(Transposing } -5 \text{ to RHS)} \\
 \Rightarrow x &= \frac{5}{3}
 \end{aligned}$$

CHECK : By substituting $x = \frac{5}{3}$ in the given equation, we get :

$$\text{LHS} = 3\left(\frac{5}{3}\right) - 5 = 5 - 5 = 0$$

$$\text{RHS} = 0$$

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

Hence checked.

Q2 **Answer :**

$$\begin{aligned}
 8x - 3 &= 9 - 2x \\
 \Rightarrow 8x + 2x &= 9 + 3 && \text{(By transposition)} \\
 \Rightarrow 10x &= 12 \\
 \Rightarrow x &= \frac{12}{10} = \frac{6}{5}
 \end{aligned}$$

CHECK : By substituting $x = \frac{6}{5}$ in the given equation, we get :

$$\text{LHS} : 8\left(\frac{6}{5}\right) - 3 = \frac{48}{5} - 3 = \frac{48-15}{5} = \frac{33}{5}$$

$$\text{RHS} : 9 - 2\left(\frac{6}{5}\right) = 9 - \frac{12}{5} = \frac{45-12}{5} = \frac{33}{5}$$

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

Hence checked.

Q3

Answer :

We have:

$$7 - 5x = 5 - 7x$$

$$\Rightarrow -5x + 7x = 5 - 7 \text{ [transposing } -7x \text{ to LHS and } 7 \text{ to RHS]}$$

$$\Rightarrow 2x = -2$$

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

$$\Rightarrow x = -1$$

Thus, $x = -1$ is a solution to the given equation.

CHECK: Substituting $x = -1$ in the given equation, we get:

$$\begin{aligned}
 \text{LHS} &= 7 - 5x \\
 &= 7 - 5 \times (-1) \\
 &= 7 + 5 \\
 &= 12
 \end{aligned}$$

$$\begin{aligned}
 \text{RHS} &= 5 - 7x \\
 &= 5 - 7 \times (-1) \\
 &= 5 + 7 \\
 &= 12
 \end{aligned}$$

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

Hence, $x = -1$ is a solution of the given equation.

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Q4

Answer :

We have:

$$\begin{aligned}3 + 2x &= 1 - x \\ \Rightarrow 2x + x + 3 - 1 &= 0 && \text{(By transposition)} \\ \Rightarrow 3x + 2 &= 0 \\ \Rightarrow x &= -\frac{2}{3}\end{aligned}$$

CHECK: Substituting $x = -\frac{2}{3}$ in the given equation, we get:

$$\begin{aligned}\text{LHS: } 3 + 2x \\ &= 3 + 2 \times \left(-\frac{2}{3}\right) \\ &= 3 - \frac{4}{3} \\ &= \frac{9-4}{3} \\ &= \frac{5}{3}\end{aligned}$$

$$\begin{aligned}\text{RHS: } 1 - x \\ &= 1 - \left(-\frac{2}{3}\right) \\ &= 1 + \frac{2}{3} \\ &= \frac{3+2}{3} \\ &= \frac{5}{3}\end{aligned}$$

\therefore LHS = RHS

Hence, $x = -\frac{2}{3}$ is a solution of the given equation.

Q5

Answer :

We have:

$$\begin{aligned}2(x - 2) + 3(4x - 1) &= 0 \\ \Rightarrow 2x - 4 + 12x - 3 &= 0 \\ \Rightarrow 14x - 7 &= 0 \\ \Rightarrow 14x &= 7 && \text{(By transposition)} \\ \Rightarrow x &= \frac{1}{2}\end{aligned}$$

CHECK: Substituting $x = \frac{1}{2}$ in the given equation, we get:

$$\begin{aligned}\text{LHS: } 2(x - 2) + 3(4x - 1) \\ &= 2x - 4 + 12x - 3 \\ &= 2 \times \frac{1}{2} - 4 + 12 \times \frac{1}{2} - 3 \\ &= 1 - 4 + 6 - 3 \\ &= -7 + 7 \\ &= 0\end{aligned}$$

RHS: 0

\therefore LHS = RHS

Hence, $x = \frac{1}{2}$ is a solution of the given equation.

Q6

Answer :

We have:

$$\begin{aligned}5(2x - 3) - 3(3x - 7) &= 5 \\ \Rightarrow 10x - 15 - 9x + 21 &= 5 \\ \Rightarrow 10x - 9x &= 5 + 15 - 21 && \text{(By transposition)} \\ \Rightarrow x &= 20 - 21 \\ \Rightarrow x &= -1\end{aligned}$$

CHECK: Substituting $x = -1$ in the given equation, we get:

$$\begin{aligned}\text{LHS: } 5(2x - 3) - 3(3x - 7) \\ &= 10x - 15 - 9x + 21 \\ &= 10 \times (-1) - 15 - 9 \times (-1) + 21 \\ &= -10 - 15 + 9 + 21 \\ &= -25 + 30 \\ &= 5\end{aligned}$$

RHS: 5

\therefore LHS = RHS

Hence, $x = -1$ is a solution of the given equation.

Q7

Answer :

We have:

$$\begin{aligned}2x - \frac{1}{3} &= \frac{1}{5} - x \\ \Rightarrow 2x + x &= \frac{1}{5} + \frac{1}{3} \\ \Rightarrow 3x &= \frac{3 \times 1 + 5 \times 1}{15} \\ \Rightarrow 3x &= \frac{3+5}{15} \\ \Rightarrow 3x &= \frac{8}{15} \\ \Rightarrow x &= \frac{8}{15 \times 3} \\ \Rightarrow x &= \frac{8}{45}\end{aligned}$$

CHECK: Substituting $x = \frac{8}{45}$ in the given equation, we get:

$$\begin{aligned}\text{LHS: } 2x - \frac{1}{3} &= 2 \times \frac{8}{45} - \frac{1}{3} \\ &= \frac{16}{45} - \frac{1}{3} \\ &= \frac{16 \times 1 - 15 \times 1}{45} \\ &= \frac{16-15}{45} \\ &= \frac{1}{45}\end{aligned}$$

$$\begin{aligned}\text{RHS: } \frac{1}{5} - x &= \frac{1}{5} - \frac{8}{45} \\ &= \frac{1 \times 9 - 1 \times 8}{45} \\ &= \frac{9-8}{45} \\ &= \frac{1}{45}\end{aligned}$$

\therefore LHS=RHS

Hence, $x = \frac{8}{45}$ is a solution of the given equation.

Q8

Answer :

We have:

$$\begin{aligned}\frac{1}{2}x - 3 &= 5 + \frac{1}{3}x \\ \Rightarrow \frac{1}{2}x - \frac{1}{3}x &= 5 + 3 \quad \left(\text{transposing } \frac{1}{3}x \text{ to LHS and } -3 \text{ to RHS}\right) \\ \Rightarrow \left(\frac{1 \times 3 - 1 \times 2}{6}\right)x &= 8 \\ \Rightarrow \left(\frac{3-2}{6}\right)x &= 8 \\ \Rightarrow \frac{1}{6}x &= 8 \\ \Rightarrow x &= 8 \times 6 \\ \Rightarrow x &= 48\end{aligned}$$

CHECK: Substituting $x=48$ in the given equation, we get:

$$\begin{aligned}\text{LHS: } \frac{1}{2}x - 3 &= \frac{1}{2} \times 48 - 3 \\ &= 24 - 3 \\ &= 21\end{aligned}$$

$$\begin{aligned}\text{RHS: } 5 + \frac{1}{3}x &= 5 + \frac{1}{3} \times 48 \\ &= 5 + 16 \\ &= 21\end{aligned}$$

\therefore LHS=RHS

Hence, $x=48$ is a solution of the given equation.

Q9

Answer :

$$\begin{aligned}\frac{x}{2} + \frac{x}{4} &= \frac{1}{8} \\ \Rightarrow \frac{x \times 2 + x \times 1}{4} &= \frac{1}{8} \\ \Rightarrow \frac{2x + x}{4} &= \frac{1}{8} \\ \Rightarrow \frac{3x}{4} &= \frac{1}{8} \\ \Rightarrow 3x &= \frac{1}{8} \times 4^1 \\ \Rightarrow 3x &= \frac{1}{2} \\ \Rightarrow x &= \frac{1}{6}\end{aligned}$$

CHECK: Substituting $x = \frac{1}{6}$ in the given equation, we get:

$$\begin{aligned}\text{LHS: } \frac{x}{2} + \frac{x}{4} &= \frac{x \times 2 + x \times 1}{4} \\ &= \frac{2x + x}{4} \\ &= \frac{3x}{4} \\ &= \frac{3^1}{4} \times \frac{1}{6^1} \\ &= \frac{1}{8}\end{aligned}$$

$$\text{RHS: } \frac{1}{8}$$

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

Hence, $x = \frac{1}{6}$ is a solution of the given equation.

Q10

Answer :

We have:

$$\begin{aligned}3x + 2(x + 2) &= 20 - (2x - 5) \\ \Rightarrow 3x + 2x + 4 &= 20 - 2x + 5 \\ \Rightarrow 3x + 2x + 2x &= 20 + 5 - 4 \quad (\text{Transposing } -2x \text{ to LHS and } 4 \text{ to RHS}) \\ \Rightarrow 7x &= 21 \\ \Rightarrow x &= \frac{21}{7} \\ \Rightarrow x &= 3\end{aligned}$$

CHECK: Substituting $x=3$ in the given equation, we get:

$$\begin{aligned}\text{LHS} &= 3x + 2(x + 2) \\ &= 3x + 2x + 4 \\ &= 5x + 4 \\ &= 5 \times 3 + 4 \\ &= 15 + 4 \\ &= 19\end{aligned}$$

$$\begin{aligned}\text{RHS} &= 20 - (2x - 5) \\ &= 20 - 2x + 5 \\ &= 25 - 2 \times 3 \\ &= 25 - 6 \\ &= 19\end{aligned}$$

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

Hence, $x=3$ is a solution of the given equation.

Q11

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Answer :

We have:

$$13(y - 4) - 3(y - 9) - 5(y + 4) = 0$$

$$\Rightarrow 13y - 52 - 3y + 27 - 5y - 20 = 0$$

$$\Rightarrow 13y - 3y - 5y = 52 + 20 - 27 \quad (\text{Transposing } -52, -20 \text{ and } 27 \text{ to RHS})$$

$$\Rightarrow 5y = 45$$

$$\Rightarrow y = \frac{45}{5}$$

$$\Rightarrow y = 9$$

CHECK: Substituting $x=9$ in the given equation, we get:

$$\text{LHS} = 13(y - 4) - 3(y - 9) - 5(y + 4)$$

$$= 13y - 52 - 3y + 27 - 5y - 20$$

$$= 13y - 3y - 5y - 52 + 27 - 20$$

$$= 5y - 45$$

$$= 5 \times 9 - 45$$

$$= 45 - 45$$

$$= 0$$

$$\text{RHS} = 0$$

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

Hence, $x=9$ is a solution of the given equation.

Q12

Answer :

We have,

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

$$\Rightarrow 2m + 5 = 3(3m - 10)$$

$$\Rightarrow 2m + 5 = 9m - 30$$

$$\Rightarrow 2m - 9m = -30 - 5 \quad (\text{Transposing } 9m \text{ to LHS and } 5 \text{ to RHS})$$

$$\Rightarrow -7m = -35$$

$$\Rightarrow m = \frac{-35}{-7}$$

$$\Rightarrow m = 5$$

CHECK: Substituting $m = 5$ in the given equation, we get:

$$\text{LHS} = \frac{2m+5}{3}$$

$$= \frac{2 \times 5 + 5}{3}$$

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

$$= \frac{15}{3}$$

$$= 5$$

$$= 5$$

$$\text{RHS} = 3m - 10$$

$$= 3 \times 5 - 10$$

$$= 15 - 10$$

$$= 5$$

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

Hence, $x=5$ is a solution of the given equation.

Q13

Answer :

We have:

$$\begin{aligned}6(3x+2) - 5(6x-1) &= 3(x-8) - 5(7x-6) + 9x \\ \Rightarrow 18x+12 - 30x+5 &= 3x-24 - 35x+30+9x \\ &\Rightarrow 18x-30x-3x+35x-9x = -24+30-12 \\ &-5 \quad (\text{Transposing } 3x, 9x \text{ and } -35x \text{ to LHS and } 12 \text{ and } 5 \text{ to RHS}) \\ \Rightarrow 53x-42x &= 30-41 \\ \Rightarrow 11x &= -11 \\ \Rightarrow x &= \frac{-11}{11} \\ \Rightarrow x &= -1\end{aligned}$$

CHECK: Substituting $x = -1$ in the given equation, we get:

$$\begin{aligned}\text{LHS} &= 6(3x+2) - 5(6x-1) \\ &= 18x+12 - 30x+5 \\ &= -12x+17 \\ &= -12 \times (-1) + 17 \\ &= 12+17 \\ &= 29\end{aligned}$$

$$\begin{aligned}\text{RHS} &= 3(x-8) - 5(7x-6) + 9x \\ &= 3x-24 - 35x+30+9x \\ &= 12x-35x-24+30 \\ &= -23x+6 \\ &= -23 \times (-1) + 6 \\ &= 23+6 \\ &= 29\end{aligned}$$

\therefore LHS=RHS

Hence, $x = -1$ is a solution of the given equation.

Q14

Answer :

We have:

$$\begin{aligned}t - (2t+5) - 5(1-2t) &= 2(3+4t) - 3(t-4) \\ \Rightarrow t-2t-5-5+10t &= 6+8t-3t+12 \\ \Rightarrow t-2t+10t-8t+3t &= 6+12+5+5 \quad (\text{By transposition}) \\ \Rightarrow 14t-10t &= 28 \\ \Rightarrow 4t &= 28 \\ \Rightarrow x &= \frac{28}{4} \\ \Rightarrow x &= 7\end{aligned}$$

CHECK: Substituting $x=7$ in the given equation, we get:

$$\begin{aligned}\text{LHS} &= t - (2t+5) - 5(1-2t) \\ &= t-2t-5-5+10t \\ &= 11t-2t-10 \\ &= 9t-10 \\ &= 9 \times 7 - 10 \\ &= 63-10 \\ &= 53\end{aligned}$$

$$\begin{aligned}\text{RHS} &= 2(3+4t) - 3(t-4) \\ &= 6+8t-3t+12 \\ &= 5t+18 \\ &= 5 \times 7 + 18 \\ &= 35+18 \\ &= 53\end{aligned}$$

\therefore LHS=RHS

Hence, $x=7$ is a solution of the given equation.

Q15

Answer :

We have:

$$\begin{aligned}\frac{2}{3}x &= \frac{3}{8}x + \frac{7}{12} \\ \Rightarrow \frac{2}{3}x - \frac{3}{8}x &= \frac{7}{12} \quad \left(\text{Transposing } \frac{3}{8}x \text{ to LHS}\right) \\ \Rightarrow \left(\frac{2 \times 8 - 3 \times 3}{24}\right)x &= \frac{7}{12} \\ \Rightarrow \left(\frac{16-9}{24}\right)x &= \frac{7}{12} \\ \Rightarrow \frac{7}{24}x &= \frac{7}{12} \\ \Rightarrow x &= \frac{7}{12} \times \frac{24}{7} \\ \Rightarrow x &= 2\end{aligned}$$

CHECK: Substituting $x=2$ in the given equation, we get:

$$\begin{aligned}\text{LHS} &= \frac{2}{3}x \\ &= \frac{2}{3} \times 2 \\ &= \frac{4}{3}\end{aligned}$$

$$\begin{aligned}\text{RHS} &= \frac{3}{8}x + \frac{7}{12} \\ &= \frac{3}{8} \times 2 + \frac{7}{12} \\ &= \frac{6}{8} + \frac{7}{12} \\ &= \frac{6 \times 3 + 7 \times 2}{24} \\ &= \frac{18+14}{24} \\ &= \frac{32}{24} \\ &= \frac{4}{3}\end{aligned}$$

\therefore LHS=RHS

Hence, $x=2$ is a solution of the given equation.

Q16

Answer :

We have:

$$\begin{aligned}\frac{3x-1}{5} - \frac{x}{7} &= 3 \\ \Rightarrow \frac{7(3x-1) - 5x}{35} &= 3 \\ \Rightarrow \left(\frac{21x-7-5x}{35}\right) &= 3 \\ \Rightarrow \left(\frac{16x-7}{35}\right) &= 3 \\ \Rightarrow 16x - 7 &= 3 \times 35 \quad \left(\text{Transposing } 35 \text{ to RHS}\right) \\ \Rightarrow 16x - 7 &= 105 \\ \Rightarrow 16x &= 105 + 7 \\ \Rightarrow 16x &= 112 \\ \Rightarrow x &= \frac{112}{16} \\ \Rightarrow x &= 7\end{aligned}$$

CHECK: Substituting $x=7$ in the given equation, we get:

$$\begin{aligned} \text{LHS} &= \frac{3x-1}{5} - \frac{x}{7} \\ &= \frac{7(3x-1) - 5 \times x}{35} \\ &= \left(\frac{21x - 7 - 5x}{35} \right) \\ &= \left(\frac{16x - 7}{35} \right) \\ &= \left(\frac{16 \times 3 - 7}{35} \right) \\ &= \frac{112 - 7}{35} \\ &= \frac{105}{35} \\ &= 3 \end{aligned}$$

$$\text{RHS} = 3$$

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

Hence, $x=3$ is a solution of the given equation.

Q17

Answer :

We have:

$$\begin{aligned} 2x - 3 &= \frac{3}{10} (5x - 12) \\ \Rightarrow 10(2x - 3) &= 3(5x - 12) \\ \Rightarrow 20x - 30 &= 15x - 36 \\ \Rightarrow 20x - 15x &= -36 + 30 \quad (\text{Transposing } 15x \text{ to LHS and } -30 \text{ to RHS}) \\ \Rightarrow 5x &= -6 \\ \Rightarrow x &= \frac{-6}{5} \end{aligned}$$

CHECK: Substituting $x = \frac{-6}{5}$ in the given equation, we get:

$$\begin{aligned} \text{LHS} &= 2x - 3 \\ &= 2 \times \left(\frac{-6}{5} \right) - 3 \\ &= \frac{-12}{5} - 3 \\ &= \frac{-12 - (3 \times 5)}{5} \\ &= \frac{-12 - 15}{5} \\ &= \frac{-27}{5} \end{aligned}$$

$$\begin{aligned} \text{RHS} &= \frac{3}{10} (5x - 12) \\ &= \frac{3}{10} \left(5^1 \times \frac{-6}{5^1} - 12 \right) \\ &= \frac{3}{10} \times (-18) \\ &= \frac{3}{\frac{10}{10}} \times \frac{-18}{10} \\ &= \frac{-27}{5} \end{aligned}$$

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

Hence, $x = \frac{-6}{5}$ is a solution of the given equation.

Q18

Answer :

We have:

$$\begin{aligned} \frac{y-1}{3} - \frac{y-2}{4} &= 1 \\ \Rightarrow \frac{4(y-1) - 3(y-2)}{12} &= 1 \\ \Rightarrow \left(\frac{4y - 4 - 3y + 6}{12} \right) &= 1 \\ \Rightarrow \left(\frac{y+2}{12} \right) &= 1 \\ \Rightarrow y + 2 &= 1 \times 12 \\ \Rightarrow y &= 12 - 2 \\ \Rightarrow y &= 10 \end{aligned}$$

CHECK: Substituting $y=10$ in the given equation, we get:

$$\begin{aligned} \text{LHS} &= \frac{y-1}{3} - \frac{y-2}{4} \\ &= \frac{4(y-1) - 3(y-2)}{12} \\ &= \left(\frac{y+2}{12} \right) \\ &= \left(\frac{10+2}{12} \right) \\ &= \frac{1+2^1}{1+2^1} \\ &= 1 \end{aligned}$$

$$\text{RHS} = 1$$

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

Hence, $y=10$ is a solution of the given equation.

Q19

Answer :

We have:

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

$$\Rightarrow \frac{x-2}{4} + \frac{2x-1}{3} - x = -\frac{1}{3} \quad \left(\text{Transposing } -\frac{2x-1}{3} \text{ to LHS and } \frac{1}{3} \text{ to RHS} \right)$$

$$\Rightarrow \left(\frac{3(x-2) + 4(2x-1) - 12x}{12} \right) = -\frac{1}{3}$$

$$\Rightarrow \left(\frac{3x-6+8x-4-12x}{12} \right) = -\frac{1}{3}$$

$$\Rightarrow 11x - 12x - 10 = -\frac{1}{3} \times 12$$

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

$$\Rightarrow -x = 6$$

$$\Rightarrow x = -6$$

CHECK: Substituting $x = -6$ in the given equation, we get:

$$\begin{aligned} \text{LHS} &= \frac{x-2}{4} + \frac{1}{3} \\ &= \frac{-6-2}{4} + \frac{1}{3} \\ &= -2 + \frac{1}{3} \\ &= \frac{-5}{3} \end{aligned}$$

$$\begin{aligned} \text{RHS} &= x - \frac{2x-1}{3} \\ &= -6 - \frac{2 \times (-6) - 1}{3} \\ &= -6 - \frac{(-13)}{3} \\ &= -6 + \frac{13}{3} \\ &= \frac{-5}{3} \end{aligned}$$

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

Hence, $y=10$ is a solution of the given equation.

Q20

Answer :

We have:

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

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

$$\Rightarrow \frac{10x-5-18x+6}{15} = \frac{1}{3}$$

$$\Rightarrow \frac{-8x+1}{15} = \frac{1}{3}$$

$$\Rightarrow -8x+1 = \frac{1}{3} \times 15$$

$$\Rightarrow -8x = 5 - 1$$

$$\Rightarrow -x = \frac{4}{8}$$

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

CHECK: Substituting $x = -\frac{1}{2}$ in the given equation, we get:

$$\begin{aligned}\text{LHS} &= \frac{2x-1}{3} - \frac{6x-2}{5} \\ &= \frac{-8x+1}{15} \\ &= \frac{-8 \times \left(-\frac{1}{2}\right) + 1}{15} \\ &= \frac{5}{15} \\ &= \frac{1}{3}\end{aligned}$$

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

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

Hence, $y = -\frac{1}{2}$ is a solution of the given equation.

Q21

Answer :

We have:

$$\begin{aligned}\frac{y+7}{3} &= 1 + \frac{3y-2}{5} \\ \Rightarrow \frac{y+7}{3} &= \frac{5 \times 1 + 3y - 2}{5} \\ \Rightarrow 5(y+7) &= 3(3+3y) \\ \Rightarrow 5y+35 &= 9+9y \\ \Rightarrow 9y-5y &= 35-9 \\ \Rightarrow 4y &= 26 \\ \Rightarrow y &= \frac{13}{2}\end{aligned}$$

CHECK: Substituting $x = \frac{13}{2}$ in the given equation, we get:

$$\begin{aligned}\text{LHS} &= \frac{y+7}{3} \\ &= \frac{\frac{13}{2}+7}{3} \\ &= \frac{1 \times 13 + 2 \times 7}{2 \times 3} \\ &= \frac{13+14}{6} \\ &= \frac{27}{6} \\ &= \frac{9}{2}\end{aligned}$$

$$\begin{aligned}\text{RHS} &= 1 + \frac{3 \times \frac{13}{2} - 2}{5} \\ &= 1 + \frac{39 - 2 \times 2}{5} \\ &= 1 + \frac{35}{10} \\ &= \frac{45}{10} \\ &= \frac{9}{2}\end{aligned}$$

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

Hence, $y = \frac{13}{2}$ is a solution of the given equation.

Q22

Answer :

We have:

$$\begin{aligned}\Rightarrow \frac{2}{7}(x-9) + \frac{x}{3} &= 3 \\ \Rightarrow \frac{2 \times 3(x-9) + 7x}{21} &= 3 \\ \Rightarrow 6(x-9) + 7x &= 3 \times 21 \\ \Rightarrow 6x - 54 + 7x &= 63 \\ \Rightarrow 13x &= 63 + 54 \\ \Rightarrow 13x &= 117 \\ \Rightarrow x &= 9\end{aligned}$$

CHECK: Substituting $x=9$ in the given equation we get.

$$\begin{aligned} \text{LHS} &= \frac{2}{7}(x-9) + \frac{x}{3} \\ &= \frac{2}{7}(9-9) + \frac{x}{3} \\ &= 0 + \frac{9}{3} \\ &= \frac{9}{3} \\ &= 3 \end{aligned}$$

$$\text{RHS} = 3$$

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

Hence, $x=9$ is a solution of the given equation.

Q23

Answer :

We have:

$$\begin{aligned} \Rightarrow \frac{2x-3}{5} + \frac{x+3}{4} &= \frac{4x+1}{7} \\ \Rightarrow \frac{4(2x-3)+5(x+3)}{20} &= \frac{4x+1}{7} \\ \Rightarrow \frac{8x-12+5x+15}{20} &= \frac{4x+1}{7} \\ \Rightarrow \frac{13x+3}{20} &= \frac{4x+1}{7} \\ \Rightarrow 7(13x+3) &= 20(4x+1) \\ \Rightarrow 91x+21 &= 80x+20 \\ \Rightarrow 91x-80x &= 20-21 \\ \Rightarrow 11x &= -1 \\ \Rightarrow x &= \frac{-1}{11} \end{aligned}$$

CHECK: Substituting $x = \frac{-1}{11}$ in the given equation, we get:

LHS:

$$\begin{aligned} \text{LHS} &= \frac{2x-3}{5} + \frac{x+3}{4} \\ &= \frac{2 \times \frac{-1}{11} - 3}{5} + \frac{\frac{-1}{11} + 3}{4} \\ &= \frac{-\frac{2}{11} - 3}{5} + \frac{\frac{-1}{11} + 3}{4} \\ &= \frac{-\frac{2-33}{11}}{5} + \frac{\frac{-1+33}{11}}{4} \\ &= -\frac{35}{55} + \frac{32}{44} \\ &= \frac{-140+160}{220} \\ &= \frac{20}{220} = \frac{1}{11} \end{aligned}$$

$$\begin{aligned} \text{RHS} &= \frac{4x+1}{7} \\ &= \frac{4 \times \left(\frac{-1}{11}\right) + 1}{7} \\ &= \frac{-\frac{4}{11} + 1}{7 \times 11} \\ &= \frac{7}{77} \\ &= \frac{1}{11} \end{aligned}$$

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

Hence, $x = \frac{-1}{11}$ is a solution of the given equation.

Q24

Answer :

We have:

$$\begin{aligned} \frac{3}{4}(7x-1) - \left(2x - \frac{1-x}{2}\right) &= x + \frac{3}{2} \\ \Rightarrow \frac{3}{4}(7x-1) - 2x + \frac{1-x}{2} - x &= \frac{3}{2} \\ \Rightarrow \frac{3 \times 7}{4}x - \frac{3}{4} - 2x + \frac{1}{2} - \frac{x}{2} - x &= \frac{3}{2} \\ \Rightarrow \frac{21}{4}x - 2x - \frac{x}{2} - x &= \frac{3}{2} + \frac{3}{4} - \frac{1}{2} \quad (\text{By transposition}) \\ \Rightarrow \frac{21x - 8x - 2x - 4x}{4} &= 1 + \frac{3}{4} \\ \Rightarrow \frac{21x - 14x}{4} &= \frac{7}{4} \\ \Rightarrow \frac{7x}{4} &= \frac{7}{4} \\ \Rightarrow x &= 1 \end{aligned}$$

CHECK: Substituting $x=1$ in the given equation, we get:

$$\begin{aligned}\text{LHS} &= \frac{3}{4}(7x-1) - \left(2x - \frac{1-x}{2}\right) \\ &= \frac{3}{4}(7 \times 1 - 1) - \left(2 \times 1 - \frac{1-1}{2}\right) \\ &= \frac{3}{4} \times 6 - 2 \\ &= \frac{9}{2} - 2 \\ &= \frac{9-4}{2} \\ &= \frac{5}{2}\end{aligned}$$

$$\begin{aligned}\text{RHS} &= x + \frac{3}{2} \\ &= 1 + \frac{3}{2} \\ &= \frac{2+3}{2} \\ &= \frac{5}{2}\end{aligned}$$

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

Hence, $x=1$ is a solution of the given equation.

Q25

Answer :

We have :

$$\begin{aligned}\frac{x+2}{6} - \left(\frac{11-x}{3} - \frac{1}{4}\right) &= \frac{3x-4}{12} \\ \Rightarrow \frac{x+2}{6} - \left(\frac{11-x}{3}\right) + \frac{1}{4} &= \frac{3x-4}{12} \\ \Rightarrow \frac{x+2}{6} - \left(\frac{11-x}{3}\right) - \frac{3x-4}{12} &= -\frac{1}{4} \quad (\text{By transposition}) \\ \Rightarrow \frac{2(x+2) - 4(11-x) - 1(3x-4)}{12} &= -\frac{1}{4} \\ \Rightarrow \frac{2x+4 - 44+4x - 3x+4}{12} &= -\frac{1}{4} \\ \Rightarrow 3x - 36 &= -\frac{1}{4} \times 12 \\ \Rightarrow 3x &= -3 + 36 \\ \Rightarrow x &= \frac{33}{3} \\ \Rightarrow x &= 11\end{aligned}$$

CHECK: Substituting $x=11$ in the given equation, we get:

$$\begin{aligned}\text{LHS} &= \frac{x+2}{6} - \left(\frac{11-x}{3} - \frac{1}{4}\right) \\ &= \frac{11+2}{6} - \left(\frac{11-11}{3} - \frac{1}{4}\right) \\ &= \frac{13}{6} - \left(-\frac{1}{4}\right) \\ &= \frac{13}{6} + \frac{1}{4} \\ &= \frac{13 \times 2 + 3}{12} \\ &= \frac{29}{12}\end{aligned}$$

$$\begin{aligned}\text{RHS} &= \frac{3x-4}{12} \\ &= \frac{3 \times 11 - 4}{12} \\ &= \frac{33-4}{12} \\ &= \frac{29}{12}\end{aligned}$$

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

Hence, $x = 11$ is a solution of the given equation.

Verified.

Q26

Answer :

We have:

$$\begin{aligned}\frac{9x+7}{2} - \left(x - \frac{x-2}{7}\right) &= 36 \\ \Rightarrow \frac{9x+7}{2} - x + \frac{x-2}{7} &= 36 \\ \Rightarrow \frac{7(9x+7) - 14x + 2(x-2)}{14} &= 36 \\ \Rightarrow \frac{63x+49-14x+2x-4}{14} &= 36 \\ \Rightarrow 51x + 45 &= 36 \times 14 \\ \Rightarrow 51x &= 504 - 45 \\ \Rightarrow x &= \frac{459}{51} \\ \Rightarrow x &= 9 \\ \Rightarrow x &= 9\end{aligned}$$

CHECK: Substituting $x=9$ in the given equation, we get:

$$\begin{aligned}\text{LHS} &= \frac{9x+7}{2} - \left(x - \frac{x-2}{7}\right) \\ &= \frac{9 \times 9 + 7}{2} - \left(9 - \frac{9-2}{7}\right) \\ &= \frac{88}{2} - 9 + \frac{7}{7} \\ &= 44 - 9 + 1 \\ &= 36 \\ \text{RHS} &= 36\end{aligned}$$

\therefore LHS=RHS

Hence, $x = 11$ is a solution of the given equation.

Verified.

Q27

Answer :

We have:

$$\begin{aligned}0.5x + \frac{x}{3} &= 0.25x + 7 \\ \Rightarrow \frac{1}{2}x + \frac{x}{3} &= \frac{x}{4} + 7 \\ \Rightarrow \frac{x}{2} + \frac{x}{3} - \frac{x}{4} &= 7 \\ \Rightarrow \frac{6x+4x-3x}{12} &= 7 \\ \Rightarrow \frac{7x}{12} &= 7 \\ \Rightarrow x &= 12\end{aligned}$$

CHECK: Substituting $x=9$ in the given equation, we get:

$$\begin{aligned}\text{LHS} &= 0.5x + \frac{x}{3} \\ &= 0.5 \times 12 + \frac{12}{3} \\ &= \frac{1}{2} \times 12 + 4 \\ &= 6 + 4 \\ &= 10 \\ \text{RHS} &= 0.25x + 7 \\ &= 0.25 \times 12 + 7 \\ &= 3 + 7 \\ &= 10\end{aligned}$$

\therefore LHS=RHS

Hence, $x = 12$ is a solution of the given equation.

Verified.

Q28

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Answer :

We have:

$$0.18(5x - 4) = 0.5x + 0.8$$

$$\Rightarrow 100 \times 0.18(5x - 4) = 100(0.5x + 0.8) \quad (\text{Multiplying both sides by } 100)$$

$$\Rightarrow 18(5x - 4) = 100 \times 0.5x + 100 \times 0.8$$

$$\Rightarrow 90x - 72 = 50x + 80$$

$$\Rightarrow 90x - 50x = 80 + 72$$

$$\Rightarrow 40x = 152$$

$$\Rightarrow x = \frac{152}{40}$$

$$\Rightarrow x = \frac{19}{5} = 3.8$$

CHECK: Substituting $x = 3.8$ in the given equation, we get:

$$\text{LHS} = 0.18(5x - 4)$$

$$= 0.18(5 \times 3.8 - 4)$$

$$= 0.18 \times 15$$

$$= 2.7$$

$$\text{RHS} = 0.5x + 0.8$$

$$= 0.5 \times 3.8 + 0.8$$

$$= 1.9 + 0.8$$

$$= 2.7$$

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

Hence, $x = 3.8$ is a solution of the given equation.

Verified.

Q29

Answer :

We have:

$$\Rightarrow 2.4(3 - x) - 0.6(2x - 3) = 0$$

$$\Rightarrow 10 \times 2.4(3 - x) - 10$$

$$\times 0.6(2x - 3) = 0 \quad (\text{Multiplying both sides by } 10 \text{ to remove decimals})$$

$$\Rightarrow 24(3 - x) - 6(2x - 3) = 0$$

$$\Rightarrow 6[4(3 - x) - (2x - 3)] = 0$$

$$\Rightarrow 4(3 - x) - (2x - 3) = 0$$

$$\Rightarrow 12 - 4x - 2x + 3 = 0$$

$$\Rightarrow 15 - 6x = 0$$

$$\Rightarrow -6x = -15$$

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

$$\Rightarrow x = \frac{5}{2} = 2.5$$

CHECK: Substituting $x = 2.5$ in the given equation, we get:

$$\text{LHS} = 2.4(3 - x) - 0.6(2x - 3)$$

$$= 2.4(3 - 2.5) - 0.6(2 \times 2.5 - 3)$$

$$= 2.4 \times 0.5 - 0.6 \times 2$$

$$= 1.2 - 1.2$$

$$= 0$$

$$\text{RHS} = 0$$

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

Hence, $x = \frac{19}{5}$ is a solution of the given equation.

Verified.

Q30

Answer :

We have:

$$0.5x - (0.8 - 0.2x) = 0.2 - 0.3x$$

$$\Rightarrow 0.5x + 0.3x - 0.8 + 0.2x = 0.2 \quad (\text{By transposition})$$

$$\Rightarrow (0.5 + 0.3 + 0.2)x = 0.2 + 0.8$$

$$\Rightarrow 1x = 1$$

$$\Rightarrow x = 1$$

CHECK: Substituting $x = 1$ in the given equation, we get:

$$\text{LHS} = 0.5x - (0.8 - 0.2x)$$

$$= 0.5 \times 1 - (0.8 - 0.2 \times 1)$$

$$= 0.5 - 0.8 + 0.2$$

$$= -0.1$$

$$\text{RHS} = 0.2 - 0.3x$$

$$= 0.2 - 0.3 \times 1$$

$$= -0.1$$

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

Hence, $x = 1$ is a solution of the given equation.

Verified.

Q31

Answer :

We have:

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

$$\Rightarrow (x+2) \times 3 = 7 \times (x-2) \quad (\text{Cross multiplication})$$

$$\Rightarrow 3x + 6 = 7x - 14$$

$$\Rightarrow 4x = 20$$

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

$$\Rightarrow x = 5$$

CHECK: Substituting $x = 5$ in the given equation, we get.

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

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

$$= \frac{7}{3}$$

$$\text{RHS} = \frac{7}{3}$$

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

Hence, $x = 5$ is a solution of the given equation.

Verified.

Q32

Answer :

We have:

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

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

$$\Rightarrow 1 \times (2x+5) = 3 \times (3x+4)$$

$$\Rightarrow 2x+5 = 9x+12$$

$$\Rightarrow 7x = -7$$

$$\Rightarrow x = -1$$

CHECK: Substituting $x = -1$ in the given equation, we get:

$$\text{LHS} : \frac{2x+5}{3x+4}$$

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

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

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

$$\text{RHS} = 3$$

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

Hence, $x = -1$ is a solution of the given equation.

Verified.

Linear equation in one variable is an equation which can be written in the form of $ax + b = 0$, where a and b are real-number constants and $a \neq 0$.

Ex.

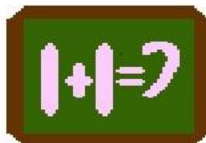
$$x + 7 = 12$$

Equation is a mathematical sentence indicating that two expressions are equal. The symbol "=" is used to indicate equality.

Ex.

$2x + 5 = 9$ is a conditional equation
since its truth or falsity depends on
the value of x

$2 + 9 = 11$ is identity equation since both of its
sides are identical to the same
number 11.



Solution Set of a Linear Equation

Example

$$4x + 2 = 10$$

this statement is either true of false

If $x = 1$, then $4x + 2 = 10$

is false because $4(1) + 2$ is $\neq 10$

If $x = 2$, then $4x + 2 = 10$

is true because $4(2) + 2 = 10$

ONE STEP SUBTRACTION EXAMPLE

The Opposite of Subtraction is Addition

$$\begin{array}{r} x - 120 = 80 \\ +120 \quad +120 \\ \hline x = 200 \checkmark \end{array}$$

The value which makes the equation true is 200.

$x - 4 = 7$	Original problem
$x - 4 = 7$	We want to remove the minus 4.
$x - 4 + 4 = 7 + 4$	The opposite of minus 4 is plus 4, so I added 4 to BOTH sides of the equation.
$x = 11$	$-4 + 4 = 0$, so x remains on the left and $7 + 4 = 11$; therefore $x = 11$
Check: $x - 4 = 7$ $11 - 4 = 7$	This is a correct statement, so my answer is $x = 11$ is correct!

Solving simple two-step equations

To solve an equation, find the value that makes the equation true.

Solve $2x + 3 = 13$

This means: $x \xrightarrow{\times 2} \xrightarrow{+ 3} = 13$

To solve, we reverse the process:

$x \xrightarrow{\times 2} \xrightarrow{+ 3} 13$
 $x \xrightarrow{\div 2} \xrightarrow{- 3} 13$

Use the opposite (inverse) operation and undo in reverse order.

$$\begin{array}{l} 2x + 3 = 13 \\ 2x = 10 \\ x = 5 \end{array} \begin{array}{l} - 3 \\ \div 2 \end{array}$$

We have solved the equation when we get to a single value of x (here, $x = 5$).

Solve $4x + 6 = 14$

$$\begin{array}{l} 4x + 6 = 14 \\ 4x = 8 \\ x = 2 \end{array} \begin{array}{l} - 6 \\ \div 4 \end{array}$$

Solve $3x - 8 = 19$

$$\begin{array}{l} 3x - 8 = 19 \\ 3x = 27 \\ x = 9 \end{array} \begin{array}{l} + 8 \\ \div 3 \end{array}$$

Q1

Answer :

Let the number be x .

Then, we have :

$$\Rightarrow 2x - 7 = 45$$

$$\Rightarrow 2x = 45 + 7$$

$$\Rightarrow x = \frac{45+7}{2}$$

$$\Rightarrow x = \frac{52}{2}$$

$$\Rightarrow x = 26$$

∴ The required number is 26.

Q2

Answer :

Let the number be x .

Then, we have:

$$\Rightarrow 3x + 5 = 44$$

$$\Rightarrow 3x = 44 - 5$$

$$\Rightarrow x = \frac{44-5}{3}$$

$$\Rightarrow x = \frac{39}{3}$$

$$\Rightarrow x = 13$$

∴ The required number is 13

Q3

Answer :

Let the number be x .

Then, we have:

$$\Rightarrow 2x + 4 = \frac{26}{5}$$

$$\Rightarrow 2x = \frac{26}{5} - 4$$

$$\Rightarrow 2x = \frac{26-20}{5}$$

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

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

\therefore The required fraction is $\frac{3}{5}$.

Q4

Answer :

Let the required number be x .

Then, we have:

$$\Rightarrow x + \frac{x}{2} = 72$$

$$\Rightarrow \frac{2x+x}{2} = 72$$

$$\Rightarrow \frac{3x}{2} = 72$$

$$\Rightarrow 3x = 72 \times 2$$

$$\Rightarrow x = \frac{72 \times 2}{3}$$

\therefore The required number is 48.

Q5

Answer :

Let the required number be x .

Then, we have:

$$\Rightarrow x + \frac{2x}{3} = 55$$

$$\Rightarrow \frac{3x+2x}{3} = 55$$

$$\Rightarrow 5x = 55 \times 3$$

$$\Rightarrow x = \frac{55 \times 3}{5}$$

\therefore The required number is 33.

Q6

Answer :

Let the required number be x .

Then, we have:

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

$$\Rightarrow 3x = \frac{45}{3}$$

$$\Rightarrow x = 15$$

\therefore The required number is 15.

Q7

Answer :

Let the number be x .

Then, we have:

$$(x - 21) = (71 - x)$$

$$\Rightarrow x + x = 71 + 21$$

$$\Rightarrow 2x = 92$$

$$\Rightarrow x = \frac{92}{2}$$

$$\Rightarrow x = 46$$

\therefore The required number is 46.

Q8

Answer :

Let the original number be x .

Then, we have:

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

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

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

$$\Rightarrow -x = -20 \times 3$$

$$\Rightarrow x = 60$$

\therefore The original number is 60.

Q9

Answer :

Let the number be x .

Then, the other number will be $\frac{2x}{5}$.

Now, we have:

$$\Rightarrow x + \frac{2x}{5} = 70$$

$$\Rightarrow \frac{5x + 2x}{5} = 70$$

$$\Rightarrow \frac{7x}{5} = 70$$

$$\Rightarrow x = \frac{70 \times 5}{7}$$

$$\therefore \text{Other number} = 50 \times \frac{2}{5} = 20$$

Hence, the numbers are 50 and 20.

Q10

Answer :

Let the number be x .

Then, we have:

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

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

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

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

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

$$\Rightarrow -x = -9$$

\therefore The required number is 9.

Q11

Answer :

Let the number be x .

Then, we have:

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

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

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

$$\Rightarrow x = 200$$

\therefore The required number is 200.

Q12

Answer :

Let the two consecutive natural number be x and $(x + 1)$.

Then, we have:

$$x + (x + 1) = 63$$

$$\Rightarrow x + x + 1 = 63$$

$$\Rightarrow 2x = 63 - 1$$

$$\Rightarrow x = \frac{63 - 1}{2}$$

$$\Rightarrow x = 31$$

\therefore The required numbers are 31 and 32 (i.e., $31 + 1$).

Q13

Answer :

Let the two consecutive odd integers whose sum is 76 be x and $(x + 2)$.

Then, $x + x + 2 = 76$

$$\Rightarrow 2x + 2 = 76$$

$$\Rightarrow 2x = 76 - 2$$

$$\Rightarrow x = 74 \div 2$$

$$\Rightarrow x = 37$$

\therefore The required integers are 37 and 39 (i.e., $37 + 2$).

Q14

Answer :

Let the three consecutive positive even integers be x , $(x + 2)$ and $(x + 4)$.

Let x be the even number.

Then, $x + x + 2 + x + 4 = 90$

$$\Rightarrow 3x = 90 - 6$$

$$\Rightarrow 3x = 84$$

$$\Rightarrow x = \frac{84}{3} = 28$$

\therefore The required numbers are 28, 30 and 32.

Q15

Answer :

Let the two parts be x and $(184 - x)$.

Then, we have:

$$\frac{1}{3}x = \frac{1}{7}(184 - x) + 8$$

$$\Rightarrow \frac{1}{3}x - \frac{1}{7}(184 - x) = 8$$

$$\Rightarrow \frac{1}{3}x - \frac{184}{7} + \frac{x}{7} = 8$$

$$\Rightarrow \frac{1}{3}x + \frac{1}{7}x = \frac{184}{7} + 8$$

$$\Rightarrow \frac{7x + 3x}{21} = 8 + \frac{184}{7}$$

$$\Rightarrow \frac{10x}{21} = \frac{56 + 184}{7}$$

$$\Rightarrow \frac{10x}{21} = \frac{240}{7}$$

$$\Rightarrow x = \frac{240 \times 21}{7 \times 10}$$

$$= 72$$

Now, other part = $184 - 72 = 112$

\therefore The two parts are 72 and 112.

Q16

Answer :

Let the number of five rupee notes be x .

Then, the number of ten rupee notes will be $(90 - x)$.

According to the question, we have :

$$5x + 10(90 - x) = 500$$

$$\Rightarrow 5x + 900 - 10x = 500$$

$$\Rightarrow -5x = -400$$

$$\Rightarrow x = 80$$

Number of ten rupee notes = $90 - 80 = 10$

\therefore There are 80 five rupee notes and 10 ten rupee notes.

Q17

Answer :

Let the numbers of 50 paise coins and 25 paise coins be x and $2x$, respectively.

Then, we have :

$$50x + 25 \times 2x = 3400$$

$$\Rightarrow 50x + 50x = 3400$$

$$\Rightarrow 100x = 3400$$

$$\Rightarrow x = 34$$

\therefore Number of 50 paise coins = 34

and number of 25 paise coins = 68

Q18

Answer :

Let the present ages of Raju and his cousin be $(x-19)$ yrs and x yrs.

According to the question, we have :

$$\frac{(x-19)+5}{x+5} = \frac{2}{3}$$

$$\Rightarrow 3(x - 14) = 2x + 10$$

$$\Rightarrow 3x - 42 = 2x + 10$$

$$\Rightarrow x = 52$$

\therefore Age of Raju's cousin = 52 yrs

and age of Raju = $52 - 19 = 33$ yrs

Q19

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Answer :

Let the age of the son and the father be x yrs and $(x + 30)$ yrs, respectively.

According to the question, we have :

$$3 \times (x + 12) = x + 30 + 12$$

$$\Rightarrow 3x + 36 = x + 42$$

$$\Rightarrow 3x - x = 42 - 36$$

$$\Rightarrow 2x = 6$$

$$\Rightarrow x = 3$$

\therefore Son's age = 3 yrs

Father's age = $(x + 30)$ yrs = $(3 + 30)$ yrs = 33 yrs

Q20

Answer :

Given ratio of Sonal's and Manoj's ages = 7 : 5

Let the ages of Sonal and Manoj be $7x$ yrs and $5x$ yrs.

According to the question, we have :

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

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

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

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

$$\Rightarrow 4x = 20$$

$$\Rightarrow x = 5$$

\therefore Sonal's present age is $7 \times 5 = 35$ yrs

Manoj's present age is $5 \times 5 = 25$ yrs

Q21

Answer :

Let x yrs be the present age of son.

Then, the age of the son 5 years ago would be $(x - 5)$ yrs

Then, Age of father = $7 \left(x - 5 \right)$ yrs

After 5 yrs, the age of the son will be $\left(x + 5 \right)$ yrs

Then, Age of father = $3 \left(x + 5 \right)$ yrs

Now, we have $3(x + 5) = 7(x - 5) + 10$

$$\Rightarrow 3x + 15 = 7x - 35 + 10$$

$$\Rightarrow 4x = 40$$

$$\Rightarrow x = 10$$

\therefore Present age of the father is = $3(x+5)-5$

$$= 3 \left(10 + 5 \right) - 5$$

$$= 40 \text{ yrs}$$

Q22

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Answer :

Let x be the present age of Manoj.

According to the question, we have :

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

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

$$\Rightarrow 2x = 24$$

$$\Rightarrow x = 12$$

\therefore Manoj's present age is 12 years.

Q23

Answer :

Let x be the total marks.

According to the question, we have:

$$40\% \text{ of } x = 185 + 15$$

$$\Rightarrow \frac{40x}{100} = 200$$

$$\Rightarrow 40x = 200 \times 100$$

$$\Rightarrow 40x = 20000$$

$$\Rightarrow x = 500$$

\therefore Total marks = 500

Q24

Answer :

Let x be the digit in the units place.

Sum of the units and tens digits = 8

Then, tens digit = $(8 - x)$

\therefore The number is $10(8 - x) + x$.

$$\text{Now, } 10(8 - x) + x + 18 = 10x + (8 - x)$$

$$\Rightarrow 80 - 10x + x + 18 = 10x + 8 - x$$

$$\Rightarrow 98 - 9x = 9x + 8$$

$$\Rightarrow 18x = 90$$

$$\Rightarrow x = 5$$

i.e., tens digit = $(8 - 5) = 3$

\therefore Required number = $10(8 - 5) + 5 = 10 \times 3 + 5 = 35$

Q25

Answer :

Let Rs x be the cost of the chair.

Then, the cost of the table is Rs $(x + 75)$.

$$\text{Now, } 3(x + 75) + 2x = 1850$$

$$\Rightarrow 3x + 225 + 2x = 1850$$

$$\Rightarrow 5x = 1625$$

$$\Rightarrow x = \frac{1625}{5} = 325$$

\therefore Cost of the chair = Rs 325; cost of the table = $(325 + 75) =$ Rs 400

Q26

Answer :

Let the cost price of the article be Rs x .

According to the question, we have:

SP = Rs 495

$$\therefore \text{Gain \%} = \frac{\text{Gain}}{\text{CP}} \times 100$$

$$\Rightarrow 10 = \frac{\text{Gain}}{x} \times 100$$

$$\Rightarrow \text{Gain} = \frac{10x}{100} = \text{Rs } \frac{x}{10}$$

Now, CP + Gain = SP

$$\Rightarrow x + \frac{x}{10} = 495$$

$$\Rightarrow \frac{x + 10x}{10} = 495$$

$$\Rightarrow 11x = 495 \times 10$$

$$\Rightarrow x = \frac{495 \times 10}{11}$$

$$\Rightarrow x = \frac{4950}{11}$$

$$\Rightarrow x = 450$$

\therefore CP = Rs 450

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Q27

Answer :

Let the length and breadth of the rectangular field be l m and b m, respectively.

According to the question, we have :

$$2(l + b) = 150 \quad \dots (i)$$

$$\Rightarrow l + b = 75$$

$$\text{Given that } l = 2b \quad \dots (ii)$$

Using (ii) in (i), we have:

$$2b + b = 75$$

$$\Rightarrow 3b = 75$$

$$\Rightarrow b = 25$$

$$\therefore l = 50 \text{ m and } b = 25 \text{ m}$$

Q28

Answer :

Let the length of third side be x m. Then, the length of the two equal sides will be $(2x - 5)$ m.

$$\therefore (2x - 5) + (2x - 5) + x = 55$$

$$\Rightarrow 2x - 5 + 2x - 5 + x = 55$$

$$\Rightarrow 5x - 10 = 55$$

$$\Rightarrow 5x = 65$$

$$\Rightarrow x = \frac{65}{5} = 13$$

$$\therefore \text{Length of the third side} = 13 \text{ m}$$

$$\text{And length of the other two equal sides} = (2 \times 13) - 5 = 21 \text{ m}$$

Q29

Answer :

Let the two complementary angles be x° and $(90 - x)^\circ$.

According to the question, we have :

$$x - (90 - x) = 8$$

$$\Rightarrow x - 90 + x = 8$$

$$\Rightarrow 2x = 98$$

$$\Rightarrow x = 49$$

$$\therefore \text{The measures of the complementary angles are } 49^\circ \text{ and } (90 - 49)^\circ = 41^\circ.$$

Q30

Answer :

Let the two supplementary angles be x° and $(180 - x)^\circ$.

$$\therefore x - (180 - x) = 44$$

$$\Rightarrow x - 180 + x = 44$$

$$\Rightarrow 2x = 224$$

$$\Rightarrow x = 112$$

$$\therefore \text{The measures of the supplementary angles are } 112^\circ \text{ and } (180 - 112)^\circ, \text{ i.e., } 68^\circ.$$

Q31

Answer :

Let the base angles of the isosceles triangle be x° each.

Then, the measure the vertex angle will be $(2x)^\circ$.

According to the question, we have :

$$x + x + 2x = 180 \quad (\text{Sum of three sides of a triangle})$$

$$\Rightarrow 4x = 180$$

$$\Rightarrow x = \frac{180}{4}$$

$$\Rightarrow x = 45$$

$$\therefore \text{Each base angle measures } 45^\circ \text{ and the vertex angle measures } (2 \times 45)^\circ, \text{ i.e., } 90^\circ.$$

Q32

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Answer :

Let the length of the total journey be x km.

According to the question, we have:

$$\frac{3}{5}x + \frac{1}{4}x + \frac{1}{8}x + 2 = x$$

$$\Rightarrow \frac{24x + 10x + 5x + 80}{40} = x$$

$$\Rightarrow 39x + 80 = 40x$$

$$\Rightarrow x = 80$$

\therefore The length of his total journey is 80 km.

Q33

Answer :

Let x be the number of days of his absence.

\therefore Number of days of his presence = $(20 - x)$

Now, $(20 - x)120 - 10x = 1880$

$$\Rightarrow 2400 - 120x - 10x = 1880$$

$$\Rightarrow 2400 - 1880 = 130x$$

$$\Rightarrow 130x = 520$$

$$\Rightarrow x = 4$$

\therefore Number of days of his absence = 4

Q34

Answer :

Let the worth of Hari Babu's property be Rs x .

According to the question, we have:

$$\text{Son's share} = \frac{1}{4}x$$

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

$$\text{Wife's share} = \left\{ x - \left(\frac{1}{4}x + \frac{1}{3}x \right) \right\}$$

It is given that his wife's share is Rs 18000.

$$\text{i.e., } x - \left(\frac{1}{4}x + \frac{1}{3}x \right) = 18000$$

$$\Rightarrow x - \left(\frac{1}{3}x + \frac{1}{4}x \right) = 18000$$

$$\Rightarrow x - \frac{7x}{12} = 18000$$

$$\Rightarrow \frac{5x}{12} = 18000$$

$$\Rightarrow x = \frac{18000 \times 12}{5}$$

$$\Rightarrow x = 43200$$

\therefore Hari Babu's total property is worth Rs 43200.

Q35

Answer :

Let the volume of the pure alcohol be x ml.

Initial concentration = 15%

So, initial amount of alcohol in the solution will be = $\frac{15}{100} \times 400 = 60$ ml

To make the strength of the solution 32%, we will keep the amount of water constant and add

On adding pure alcohol, the volume of the solution increases to $400 + x$.

According to the question, we have :

$$\frac{x+60}{400+x} = \frac{32}{100}$$

$$\Rightarrow 100x + 6000 = 12800 + 32x$$

$$\Rightarrow 100x - 32x = 12800 - 6000$$

$$\Rightarrow 68x = 6800$$

$$\Rightarrow x = 100$$

So, amount of pure alcohol to be added = 100 ml

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Linear Equations in One Variable

Ex 7C

Q1

Answer :

(d) $\frac{1}{36}$

We have:

$$\begin{aligned}5x - \frac{3}{4} &= 2x - \frac{2}{3} \\ \Rightarrow 5x - 2x &= \frac{-2}{3} + \frac{3}{4} \\ \Rightarrow 3x &= \frac{-8+9}{12} \\ \Rightarrow x &= \frac{1}{12 \times 3} \\ \Rightarrow x &= \frac{1}{36}\end{aligned}$$

Q2

Answer :

(d) $\frac{4}{3}$

We have:

$$\begin{aligned}2z + \frac{8}{3} &= \frac{1}{4}z + 5 \\ \Rightarrow 2z - \frac{1}{4}z &= 5 - \frac{8}{3} \\ \Rightarrow \frac{8z-z}{4} &= \frac{15-8}{3} \\ \Rightarrow \frac{7z}{4} &= \frac{7}{3} \\ \Rightarrow z &= \frac{7^1 \times 4}{3 \times 7^1} \\ \Rightarrow z &= \frac{4}{3}\end{aligned}$$

Q3

Answer :

(a) 5

We have:

$$\begin{aligned}(2n + 5) &= 3(3n - 10) \\ \Rightarrow 2n + 5 &= 9n - 30 \\ \Rightarrow 2n - 9n &= -30 - 5 \\ \Rightarrow \cancel{7}n &= \cancel{35} \\ \Rightarrow n &= \frac{-35}{-7} \\ \Rightarrow n &= 5\end{aligned}$$

Q4

Answer :

(c) 8

We have:

$$\begin{aligned}\frac{x-1}{x+1} &= \frac{7}{9} \\ \Rightarrow 9(x-1) &= 7(x+1) \\ \Rightarrow 9x - 9 &= 7x + 7 \\ \Rightarrow 9x - 7x &= 7 + 9 \\ \Rightarrow 2x &= 16 \\ \Rightarrow x &= \frac{16}{2} \\ \Rightarrow x &= 8\end{aligned}$$

Q5

Answer :

(c) $\frac{1}{2}$

We have:

$$\begin{aligned}8(2x - 5) - 6(3x - 7) &= 1 \\ \Rightarrow 16x - 40 - 18x + 42 &= 1 \\ \Rightarrow -2x + 2 &= 1 \\ \Rightarrow -2x &= 1 - 2 \\ \Rightarrow \cancel{2}x &= \cancel{1} \frac{1}{2} \\ \Rightarrow x &= \frac{1}{2}\end{aligned}$$

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Q6

Answer :

(d) 30

We have:

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

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

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

$$\Rightarrow 3x - 6 = 2x + 24$$

$$\Rightarrow 3x - 2x = 24 + 6$$

$$\Rightarrow x = 30$$

Q7

Answer :

(a) 2

We have:

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

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

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

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

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

$$\Rightarrow 3x = 6$$

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

Q8

Answer :

(b) 26

Let the consecutive whole numbers be x and $(x+1)$.

$$\text{Then, } x + (x+1) = 53$$

$$\Rightarrow 2x + 1 = 53$$

$$\Rightarrow 2x = 53 - 1$$

$$\Rightarrow x = \frac{53-1}{2} = 26$$

$$\Rightarrow x = 26$$

Q9

Answer :

(d) 44

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

$$\text{Then, } x + (x+2) = 86$$

$$\Rightarrow 2x + 2 = 86$$

$$\Rightarrow 2x = 86 - 2$$

$$\Rightarrow x = \frac{86-2}{2} = 42$$

$$\Rightarrow x = 42$$

\therefore The required numbers are 42 and $(42+2)$, i.e., 44.

Q10

Answer :

(b) 17

Let the two consecutive odd numbers be $(x+1)$ and $(x+3)$.

$$\text{Then, } (x+1) + (x+3) = 36$$

$$\Rightarrow 2x + 4 = 36$$

$$\Rightarrow 2x = 36 - 4$$

$$\Rightarrow x = \frac{36-4}{2} = 16$$

$$\Rightarrow x = 16$$

\therefore The smaller number is 17.

Q11

Answer :

(d) 11

Let the whole number be x .

$$\text{Then, } 2x + 9 = 31$$

$$\Rightarrow 2x = 31 - 9$$

$$\Rightarrow 2x = 22$$

$$\Rightarrow x = \frac{22}{2} = 11$$

$$\Rightarrow x = 11$$

Q12

Answer :

(a) 6

Let the whole number be x .

$$\text{Then, } 3x + 6 = 24$$

$$\Rightarrow 3x = 24 - 6$$

$$\Rightarrow 3x = 18$$

$$\Rightarrow x = \frac{18}{3} = 6$$

$$\Rightarrow x = 6$$

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Answer :

(a) 30

Let the original number be x .

Then, $\frac{2}{3}x = x - 10$

$$\Rightarrow 2x = 3x - 30$$

$$\Rightarrow 2x - 3x = -30$$

$$\Rightarrow -x = -30$$

$$\Rightarrow x = 30$$

\therefore The required number is 30.

Q14

Answer :

(b) 50°

Let the angle be x° .

Then, complementary of $x = 90^\circ - x^\circ$

According to the question, we have :

$$x - 90 - x = 10$$

$$\Rightarrow 2x = 90 + 10$$

$$\Rightarrow 2x = 100$$

$$\Rightarrow x = 50$$

So, the larger angle is 50° .

Q15

Answer :

(b) 80°

Let the angle be x° .

Then, complementary angle of $x = 180^\circ - x^\circ$

According to the question, we have :

$$x - (180 - x) = 20$$

$$\Rightarrow x - 180 + x = 20$$

$$\Rightarrow 2x = 10 + 180$$

$$\Rightarrow 2x = 200$$

$$\Rightarrow x = 100$$

Hence, the smaller angle is 80° .

Q16

Answer :

(c) 15 years

Let the present ages of A and B be $5x$ and $3x$, respectively.

According to the question, we have :

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

$$\Rightarrow 25x + 30 = 21x + 42$$

$$\Rightarrow 25x - 21x = 42 - 30$$

$$\Rightarrow 4x = 12$$

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

$$\Rightarrow x = 3$$

\therefore A's present age = 5×3 years = 15 years

Q17

Answer :

(b) 20

Let the number be x .

Then, $5x = x + 80$

$$\Rightarrow 5x - x = 80$$

$$\Rightarrow 4x = 80$$

$$\Rightarrow x = \frac{80}{4}$$

$$\Rightarrow x = 20$$

\therefore The required number is 20.

Q18 Answer :

(c) 32 m

Let the width of the rectangle be x . Then, its length will be $3x$.

Perimeter of the rectangle = 96 m

Now, $2(l + b) = 96$

$$\Rightarrow 2(3x + x) = 96$$

$$\Rightarrow 2 \times 4x = 96$$

$$\Rightarrow 8x = 96$$

$$\Rightarrow x = \frac{96}{8}$$

$$\Rightarrow x = 12$$

\therefore Length of the rectangle = 3×12 m = 36 m