

Simple Linear Equations (Including Word Problems)

POINTS TO REMEMBER

1. **Equation:** An equation is a statement which states that two expressions are equal.
2. To solve an equation means to find the value of the variable (unknown quantity) used in it.
Note : An equation remains unchanged if
 - (i) the same number is added to each side of the equation. .
 - (ii) the same number is subtracted from each side of the equation.
 - (iii) the same number is multiplied to each side of the equation.
 - (iv) Each side of the equation is divided by the same non-zero number.
 - (v) In transposing any term of an equation from one side to another, then its sign is reversed is
 - (a) from positive to negative and from negative to positive
 - (b) from multiplication to division and from division to multiplication.
3. **In equation :**
It is a statement of inequality between two expressions involving a single variable with the highest power one.
4. **Replacement set**
For a given inequation, the set from which the values of its variable are taken is called the replacement set or domain of the variable.
5. **Solution set**
It is the subset of the replacement set, consisting of those values of the variable which satisfy the given inequation
6. **Properties of inequations**
Adding, subtracting, multiplying or dividing by the same positive number to each side of an inequation does not change the inequality but multiplying or dividing by a negative number to each side of an inequation, it changes the inequality.

EXERCISE 12 (A)

Solve the following equations :

Question 1.

$$x + 5 = 10$$

Solution:

$$x + 5 = 10$$

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

Question 2.

$$2 + y = 7$$

Solution:

$$\begin{aligned} 2 + y &= 7 \\ \Rightarrow y &= 7 - 2 = 5 \end{aligned}$$

Question 3.

$$a - 2 = 6$$

Solution:

$$\begin{aligned} a - 2 &= 6 \\ \Rightarrow a &= 6 + 2 = 8 \end{aligned}$$

Question 4.

$$x - 5 = 8$$

Solution:

$$\begin{aligned} x - 5 &= 8 \\ \Rightarrow x &= 8 + 5 = 13 \end{aligned}$$

Question 5.

$$5 - d = 12$$

Solution:

$$\begin{aligned} 5 - d &= 12 \\ \Rightarrow -d &= 12 - 5 = 7 \\ \Rightarrow d &= -7 \end{aligned}$$

Question 6.

$$3p = 12$$

Solution:

$$\begin{aligned} 3p &= 12 \\ \Rightarrow p &= \frac{12}{3} = 4 \text{ Ans.} \end{aligned}$$

Question 7.

$$14 = 7m$$

Solution:

$$14 = 7m$$

$$\Rightarrow m = \frac{14}{7} = 2$$

Question 8.

$$2x = 0$$

Solution:

$$2x = 0 \Rightarrow x = \frac{0}{2} = 0$$

Question 9.

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

Solution:

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

$$\Rightarrow x = 2 \times 9 = 18$$

$$\therefore x = 18$$

Question 10.

$$\frac{y}{-12} = -4$$

Solution:

$$\frac{y}{-12} = -4$$

$$\Rightarrow \frac{y}{-12} = -4$$

$$\Rightarrow y = (-4) \times (-12)$$

$$\therefore y = 48$$

Question 11.

$$8x - 2 = 38$$

Solution:

$$8x - 2 = 38$$

$$8x = 38 + 2 = 40$$

$$\Rightarrow x = \frac{40}{8} = 5$$

$$\therefore x = 5$$

Question 12.

$$2x + 5 = 5$$

Solution:

$$\begin{aligned}2x + 5 &= 5 \\ \Rightarrow 2x &= 5 - 5 = 0 \\ x &= \frac{0}{2} = 0 \\ \therefore x &= 0\end{aligned}$$

Question 13.

$$5x - 1 = 74$$

Solution:

$$\begin{aligned}5x - 1 &= 74 \\ \Rightarrow 5x &= 74 + 1 = 75 \\ \Rightarrow x &= \frac{75}{5} = 15\end{aligned}$$

Question 14.

$$14 = 27 - x$$

Solution:

$$\begin{aligned}14 &= 27 - x \\ \Rightarrow x &= 27 - 14 \\ \Rightarrow x &= 13 \\ \therefore x &= 13\end{aligned}$$

Question 15.

$$10 + 6a = 40$$

Solution:

$$\begin{aligned}10 + 6a &= 40 \\ \Rightarrow 6a &= 40 - 10 = 30 \\ \Rightarrow a &= \frac{30}{6} = 5 \\ \therefore a &= 5\end{aligned}$$

Question 16.

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

Solution:

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

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

$$\therefore c = \frac{5}{6}$$

Question 17.

$$\frac{a}{15} - 2 = 0$$

Solution:

$$\frac{a}{15} - 2 = 0 \Rightarrow \frac{a}{15} = 2$$

$$\Rightarrow a = 2 \times 15 = 30$$

$$\therefore a = 30$$

Question 18.

$$12 = c - 2$$

Solution:

$$12 = c - 2$$

$$\Rightarrow 12 + 2 = c$$

$$\Rightarrow 14 = c$$

$$\therefore c = 14$$

Question 19.

$$4 = x - 2.5$$

Solution:

$$4 = x - 2.5$$

$$\Rightarrow 4 + 2.5 = x$$

$$\Rightarrow 6.5 = x$$

$$\therefore x = 6.5$$

Question 20.

$$y + 5 = 8\frac{1}{4}$$

Solution:

$$y + 5 = 8\frac{1}{4} \Rightarrow y + 5 = \frac{33}{4}$$

$$\Rightarrow y = \frac{33}{4} - \frac{5}{1} = \frac{33 - 20}{4} = \frac{13}{4}$$

$$\therefore y = \frac{13}{4} = 3\frac{1}{4}$$

Question 21.

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

Solution:

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

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

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

Question 22.

$$p + 0.02 = 0.08$$

Solution:

$$p + 0.02 = 0.08$$

$$\Rightarrow p = 0.08 - 0.02 = 0.06$$

$$\therefore p = 0.06$$

Question 23.

$$p - 12 = 2\frac{2}{3}$$

Solution:

$$\begin{aligned}p - 12 &= 2\frac{2}{3} \Rightarrow p - 12 = \frac{8}{3} \\ \Rightarrow p &= \frac{8}{3} + \frac{12}{1} = \frac{8 + 36}{3} = \frac{44}{3} \\ \therefore p &= \frac{44}{3} = 14\frac{2}{3}\end{aligned}$$

Question 24.

$$-3x = 15$$

Solution:

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

Question 25.

Solution:

$$\begin{aligned}1.3b &= 39 \Rightarrow b = \frac{39}{1.3} = \frac{39 \times 10}{13} = 30 \\ \therefore b &= 30\end{aligned}$$

Question 26.

$$\frac{5}{8}n = 20$$

Solution:

$$\begin{aligned}\frac{5}{8}n &= 20 \Rightarrow 5n = 20 \times 8 = 160 \\ \Rightarrow n &= \frac{160}{5} = 32 \\ \therefore n &= 32\end{aligned}$$

Question 27.

$$\frac{3}{16}m = 21$$

Solution:

$$\frac{3}{16}m = 21 \Rightarrow 3m = 21 \times 16 = 336$$

$$\Rightarrow m = \frac{336}{3} = 112 \therefore m = 112$$

Question 28.

$$2a - 3 = 5$$

Solution:

$$2a - 3 = 5$$

$$\Rightarrow 2a = 5 + 3$$

$$\Rightarrow 2a = 8$$

$$\Rightarrow a = \frac{8}{2} = 4$$

$$\therefore a = 4$$

Question 29.

$$3p - 1 = 8$$

Solution:

$$3p - 1 = 8$$

$$\Rightarrow 3p = 8 + 1 = 9$$

$$\Rightarrow p = \frac{9}{3} = 3$$

$$\therefore p = 3$$

Question 30.

$$9y - 7 = 20$$

Solution:

$$9y - 7 = 20 \Rightarrow 9y = 20 + 7 = 27$$

$$\Rightarrow y = \frac{27}{9} = 3$$

$$\therefore y = 3$$

Question 31.

$$2b - 14 = 8$$

Solution:

$$2b - 14 = 8 \Rightarrow 2b = 8 + 14 = 22$$

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

$$\therefore b = 11$$

Question 32.

$$\frac{7}{10}x + 6 = 41$$

Solution:

$$\frac{7}{10}x + 6 = 41$$

$$\frac{7}{10}x + 6 = 41 \Rightarrow \frac{7}{10}x = 41 - 6 = 35$$

$$\Rightarrow 7x = 35 \times 10 = 350$$

$$\Rightarrow x = \frac{350}{7} = 50$$

$$\therefore x = 50$$

Question 33.

$$\frac{5}{12}m - 12 = 48$$

Solution:

$$\frac{5}{12}m - 12 = 48 \Rightarrow \frac{5}{12}m = 48 + 12 = 60$$

$$\Rightarrow 5m = 60 \times 12 = 720$$

$$\Rightarrow m = \frac{720}{5} = 144$$

$$\therefore m = 144$$

EXERCISE 12 (B)

Question 1.

$$8y - 4y = 20$$

Solution:

$$8y - 4y = 20 \Rightarrow 4y = 20$$

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

$$\therefore y = 5$$

Question 2.

$$9b - 4b + 3b = 16$$

Solution:

$$9b - 4b + 3b = 16$$

$$\Rightarrow (9 - 4 + 3)b = 16 \Rightarrow 8b = 16$$

$$\Rightarrow b = \frac{16}{8} = 2$$

$$\therefore b = 2$$

Question 3.

$$5y + 8 = 8y - 18$$

Solution:

$$5y + 8 = 8y - 18$$

$$\Rightarrow 5y - 8y = -18 - 8$$

$$\Rightarrow -3y = -26 \Rightarrow y = \frac{-26}{-3} = \frac{26}{3}$$

$$\therefore y = 8\frac{2}{3}$$

Question 4.

$$6 = 7 + 2p - 5$$

Solution:

$$6 = 7 + 2p - 5 \Rightarrow -2p = 7 - 5 - 6$$

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

$$\therefore p = 2$$

Question 5.

$$8 - 7x = 13x + 8$$

Solution:

$$8 - 7x = 13x + 8 \Rightarrow -7x - 13x = 8 - 8$$

$$\Rightarrow -20x = 0 \Rightarrow x = \frac{0}{-20} = 0$$

$$\therefore x = 0$$

Question 6.

$$4x - 5x + 2x = 28 + 3x$$

Solution:

$$4x - 5x + 2x = 28 + 3x$$

$$\Rightarrow 4x - 5x + 2x - 3x = 28$$

$$\Rightarrow 6x - 8x = 28$$

$$\Rightarrow x = \frac{28}{-2} = -14$$

$$\therefore x = -14$$

Question 7.

$$9 + m = 6m + 8 - m$$

Solution:

$$9 + m = 6m + 8 - m$$

$$\Rightarrow m - 6m + m = 8 - 9$$

$$\Rightarrow 2m - 6m = -1 \quad \Rightarrow -4m = -1$$

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

Question 8.

$$24 = y + 2y + 3 + 4y$$

Solution:

$$24 = y + 2y + 3 + 4y$$

$$\Rightarrow 24 - 3 = y + 2y + 4y \Rightarrow 21 = 7y$$

$$\Rightarrow 7y = 21 \quad \Rightarrow y = \frac{21}{7} = 3$$

$$\therefore y = 3$$

Question 9.

$$19x - 13 - 12x + 3 = 23$$

Solution:

$$19x + 13 - 12x + 3 = 23$$

$$\Rightarrow 19x - 12x = 23 - 13 - 3$$

$$\Rightarrow 7x = 23 - 16 = 7 \Rightarrow x = \frac{7}{7} = 1$$

$$\therefore x = 1$$

Question 10.

$$6b + 40 = -100 - b$$

Solution:

$$6b + 40 = -100 - b$$

$$\Rightarrow 6b + b = -100 - 40 \Rightarrow 7b = -140$$

$$\Rightarrow b = \frac{-140}{7} = -20$$

$$\therefore b = -20$$

Question 11.

$$6 - 5m - 1 + 3m = 0$$

Solution:

$$6 - 5m - 1 + 3m = 0$$

$$\Rightarrow -5m + 3m = -6 + 1 \Rightarrow -2m = -5$$

$$\Rightarrow m = \frac{-5}{-2} = \frac{5}{2}$$

$$\therefore m = \frac{5}{2} = 2\frac{1}{2}$$

Question 12.

$$0.4x - 1.2 = 0.3x + 0.6$$

Solution:

$$0.4x - 1.2 = 0.3x + 0.6$$

$$\Rightarrow 0.4x - 0.3x = 0.6 + 1.2$$

$$\Rightarrow 0.1x = 1.8$$

$$\Rightarrow \frac{1}{10}x = \frac{18}{10} \Rightarrow x = \frac{18}{10} \times \frac{10}{1} = 18$$

$$\therefore x = 18$$

Question 13.

$$6(x+4) = 36$$

Solution:

$$6(x + 4) = 36 \Rightarrow 6x + 24 = 36$$

$$\Rightarrow 6x = 36 - 24 = 12 \Rightarrow x = \frac{12}{6} = 2$$

$$\therefore x = 2$$

Question 14.

$$9(a + 5) + 2 = 11$$

Solution:

$$9(a + 5) + 2 = 11 \Rightarrow 9a + 45 + 2 = 11$$

$$\Rightarrow 9a = 11 - 45 - 2 \Rightarrow 9a = 11 - 47 = -36$$

$$\Rightarrow a = \frac{-36}{9} = -4$$

$$\therefore a = -4$$

Question 15.

$$4(x - 2) = 12$$

Solution:

$$4(x - 2) = 12 \Rightarrow 4x - 8 = 12$$

$$\Rightarrow 4x = 12 + 8 = 20 \Rightarrow x = \frac{20}{4} = 5$$

$$\therefore x = 5$$

Question 16.

$$-3(a - 6) = 24$$

Solution:

$$-3(a - 6) = 24 \Rightarrow -3a + 18 = 24$$

$$\Rightarrow -3a = 24 - 18 = 6 \Rightarrow a = \frac{6}{-3} = -2$$

$$\therefore a = -2$$

Question 17.

$$7(x-2) = 2(2x-4)$$

Solution:

$$7(x-2) = 2(2x-4) \Rightarrow 7x - 14 = 4x - 8$$

$$\Rightarrow 7x - 4x = -8 + 14 \Rightarrow 3x = 6$$

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

$$\therefore x = 2$$

Question 18.

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

Solution:

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

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

$$\Rightarrow 2x^2 + 3x - 8x - 12 = 2x^2$$

$$\Rightarrow 2x^2 + 3x - 8x - 2x^2 = 12$$

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

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

Question 19.

$$21 - 3(b-7) = b + 20$$

Solution:

$$21 - 3(b - 7) = b + 20$$

$$\Rightarrow 21 - 3b + 21 = b + 20$$

$$\Rightarrow -3b + 42 = b + 20$$

$$\Rightarrow -3b - b = 20 - 42 \Rightarrow -4b = -22$$

$$\Rightarrow b = \frac{-22}{-4} = \frac{11}{2}$$

$$\therefore b = \frac{11}{2} = 5\frac{1}{2}$$

Question 20.

$$x(x + 5) = x^2 + x + 32$$

Solution:

$$x(x + 5) = x^2 + x + 32$$

$$\Rightarrow x^2 + 5x = x^2 + x + 32$$

$$\Rightarrow x^2 + 5x - x^2 - x = 32 \Rightarrow 4x = 32$$

$$\Rightarrow x = \frac{32}{4} = 8$$

$$\therefore x = 8$$

EXERCISE 12 (C)

Solve

Question 1.

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

Solution:

$$\frac{x}{2} + \frac{x}{1} = 9$$

$$\frac{x+2x}{2} = 9 \Rightarrow x+2x = 2 \times 9 \Rightarrow 3x = 18$$

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

$$\therefore x = 6$$

Question 2.

$$\frac{x}{5} + 2x = 33$$

Solution:

$$\frac{x}{5} + \frac{2x}{1} = 33$$

$$\frac{x+10x}{5} = 33 \Rightarrow \frac{11x}{5} = 33$$

$$\Rightarrow 11x = 33 \times 5 = 165$$

$$\Rightarrow x = \frac{165}{11} = 15$$

$$\therefore x = 15$$

Question 3.

$$\frac{3x}{4} + 4x = 38$$

Solution:

$$\frac{3x}{4} + 4x = 38 \Rightarrow \frac{3x}{4} + \frac{4x}{1} = 38$$

$$\frac{3x + 16x}{4} = 38 \Rightarrow 3x + 16x = 38 \times 4$$

$$3x + 16x = 152 \Rightarrow 19x = 152 \Rightarrow x = \frac{152}{19} = 8$$

$$\therefore x = 8$$

Question 4.

$$\frac{x}{2} + \frac{x}{5} = 14$$

Solution:

$$\frac{x}{2} + \frac{x}{5} = 14 \Rightarrow \frac{x}{2} + \frac{x}{5} = 14$$

$$\frac{5x + 2x}{10} = 14 \Rightarrow 5x + 2x = 14 \times 10$$

$$\Rightarrow 5x + 2x = 140 \Rightarrow 7x = 140$$

$$\Rightarrow x = \frac{140}{7} = 20$$

$$\therefore x = 20$$

Question 5.

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

Solution:

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

$$\Rightarrow 4x - 3x = 2 \times 12 \Rightarrow x = 24$$

$$\therefore x = 24$$

Question 6.

$$y + \frac{y}{2} = \frac{7}{4} - \frac{y}{4}$$

Solution:

$$\begin{aligned}\frac{y}{1} + \frac{y}{2} &= \frac{7}{4} - \frac{y}{4} \Rightarrow \frac{4y + 2y = 7 - y}{4} \\ \Rightarrow 4y + 2y &= 7 - y \Rightarrow 4y + 2y \Rightarrow 7y = 7 \\ \Rightarrow y &= \frac{7}{7} = 1 \\ \therefore y &= 1\end{aligned}$$

Question 7.

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

Solution:

$$\begin{aligned}\frac{4x}{3} - \frac{7x}{3} &= 1 \Rightarrow \frac{4x - 7x}{3} = 1 \\ \Rightarrow \frac{-3x}{3} &= 1 \Rightarrow -3x = 3 \Rightarrow x = \frac{3}{-3} = -1 \\ \therefore x &= -1\end{aligned}$$

Question 8.

$$\frac{1}{2}m + \frac{3}{4}m - m = 2.5$$

Solution:

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

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

$$\frac{2m + 3m - 4m}{4} = 2 \cdot 5 \Rightarrow \frac{2m + 3m - 4m}{4} = 4 \times 2 \cdot 5$$

$$\Rightarrow 2m + 3m - 4m = 10 \Rightarrow 5m - 4m = 10 \Rightarrow m = 10$$

$$\therefore m = 10$$

Question 9.

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

Solution:

$$\frac{2x}{3} + \frac{x}{2} - \frac{3x}{4} = 1 \Rightarrow \frac{8x + 6x - 9x}{12} = 1$$

$$\Rightarrow 8x + 6x - 9x = 12 \times 1 \Rightarrow 8x + 6x - 9x = 12$$

$$\Rightarrow 14x - 9x = 12 \Rightarrow 5x = 12 \Rightarrow x = \frac{12}{5} = 2\frac{2}{5}$$

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

Question 10.

$$\frac{3a}{4} + \frac{a}{6} = 66$$

Solution:

$$\begin{aligned}\frac{3a}{4} + \frac{a}{6} &= 66 \Rightarrow \frac{9a + 2a}{12} = 66 \\ \Rightarrow 9a + 2a &= 66 \times 12 \Rightarrow 9a + 2a = 792 \\ \Rightarrow 11a &= 792 \Rightarrow a = \frac{792}{11} = 72 \\ \therefore a &= 72\end{aligned}$$

Question 11.

$$\frac{2p}{3} - \frac{p}{5} = 35$$

Solution:

$$\begin{aligned}\frac{2p}{3} - \frac{p}{5} &= 35 \Rightarrow \frac{10p - 3p}{15} = 35 \\ \Rightarrow 10p - 3p &= 35 \times 15 \Rightarrow 10p - 3p = 525 \\ \Rightarrow 7p &= 525 \\ \Rightarrow p &= \frac{525}{7} = 75 \\ \therefore p &= 75\end{aligned}$$

Question 12.

$$0.6a + 0.2a = 0.4a + 8$$

Solution:

$$\begin{aligned}0.6a + 0.2a &= 0.4a + 8 \\ \frac{6}{10}a + \frac{2}{10}a &= \frac{4}{10}a + \frac{8}{1} \\ \frac{6a + 2a}{10} &= 4a + 80 \Rightarrow 6a + 2a = 4a + 80 \\ \Rightarrow 6a + 2a - 4a &= 80 \Rightarrow 4a = 80 \\ \Rightarrow a &= \frac{80}{4} = 20 \quad \therefore a = 20\end{aligned}$$

Question 13.

$$p + 104p = 48$$

Solution:

$$p + 1 \cdot 4p = 48$$

$$p + \frac{14}{10}p = 48 \Rightarrow \frac{10p + 14p}{10} = 48$$

$$\Rightarrow 10p + 14p = 48 \times 10 \Rightarrow 10p + 14p = 480$$

$$\Rightarrow 24p = 480 \Rightarrow p = \frac{480}{24} = 20$$

$$\therefore p = 20$$

Question 14.

$$10\% \text{ of } x = 20$$

Solution:

$$10\% \text{ of } x = 20$$

$$\Rightarrow \frac{10}{100} \times x = 20 \Rightarrow \frac{x}{10} = 20 \Rightarrow x = 20 \times 10 = 200$$

$$\therefore x = 200$$

Question 15.

$$y + 20\% \text{ of } y = 18$$

Solution:

$$y + 20\% \text{ of } y = 18$$

$$\Rightarrow y + \frac{20}{100} \times y = 18 \Rightarrow \frac{100y + 20y}{100} = 18$$

$$\Rightarrow 100y + 20y = 18 \times 100$$

$$\Rightarrow 100y + 20y = 1800 \Rightarrow 120y = 1800$$

$$\Rightarrow y = \frac{1800}{120} = 15$$

$$\therefore y = 15$$

Question 16.

$$x - 13\% \text{ of } x = 35$$

Solution:

$$x - 30\% \text{ of } x = 35$$

$$x - \frac{30}{100} \times x = 35 \Rightarrow \frac{100x - 30x}{100} = 35$$

$$\Rightarrow 100x - 30x = 35 \times 100$$

$$100x - 30x = 3500 \Rightarrow 70x = 3500$$

$$\Rightarrow x = \frac{3500}{70} = 50$$

$$\therefore x = 50$$

Question 17.

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

Solution:

$$\frac{x+4}{2} + \frac{x}{3} = 7 \Rightarrow \frac{3x+12+2x}{6} = 7$$

$$\Rightarrow 3x + 12 + 2x = 7 \times 6 \Rightarrow 3x + 12 + 2x = 42$$

$$\Rightarrow 5x = 42 - 12 = 30 \Rightarrow x = \frac{30}{5} = 6$$

$$\therefore x = 6$$

Question 18.

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

Solution:

$$\begin{aligned}\frac{y+2}{3} + \frac{y+5}{4} &= 6 \Rightarrow \frac{4y+8+3y+15}{12} = 6 \\ \Rightarrow 4y+8+3y+15 &= 6 \times 12 \\ \Rightarrow 4y+8+3y+15 &= 72 \Rightarrow 7y+23 = 72 \\ \Rightarrow 7y &= 72 - 23 = 49 \Rightarrow y = \frac{49}{7} = 7 \\ \therefore y &= 7\end{aligned}$$

Question 19.

$$\frac{3a-2}{7} - \frac{a-2}{4} = 2$$

Solution:

$$\begin{aligned}\frac{3a-2}{7} - \frac{a-2}{4} &= 2 \\ \frac{12a-8-7a+14}{28} &= 2 \\ \Rightarrow 12a-8-7a+14 &= 2 \times 28 \\ \Rightarrow 12a-8-7a+14 &= 56 \\ \Rightarrow 12a-7a+14-8 &= 56 \Rightarrow 5a+6 = 56 \\ \Rightarrow 5a &= 56-6 = 50 \Rightarrow a = \frac{50}{5} = 10 \\ \therefore a &= 10\end{aligned}$$

Question 20.

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

Solution:

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

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

$$\Rightarrow 3x + 15 - 2x + 4 = 4 \times 6$$

$$3x + 15 - 2x + 4 = 24$$

$$\Rightarrow 3x - 2x = 24 - 15 - 4 \Rightarrow x = 24 - 19 = 5$$

$$\therefore x = 5$$

Question 21.

$$\frac{x-1}{2} - \frac{x-2}{3} - \frac{x-3}{4} = 0$$

Solution:

$$\frac{x-1}{2} - \frac{x-2}{3} - \frac{x-3}{4} = 0$$

$$\frac{6(x-1) - 4(x-2) - 3(x-3)}{12} = 0$$

$$6(x-1) - 4(x-2) - 3(x-3) = 0$$

$$\therefore 6x - 6 - 4x + 8 - 3x + 9 = 0$$

$$\therefore 6x - 4x - 3x - 6 + 8 + 9 = 0$$

$$\therefore 6x - 7x = 6 - 8 - 9$$

$$\Rightarrow -x = 6 - 17 = -11$$

$$\therefore x = 11$$

Question 22.

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

Solution:

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

$$\underline{35(x+1) + 21(x+4) = 15(x-4)}$$

105

(L.C.M. of 3, 5, 7 = 105)

$$35(x+1) + 21(x+4) = 15(x-4)$$

$$35x + 35 + 21x + 84 = 15x - 60$$

$$\Rightarrow 35x + 21x - 15x = -60 - 35 - 84$$

$$\Rightarrow 56x - 15x = -(60 + 35 + 84)$$

$$\Rightarrow 41x = -179$$

$$\therefore x = \frac{-179}{41} = -4\frac{15}{41}$$

Question 23.

$$15 - 2(5-3x) = 4(x-3) + 13$$

Solution:

$$15 - 2(5 - 3x) = 4(x - 3) + 13$$

$$\Rightarrow 15 - 10 + 6x = 4x - 12 + 13$$

$$6x - 4x = -12 + 13 - 15 + 10$$

$$\Rightarrow 2x = 23 - 27 = -4 \Rightarrow x = \frac{-4}{2} = -2$$

Hence $x = -2$

Question 24.

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

Solution:

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

By cross multiplication

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

$$\Rightarrow 15x - 10 = 8x + 4$$

$$\Rightarrow 15x - 8x = 4 + 10 \Rightarrow 7x = 14 \Rightarrow x = \frac{14}{7} = 2$$

$$\therefore x = 2$$

Question 25.

$$21 - 3(x - 7) = x + 20$$

Solution:

$$21 - 3(x - 7) = x + 20$$

$$\Rightarrow 21 - 3x + 21 = x + 20 \Rightarrow 42 - 3x = x + 20$$

$$\Rightarrow 42 - 20 = x + 3x \Rightarrow 4x = 22$$

$$\Rightarrow x = \frac{22}{4} = \frac{11}{2} = 5\frac{1}{2} \quad \therefore x = 5\frac{1}{2}$$

Question 26.

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

Solution:

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

$$\Rightarrow \frac{12x-8-7x+14}{28} = 2$$

$$\Rightarrow \frac{5x+6}{28} = 2 \Rightarrow 5x+6 = 28 \times 2$$

$$\Rightarrow 5x+6 = 56 \Rightarrow 5x = 56-6 = 50 \Rightarrow x = \frac{50}{5} = 10$$

$$\therefore x = 10$$

Question 27.

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

Solution:

$$\begin{aligned}\frac{2x-3}{3} - \frac{(x-5)}{1} &= \frac{x}{3} \\&= \frac{2x-3-3x+15}{3} \quad -x+12=x \\&\Rightarrow 12 = x+x \Rightarrow 2x = 12 \\&\therefore x = \frac{12}{2} = 6\end{aligned}$$

Question 28.

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

Solution:

$$\begin{aligned}\frac{x-4}{7} &= \frac{x+3}{7} + \frac{x+4}{5} \\&= \frac{5x-20=5x+15+7x+28}{35} \\&\Rightarrow 5x-5x-7x = 15+28+20 \\&\Rightarrow -7x = 63 \Rightarrow x = \frac{63}{-7} = -9 \\&\therefore x = -9\end{aligned}$$

Question 29.

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

Solution:

$$\begin{aligned}\frac{x-1}{5} - \frac{x}{3} &= 1 - \frac{x-2}{2} \\&= \frac{6x-6-10x=30-15x+30}{30} \\&\Rightarrow -4x-6 = 60-15x \\&\Rightarrow 15x-4x = 60+6 \Rightarrow 11x = 66 \Rightarrow x = \frac{66}{11} = 6 \\&\therefore x = 6\end{aligned}$$

Question 30.

$$2x + 20\% \text{ of } x = 12.1$$

Solution:

$$2x + 20\% \text{ of } x = 12.1$$

$$\Rightarrow 2x + \frac{x \times (20)}{100} = 12.1 \Rightarrow 2x + \frac{20x}{100} = 12.1$$

$$\Rightarrow 2x + \frac{2x}{10} = 12.1$$

$$\frac{20x + 2x = 121}{10} \Rightarrow 22x = 121 \Rightarrow x = \frac{121}{22} = \frac{11}{2}$$

$$\therefore x = \frac{11}{2} \text{ or } 5\frac{1}{2}$$

EXERCISE 12 (D)**Question 1.**

One-fifth of a number is 5, find the number.

Solution:

Let the number = x

According to the condition

$$\frac{1}{5}x = 5 \Rightarrow x = 5 \times 5$$

$$\Rightarrow x = 25$$

$$\therefore \text{Number} = 25$$

Question 2.

Six times a number is 72, find the number.

Solution:

Let the number = x

According to the condition

$$6x = 72$$

$$\Rightarrow x = \frac{72}{6}$$

$$\Rightarrow x = 12$$

$$\therefore \text{Number} = 12$$

Question 3.

If 15 is added to a number, the result is 69, find the number.

Solution:

Let the number = x

According to the condition

$$x + 15 = 69$$

$$\Rightarrow x = 69 - 15 \quad x = 54$$

$$\therefore \text{Number} = 54$$

Question 4.

The sum of twice a number and 4 is 80, find the number.

Solution:

Let the number = x

According to the condition

$$2x + 4 = 80$$

$$\Rightarrow 2x = 80 - 4$$

$$\Rightarrow 2x = 76$$

$$\Rightarrow x = \frac{76}{2} = 38$$

$$\text{Number} = 38$$

Question 5.

The difference between a number and one-fourth of itself is 24, find the number.

Solution:

Let the number = x

According to the condition

$$x - \frac{1}{4}x = 24$$

$$\Rightarrow \frac{4x - x}{4} = 24 \Rightarrow \frac{3x}{4} = 24$$

$$\Rightarrow x = 24 \times \frac{4}{3} \Rightarrow x = 8 \times 4$$

$$\Rightarrow x = 32$$

$$\therefore \text{Number} = 32$$

Question 6.

Find a number whose one-third part exceeds its one-fifth part by 20.

Solution:

Let the number = x

According to the condition

$$\frac{1}{3}x - \frac{1}{5}x = 20$$

$$\Rightarrow \frac{5x - 3x}{15} = 20$$

$$[\because \text{LCM of 3 and 5} = 15]$$

$$\Rightarrow \frac{2x}{15} = 20 \Rightarrow x = \frac{20 \times 15}{2}$$

$$\Rightarrow x = 150$$

$$\therefore \text{Number} = 150$$

Question 7.

A number is as much greater than 35 as is less than 53. Find the number.

Solution:

Let the number = x

According to the condition

$$x - 35 = 53 - x$$

$$\Rightarrow x + x = 53 + 35$$

$$88$$

$$\Rightarrow 2x = 88$$

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

$$\therefore \text{Number} = 44$$

Question 8.

The sum of two numbers is 18. If one is twice the other, find the numbers.

Solution:

Let the first number = x

and the second number = y

According to the condition

$$x + y = 18 \dots (i)$$

$$\text{and } x = 2y \dots (ii)$$

Substitute the eq. (ii) in eq. (i), we get

$$2y + y = 18$$

$$x = 2y = 18$$

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

Now, substitute the value of y in eq. (ii), we get

$$x = 2 \times 6 = 12$$

$\therefore$ The two numbers are 12, 6

Question 9.

A number is 15 more than the other. The sum of the two numbers is 195. Find the numbers.

Solution:

Let the First number = x

and the Second number = y

According to the condition

$$x = y + 15 \dots (i)$$

$$x + y = 195 \dots (ii)$$

Substitute the eq. (i) in eq. (ii), we get

$$y + 15 + y = 195$$

$$\Rightarrow 2y = 195 - 15$$

$$\Rightarrow y = \frac{180}{2} = 90$$

Now, substitute the value of y in eq. (i), we get

$$x = 90 + 15 = 105$$

$\therefore$ The two numbers are 105 and 90

Question 10.

The sum of three consecutive even numbers is 54. Find the numbers.

Solution:

Let the first even number = x

second even number = $x + 2$

and third even number = $x + 4$

According to the condition,

$$x + x + 2 + x + 4 = 54$$

$$\Rightarrow 3x + 6 = 54$$

$$\Rightarrow 3x = 54 - 6$$

$$\Rightarrow x = \frac{48}{3} = 16$$

$\therefore$ First even number = 16

Second even number = $16 + 2 = 18$

and third even number = $16 + 4 = 20$

Question 11.

The sum of three consecutive odd numbers is 63. Find the numbers.

Solution:

Let the first odd number = x

second odd number = $x + 2$

and third odd number = $x + 4$

According to the condition,

$$x + x + 2 + x + 4 = 63$$

$$3x + 6 = 63 \Rightarrow 3x = 63 - 6$$

$$\Rightarrow 3x = 57 \Rightarrow x = \frac{57}{3} = 19$$

$\therefore$ First odd number = 19

Second odd number = $19 + 2 = 21$

third odd number = $19 + 4 = 23$

Question 12.

A man has ₹ x from which he spends ₹6. If twice of the money left with him is ₹86, find x .

Solution:

Let the total amount be x

According to the condition

$$2x = 86$$

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

$$\Rightarrow x = 43$$

Amount spent by him = 6

$\therefore$ Total money he have = ₹43 + ₹6 = ₹49

Question 13.

A man is four times as old as his son. After 20 years, he will be twice as old as his son at that time. Find their present ages.

Solution:

Let the present age of the son = x years

Present age of the father = $4x$ years

After 20 years,

Son's age will be $(x + 20)$ years

and Father's age will be $(4x + 20)$ years

According to the condition,

$$4x + 20 = 2(x + 20)$$

$$4x + 20 = 2x + 40$$

$$4x - 2x = 40 - 20$$

$$2x = 20$$

$$\Rightarrow x = 10$$

$\therefore$ Present age of the son = 10 years and Present age of the father = 4×10 years = 40 years

Question 14.

If 5 is subtracted from three times a number, the result is 16. Find the number.

Solution:

Let the number = x

According to the condition,

$$3x - 5 = 16$$

$$\Rightarrow 3x = 16 + 5$$

$$\Rightarrow 3x = 21$$

$$\Rightarrow x = \frac{21}{3}$$

$$\Rightarrow x = 7$$

$\therefore$ The number = 7

Question 15.

Find three consecutive natural numbers such that the sum of the first and the second is 15 more than the third.

Solution:

Let the first consecutive number = x ,

Second consecutive number = $x + 1$

and Third consecutive number = $x + 2$

According to the condition,

$$x + x + 1 = 15 + x + 2$$

$$\Rightarrow 2x + 1 = 17 + x$$

$$\Rightarrow 2x - x = 17 - 1$$

$$\Rightarrow x = 16$$

$\therefore$ The first consecutive number = 16

Second consecutive number = $16 + 1 = 17$

Third consecutive number = $16 + 2 = 18$

Question 16.

The difference between two numbers is 7. Six times the smaller plus the larger is 77. Find the numbers.

Solution:

Let the smallest number = x

and the largest number = y

According to the condition,

$$y - x = 7 \dots (i)$$

$$\text{and } 6x + y = 77 \dots (ii)$$

From eq. (i)

$$y = 7 + x \dots (iii)$$

Substitute the eq. (iii) in eq. (ii)

$$6x + 7 + x = 77$$

$$\Rightarrow 7x = 77 - 7$$

$$\Rightarrow x = \frac{70}{7} = 10$$

Now, substitute the value of x in eq. (iii)

$$y = 7 + 10 = 17$$

$\therefore$ The smallest number 10 and the largest number is 17.

Question 17.

The length of a rectangular plot exceeds its breadth by 5 metre. If the perimeter of the plot is 142 metres, find the length and the breadth of the plot.

Solution:

Let the length of a rectangular plot = x

and the breadth of a rectangular plot = y

According to the condition,

$$x = y + 5 \quad \dots(i)$$

$$\text{and } 2(x + y) = 142$$

$$\Rightarrow x + y = \frac{142}{2} = 71$$

$$\Rightarrow x + y = 71 \quad \dots(ii)$$

Now, substitute the value of eq. (i) in eq. (ii)

$$y + 5 + y = 71$$

$$\Rightarrow 2y = 71 - 5$$

$$\Rightarrow y = \frac{66}{2} = 33$$

Now, put the value of y in eq. (i)

$$x = 33 + 5 = 38$$

$\therefore$ The length of rectangular plot is 38 m and breadth is 33 m

Question 18.

The numerator of a fraction is four less than its denominator. If 1 is added to both, is numerator and denominator, the fraction becomes $\frac{1}{2}$ Find the fraction.

Solution:

Let the numerator of a fraction = x

and the denominator of a fraction = y

According to the condition,

$$x = y - 4 \quad \dots(i)$$

$$\text{and } \frac{(x+1)}{(y+1)} = \frac{1}{2}$$

$$\Rightarrow 2(x + 1) = y + 1 \Rightarrow 2x + 2 = y + 1$$

$$\Rightarrow 2x - y = -1 \quad \dots(ii)$$

Substitute the eq. (i) in eq. (ii)

$$2(y - 4) - y = -1$$

$$2y - 8 - y = -1$$

$$y = -1 + 8$$

$$y = 7$$

Now, put the value of y in eq. (i), we get

$$x = 7 - 4$$

$$x = 3$$

$\therefore$ The numerator of a fraction is 3

and denominator is 7 and the fraction is $\frac{3}{7}$

Question 19.

A man is thrice as old as his son. After 12 years, he will be twice as old as his son at that time. Find their present ages.

Solution:

Let the present age of the son = x years

and the present age of the father = $3x$ years

After 12 years,

Son's age will be $(x + 12)$ years

and father's age will be $(3x + 12)$ years

According to the condition,

$$3x + 12 = 2(x + 12)$$

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

$$3x - 2x = 24 - 12$$

$$x = 12$$

∴ Present age of the son = 12 years

and Present age of the father = 3×12 years

= 36 years

Question 20.

A sum of ₹ 500 is in the form of notes of denominations of ₹ 5 and ₹ 10. If the total number of notes is 90, find the number of notes of each type.

Solution:

Let the number of ₹ 5 notes = x

∴ The number of ₹ 10 notes = $90 - x$

Value of ₹ 5 notes = $x \times ₹ 5 = ₹ 5x$

and value of ₹ 10 notes = $(90 - x) \times ₹ 10 = ₹ (900 - 10x)$

∴ Total value of all the notes = ₹ 500

$$∴ 5x + (900 - 10x) = 500$$

$$⇒ 5x + 900 - 10x = 500$$

$$⇒ -5x = 500 - 900$$

$$⇒ x = \frac{400}{5}$$

$$⇒ x = 80$$

∴ The number of ₹ 5 notes = $x = 80$

and the number of ₹ 10 notes = $90 - x$

$$= 90 - 80 = 10$$