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
⇒ x=10 -5 = 5

Question 2.
2 + y=7

Solution:
2 + y = 7
⇒ = 7- 2 = 5

Question 3.
a – 2 = 6

Solution:
a -2 =6
⇒a = 6 + 2 = 8

Question 4.
x – 5 = 8

Solution:
x-5 =8
⇒ x = 8 +5 = 13

Question 5.
5 – d= 12

Solution:
5-d = 12
⇒ -d = 12-5 =7
⇒ d = – 7

Question 6.
3p = 12

Solution:
3p = 12
⇒ P =$\frac{12}{3}$ = 4 Ans.

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 ×9 = 18
$\therefore$ x = 18

Question 10.
$\frac{y}{-12}$ **= -4**

Solution:
$\frac{y}{-12}$ = -4
$\Rightarrow$ $\frac{y}{-12}$ = -4
$\Rightarrow$ y = (-4) × (-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:
2x + 5 = 5
⇒ 2x = 5 – 5 = 0
x = $\frac{0}{2}$ = 0
∴x = 0

Question 13.
5x – 1 = 74

Solution:
5x- 1 = 74
⇒ 5x = 74 + 1 = 75
⇒ x =$\frac{75}{5}$ = 15

Question 14.
14 = 27-x

Solution:
14 = 27 -x
⇒ x = 27- 14
⇒ x = 13
∴ x= 13

Question 15.
10 + 6a = 40

Solution:
10 + 6a = 40
⇒ 6a = 40 -10 = 30
⇒ a = $\frac{30}{6}$ = 5
∴ a= 5

Question 16.
$$c - \frac{1}{2} = \frac{1}{3}$$

Solution:

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

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

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

Question 17.

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

Solution:

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

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

$$\therefore \quad a = 30$$

Question 18.

12 = c – 2

Solution:

12 = c – 2

⇒ 12 + 2 =c

⇒ 14 = c

∴c = 14

Question 19.

4 = x- 2.5

Solution:

4 = x – 2.5

⇒4 + 2.5=x

⇒ 6.5 =x

∴ x = 6.5

Question 20.

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

Solution:

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

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

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

Question 21.

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

Solution:

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

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

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

Question 22.

p + 0.02 = 0.08

Solution:

p + 0.02 = 0.08

⇒ p = 0.08 – 0.02 = 0.06

∴ p = 0 06

Question 23.

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

Solution:

$$p - 12 = 2\frac{2}{3} \quad \Rightarrow p - 12 = \frac{8}{3}$$

$$\Rightarrow \quad p = \frac{8}{3} + \frac{12}{1} = \frac{8+36}{3} = \frac{44}{3}$$

$$\therefore \quad p = \frac{44}{3} = 14\frac{2}{3}$$

Question 24.

$-3x = 15$

Solution:

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

$$\therefore x = -5$$

Question 25.

Solution:

$$1 \cdot 3b = 39 \Rightarrow b = \frac{39}{1 \cdot 3} = \frac{39 \times 10}{13} = 30$$

$$\therefore b = 30$$

Question 26.

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

Solution:

$$\frac{5}{8}n = 20 \quad \Rightarrow 5n = 20 \times 8 = 160$$

$$\Rightarrow n = \frac{160}{5} = 32$$

$$\therefore n = 32$$

Question 27.

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

Solution:

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

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

Question 28.

2a – 3 =5

Solution:

2a – 3 = 5

⇒2a = 5 +3

⇒ 2a = 8

⇒ a = $\frac{8}{2}$ = 4

∴a = 4

Question 29.

3p – 1 = 8

Solution:

3p – 1 = 8

⇒3p = 8 + 1 = 9

⇒ p = $\frac{9}{3}$ = 3

∴p = 3

Question 30.

9y -7 = 20

Solution:

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

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

$$\therefore \quad y = 3$$

Question 31.
2b – 14 = 8

Solution:

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

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

$\therefore \quad b = 11$

Question 32.

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

Solution:

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

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

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

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

$\therefore \quad x = 50$

Question 33.

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

Solution:

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

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

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

$\therefore \quad m = 144$

EXERCISE 12 (B)

Question 1.
8y – 4y = 20

Solution:

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

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

$$\therefore \quad y = 5$$

Question 2.
9b – 4b + 3b = 16

Solution:

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

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

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

$$\therefore \quad b = 2$$

Question 3.
5y + 8 = 8y – 18

Solution:

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

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

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

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

Question 4.
6 = 7 + 2p -5

Solution:

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

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

$\therefore \quad p = 2$

Question 5.

8 – 7x = 13x + 8

Solution:

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

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

$\therefore \quad x = 0$

Question 6.

4x – 5x + 2x = 28 + 3x

Solution:

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

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

$\Rightarrow 6x - 8x = 28$

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

$\therefore \quad x = -14$

Question 7.

9 + m = 6m + 8 – m

Solution:

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

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

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

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

Question 8.

24 = y + 2y + 3 + 4y

Solution:

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

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

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

$\therefore \quad y = 3$

Question 9.

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

Solution:

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

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

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

$\therefore \quad x = 1$

Question 10.

6b + 40 = – 100 – b

Solution:

$6b + 40 = -100 - b$

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

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

$\therefore \quad b = -20$

Question 11.

6 – 5m – 1 + 3m = 0

Solution:

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

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

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

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

Question 12.

0.4x – 1.2 = 0.3x + 0.6

Solution:

$0{\cdot}4x - 1{\cdot}2 = 0{\cdot}3x + 0{\cdot}6$

$\Rightarrow 0{\cdot}4x - 0{\cdot}3x = 0{\cdot}6 + 1{\cdot}2$

$\Rightarrow 0{\cdot}1x = 1{\cdot}8$

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

$\therefore \quad x = 18$

Question 13.

6(x+4) = 36

Solution:

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

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

$\therefore \quad x = 2$

Question 14.

9 (a+ 5) + 2 = 11

Solution:

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

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

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

$\therefore \quad a = -4$

Question 15.

4 (x- 2) = 12

Solution:

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

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

$\therefore x = 5$

Question 16.

-3 (a- 6) = 24

Solution:

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

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

$\therefore a = -2$

Question 17.
7 (x-2) = 2 (2x -4)

Solution:

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

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

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

$$\therefore \quad x = 2$$

Question 18.
(x-4) (2x +3) = 2x²

Solution:

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

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

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

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

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

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

Question 19.
21 – 3 (b-7) = b+ 20

Solution:

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

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

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

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

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

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

Question 20.

x (x +5) = x² +x + 32

Solution:

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

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

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

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

$\therefore x = 8$

EXERCISE 12 (C)

Solve

Question 1.

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

Solution:

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

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

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

$$\therefore \quad x=6$$

Question 2.

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

Solution:

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

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

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

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

$$\therefore \quad x=15$$

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:

$$\frac{y}{1} + \frac{y}{2} = \frac{7}{4} - \frac{y}{4} \Rightarrow \frac{4y + 2y = 7 - y}{4}$$

$$\Rightarrow 4y + 2y = 7 - y \Rightarrow 4y + 2y \Rightarrow 7y = 7$$

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

$$\therefore y = 1$$

Question 7.

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

Solution:

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

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

$$\therefore x = -1$$

Question 8.

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

Solution:

$$\frac{1}{2}m + \frac{3}{4}m - m = 2\cdot5$$

$$\frac{1}{2}m + \frac{3}{4}m - \frac{m}{1} = 2\cdot5$$

$$\frac{2m + 3m - 4m}{4} = 2\cdot5 \Rightarrow \frac{2m + 3m - 4m}{4} = 4 \times 2\cdot5$$

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

$$\therefore \quad m = 10$$

Question 9.

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

Solution:

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

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

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

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

Question 10.

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

Solution:

$$\frac{3a}{4}+\frac{a}{6}=66 \Rightarrow \frac{9a+2a}{12}=66$$

$$\Rightarrow 9a+2a=66\times 12 \Rightarrow 9a+2a=792$$

$$\Rightarrow 11a=792 \Rightarrow a=\frac{792}{11}=72$$

$$\therefore a=72$$

Question 11.

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

Solution:

$$\frac{2p}{3}-\frac{p}{5}=35 \Rightarrow \frac{10p-3p}{15}=35$$

$$\Rightarrow 10p-3p=35\times 15 \Rightarrow 10p-3p=525$$

$$\Rightarrow 7p=525$$

$$\Rightarrow p=\frac{525}{7}=75$$

$$\therefore p=75$$

Question 12.

0.6a +0.2a = 0.4 a +8

Solution:

$$0{\cdot}6a+0{\cdot}2a=0{\cdot}4a+8$$

$$\frac{6}{10}a+\frac{2}{10}a=\frac{4}{10}a+\frac{8}{1}$$

$$\frac{6a+2a}{10}=4a+80 \Rightarrow 6a+2a=4a+80$$

$$\Rightarrow 6a+2a-4a=80 \Rightarrow 4a=80$$

$$\Rightarrow a=\frac{80}{4}=20 \quad \therefore a=20$$

Question 13.
p + 104p= 48

Solution:

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

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

$$\Rightarrow 10\text{ P} + 14\text{ P} = 48 \times 10 \quad \Rightarrow 10p + 14p = 480$$

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

$$\therefore \ p = 20$$

Question 14.
10% 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% of y = 18

Solution:

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

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

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

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

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

$$\therefore \ y = 15$$

Question 16.
x – 13% 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:

$$\frac{y+2}{3}+\frac{y+5}{4}=6 \Rightarrow \frac{4y+8+3y+15}{12}=6$$

$$\Rightarrow 4y+8+3y+15=6\times 12$$

$$\Rightarrow 4y+8+3y+15=72 \Rightarrow 7y+23=72$$

$$\Rightarrow 7y=72-23=49 \Rightarrow y=\frac{49}{7}=7$$

$$\therefore\ y=7$$

Question 19.

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

Solution:

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

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

$$\Rightarrow 12a-8-7a+14=2\times 28$$

$$\Rightarrow 12a-8-7a+14=56$$

$$\Rightarrow 12a-7a+14-8=56 \Rightarrow 5a+6=56$$

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

$$\therefore\ a=10$$

Question 20.

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

Solution:

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

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

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

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

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

$$\therefore\ x=5$$

Question 21.

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

Solution:

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

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

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

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

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

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

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

$$\therefore\quad x=11$$

Question 22.

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

Solution:

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

$$\frac{35(x+1)+21(x+4)=15(x-4)}{105}$$

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

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

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

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

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

$\Rightarrow \quad 41x=-179$

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

Question 23.

15 – 2 (5-3x) = 4 (x-3) + 13

Solution:

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

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

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

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

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:

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

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

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

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

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:

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

$$= \frac{2x-3-3x+15=x}{3} - x + 12 = x$$

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

$$\therefore x = \frac{12}{2} = 6$$

Question 28.

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

Solution:

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

$$= \frac{5x-20=5x+15+7x+28}{35}$$

$$\Rightarrow 5x - 5x - 7x = 15 + 28 + 20$$

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

$$\therefore = x = -9$$

Question 29.

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

Solution:

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

$$= \frac{6x-6-10x=30-15x+30}{30}$$

$$\Rightarrow -4x - 6 = 60 - 15x$$

$$\Rightarrow 15x - 4x = 60 + 6 \Rightarrow 11x = 66 \quad \Rightarrow x = \frac{66}{11} = 6$$

$$\therefore x = 6$$

Question 30.
2x + 20% 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 ⇒ x = 5 x 5
⇒ x = 25
∴ Number = 25

Question 2.
Six times a number is 72, find the number.

Solution:
Let the number = x
According to the condition
6x = 72
⇒ x = $\frac{72}{6}$
⇒x= 12
∴ 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
⇒ x = 69 – 15 x = 54
∴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
⇒2x = 80 – 4
⇒ 2x = 76
⇒ x = $\frac{76}{2}$ = 38
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

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

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

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

$$\Rightarrow x = 32$$

$\therefore$ 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

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

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

[∵ LCM of 3 and 5 = 15]

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

$$\Rightarrow x = 150$$

∴ 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
⇒ x + x = 53 + 35
88
⇒2x = 88
⇒ x = $\frac{88}{2}$ = 44
∴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 …(i)
and x = 27 ….(ii)
Substitute the eq. (ii) in eq. (i), we get
2y + y= 18
x= 2y = 18
⇒ 3y= 18 ⇒y= $\frac{18}{3}$ = 6

Now, substitute the value of y in eq. (ii), we get
x = 2 x 6= 12
∴ The two numbers are 12, 6

Question 9.
A number is 15 more than the other. The sum of 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 …(i)
x + 7=195 …(ii)
Substitute the eq. (i) in eq. (ii), we get
y+15+7=195
⇒2y= 195- 15
⇒ y = $\frac{180}{2}$ = 90
Now, substitute the value of y in eq. (i), we get
x = 90+ 15 = 105
∴ 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
⇒ 3x + 6 = 54
⇒ 3x = 54 – 6
⇒ x =$\frac{48}{3}$ = 16
∴ 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 ⇒ 3x = 63 – 6
⇒3x = 57 ⇒ x = $\frac{57}{3}$ =19
∴ 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
⇒x = $\frac{86}{2}$
⇒ x = 43
Amount spent by him = 6
∴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
⇒ x = 10
∴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
⇒ 3x = 16 + 5
⇒ 3x = 21
⇒ x = $\frac{21}{3}$
⇒ x = 7
∴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 conscutive number = x,
Second consecutive number = x + 1
and Third consecutive number = x + 2
According to the condition,
x + x + 1 = 15 + x + 2
⇒ 2x + 1 = 17 +x
⇒ 2x -x = 17 – 1
⇒ x= 16
∴ 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 …(i)
and 6x + y = 77 ….(ii)
From eq. (i)
y = 7 + x …(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)
$y = 7+ 10= 17$
∴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,
$x = y + 5$ ...(*i*)
and $2(x + y) = 142$

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

$\Rightarrow x + y = 71$ ...(*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)
$x = 33 + 5 = 38$
∴ 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,

$x = y - 4$ ...(*i*)

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

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

$\Rightarrow 2x - y = -1$ ..(*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 ₹10 notes = x ×₹ 5 = ₹3x
and value of ₹10 notes = (90 – x) x ₹ 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