

CHAPTER-2

Linear Equations in One Variable

1Mark Q&A

Exercise 2.1

Solve the following equations.

1. $x - 2 = 7$

Solution:

$$x - 2 = 7$$

$$x = 7 + 2$$

$$x = 9$$

2. $y + 3 = 10$

Solution:

$$y + 3 = 10$$

$$y = 10 - 3$$

$$y = 7$$

3. $6 = z + 2$

Solution:

$$6 = z + 2$$

$$z + 2 = 6$$

$$z = 6 - 2$$

$$z = 4$$

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

Solution:

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

$$x = \frac{17}{7} - \frac{3}{7}$$

$$x = \frac{14}{7}$$

$$x = 2$$

$$**5. $6x = 12$**$$

Solution:

$$6x = 12$$

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

$$x = 2$$

$$**6. $\frac{t}{5} = 10$**$$

Solution:

$$\frac{t}{5} = 10$$

$$t = 10 \times 5$$

$$t = 50$$

7. $2x/3 = 18$

Solution:

$$2x/3 = 18$$

$$2x = 18 \times 3$$

$$2x = 54$$

$$x = 54/2$$

$$x = 27$$

8. $1.6 = y/15$

Solution:

$$1.6 = y/1.5$$

$$y/1.5 = 1.6$$

$$y = 1.6 \times 1.5$$

$$y = 2.4$$

9. $7x - 9 = 16$

Solution:

$$7x - 9 = 16$$

$$7x = 16+9$$

$$7x = 25$$

$$x = 25/7$$

10. $14y - 8 = 13$

Solution:

$$14y - 8 = 13$$

$$14y = 13 + 8$$

$$14y = 21$$

$$y = 21/14$$

$$y = 3/2$$

11. $17 + 6p = 9$

Solution:

$$17 + 6p = 9$$

$$6p = 9 - 17$$

$$6p = -8$$

$$p = -8/6$$

$$p = -4/3$$

12. $x/3 + 1 = 7/15$

Solution:

$$x/3 + 1 = 7/15$$

$$x/3 = 7/15 - 1$$

$$x/3 = (7 - 15)/15$$

$$x/3 = -8/15$$

$$x = -8/15 \times 3$$

$$x = -8/5$$

2Mark Q&A

Exercise 2.2

Solve the following linear equations.

1. $x/2 - 1/5 = x/3 + 1/4$

Solution:

$$x/2 - 1/5 = x/3 + 1/4$$

$$\Rightarrow x/2 - x/3 = 1/4 + 1/5$$

$$\Rightarrow (3x - 2x)/6 = (5 + 4)/20$$

$$\Rightarrow 3x - 2x = 9/20 \times 6$$

$$\Rightarrow x = 54/20$$

$$\Rightarrow x = 27/10$$

2. $n/2 - 3n/4 + 5n/6 = 21$

Solution:

$$n/2 - 3n/4 + 5n/6 = 21$$

$$\Rightarrow (6n - 9n + 10n)/12 = 21$$

$$\Rightarrow 7n/12 = 21$$

$$\Rightarrow 7n = 21 \times 12$$

$$\Rightarrow n = 252/7$$

$$\Rightarrow n = 36$$

$$\mathbf{3. \ x + 7 - 8x/3 = 17/6 - 5x/2}$$

Solution:

$$x + 7 - 8x/3 = 17/6 - 5x/2$$

$$\Rightarrow x - 8x/3 + 5x/2 = 17/6 - 7$$

$$\Rightarrow (6x - 16x + 15x)/6 = (17 - 42)/6$$

$$\Rightarrow 5x/6 = -25/6$$

$$\Rightarrow 5x = -25$$

$$\Rightarrow x = -5$$

$$\mathbf{4. \ (x - 5)/3 = (x - 3)/5}$$

Solution:

$$(x - 5)/3 = (x - 3)/5$$

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

$$\Rightarrow 5x-25 = 3x-9$$

$$\Rightarrow 5x - 3x = -9+25$$

$$\Rightarrow 2x = 16$$

$$\Rightarrow x = 8$$

5. $(3t - 2)/4 - (2t + 3)/3 = 2/3 - t$

Solution:

$$(3t - 2)/4 - (2t + 3)/3 = 2/3 - t$$

$$\Rightarrow ((3t - 2)/4) \times 12 - ((2t + 3)/3) \times 12$$

$$\Rightarrow (3t - 2) \times 3 - (2t + 3) \times 4 = 2 \times 4 - 12t$$

$$\Rightarrow 9t - 6 - 8t - 12 = 8 - 12t$$

$$\Rightarrow 9t - 6 - 8t - 12 = 8 - 12t$$

$$\Rightarrow t - 18 = 8 - 12t$$

$$\Rightarrow t + 12t = 8 + 18$$

$$\Rightarrow 13t = 26$$

$$\Rightarrow t = 2$$

6. $m - (m - 1)/2 = 1 - (m - 2)/3$

Solution:

$$m - (m - 1)/2 = 1 - (m - 2)/3$$

$$\Rightarrow m - m/2 - 1/2 = 1 - (m/3 - 2/3)$$

$$\Rightarrow m - m/2 + 1/2 = 1 - m/3 + 2/3$$

$$\Rightarrow m - m/2 + m/3 = 1 + 2/3 - 1/2$$

$$\Rightarrow m/2 + m/3 = 1/2 + 2/3$$

$$\Rightarrow (3m + 2m)/6 = (3 + 4)/6$$

$$\Rightarrow 5m/6 = 7/6$$

$$\Rightarrow m = 7/6 \times 6/5$$

$$\Rightarrow m = 7/5$$

Simplify and solve the following linear equations.

7. $3(t - 3) = 5(2t + 1)$

Solution:

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

$$\Rightarrow 3t - 9 = 10t + 5$$

$$\Rightarrow 3t - 10t = 5 + 9$$

$$\Rightarrow -7t = 14$$

$$\Rightarrow t = 14/-7$$

$$\Rightarrow t = -2$$

8. $15(y - 4) - 2(y - 9) + 5(y + 6) = 0$

Solution:

$$15(y - 4) - 2(y - 9) + 5(y + 6) = 0$$

$$\Rightarrow 15y - 60 - 2y + 18 + 5y + 30 = 0$$

$$\Rightarrow 15y - 2y + 5y = 60 - 18 - 30$$

$$\Rightarrow 18y = 12$$

$$\Rightarrow y = 12/18$$

$$\Rightarrow y = 2/3$$

$$\mathbf{9.3 \ (5z - 7) - 2(9z - 11) = 4(8z - 13) - 17}$$

Solution:

$$3(5z - 7) - 2(9z - 11) = 4(8z - 13) - 17$$

$$\Rightarrow 15z - 21 - 18z + 22 = 32z - 52 - 17$$

$$\Rightarrow 15z - 18z - 32z = -52 - 17 + 21 - 22$$

$$\Rightarrow -35z = -70$$

$$\Rightarrow z = -70/-35$$

$$\Rightarrow z = 2$$

$$\mathbf{10. \ 0.25(4f - 3) = 0.05(10f - 9)}$$

Solution:

$$0.25(4f - 3) = 0.05(10f - 9)$$

$$\Rightarrow f - 0.75 = 0.5f - 0.45$$

$$\Rightarrow f - 0.5f = -0.45 + 0.75$$

$$\Rightarrow 0.5f = 0.30$$

$$\Rightarrow f = 0.30/0.5$$

$$\Rightarrow f = 3/5$$

$$\Rightarrow f = 0.6$$

Exercise 2.3

Solve the following equations.

1. $(8x - 3)/3x = 2$

Solution:

$$(8x - 3)/3x = 2$$

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

$$\Rightarrow 8/3 - 1/x = 2$$

$$\Rightarrow 8/3 - 2 = 1/x$$

$$\Rightarrow (8 - 6)/3 = 1/x$$

$$\Rightarrow 2/3 = 1/x$$

$$\Rightarrow x = 3/2$$

2. $9x/(7 - 6x) = 15$

Solution:

$$9x/(7 - 6x) = 15$$

$$\Rightarrow 9x = 15(7 - 6x)$$

$$\Rightarrow 9x = 105 - 90x$$

$$\Rightarrow 9x + 90x = 105$$

$$\Rightarrow 99x = 105$$

$$\Rightarrow x = 105/99 = 35/33$$

3. $z/(z + 15) = 4/9$

Solution:

$$z/(z + 15) = 4/9$$

$$\Rightarrow z = 4/9 (z + 15)$$

$$\Rightarrow 9z = 4(z + 15)$$

$$\Rightarrow 9z = 4z + 60$$

$$\Rightarrow 9z - 4z = 60$$

$$\Rightarrow 5z = 60$$

$$\Rightarrow z = 12$$

4. $(3y + 4)/(2 - 6y) = -2/5$

Solution:

$$(3y + 4)/(2 - 6y) = -2/5$$

$$\Rightarrow 3y + 4 = -2/5 (2 - 6y)$$

$$\Rightarrow 5(3y + 4) = -2(2 - 6y)$$

$$\Rightarrow 15y + 20 = -4 + 12y$$

$$\Rightarrow 15y - 12y = -4 - 20$$

$$\Rightarrow 3y = -24$$

$$\Rightarrow y = -8$$

5. $(7y + 4)/(y + 2) = -4/3$

Solution:

$$(7y + 4)/(y + 2) = -4/3$$

$$\Rightarrow 7y + 4 = -4/3 (y + 2)$$

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

$$\Rightarrow 21y + 12 = -4y - 8$$

$$\Rightarrow 21y + 4y = -8 - 12$$

$$\Rightarrow 25y = -20$$

$$\Rightarrow y = -20/25 = -4/5$$

6. The ages of Hari and Harry are in the ratio of 5:7. Four years from now, the ratio of their ages will be 3:4. Find their present ages.

Solution:

Let the age of Hari be $5x$ and Harry be $7x$. 4 years later,

$$\text{Age of Hari} = 5x + 4$$

$$\text{Age of Harry} = 7x + 4$$

According to the question,

$$(5x + 4)/(7x + 4) = 3/4$$

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

$$\Rightarrow 20x + 16 = 21x + 12$$

$$\Rightarrow 21x - 20x = 16 - 12$$

$$\Rightarrow x = 4$$

$$\text{Hari's age} = 5x = 5 \times 4 = 20 \text{ years}$$

$$\text{Harry's age} = 7x = 7 \times 4 = 28 \text{ years}$$

7. The denominator of a rational number is greater than its numerator by 8. If the numerator is increased by 17 and the denominator is decreased by 1, the number obtained is $\frac{3}{2}$. Find the rational number.

Solution:

Let the numerator be x , then the denominator will be $(x + 8)$

According to the question,

$$(x + 17)/(x + 8 - 1) = 3/2$$

$$\Rightarrow (x + 17)/(x + 7) = 3/2$$

$$\Rightarrow 2(x + 17) = 3(x + 7)$$

$$\Rightarrow 2x + 34 = 3x + 21$$

$$\Rightarrow 34 - 21 = 3x - 2x$$

$$\Rightarrow 13 = x$$

The rational number is $x/(x + 8) = 13/21$

3Mark Q&A

Exercise 2.4

Solve the following equations and check your results.

1. $3x = 2x + 18$

Solution:

$$3x = 2x + 18$$

$$\Rightarrow 3x - 2x = 18$$

$$\Rightarrow x = 18$$

Putting the value of x in RHS and LHS, we get, $3 \times 18 = (2 \times 18) + 18$

$$\Rightarrow 54 = 54$$

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

2. $5t - 3 = 3t - 5$

Solution:

$$5t - 3 = 3t - 5$$

$$\Rightarrow 5t - 3t = -5 + 3$$

$$\Rightarrow 2t = -2$$

$$\Rightarrow t = -1$$

Putting the value of t in RHS and LHS, we get, $5 \times (-1) - 3 = 3 \times (-1) - 5$

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

$$\Rightarrow -8 = -8$$

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

$$\mathbf{3. \ 5x + 9 = 5 + 3x}$$

Solution:

$$5x + 9 = 5 + 3x$$

$$\Rightarrow 5x - 3x = 5 - 9$$

$$\Rightarrow 2x = -4$$

$$\Rightarrow x = -2$$

Putting the value of x in RHS and LHS, we get, $5 \times (-2) + 9 = 5 + 3 \times (-2)$

$$\Rightarrow -10 + 9 = 5 + (-6)$$

$$\Rightarrow -1 = -1$$

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

$$\mathbf{4. \ 4z + 3 = 6 + 2z}$$

Solution:

$$4z + 3 = 6 + 2z$$

$$\Rightarrow 4z - 2z = 6 - 3$$

$$\Rightarrow 2z = 3$$

$$\Rightarrow z = 3/2$$

Putting the value of z in RHS and LHS, we get,

$$(4 \times 3/2) + 3 = 6 + (2 \times 3/2)$$

$$\Rightarrow 6 + 3 = 6 + 3$$

$$\Rightarrow 9 = 9$$

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

$$\mathbf{5. \ 2x - 1 = 14 - x}$$

Solution:

$$2x - 1 = 14 - x$$

$$\Rightarrow 2x + x = 14 + 1$$

$$\Rightarrow 3x = 15$$

$$\Rightarrow x = 5$$

Putting the value of x in RHS and LHS, we get, $(2 \times 5) - 1 = 14 - 5$

$$\Rightarrow 10 - 1 = 9$$

$$\Rightarrow 9 = 9$$

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

$$\mathbf{6. \ 8x + 4 = 3(x - 1) + 7}$$

Solution:

$$8x + 4 = 3(x - 1) + 7$$

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

$$\Rightarrow 8x + 4 = 3x + 4$$

$$\Rightarrow 8x - 3x = 4 - 4$$

$$\Rightarrow 5x = 0$$

$$\Rightarrow x = 0$$

Putting the value of x in RHS and LHS, we get, $(8 \times 0) + 4 = 3(0 - 1) + 7$

$$\Rightarrow 0 + 4 = 0 - 3 + 7$$

$$\Rightarrow 4 = 4$$

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

$$\mathbf{7. x = 4/5 (x + 10)}$$

Solution:

$$x = 4/5 (x + 10)$$

$$\Rightarrow x = 4x/5 + 40/5$$

$$\Rightarrow x - (4x/5) = 8$$

$$\Rightarrow (5x - 4x)/5 = 8$$

$$\Rightarrow x = 8 \times 5$$

$$\Rightarrow x = 40$$

Putting the value of x in RHS and LHS, we get,

$$40 = 4/5 (40 + 10)$$

$$\Rightarrow 40 = 4/5 \times 50$$

$$\Rightarrow 40 = 200/5$$

$$\Rightarrow 40 = 40$$

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

$$\mathbf{8. \frac{2x}{3} + 1 = \frac{7x}{15} + 3}$$

Solution:

$$\frac{2x}{3} + 1 = \frac{7x}{15} + 3$$

$$\Rightarrow \frac{2x}{3} - \frac{7x}{15} = 3 - 1$$

$$\Rightarrow \frac{(10x - 7x)}{15} = 2$$

$$\Rightarrow 3x = 2 \times 15$$

$$\Rightarrow 3x = 30$$

$$\Rightarrow x = 30/3$$

$$\Rightarrow x = 10$$

Putting the value of x in RHS and LHS, we get,

$$\mathbf{9. 2y + \frac{5}{3} = \frac{26}{3} - y}$$

Solution:

$$2y + \frac{5}{3} = \frac{26}{3} - y$$

$$\Rightarrow 2y + y = \frac{26}{3} - \frac{5}{3}$$

$$\Rightarrow 3y = \frac{(26 - 5)}{3}$$

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

$$\Rightarrow 3y = 7$$

$$\Rightarrow y = 7/3$$

Putting the value of y in RHS and LHS, we get,

$$\Rightarrow (2 \times 7/3) + 5/3 = 26/3 - 7/3$$

$$\Rightarrow 14/3 + 5/3 = 26/3 - 7/3$$

$$\Rightarrow (14 + 5)/3 = (26 - 7)/3$$

$$\Rightarrow 19/3 = 19/3$$

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

$$\mathbf{10. \ 3m = 5m - 8/5}$$

Solution:

$$3m = 5m - 8/5$$

$$\Rightarrow 5m - 3m = 8/5$$

$$\Rightarrow 2m = 8/5$$

$$\Rightarrow 2m \times 5 = 8$$

$$\Rightarrow 10m = 8$$

$$\Rightarrow m = 8/10$$

$$\Rightarrow m = 4/5$$

Putting the value of m in RHS and LHS, we get,

$$\Rightarrow 3 \times (4/5) = (5 \times 4/5) - 8/5$$

$$\Rightarrow 12/5 = 4 - (8/5)$$

$$\Rightarrow 12/5 = (20 - 8)/5$$

$$\Rightarrow 12/5 = 12/5$$

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

5Mark Q&A

Exercise 2.5

1. If you subtract $\frac{1}{2}$ from a number and multiply the result by $\frac{1}{2}$, you get $\frac{1}{8}$. What is the number?

Solution:

Let the number be x .

According to the question,

$$(x - \frac{1}{2}) \times \frac{1}{2} = \frac{1}{8}$$

$$x/2 - \frac{1}{4} = \frac{1}{8}$$

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

$$x/2 = \frac{1}{8} + \frac{2}{8}$$

$$x/2 = (1 + 2)/8$$

$$x/2 = \frac{3}{8}$$

$$x = (\frac{3}{8}) \times 2$$

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

2. The perimeter of a rectangular swimming pool is 154 m. Its length is 2 m, more than twice its breadth. What are the length and breadth of the pool?

Solution:

Given that,

The perimeter of the rectangular swimming pool = 154 m. Let the breadth of the rectangle be = x

According to the question,

Length of the rectangle = $2x + 2$ We know that,

Perimeter = $2(\text{length} + \text{breadth})$

$$\Rightarrow 2(2x + 2 + x) = 154 \text{ m}$$

$$\Rightarrow 2(3x + 2) = 154$$

$$\Rightarrow 3x + 2 = 154/2$$

$$\Rightarrow 3x = 77 - 2$$

$$\Rightarrow 3x = 75$$

$$\Rightarrow x = 75/3$$

$$\Rightarrow x = 25 \text{ m}$$

Therefore, Breadth = $x = 25 \text{ cm}$

Length = $2x + 2$

$$= (2 \times 25) + 2$$

$$= 50 + 2$$

$$= 52 \text{ m}$$

3. The base of an isosceles triangle is $\frac{4}{3}$ cm. The perimeter of the triangle is $4\frac{2}{15}$ cm. What is the length of either of the remaining equal sides?

Solution:

Base of isosceles triangle = $\frac{4}{3}$ cm

Perimeter of triangle =
 $4\frac{2}{15}$ cm = $\frac{62}{15}$

Let the length of equal sides of the triangle be x.

According to the question,

$$\frac{4}{3} + x + x = \frac{62}{15} \text{ cm}$$

$$\Rightarrow 2x = \left(\frac{62}{15} - \frac{4}{3}\right) \text{ cm}$$

$$\Rightarrow 2x = \frac{(62 - 20)}{15} \text{ cm}$$

$$\Rightarrow 2x = \frac{42}{15} \text{ cm}$$

$$\Rightarrow x = \left(\frac{42}{30}\right) \times \left(\frac{1}{2}\right)$$

$$\Rightarrow x = \frac{42}{30} \text{ cm}$$

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

The length of either of the remaining equal sides is $\frac{7}{5}$ cm.

4. Sum of two numbers is 95. If one exceeds the other by 15, find the numbers.

Solution:

Let one of the numbers be x .

Then, the other number becomes $x + 15$. According to the question,

$$x + x + 15 = 95$$

$$\Rightarrow 2x + 15 = 95$$

$$\Rightarrow 2x = 95 - 15$$

$$\Rightarrow 2x = 80$$

$$\Rightarrow x = 80/2$$

$$\Rightarrow x = 40$$

$$\text{First number} = x = 40$$

$$\text{And, other number} = x + 15 = 40 + 15 = 55$$

5. Two numbers are in the ratio 5:3. If they differ by 18, what are the numbers?

Solution:

Let the two numbers be $5x$ and $3x$. According to the question,

$$5x - 3x = 18$$

$$\Rightarrow 2x = 18$$

$$\Rightarrow x = 18/2$$

$$\Rightarrow x = 9$$

Thus,

$$\text{The numbers are } 5x = 5 \times 9 = 45$$

$$\text{And } 3x = 3 \times 9 = 27.$$

6. Three consecutive integers add up to 51. What are these integers?

Solution:

Let the three consecutive integers be x , $x+1$ and $x+2$. According to the question,

$$x + (x+1) + (x+2) = 51$$

$$\Rightarrow 3x + 3 = 51$$

$$\Rightarrow 3x = 51 - 3$$

$$\Rightarrow 3x = 48$$

$$\Rightarrow x = 48/3$$

$$\Rightarrow x = 16$$

Thus, the integers are

$$x = 16$$

$$x + 1 = 17$$

$$x + 2 = 18$$

7. The sum of three consecutive multiples of 8 is 888. Find the multiples.

Solution:

Let the three consecutive multiples of 8 be $8x$, $8(x+1)$ and $8(x+2)$.
According to the question,

$$8x + 8(x+1) + 8(x+2) = 888$$

$$\Rightarrow 8(x + x+1 + x+2) = 888 \text{ (Taking 8 as common)}$$

$$\Rightarrow 8(3x + 3) = 888$$

$$\Rightarrow 3x + 3 = 888/8$$

$$\Rightarrow 3x + 3 = 111$$

$$\Rightarrow 3x = 111 - 3$$

$$\Rightarrow 3x = 108$$

$$\Rightarrow x = 108/3$$

$$\Rightarrow x = 36$$

Thus, the three consecutive multiples of 8 are:

$$8x = 8 \times 36 = 288$$

$$8(x + 1) = 8 \times (36 + 1) = 8 \times 37 = 296$$

$$8(x + 2) = 8 \times (36 + 2) = 8 \times 38 = 304$$

8. Three consecutive integers are such that when they are taken in increasing order and multiplied by 2, 3 and 4, respectively, they add up to 74. Find these numbers.

Solution:

Let the three consecutive integers be x , $x+1$ and $x+2$. According to the question,

$$2x + 3(x+1) + 4(x+2) = 74$$

$$\Rightarrow 2x + 3x + 3 + 4x + 8 = 74$$

$$\Rightarrow 9x + 11 = 74$$

$$\Rightarrow 9x = 74 - 11$$

$$\Rightarrow 9x = 63$$

$$\Rightarrow x = 63/9$$

$$\Rightarrow x = 7$$

Thus, the numbers are:

$$x = 7$$

$$x + 1 = 8$$

$$x + 2 = 9$$

9. The ages of Rahul and Haroon are in the ratio 5:7. Four years later, the sum of their ages will be 56 years. What are their present ages?

Solution:

Let the ages of Rahul and Haroon be $5x$ and $7x$. Four years later,

The ages of Rahul and Haroon will be $(5x + 4)$ and $(7x + 4)$, respectively. According to the question,

$$(5x + 4) + (7x + 4) = 56$$

$$\Rightarrow 5x + 4 + 7x + 4 = 56$$

$$\Rightarrow 12x + 8 = 56$$

$$\Rightarrow 12x = 56 - 8$$

$$\Rightarrow 12x = 48$$

$$\Rightarrow x = 48/12$$

$$\Rightarrow x = 4$$

Therefore, Present age of Rahul = $5x = 5 \times 4 = 20$

And, present age of Haroon = $7x = 7 \times 4 = 28$

10. The number of boys and girls in a class is in the ratio of 7:5. The number of boys is 8 more than the number of girls. What is the total class strength?

Solution:

Let the number of boys be $7x$, and girls be $5x$.

According to the question,

$$7x = 5x + 8$$

$$\Rightarrow 7x - 5x = 8$$

$$\Rightarrow 2x = 8$$

$$\Rightarrow x = 8/2$$

$$\Rightarrow x = 4$$

Therefore, number of boys = $7 \times 4 = 28$

And, number of girls = $5 \times 4 = 20$

Total number of students = $20 + 28 = 48$

11. Baichung's father is 26 years younger than Baichung's grandfather and 29 years older than Baichung. The sum of the ages of all the three is 135 years. What is the age of each one of them?

Solution:

Let the age of Baichung's father be x .

Then, the age of Baichung's grandfather = $(x+26)$

and, the age of Baichung = $(x-29)$. According to the question,

$$x + (x+26) + (x-29) = 135$$

$$\Rightarrow 3x + 26 - 29 = 135$$

$$\Rightarrow 3x - 3 = 135$$

$$\Rightarrow 3x = 135 + 3$$

$$\Rightarrow 3x = 138$$

$$\Rightarrow x = 138/3$$

$$\Rightarrow x = 46$$

Age of Baichung's father = $x = 46$

Age of Baichung's grandfather = $(x+26) = 46 + 26 = 72$

Age of Baichung = $(x-29) = 46 - 29 = 17$

12. Fifteen years from now, Ravi's age will be four times his present age. What is Ravi's present age?

Solution:

Let the present age of Ravi be x .

Fifteen years later, Ravi's age will be $x+15$ years. According to the question,

$$x + 15 = 4x$$

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

$$\Rightarrow 3x = 15$$

$$\Rightarrow x = 15/3$$

$$\Rightarrow x = 5$$

Therefore, the present age of Ravi = 5 years.

13. A rational number is such that when you multiply it by $\frac{5}{2}$ and add $\frac{2}{3}$ to the product, you get $-\frac{7}{12}$. What is the number?

Solution:

Let the rational be x .

According to the question,

$$x \times \left(\frac{5}{2}\right) + \frac{2}{3} = -\frac{7}{12}$$

$$\Rightarrow \frac{5x}{2} + \frac{2}{3} = -\frac{7}{12}$$

$$\Rightarrow \frac{5x}{2} = -\frac{7}{12} - \frac{2}{3}$$

$$\Rightarrow \frac{5x}{2} = \frac{-7-8}{12}$$

$$\Rightarrow \frac{5x}{2} = -\frac{15}{12}$$

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

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

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

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

Therefore, the rational number is $-\frac{1}{2}$.

14. Lakshmi is a cashier in a bank. She has currency notes of denominations ₹100, ₹50 and ₹10, respectively. The ratio of the number of these notes is 2:3:5. The total cash with Lakshmi is ₹4,00,000. How many notes of each denomination does she have?

Solution:

Let the numbers of notes of ₹100, ₹50 and ₹10 be $2x$, $3x$ and $5x$, respectively.

$$\text{Value of ₹100} = 2x \times 100 = 200x$$

$$\text{Value of ₹50} = 3x \times 50 = 150x$$

$$\text{Value of ₹10} = 5x \times 10 = 50x$$

According to the question,

$$200x + 150x + 50x = 4,00,000$$

$$\Rightarrow 400x = 4,00,000$$

$$\Rightarrow x = 400000/400$$

$$\Rightarrow x = 1000$$

$$\text{Numbers of ₹100 notes} = 2x = 2000$$

$$\text{Numbers of ₹50 notes} = 3x = 3000$$

$$\text{Numbers of ₹10 notes} = 5x = 5000$$

15. I have a total of ₹300 in coins of denomination ₹1, ₹2 and ₹5. The number of ₹2 coins is 3 times the number of ₹5 coins. The total number of coins is 160. How many coins of each denomination are with me?

Solution:

Let the number of ₹5 coins be x .

Then,

Number ₹2 coins = $3x$

And, number of ₹1 coins = $(160 - 4x)$ Now,

Value of ₹5 coins = $x \times 5 = 5x$

Value of ₹2 coins = $3x \times 2 = 6x$

Value of ₹1 coins = $(160 - 4x) \times 1 = (160 - 4x)$

According to the question,

$$5x + 6x + (160 - 4x) = 300$$

$$\Rightarrow 11x + 160 - 4x = 300$$

$$\Rightarrow 7x = 140$$

$$\Rightarrow x = 140/7$$

$$\Rightarrow x = 20$$

Number of ₹5 coins = $x = 20$

Number of ₹2 coins = $3x = 60$

Number of ₹1 coins = $(160 - 4x) = 160 - 80 = 80$

16. The organisers of an essay competition decide that a winner in the competition gets a prize of ₹100 and a participant who does not win gets a prize of ₹25. The total prize money distributed is ₹3,000. Find the number of winners, if the total number of participants is 63.

Solution:

Let the number of winners be x .

Then, the number of participants who didn't win = $63 - x$

Total money given to the winner = $x \times 100 = 100x$

Total money given to the participant who didn't win = $25 \times (63 - x)$

According to the question,

$$100x + 25 \times (63 - x) = 3,000$$

$$\Rightarrow 100x + 1575 - 25x = 3,000$$

$$\Rightarrow 75x = 3,000 - 1575$$

$$\Rightarrow 75x = 1425$$

$$\Rightarrow x = 1425/75$$

$$\Rightarrow x = 19$$

Therefore, the numbers of winners are 19.

Exercise 2.6

1. Amina thinks of a number and subtracts $5/2$ from it. She multiplies the result by 8. The result now obtained is 3 times the same number she thought of. What is the number?

Solution:

Let the number be x ,

According to the question,

$$(x - 5/2) \times 8 = 3x$$

$$\Rightarrow 8x - 40/2 = 3x$$

$$\Rightarrow 8x - 3x = 40/2$$

$$\Rightarrow 5x = 20$$

$$\Rightarrow x = 4$$

Thus, the number is 4.

2. A positive number is 5 times another number. If 21 is added to both numbers, then one of the new numbers becomes twice the other new number. What are the numbers?

Solution:

Let one of the positive numbers be x , then the other number will be $5x$.

According to the question,

$$5x + 21 = 2(x + 21)$$

$$\Rightarrow 5x + 21 = 2x + 42$$

$$\Rightarrow 5x - 2x = 42 - 21$$

$$\Rightarrow 3x = 21$$

$$\Rightarrow x = 7$$

$$\text{One number} = x = 7$$

$$\text{Other number} = 5x = 5 \times 7 = 35. \text{ The two numbers are } 7 \text{ and } 35.$$

3. Sum of the digits of a two-digit number is 9. When we interchange the digits, it is found that the resulting new number is greater than the original number by 27. What is the two-digit number?

Solution:

Let the digit at tens place be x , then the digit at ones place will be $(9-x)$.

$$\text{Original two-digit number} = 10x + (9-x)$$

$$\text{After interchanging the digits, the new number} = 10(9-x) + x$$

According to the question,

$$10x + (9-x) + 27 = 10(9-x) + x$$

$$\Rightarrow 10x + 9 - x + 27 = 90 - 10x + x$$

$$\Rightarrow 9x + 36 = 90 - 9x$$

$$\Rightarrow 9x + 9x = 90 - 36$$

$$\Rightarrow 18x = 54$$

$$\Rightarrow x = 3$$

$$\text{Original number} = 10x + (9-x) = (10 \times 3) + (9-3) = 30 + 6 = 36$$

Thus, the number is 36.

4. One of the two digits of a two-digit number is three times the other digit. If you interchange the digits of this two-digit number and add the resulting number to the original number, you get 88. What is the original number?

Solution:

Let the digit at tens place be x , then the digit at ones place will be $3x$.

Original two-digit number = $10x + 3x$

After interchanging the digits, the new number = $30x + x$

According to the question,

$$(30x + x) + (10x + 3x) = 88$$

$$\Rightarrow 31x + 13x = 88$$

$$\Rightarrow 44x = 88$$

$$\Rightarrow x = 2$$

$$\text{Original number} = 10x + 3x = 13x = 13 \times 2 = 26$$

5. Shobo's mother's present age is six times Shobo's present age. Shobo's age five years from now will be one-third of his mother's present age. What are their present ages?

Solution:

Let the present age of Shobo be x , then the age of her mother will be $6x$.

Shobo's age after 5 years = $x + 5$

According to the question,

$$(x + 5) = (1/3) \times 6x$$

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

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

$$\Rightarrow x = 5$$

Present age of Shobo = $x = 5$ years

The present age of Shobo's mother = $6x = 30$ years.

6. There is a narrow rectangular plot reserved for a school in Mahuli village. The length and breadth of the plot are in the ratio 11:4. At the rate ₹100 per metre, it will cost the village panchayat ₹75000 to fence the plot. What are the dimensions of the plot?

Solution:

Let the length of the rectangular plot be $11x$ and the breadth be $4x$.

Rate of fencing per metre = ₹100

Total cost of fencing = ₹75000

Perimeter of the plot = $2(l+b) = 2(11x + 4x) = 2 \times 15x = 30x$

Total amount of fencing = $(30x \times 100)$

According to the question,

$$(30x \times 100) = 75000$$

$$\Rightarrow 3000x = 75000$$

$$\Rightarrow x = 75000/3000$$

$$\Rightarrow x = 25$$

$$\text{Length of the plot} = 11x = 11 \times 25 = 275\text{m}$$

$$\text{Breadth of the plot} = 4 \times 25 = 100\text{m.}$$

7. Hasan buys two kinds of cloth materials for school uniforms; shirt material that costs him ₹50 per metre and trouser material that costs him ₹90 per metre. For every 3 meters of the shirt material, he buys 2 metres of the trouser material. He sells the materials at 12% and 10% profit, respectively. His total sale is ₹36,600. How much trouser material did he buy?

Solution:

Let $2x$ m of trouser material and $3x$ m of shirt material be bought by him

$$\text{Selling price of shirt material per meter} = ₹ 50 + 50 \times (12/100) = ₹ 56$$

$$\text{Selling price of trouser material per meter} = ₹ 90 + 90 \times (10/100) = ₹ 99$$

$$\text{Total amount of sale} = ₹36,600$$

According to the question,

$$(2x \times 99) + (3x \times 56) = 36600$$

$$\Rightarrow 198x + 168x = 36600$$

$$\Rightarrow 366x = 36600$$

$$\Rightarrow x = 36600/366$$

$$\Rightarrow x = 100$$

Total trouser material he bought = $2x = 2 \times 100 = 200$ m.

8. Half of a herd of deer is grazing in the field, and three-fourths of the remaining are playing nearby. The rest 9 are drinking water from the pond. Find the number of deer in the herd.

Solution:

Let the total number of deer be x .

Deer grazing in the field = $x/2$

Deer playing nearby = $x/2 \times \frac{3}{4} = 3x/8$

Deer drinking water = 9

According to the question,

$$x/2 + 3x/8 + 9 = x$$

$$(4x + 3x)/8 + 9 = x$$

$$\Rightarrow 7x/8 + 9 = x$$

$$\Rightarrow x - 7x/8 = 9$$

$$\Rightarrow (8x - 7x)/8 = 9$$

$$\Rightarrow x = 9 \times 8$$

$$\Rightarrow x = 72$$

9. A grandfather is ten times older than his granddaughter. He is also 54 years older than her. Find their present ages.

Solution:

Let the age of granddaughter be x and grandfather be $10x$.

Also, he is 54 years older than her.

According to the question, $10x = x + 54$

$$\Rightarrow 10x - x = 54$$

$$\Rightarrow 9x = 54$$

$$\Rightarrow x = 6$$

Age of grandfather = $10x = 10 \times 6 = 60$ years.

Age of granddaughter = $x = 6$ years.

10. Aman's age is three times his son's age. Ten years ago, he was five times his son's age. Find their present ages.

Solution:

Let the age of Aman's son be x , then the age of Aman will be $3x$.

According to the question,

$$5(x - 10) = 3x - 10$$

$$\Rightarrow 5x - 50 = 3x - 10$$

$$\Rightarrow 5x - 3x = -10 + 50$$

$$\Rightarrow 2x = 40$$

$$\Rightarrow x = 20$$

Aman's son age = $x = 20$ years

Aman age = $3x = 3 \times 20 = 60$ years

Exercise 2.7

Multiple-choice question and answers:

1. What is the solution to the equation $3x + 5 = 11$?

A) $x = 2$

B) $x = 3$

C) $x = 6$

D) $x = 1$

Answer: A) $x = 2$

2. Solve for x : $2(x - 4) = 10$.

A) $x = 7$

B) $x = 5$

C) $x = 4$

D) $x = 10$

Answer: A) $x = 7$

3. Which of the following is a linear equation in one variable?

A) $2x^2 + 3x + 1 = 0$

B) $|x| = 5$

C) $4x - 7 = 2x + 3$

D) $x^3 + 2x - 1 = 0$

Answer: C) $4x - 7 = 2x + 3$

4. If $2x - 5 = 3x + 2$, what is the value of x ?

A) $x = -7$

B) $x = 7$

C) $x = 3$

D) $x = -3$

Answer: A) $x = -7$

5. Which of the following equations has no solution?

A) $4x - 3 = 2(x - 1)$

B) $5x - 4 = 5(x - 2)$

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

D) $x + 3 = x + 3$

Answer: D) $x + 3 = x + 3$

6. Solve for x: $2(2x + 3) = 4x - 1$.

A) $x = -4$

B) $x = 1$

C) $x = 4$

D) $x = -1$

Answer: B) $x = 1$

7. What is the solution to the equation $5(x - 2) = 15$?

A) $x = 4$

B) $x = 5$

C) $x = 2$

D) $x = 3$

Answer: C) $x = 2$

8. If $3(2x + 1) = 5(x - 2)$, what is the value of x?

A) $x = 2$

B) $x = 4$

C) $x = -1$

D) $x = -4$

Answer: A) $x = 2$

9. Which of the following equations represents a line with a slope of -2 and a y-intercept of 3?

A) $y = -2x + 3$

B) $y = 2x + 3$

C) $y = -2x - 3$

D) $y = 3x + 2$

Answer: A) $y = -2x + 3$

10. Solve for x: $4(x - 3) = 2x - 1$.

A) $x = 5$

B) $x = 4$

C) $x = 3$

D) $x = 6$

Answer: A) $x = 5$

Exercise 2.8

Fill in the blanks:

- a) The solution to the equation $2x - 5 = 11$ is $x = \underline{\hspace{2cm}}$.
- b) To solve the equation $3(x + 4) = 21$, first distribute the 3, then simplify to $x + \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$, and finally, solve for x .
- c) The solution set of the equation $4 - 2y = 10$ is $y = \underline{\hspace{2cm}}$.
- d) The solution to the equation $2(3x - 1) = 5$ is $x = \underline{\hspace{2cm}}$.
- e) Solve the equation $7 - 2y = 3y + 5$ to find $y = \underline{\hspace{2cm}}$.
- f) If $4x + 6 = 14$, then $x = \underline{\hspace{2cm}}$.
- g) Solve the equation $2x + 3 = 7$ to find $x = \underline{\hspace{2cm}}$.
- h) If $5(2y - 1) = 15$, then $y = \underline{\hspace{2cm}}$.
- i) The solution to $3 + 2(4 - x) = 11$ is $x = \underline{\hspace{2cm}}$.

Answers:

- a) $x = 8$
- b) $x + 12 = 21, x = 9$
- c) $y = -3$
- d) $x = 2$

e) $y = -2$

f) $x = 2$

g) $x = 2$

h) $y = 2$

i) $x = -1$

summary

1. Definition:

- Linear equations in one variable are mathematical expressions of the form $(ax + b = 0)$, where (a) and (b) are constants, and (x) is the variable.

2. Solution:

- The solution to a linear equation is the value of the variable that makes the equation true.

3. Solving Process:

- For equations like $(ax + b = 0)$, isolate the variable (x) by performing operations such as addition, subtraction, multiplication, and division on both sides of the equation.

4. Distributive Property:

- When dealing with expressions like $a(x + b) = c$, distribute (a) to both terms inside the parentheses before solving.

5. Examples:

- Example 1: $(2x - 5 = 11)$, solution $(x = 8)$.
- Example 2: $(3(x + 4) = 21)$, distribute and solve to get $(x = 9)$.
- Example 3: $(4 - 2y = 10)$, solution $(y = -3)$.

6. Verification:

- After finding a solution, it can be verified by substituting the value back into the original equation to ensure it satisfies the equality.

7. Representation:

- Solutions can be represented as single values (e.g., $(x = 8)$) or assets (e.g., $(y = -3)$).

8. Word Problems:

- Linear equations are often used to solve real-world problems by representing relationships between quantities.

9. Decimal and Fraction Solutions:

- Solutions can be expressed as decimals or fractions, depending on the context of the problem.

10. Graphical Representation:

- Linear equations can be graphed on the coordinate plane, where the solution corresponds to the x-coordinate of the point of intersection with the x-axis.
