Linear Equations in One Variable

Solution of Equations by Transposing Terms

So, the most important point to remember about transposing terms is:

> **"When we transpose a term from one side to the other side of the equation, the sign of the term changes."**

We can also represent the solution of an equation graphically. Let us see how.

First of all, we need to find the solution of the given equation. Then, we need to represent it on a number line.

Let us start working with the equation $3x - 5 = -14$.

Here, we have

$3x - 5 = -14$

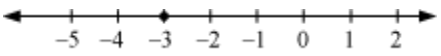
$\Rightarrow 3x = -14 + 5$ (Transposing 5 towards right side)

$\Rightarrow 3x = -9$

$\Rightarrow x = \frac{-9}{3}$ (Transposing 3 towards right side)

$\Rightarrow x = -3$

The solution is represented by a thick dot on the number line as shown below.



Let us now use this method of transposing the terms to solve some equations.

Example 1:

Solve the following equations. Also, represent their solutions graphically.

1. $z + 5/3 = 20$

2. $5(2a + 1) = 100$

Solution:

1. $z + 5/3 = 20$

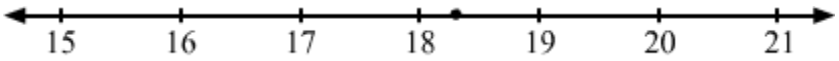
On transposing 5/3 to R.H.S., we obtain

$z = 20 - 5/3$

$\Rightarrow z = \frac{60-5}{3}$

$\Rightarrow z = \frac{55}{3} = 18\frac{1}{3}$

The solution is represented by a thick dot on the number line as shown below.



2. $5(2a + 1) = 100$

On transposing 5 to R.H.S., we obtain

$2a + 1 = \frac{100}{5}$

$\Rightarrow 2a + 1 = 20$

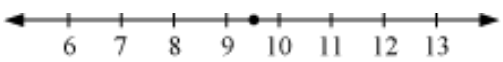
On transposing 1 to R.H.S., we obtain

$2a = 20 - 1$

$\Rightarrow 2a = 19$

$\Rightarrow a = \frac{19}{2} = 9\frac{1}{2}$

The solution is represented by a thick dot on the number line as shown below.



Example 2:

If 1 is added to one-third of a number, then it becomes 8. Find the number.

Solution:

Let the number be *n*.

Now, one-third of *n* is n/3.

According to the question,

n/3 + 1 = 8

On transposing 1 to R.H.S., we obtain

n/3 = 8 −1

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

On transposing 3 to R.H.S., we obtain

n = 7 × 3

⇒ *n* = 21

Thus, the required number is 21.

Equations Reducible To Linear Form

Some equations may not seem to be linear on first observation. However, it may be possible to reduce them to a linear form.

Look at the video to understand the concept of equations reducible to linear form.

Let us solve some more examples involving equations reducible to linear form.

Example 1:

Solve the following equations.

(a) $\frac{7x-45}{4x} = -2$

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

Solution:

(a)

$$\frac{7x-45}{4x} = -2$$

$$\Rightarrow 7x - 45 = -8x$$

$$\Rightarrow 7x + 8x = 45$$

$$\Rightarrow 15x = 45$$

$$\Rightarrow x = 3$$

(b)

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

$$\Rightarrow 3x + 1 = 5(x - 3)$$

$$\Rightarrow 3x + 1 = 5x - 15$$

$$\Rightarrow 3x - 5x = -15 - 1$$

$$\Rightarrow -2x = -16$$

$$\Rightarrow x = 8$$

Example 2:

Solve the following equations.

(a) $\frac{15y+7}{9y+8} = \frac{3}{2}$

(b) $\frac{2z-11}{5} = 9 - z$

Solution:

(a)

$$\frac{15y+7}{9y+8} = \frac{3}{2}$$

$$\Rightarrow 2(15y + 7) = 3(9y + 8)$$

$$\Rightarrow 30y + 14 = 27y + 24$$

$$\Rightarrow 30y - 27y = 24 - 14$$

$$\Rightarrow 3y = 10$$

$$\Rightarrow y = \frac{10}{3}$$

(b)

$$\frac{2z-11}{5} = 9 - z$$

$$\Rightarrow 2z - 11 = 5(9 - z)$$

$$\Rightarrow 2z - 11 = 45 - 5z$$

$$\Rightarrow 2z + 5z = 45 + 11$$

$$\Rightarrow 7z = 56$$

$$\Rightarrow z = 8$$

Example 3:

The present ages of Ravi and Meena are in the ratio 2:3. After seven years, the ratio of their ages will be 3:4. Find the present ages of Ravi and Meena.

Solution:

Let the present ages of Ravi and Meena be 2*x* years and 3*x* years respectively.

After seven years,

Ravi's age = (2*x* + 7) years

Meena's age = (3*x* + 7) years

Ratio of their ages after seven years $= \frac{2x+7}{3x+7}$

This ratio is given as 3:4.

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

By cross multiplication, we obtain

$4(2x + 7) = 3(3x + 7)$

$\Rightarrow 8x + 28 = 9x + 21$

$\Rightarrow 9x - 8x = 28 - 21$

$\Rightarrow x = 7$

Thus, present age of Ravi = $2x = 2 \times 7 = 14$ years

Present age of Meena = $3x = 3 \times 7 = 21$ years

Example 4:

The numerator of a rational number is less than its denominator by 3. If the numerator is increased by 12 and the denominator is increased by 3, then the number obtained is $\frac{7}{4}$. Find the rational number.

Solution:

Let the denominator of the rational number be x.

Then, numerator = $x - 3$

When the numerator is increased by 12 and denominator by 3, the rational number obtained is $\frac{x-3+12}{x+3}$.

According to the question,

$$\frac{x-3+12}{x+3}=\frac{7}{4}$$

$$\Rightarrow \frac{x+9}{x+3}=\frac{7}{4}$$

By cross-multiplication, we obtain

$4(x + 9) = 7(x + 3)$

$\Rightarrow 4x + 36 = 7x + 21$

$\Rightarrow 7x - 4x = 36 - 21$

$\Rightarrow 3x = 15$

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

$\Rightarrow x = 5$

Thus, numerator of the rational number, $x - 3 = 5 - 3 = 2$

Denominator = $x = 5$

Thus, the required rational number is 2/5.

Mathematical Expressions Of Word Problems

Suppose Rahul has Rs 2100 with him. He goes to a market and purchases five shirts. Now the money left with him is Rs 100.

How can we write this situation mathematically?

Let us look at some more examples now.

Example:

Write the following statements in the form of a linear equation.

1. The sum of two consecutive even numbers is 46.

2. One-fourth of a number plus 5 is 30.

3. When 20 is subtracted from *m,* the result is 16.

4. The perimeter of an equilateral triangle is 27 cm.

5. Mohit is 5 years older than Rohit and the sum of their ages is 35.

Solution:

1. Let one even number be $2x$.
   Then, the other even number will be $(2x + 2)$.
   The linear equation is
   $2x + (2x + 2) = 46$
   $\Rightarrow 4x + 2 = 46$

2. Let the number be z.
   One-fourth of the number = z4
   According to the given statement,
   z4+5=30

3. The difference between m and 20 is 16.
   Therefore,
   $m - 20 = 16$

4. We know that in an equilateral triangle, all sides are equal in length.
   Let the length of one side be x.
   The perimeter is the sum of all sides of the triangle.
   $\Rightarrow x + x + x = 27$
   $\Rightarrow 3x = 27$

5. Let the age of Rohit be x years.
   Mohit's age will be $(x + 5)$ years.
   The sum of their ages is 35,
   $\therefore x + (x + 5) = 35$
   $\Rightarrow 2x + 5 = 35$