# Simple Equations

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**Solution of Equations by Performing Same Mathematical Operation on Both Sides**

We know that many day to day situations can be expressed in the form of equations. However, the importance of these equations can only be understood, if we are able to solve them.

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 $2x - 3 = -11$.

Here, we have

$2x - 3 = -11$

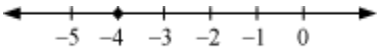
$\Rightarrow 2x - 3 + 3 = -11 + 3$(Adding 3 to both sides)

$\Rightarrow 2x = -8$

$\Rightarrow x = \frac{-8}{2}$ (Dividing both sides by 2)

$\Rightarrow x = -4$

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




Let us now look at some more examples to understand the concept better.

**Example 1:**

**Solve the following equations.**

1. **$9x + 3 = 21$**
2. **$3y - 4 = 14$**
3. **$-10 =$** 23m23m

**Solution:**

**1.** $9x + 3 = 21$

On subtracting 3 from both sides, we obtain

$9x + 3 - 3 = 21 - 3$

$\Rightarrow 9x = 18$

On dividing both sides by 9, we obtain

$\Rightarrow 9x \div 9 = 18 \div 9$

$\Rightarrow x = 2$

**2.** $3y - 4 = 14$

On adding 4 to both sides, we obtain

$3y - 4 + 4 = 14 + 4$

$\Rightarrow 3y = 18$

On dividing both sides by 3, we obtain

$3y \div 3 = 18 \div 3$

$\Rightarrow y = 6$

**3.** $-10 = \frac{2}{3}m$

On multiplying both sides by 3, we obtain

$-10 \times 3 = \frac{2}{3} \times 3m$

$\Rightarrow -30 = 2m$

On dividing both sides by 2, we obtain

$-30 \div 2 = 2m \div 2$

$\Rightarrow -15 = m$

$\Rightarrow m = -15$

**Example 2:**

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

1. $3p + 2 = 35$
2. $z - \frac{10}{3} = \frac{17}{3}$

**Solution:**

1. $3p + 2 = 35$

   On subtracting 2 from both the sides, we obtain

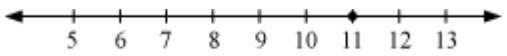
   $3p + 2 - 2 = 35 - 2$

   $\Rightarrow 3p = 33$

   On dividing both the sides by 3, we obtain

   $p = 11$

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




2. $z - \frac{10}{3} = \frac{17}{3}$

   On adding $\frac{10}{3}$ to both the sides, we obtain

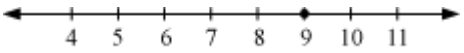
   $z - \frac{10}{3} + \frac{10}{3} = \frac{17}{3} + \frac{10}{3}$

   $\Rightarrow z = \frac{17}{3} + \frac{10}{3}$

   $\Rightarrow z = \frac{27}{3}$

$\Rightarrow z = 9$

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




**Example 3:**

**The average of three numbers is 15. If two of these numbers are 12 and 24, then find the third number.**

**Solution:**

Let the required number be $x$.

It is given that the average of 12, 24, and $x$ is 15. Therefore,

$$\frac{12+24+x}{3}=15$$

$$\Rightarrow \frac{x+36}{3}=15$$

On multiplying both the sides with 3, we obtain

$$\frac{x+36}{3}\times 3 = 15\times 3 = 45$$

$\Rightarrow x + 36 = 45$

On subtracting 36 from both the sides, we obtain

$x + 36 - 36 = 45 - 36$

$\Rightarrow x = 9$

Thus, the required number is 9.

**Example 4:**

**Mohit and Rohit are friends. Mohit has Rs 5 more than 3 times the money Rohit has. If Mohit has Rs 23, then how much money does Rohit have?**

**Solution:**

Let us assume that Rohit has Rs $x$.

Three times the money with Rohit = Rs $3x$

According to the question, Mohit has Rs $(3x + 5)$.

It is given that Mohit has Rs 23.

$\therefore 3x + 5 = 23$

On subtracting 5 from both the sides, we obtain

$3x + 5 - 5 = 23 - 5$

$\Rightarrow 3x = 18$

Now, on dividing both the sides by 3, we obtain

$x = 6$

Thus, Rohit has Rs 6.

Solution of Equations by Transposing Terms

We know how to solve an equation by performing the same mathematical operation on both its sides. There is one more method and is known as 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

$3x - 5 = -14$

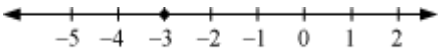
$\Rightarrow 3x = -14 + 5$ (Transposing 5 towards right side)

$\Rightarrow 3x = -9$

$\Rightarrow x = \frac{-9}{3}$ (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.** $z + \frac{5}{3} = 20$

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

**Solution:**

**1.** $z + \frac{5}{3} = 20$

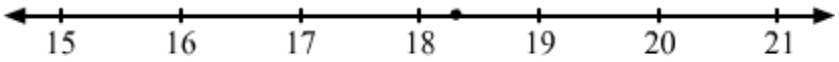
On transposing $\frac{5}{3}$ to R.H.S., we obtain

$z = 20 - \frac{5}{3}$

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

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

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

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

$\Rightarrow 2a + 1 = 20$

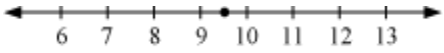
On transposing 1 to R.H.S., we obtain

$2a = 20 - 1$

$\Rightarrow 2a = 19$

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

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 $\frac{n}{3}$.

According to the question,

$\frac{n}{3} + 1 = 8$

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

$\frac{n}{3} = 8 - 1$

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

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

$n = 7 \times 3$

$\Rightarrow n = 21$

Thus, the required number is 21.