10 Equations

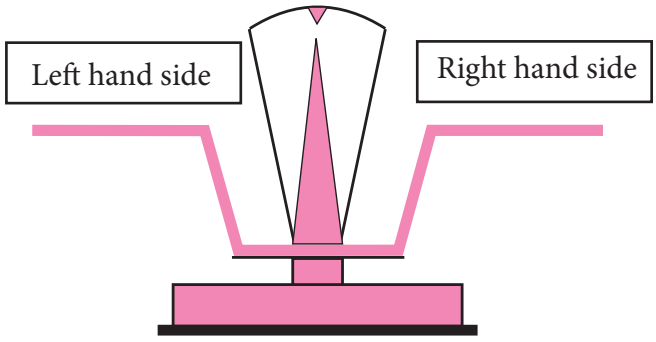
PART TWO

YHYG67

Let's discuss.

Teacher : Find two numbers and a mathematical operation to get the answer 15.
Sharvari : 5 × 3 gives 15 and 45 divided by 3 also gives 15.
Shubhankar : 17 − 2 gives 15. And 5 added to 10 also gives 15.
Teacher : Very good! We see that the operations 5 × 3 and 17 − 2 both give the same result. We write this as 5 × 3 = 17 − 2. In mathematics, the sign of equality (=) shows that the numbers on both its sides are equal. They may be the result of different operations on the left and right hand sides. Such an expression of equality is called an **equation**.
Sharvari : Can we also write the equation 17 − 2 = 5 × 3?
Teacher : Yes, that equation is right, too. If you write a new equation simply by exchanging the two sides of an equation, then the new equation is also correct, that is, balanced.

Let's learn.



If there are equal weights in both pans of a weighing scale, then the scale is balanced. Such a balanced scale is like an equation.

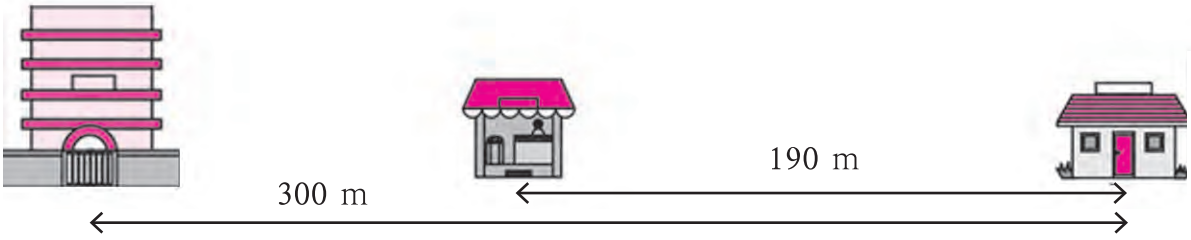
Practice Set 26

✸ Different mathematical operations are given in the two rows below. Find out the number you get in each operation and make equations.

16 ÷ 2,	5 × 2,	9 + 4,	72 ÷ 3,	4 + 5
8 × 3,	19 − 10,	10 − 2,	37 − 27,	6 + 7

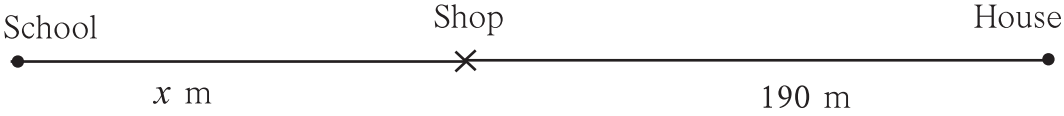
Let's learn.

The Solution of an Equation



In the picture above, the distance between the house and the school is seen to be 300 m. On the same straight road, there is a shop between the school and the house. The distance between the shop and the house is 190 m. What is the distance between the school and the shop?

Use of a Letter for a Number



Teacher : See how the given information is shown in the picture above.

Sujata : Sir, why is the distance from the shop to the school shown as x?

Teacher : Instead of writing the number, we suppose that the distance is x. That is the distance we have to find out. Till we do so, we write it as x.

Samir : Then the sum of x and 190 should be 300.

Teacher : That's right! Let's write this in the form of an equation. Remember that x is a number but we do not know its value as yet.

$x + 190 = 300$ What is the value of x here?

Shabana tried out various numbers for x.

First she supposed x was equal to 70. The left hand side became $70 + 190 = 260$. That was less than the right hand side. Then she took 150 for x and the left hand side became 340. This was greater than the right hand side. Finally, she chose 110 for the value of x. That made the left hand side the same as the right hand side and the equation was balanced. It meant that the value of x or the distance between the shop and the school was 110 metres.

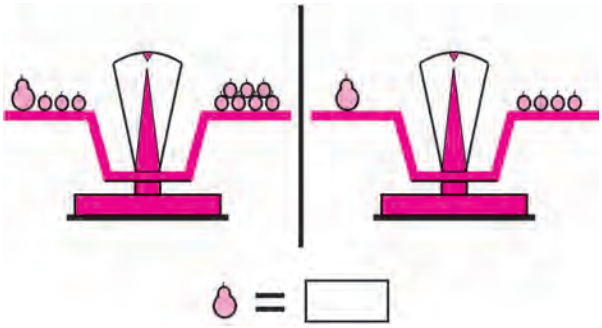
In an equation, a letter is sometimes used in place of a number. A value for the letter has to be found that will make the equation balanced. Such a letter is called a **'variable'**.

The value of the variable which balances or satisfies the equation is called the 'solution' to the equation. To solve an equation is to find the value of the variable in the equation or to find the solution to the equation.

In the example above, the solution to the equation '$x + 190 = 300$' is 110.

Let's learn.

Solving an Equation



Teacher : How can we find the weight of a guava in terms of bors ?

John : If we remove 3 bors from each of the pans, they remain balanced, and then we can see that one guava weighs 4 bors.

Teacher : Excellent! You found the right operation. When solving an equation with one variable, we carry out the same operations on both sides of the equation to obtain simpler balanced equations, because, if the first equation is balanced then the new one obtained in this way is also balanced. The equations become simpler and simpler and finally we get the value of the variable, that is, the solution to the equation.

$x + 3 = 7$

$\therefore\ x + 3 - 3 = 7 - 3$ (Subtracting 3 from both sides)

$\therefore\ x + 0 = 4$

$\therefore\ x = 4$

Let us take a second look at the previous equation.

$x + 190 = 300$

$\therefore\ x + 190 - 190 = 300 - 190$ (Subtracting 190 from both sides)

$\therefore\ x + 0 = 110$

$\therefore\ x = 110$

While solving an equation, we can use this simple and unerring way rather than examining several random solutions.

Let us solve some examples using equations.

Example : Four years ago, Diljit was 8 years old. How old is he today?

Let us suppose he is a years old today.

Now, let's write the given information using a.

$a - 4 = 8$

$\therefore\ a - 4 + 4 = 8 + 4$ (Adding 4 to both sides)

$\therefore\ a + 0 = 12$

$\therefore\ a = 12$

$\therefore$ Diljit is 12 years old today.

Example : Jasmine has some money. Mother gave her 7 rupees. Jasmine now has 10 rupees. How much did she have to start with?

Let us suppose Jasmine had y rupees.

$\therefore \quad y + 7 = 10$

$\therefore \quad y + 7 - 7 = 10 - 7$ (Subtracting 7 from both sides)

$\therefore \quad y + 0 = 3$

$\therefore \quad y = 3$

It means that Jasmine had 3 rupees to start with.

Example : There are some pedhas in a box. If some children are given 2 pedhas each, the pedhas would be enough for 20 children. How many pedhas are there in the box?

Let the total number of pedhas be p.

$$\frac{p}{2} = 20$$

$\therefore \quad \frac{p}{2} \times 2 = 20 \times 2$ (Multiplying both sides by 2)

$$p = 40$$

Therefore, there are 40 pedhas in the box.

Example : 5 chocolates cost 25 rupees.

How much does one cost?

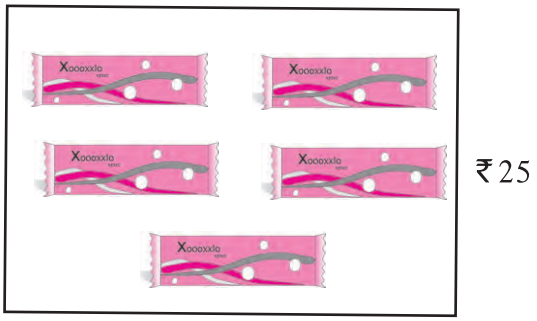
If one chocolate costs k rupees,

$$5k = 25$$

$\therefore \quad \frac{5k}{5} = \frac{25}{5}$ (Dividing both sides by 5)

$\therefore \quad 1k = 5$

$\therefore \quad k = 5$



Therefore, one chocolate costs 5 rupees.

Now I know –

If the same operation is carried out on both sides of an equation every time, the equation remains balanced. When any of the following operations are carried out on an equation, the equation remains balanced.

- Adding the same number to both the sides.
- Subtracting the same number from both the sides.
- Multiplying both the sides by the same number.
- Dividing both the sides by the same non-zero number.
- Exchanging the two sides.

Practice Set 27

1. Rewrite the following using a letter.
   (1) The sum of a certain number and 3.
   (2) The difference obtained by subtracting 11 from another number.
   (3) The product of 15 and another number.
   (4) Four times a number is 24.
2. Find out which operation must be done on both sides of these equations in order to solve them.
   (1) $x + 9 = 11$ (2) $x - 4 = 9$ (3) $8x = 24$ (4) $\frac{x}{6} = 3$
3. Given below are some equations and the values of the variables. Are these values the solutions to those equations?

No	Equation	Value of the variable	Solution (Yes/No)
1	$y - 3 = 11$	$y = 3$	No
2	$17 = n + 7$	$n = 10$	
3	$30 = 5x$	$x = 6$	
4	$\frac{m}{2} = 14$	$m = 7$	

4. Solve the following equations.
   (1) $y - 5 = 1$ (2) $8 = t + 5$ (3) $4x = 52$ (4) $19 = m - 4$
   (5) $\frac{P}{4} = 9$ (6) $x + 10 = 5$ (7) $m - 5 = -12$ (8) $p + 4 = -1$
5. Write the given information as an equation and find its solution.
   (1) Haraba owns some sheep. After selling 34 of them in the market, he still has 176 sheep. How many sheep did Haraba have at first?
   (2) Sakshi prepared some jam at home and filled it in bottles. After giving away 7 of the bottles to her friends, she still has 12 for herself. How many bottles had she made in all? If she filled 250g of jam in each bottle, what was the total weight of the jam she made?
   (3) Archana bought some kilograms of wheat. She requires 12kg per month and she got enough wheat milled for 3 months. After that, she had 14 kg left. How much wheat had Archana bought altogether?