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## Constructing Algebraic Expressions and Substitution

By studying this lesson, you will be able to,

- construct algebraic expressions using algebraic symbols,
- find the value of an algebraic expression containing one unknown of coefficient 1, by substituting a whole number for the unknown term.

### 19.1 Constructing algebraic expressions

Sunimal has 5 exercise books and Chathura has 4 exercise books. Let us find the number of exercise books that the two of them together have.

The number of exercise books the two of them together have is  $5 + 4$ ; that is 9.

Chalani had 4 exercise books. She received a parcel containing exercise books from her uncle. Now let us find the amount of exercise books she has.



Four books



Parcel

Since the number of books in the parcel is not known, it is an unknown constant. Let us represent the number of books in the parcel by  $n$ .

The number of books that Chalani originally possessed = 4

The number of books in the parcel she received from her uncle =  $n$

The total number of books Chalani now possesses =  $4 + n$

“The total number of books Chalani now possesses” is written as  $4 + n$ . This can also be written as  $n + 4$ .

Expressions such as the above which contain an algebraic symbol are called **algebraic expressions**.



Let us construct an algebraic expression for another situation.

5 marbles are removed from a bag of marbles. Now let us construct an algebraic expression for the number of marbles that are remaining in the bag.



Number of marbles is  $a$

Let us take the number of marbles that were in the bag to be  $a$ . This is an unknown constant.

Number of marbles that were in the bag	$= a$
Number of marbles that were taken out of the bag	$= 5$
Number of marbles remaining in the bag	$= a - 5$

An algebraic expression denoting the number of marbles remaining in the bag is  $a - 5$ .

### Example 1

There are 45 students in a class. If the number of boys in the class is taken to be  $m$ , construct an algebraic expression for the number of girls in the class.

To find the number of girls in the class, the number of boys in the class needs to be subtracted from the total number of students in the class.

Total number of students in the class	$= 45$
Number of boys in the class	$= m$
Number of girls in the class	$= 45 - m$



### Exercise 19.1

(1) Complete the following table.

First Term	Second Term	The algebraic expression obtained by adding the first and second terms
$x$	10	
3	9	
15	$x$	
$y$	4	
$n$	7	
$p$	5	
6	.....	$6 + y$
.....	$d$	$25 + d$

(2) Complete the following table.

First Term	Second Term	The algebraic expression obtained by subtracting the second term from the first term
$x$	2	
100	9	
$y$	45	
$p$	100	
32	$x$	
$m$	8	

- (3) The number of teachers in the teaching staff of a certain school was  $p$ . Two new teachers joined the school. Represent the number of teachers in the school now by an algebraic expression.
- (4) A past pupil of a certain school donated 100 books to the school library. By taking the number of books that were earlier in the library to be  $x$ , construct an algebraic expression for the number of books there are in the library now.
- (5) From the money I had in hand, I gave Rs 10 to a derelict. Represent the amount I have remaining by an algebraic expression.



- (6) Nimal's father's daily income is Rs 750. His mother earns an income of Rs  $x$  a day through her sales. Find his parents total daily income.
- (7) It is 10 minutes since Ruvan arrived at the bus halt. The bus he travels in will arrive  $t$  minutes from now. How much time does he have to spend in total at the bus halt?
- (8) The price of a coconut is Rs  $x$ . A mother has Rs 150 in her hand. If the price of a coconut is less than the amount in her hand she buys a coconut how much money will be remaining?

## 19.2 Substitution

Let us consider the algebraic expression  $x + 6$ . Here,  $x$  represents a number.

Suppose  $x = 2$ .

$$\text{Then } x + 6 = 2 + 6$$

$$x + 6 = 8$$

When  $x = 2$ , the value of the algebraic expression  $x + 6$  is 8.

Assigning a numerical value to an unknown term or a variable in an algebraic expression is called **substitution**. By substitution, an algebraic expression receives a numerical value.

Now, let us find the values that the algebraic expression  $x + 6$  takes when we substitute various values for  $x$ .

$$\begin{aligned} \text{When } x = 2, x + 6 &= 2 + 6, \\ &= 8 \end{aligned}$$

$$\begin{aligned} \text{When } x = 4, x + 6 &= 4 + 6, \\ &= 10 \end{aligned}$$

$$\begin{aligned} \text{When } x = 8, x + 6 &= 8 + 6, \\ &= 14 \end{aligned}$$



The following table shows how the values of various algebraic expressions are obtained after substituting a numerical value for the unknown term in the expression.

Algebraic Expression	Value that is substituted for the unknown term in the algebraic expression	Expression after substituting the value	Value of the expression
$x + 7$	3	$3 + 7$	10
$y + 50$	14	$14 + 50$	64
$a - 3$	8	$8 - 3$	5
$p - 14$	20	$20 - 14$	6

### Example 1

Find the value of the expression  $x - 4$  when  $x = 5$ .

When  $x = 5$ ,

$$\begin{aligned} x - 4 &= 5 - 4 \\ &= \underline{\underline{1}} \end{aligned}$$



### Activity 1

Copy the following table and complete it.

Algebraic Expression	The unknown term or variable term in the expression	Value to be substituted	Numerical value of the expression after substitution
$x + 6$		5	
$y + 5$		14	
$a - 8$		12	
$p - 10$		20	
$15 - n$		6	

### Exercise 19.2

(1) Find the value of each of the following algebraic expressions when  $x = 10$ .

(i)  $x + 5$

(ii)  $x + 8$

(iii)  $25 - x$



- (2) Find separately the value of each of the following algebraic expressions when  $y = 25$ .
- (i)  $y + 5$                       (ii)  $y - 10$                       (iii)  $y - 20$
- (3) Find separately the value of each of the following algebraic expressions when  $a = 8$ .
- (i)  $20 - a$                       (ii)  $15 - a$                       (iii)  $35 - a$
- (4) The price of a coconut is Rs  $x$  and the price of a kilogramme of sugar is Rs 110. Write down an algebraic expression for the total cost of a coconut and a kilogramme of sugar. If the price of a coconut is Rs 35, find the value of the algebraic expression.
- (5) The daily income of both the father and the mother of a certain family is Rs  $850 + x$ . Here, Rs 850 is the father's daily income and  $x$  represents the mother's daily income. On five days of a certain week, the mother's daily income was Rs 600, Rs 550, Rs 435, Rs 525 and Rs 515 respectively. Find separately the total income of the family on each of the five days.

### Summary

- Algebraic expressions are expressions which contain algebraic terms.
- Substitution is assigning a numerical value to an unknown term or a variable term in an algebraic expression.