

CHAPTER: INTRODUCTION TO ALGEBRA

1. ALGEBRAIC EXPRESSIONS : An **algebraic expression** is a combination of constants and variables connected by one or more of the four arithmetic operations: $+$, $-$, \times and \div

Parts of an expression separated by either $+$ or $-$ are called **terms**.

For example,

(a) $30a - 2b - 42ab$ is an expression. The three terms of this expression are $30a$, $-2b$ and $-42ab$.

(b) $x^2 + y^3 - xyz - y^2z$ is an expression with four terms x^2 , y^3 , $-xyz$ and $-y^2z$.

2. Like Terms : Terms which have the same variable are called the like terms.

For example,

(a) In the expression, $-4.xy + 2x + 3.xy - y$; $-4xy$ and $3.xy$ are like terms.

(b) In the expression, $56x + 14xy - 71y - 21xy$; $14.xy$ and $-21xy$ are like terms.

3. Unlike Terms : Terms which do not have the same variable are called unlike terms.

For example, in $-4.xy + 2x + 3.xy - y$; $-4.xy$ and $2x$; $-4.xy$ and $-y$; $2x$ and $3xy$; $2x$ and $-y$; $3.xy$ and $-y$ are all unlike terms.

4. Factors : Each of the numbers or variables that are multiplied to give a product is called a **factor** of the product. A constant (number) is called a numerical factor and a variable (literal) is called a literal factor.

For example,

(a) In $-27xz$, -27 is the numerical factor; x and z are the variable factors (also called literal factors) of the product.

(b) In $-yx$, -1 is the numerical factor; y and x are the variable factors.

5. Coefficient : Any factor of a term is called the coefficient of the product of the remaining factors.

For example

(a) In $-z$, the coefficient of z is -1 .

(b) In $-27xy$, $-27x$ is the coefficient of y , -27 is the coefficient of xy .

6. Constant term : A term of an expression without a variable is called a constant term.

For example,

in $3xy + 4x + 15$, the constant term is 15 and in $m x - 108$, -108 is the constant term.

TYPES OF EXPRESSIONS

As per the number of terms of any algebraic expression it is divided as -

1. Monomial

An expression with only one term is called a monomial. For example $3xy$, $47y$, $92zx$ and -19 are monomials.

2. Binomial

An expression with two terms is called a binomial. For example, $x + 4$, $7x + 14$, $32 - 5lz$ and $x - y$ are binomials.

3. Trinomials

An expression with three terms is called a trinomial. For example, $ax + by + c$ and $86y + 27z + 19$ are trinomials.

EVALUATING AN ALGEBRAIC EXPRESSION

An algebraic expression can be evaluated by substituting the variables by their corresponding numerical values. This method is called the **substitution** method.

Example : Evaluate the following if $x = -1$, $y = 2$, $z = -2$.

(a) $x + y - z$

(b) $3y - 4z + 9$

Solution:

(a) Substituting the values of x , y and z in $x + y - z$, we get

$$x + y - z = (-1) + (2) - (-2) = (-1) + 2 + 2 = 3$$

(b) Substituting the values for y and z in $3y - 4z + 9$, we get

$$3y - 4z + 9 = 3(2) - 4(-2) + 9 = 6 + 8 + 9 = 23$$

For 27/ 11/2020

OPERATIONS ON ALGEBRAIC EXPRESSIONS

Horizontal Method

Addition of Algebraic Expressions

Rule: Add the numerical coefficients of all the like terms and write the sum in front of the variable/s in the terms.

Example 2 : Add $4xy$, $-2yx$, $-7yx$

Solution:

$$\begin{aligned} & \text{Add } 4xy, -2yx, -7yx \\ & 4xy + (-2yx) + (-7yx) \\ & = (4 - 2 - 7)xy = -5xy \end{aligned}$$

Example 3 : Simplify: $3x - 7y + 2yx - 9 + 4x - 18y + 10yx$

Solution:

Simplify: $3x - 7y + 2yx - 9 + 4x - 18y + 10yx$

Re-arranging and putting the like terms together, we get

$$\begin{aligned} & 3x + 4x + 2yx + 10yx - 7y - 18y - 9 \\ &= (3 + 4)x + (2 + 10)yx + (-7 - 18)y - 9 \\ &= 7x + 12yx - 25y - 9 \end{aligned}$$

Subtraction of Algebraic Expressions:

Rule: Change the sign of each of the terms of the second expressions to be subtracted and add to the first by combining the like terms.

Example 4 : Subtract $14x - 9y + 8xy - 29$ from $18y - 51x - 12xy + 32$.

Solution:

$$\begin{aligned} & 18y - 51x - 12xy + 32 - (14x - 9y + 8xy - 29) \\ &= 18y - 51x - 12xy + 32 - 14x + 9y - 8xy + 29 \\ &= -51x - 14x + 18y + 9y - 12xy - 8xy + 32 + 29 \\ &= (-51 - 14)x + (18 + 9)y + (-12 - 8)xy + (32 + 29) \\ &= -65x + 27y - 20xy + 61 \end{aligned}$$

Vertical/Column Method

Rule: Place the like terms one below the other in columns and add/subtract them column-wise.

Addition of Algebraic Expressions

Example 5 Add $5xy + 2x + 9$, $7xy + 3y - 4$, $6xy + 18 + 12x - 4y$

Solution:

$$\begin{array}{r} 5xy + 2x + 9 \\ 7xy \quad - 4 + 3y \\ 6xy + 12x + 18 - 4y \\ \hline 18xy + 14x + 23 - y \end{array}$$

Subtraction of Algebraic Expressions

Example 6 Subtract $16x - 51xy + 2z - 29$ from $-12x + 24xy + 6z - 40$

Solution:

$$\begin{array}{r} -12x + 24xy + 6z - 40 \\ + 16x - 51xy + 2z - 29 \\ (-) \quad (+) \quad (-) \quad (+) \\ \hline -28x + 75xy + 4z - 11 \end{array}$$

SOME EXAMPLES OF EXPRESSIONS IN DAILY LIFE

• Let us suppose Parth is 10 years older than Raj and we need to find the age of Parth. To find Parth's age, let Raj's age = x

So, Parth's age = $x + 10$

Let us suppose a box had x mangoes out of which 12 were rotten and we need to find the number of good mangoes in the box. To find the number of good mangoes, let the total number of mangoes = x

So, good mangoes = $x - 12$

• Let us suppose Manoj's age is 5 years more than twice of Banu's

we need to find Manoj's age in terms of y . To find Manoj's age let Banu's age = y years

So, Manoj's age = $2 \times \text{Banu's age} + 5 = 2y + 5$

• Let us suppose the length of a room is twice the breadth and the height is 15 m more than the breadth and we need to find the volume of the room in terms of b .

To find the volume of the room, let breadth = b

So, length = $2 \times \text{Breadth} = 2b$; Height = Breadth + 15 = $b + 15$

∴ Volume = Length \times Breadth \times Height = $2b \times b \times (b + 15) \text{ m}^3$

