Grade 8

Chapter 9 : Algebraic Expressions

Algebra is a generalized form of Arithmetic. In Arithmetic, we use numbers that have one single definite value while in Algebra we use alphabets that may have any value we assign to them. These letters are called Variables.

Term

Any constant or any variable or a combination of constants and variables is a term if in combination only product or quotient is used e.g 3,x, 5 x,$\frac{2x}{3y}$ etc.

Like Terms

The terms having same variable factors are called like terms e.g $3x^2y$ and $-5\ x^2y$ are like terms.

Unlike Terms

The terms having different variable factors are called unlike terms e.g $3x^2y$ and $-5\ xy^2$ are unlike terms.

Constant Term

The term not containing any variable factor is a constant term e.g 3,-5 and 17 are constant terms.

Algebraic Expressions

A single or a combination of two or more terms connected by the fundamental operators form an algebraic expression.

Example

$5-3x+4x^2y$ is an algebraic expression with three terms namely 5, -3x and $4x^2y$.

Depending upon the number of terms present in an algebraic expression, we can define various types of algebraic expressions as follows:

i) Monomials: An expression which contains only one term is known as a monomial.

e.g 3x, $5x^2y$, -2abc, -8 etc. are all monomials.

ii) Binomials: An expression containing two terms is known as a binomial.

e.g 6-y, 5x+2y, x^2-5xyz^2 etc. are all binomials.

iii) Trinomials: An expression containing three terms is known as a trinomial.

e.g 3 +x-y, $x^3+y^3-z^3$ etc. are all trinomials.

iv) Polynomials: Any algebraic expression which can be expressed in the form of $a_0x^n+a_1x^{n-1}+a_2x^{n-2}+.....+a_n$ where, $a_0 \neq 0$ is known as a polynomial of degree n. Also it is to noted that the exponents of x presenting the expression has to be whole numbers.

Thus, $2+x-3x^2+4x^3$, $\frac{x^3+1}{x+1}$,etc. are all polynomials but $x^2+\sqrt{x}+1$ or, $\frac{x^3-1}{x+1}$ are not polynomials.

Note

- If a polynomial contains only a non-zero constant term and no variable at all, then it is called a constant polynomial, e.g. 7 , -5 , 3 etc.
- If a polynomial contains zero as its only constant term then it is called a zero polynomial.
- A polynomial in one variable and of degree one is called linear polynomial e.g., 3x+2, 5-7y etc.
- A polynomial in one variable and of degree two is called a quadratic polynomial. e.g., $3x^2+x+1$, $2x^2+5$ etc.
- A polynomial in one variable and of degree three is called a cubic polynomial. e.g., $3x^3+x+1$, $2x^3+5x^2+3x+4$ etc.

Adding and subtracting algebraic fractions:

To add or subtract algebraic functions, the steps given below should be followed:

- For the same denominators (i) write a fraction whose numerator is the sum (difference)
  of these numerators and denominator of the given fraction; and (ii) reduce the obtained fraction to its simplest form.
- For the different denominators (i) make the denominator common for each fraction by finding the L.C.M of the denominator of the given fractions; (ii) change each fraction to an equivalent fraction with the common denominator; and (iii) follow the method for same denominators.
- Finally, reduce the obtained fraction to its lowest form.

Example:

Add: $\frac{a}{4} + \frac{b}{5} + \frac{a+b}{3}$

Solution:

The L.C.M of 4, 5, 3 is 60.

Making 60 as the common denominator, we get

$\frac{15a+12b+20(a+b)}{60} = \frac{15a+12b+20a+20b}{60} = \frac{35a+32b}{60}$

Multiplying algebraic fractions

We have learnt that product of two fractions is a fraction.

In general, $\frac{x}{y} \cdot \frac{w}{z} = \frac{xw}{yz}$ $\left[\frac{Product\ of\ numerator}{Product\ of\ denominator}\right]$

To multiply algebraic fraction:

- Multiply the numerator and the denominator of the given fractions.
- Factorise the numerator and the denominator completely.
- Reduce the fraction in its lowest form.

Example

Multiply: $\frac{a}{4}$ and $\frac{b}{5}$

Solution: $\frac{a}{4} \times \frac{b}{5} = \frac{ab}{20}$