Algebraic Expressions

Understanding Algebraic Expressions

Expressions that contain only constants are called numeric or arithmetic expressions. It is a set of numerical values that are separated by the four mathematical operations, addition, subtraction, multiplication and division.

e.g. 9 + 8, 5 – 3

Expressions that contain constants and variables, or just variables, are called algebraic expressions. Variables and constants are combined using mathematical operations to form an algebraic expression.
e.g. x – 5, 3b – 6

While writing algebraic expressions, we do not write the sign of multiplication. An algebraic expression containing only variables also has the constant 1 associated with it. The parts of an algebraic expression added to form the expression are called its terms.
e.g. The number of terms in the expression $x^2 + 3x + 5$ is 3.

A term that contains variables is called a variable term. A term that contains only a number is called a constant term.

The constants and the variables whose product makes a term of an algebraic expression, are called the factors of the term. The factors of a constant term in an algebraic expression are not considered. The numerical factor of a variable term is called its coefficient. If the coefficient of a term is 1, it is usually omitted. If the coefficient of a term is –1, it is indicated by only the minus sign. The variable factors of a term are called its algebraic factors.

Terms that have different algebraic factors are called unlike terms. Terms that have the same algebraic factors are called like terms. We can compare only the like terms.The unlike terms can not be compared.

Algebraic expressions that contain only one term are called monomials. Algebraic expressions that contain two unlike terms are called binomials. Algebraic expressions that contain three unlike terms are called trinomials. All algebraic expressions that have one or more terms are called polynomials. Therefore, monomials, binomials and trinomials are also polynomials.

Operations on Algebraic Expressions

Addition of algebraic expressions

To add algebraic expressions, rearrange the terms in the sum of the given algebraic expressions, so that their like terms and constants are grouped together. While rearranging terms, move them with the correct plus (+) or minus (–) sign before them.

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To add like terms in an algebraic expression, multiply the sum of their coefficients with their common algebraic factors.

e.g. Add $5x^2y + 6$ and $2x^2y - 11$.

Sol: $(5x^2y + 6) + (2x^2y - 11)$

$= 5x^2y + 6 + 2x^2y - 11$

$= 5x^2y + 2x^2y + 6 - 11$

$= (5 + 2)x^2y + 6 - 11$

$= 7x^2y - 5$.

Subtraction of algebraic expressions

To subtract algebraic expressions

- Change the signs of the terms of the expression being subtracted.
- Rearrange the terms in the difference of the given algebraic expressions, so that their like terms and constants are grouped together.
- While rearranging terms, move them with the correct signs before them.
- Multiply the difference of their coefficients with their common algebraic factors.
- Unlike terms remain unchanged in the sum or difference of algebraic expressions.

e.g. Subtract $2xy - 3x^2y - 4$ from $2x^2y - 3xy + 4y + 5$.

$= (2x^2y - 3xy + 4y + 5) - (2xy - 3x^2y - 4)$

$= 2x^2y - 3xy + 4y + 5 - 2xy + 3x^2y + 4$

$= 2x^2y + 3x^2y - 3xy - 2xy + 4y + 5 + 4$

$= (2 + 3)x^2y - 3xy - 2xy + 4y + 5 + 4$

$= 5x^2y - 5xy + 4y + 9$.

Application of Algebraic Expressions

Algebraic expressions can be used to represent number patterns.

Ex: Table showing the relation between the number of cones and the number of ice-cream scoops.

Number of cones(n)	Number of ice-cream scoops (2n)
1	2
2	4
3	6
8	16
15	30

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Thus, we can find the value of an algebraic expression if the values of all the variables in the expression are known.
e.g. Find the value of the expression $3x^2y – 2xy^2 + 2xy$ for x = 2 and y = –2.

Sol:
$3x^2y – 2xy^2 + 2xy$.
Putting x = 2 and y = –2 in the given expression,
$3x^2y – 2xy^2 + 2xy$
$= 3\times(2)^2\times(–2) – 2\times(2)\times(–2)^2 + 2\times(2)\times(–2)$
$= 3\times4\times(–2) – 4\times4 + 4\times(–2)$
$= – 24 –16 – 8$
$= – 48.$

Formulas and rules such as the perimeter and area for different geometrical figures are written in a concise and general form using simple, and easy-to-remember algebraic expressions.
If 's' represents the side of a square, then its perimeter is '4s' and area is 's^2'.
If 'l' represents the length and 'b' represents the breadth of a rectangle, then its perimeter is '2(l + b)' and area is 'l × b'.
Area of a triangle with base 'b' and the corresponding altitude 'h' is '$\frac{1}{2}$ × base × height'.
Perimeter of an equilateral triangle with the length of the side as 'a' units is '3a'.