

Algebraic Expression

A **Variable** is a letter that can represent any number from a given set of numbers.

Algebraic expression.

$2x^2 - 3x + 4$ $\sqrt{x} + 10$ $\frac{y - 2z}{y^2 + 4}$

A **monomial** is an expression of the form ax^k , where a is a real number and k is a nonnegative integer.

A **binomial** is a sum of two monomials

A **trinomial** is a sum of three monomials.

In general, a sum of monomials is called a **polynomial**.

polynomial

A **polynomial** is an expression of the form

$a_nx^n + a_{n-1}x^{n-1} + \dots + a_1x + a_0$

where $a_0, a_1, \dots, a_n$ are real numbers, and n is a nonnegative integer. If $a_n \neq 0$, then the polynomial has **degree n**. The **monomials** a_kx^k that make up the polynomial are called the **terms** of the polynomial

Polynomial	Type	Terms	Degree
$2x^2 - 3x + 4$	trinomial	$2x^2, -3x, 4$	2
$x^8 + 5x$	binomial	$x^8, 5x$	8
$8 - x + x^2 - \frac{1}{2}x^3$	four terms	$-\frac{1}{2}x^3, x^2, -x, 8$	3
$5x + 1$	binomial	$5x, 1$	1
$9x^5$	monomial	$9x^5$	5
6	monomial	6	0



Example 1: Which of the following expressions are polynomials?

- $2x^3 - \frac{1}{2}x + \sqrt{3}$
- $x^2 - \frac{1}{2} - 3\sqrt{x}$
- $\frac{1}{x^2 + 4x + 7}$
- $\sqrt[3]{8x^6 - 5x^3 + 7x - 3}$

Example 2: Complete the following table

Polynomial	Type	Terms	Degree
$-2x^2 + 5x - 3$			
-8			
$\frac{1}{2}x^7$			
$x - x^2 + x^3 - x^4$			
$\sqrt{2}x - \sqrt{3}$			



Adding and Subtracting Polynomials

Distributive Property

$$a(b + c) = ab + ac$$

Example 1:

Find the sum of the polynomials:

$$8x^3 - 2x^2 + 6x - 2 \text{ and } 3x^4 - 2x^3 + x^2 + x$$

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Subtracting Polynomials

Example 2:

Find the difference:

$$(3x^4 - 4x^3 + 6x^2 - 1) - (2x^4 - 8x^2 - 6x + 5)$$



Example 3: Find the sum or difference.

- $(6x - 3) + (3x + 7)$

- $(5x^3 + 4x^2 - 3x) - (x^2 + 7x + 2)$

- $(-2x^2 - 3x + 1) + (3x^2 + 5x - 4)$

- $8(2x + 5) - 7(x - 9)$

- $(x^2 - x + 2) + (2x^2 - 3x + 5) - (x^2 + 1)$

- $v^3(v - 9) - 2v^2(2 - 2v)$

- $8(1 - y^3) + 4(1 + y + y^2 + y^3)$



Multiplying Algebraic Expressions

Example 1:

Find the product: $(2x + 5)(x^2 - x + 2)$

FOIL (First, Outer, Inner, Last): method of multiplying two binomials.

$$\begin{aligned}
 & \begin{array}{c} \text{Outer} \\ \text{First} \\ (ax + b)(cx + d) \\ \text{inner} \\ \text{Last} \end{array} = \begin{array}{c} \text{First} \quad \text{Outer} \quad \text{Inner} \quad \text{Last} \\ ax \cdot cx + ax \cdot d + b \cdot cx + b \cdot d \\ = acx^2 + adx + bcx + bd \\ = acx^2 + (ad + bc)x + bd \end{array}
 \end{aligned}$$

Example 2:

Multiply the Binomial using FOIL : $(2x + 1)(3x - 5)$



Example 3: Multiply the following polynomials

- $(x + 2)(x^2 + 2x + 3)$

- $(2x - 3)(x^2 + 1)$

Example 4: Multiply the expressions using the FOIL method.

- $(x - 3y)(-2x + y)$

- $(2r - 5s)(3r - 2s)$

