

Polynomials: Lesson Summary with Examples

A monomial is a number, a variable, or the product of a number and one or more variables with nonnegative integer exponents. A binomial is a polynomial with two terms. A trinomial is a polynomial with three terms.

A polynomial whose terms are written in descending order by degree is written in standard form.

Classifying Polynomials by Degree		
Polynomial	Degree	Name
-19	0	constant
$-6x + 1$	1	linear
$\frac{1}{3}x^2 + 4x - 8$	2	quadratic
$-2x^3 + 6x^2 + 4x - 5$	3	cubic

Classifying Polynomials by Number of Terms		
Polynomial	Number of Terms	Name
-19	1	monomial
$-6x + 1$	2	binomial
$\frac{1}{3}x^2 + 4x - 8$	3	trinomial
$-2x^3 + 6x^2 + 4x - 5$	4	polynomial

To add polynomials

1. Identify and group like terms.
2. Simplify

To subtract polynomials

1. Write the expression using addition.
2. Identify like terms and simplify.

Monomials

The degree of a monomial with one variable is the exponent of the variable. The degree of a monomial with multiple variables is the sum of the exponents of the variables.

$$3a^2$$

The exponent of the variable is 2, so $3a^2$ has a degree of 2.

$$-8x^2yz^5$$

The exponents of the variables are 2, 1 and 5.

$$2 + 1 + 5 = 8$$

So $-8x^2yz^5$ has a degree of 8.

$$6^{12}m^2n^4$$

The exponents of the *variables* are 2 and 4.

$$2 + 4 = 6$$

So $6^{12}m^2n^4$ has a degree of 6.

Classifying Polynomials

Find the degree of the polynomial $3x^2 + 5x - 4$.

- | | | |
|--|--------|-----------|
| Identify the terms in the polynomial. | $3x^2$ | degree: 2 |
| Find the degree of each term. | $5x$ | degree: 1 |
| The highest degree of the terms is the degree of the polynomial. | -4 | degree: 0 |

The polynomial $3x^2 + 5x - 4$ has a degree of 2.

Simplifying Polynomial Expressions

Simplify $6x^2 - 8x^3 + 24x + 9x^3 - 7x + x^2$.

- Identify like terms.

$$6x^2 - 8x^3 + 24x + 9x^3 - 7x + x^2$$

- Combine like terms.

$$6x^2 - 8x^3 + 24x + 9x^3 - 7x + x^2$$

$$6x^2 + x^2 - 8x^3 + 9x^3 + 24x - 7x$$

$$7x^2 + x^3 + 17x$$

$$x^3 + 7x^2 + 17x$$

Adding Polynomials

Polynomials can be added horizontally or vertically. Adding polynomials horizontally is similar to simplifying polynomials – identify the like terms, then combine them.

Add the polynomials.

$$(12x - 4) + (-6x + 11) + (2x^2 + x + 5) + (x^2 + 2)$$

- Identify and group like terms.

$$(12x - 6x + x) + (2x^2 + x^2) + (-4 + 11 + 5 + 2)$$

- Simplify.

$$3x^2 + 7x + 14$$

To add polynomials vertically, align like terms.

Add $(x^2 + 6x - 4)$ and $(9x^2 + x - 15)$.

- Align like terms.

$$x^2 + 6x - 4$$

- Simplify.

$$+ 9x^2 + x - 15$$

$$10x^2 + 7x - 19$$

Subtracting Polynomials

Subtracting polynomials is very similar to adding polynomials. We can subtract polynomials using either the vertical method or the horizontal method.

Simplify $(-4x^2 + 2x + 1) - (6x^2 - x + 3)$.

vertical method

$$\begin{array}{r} -4x^2 + 2x + 1 \\ - (6x^2 - x + 3) \\ \hline \end{array}$$

$$\begin{array}{r} -4x^2 + 2x + 1 \\ + -6x^2 + x - 3 \\ \hline \end{array}$$

$$\boxed{-10x^2 + 3x - 2}$$

horizontal method

$$\begin{aligned} &(-4x^2 + 2x + 1) - (6x^2 - x + 3) \\ &-4x^2 + 2x + 1 - 6x^2 + x - 3 \end{aligned}$$

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

$$\boxed{-10x^2 + 3x - 2}$$