Math 1111 - Polynomials

Objectives:

1. Understand the vocabulary, identify the degree and leading coefficients

2. Add and subtract polynomials

3. Multiply polynomials

4. Use FOIL in multiplication

5. Use special products in polynomial multiplication

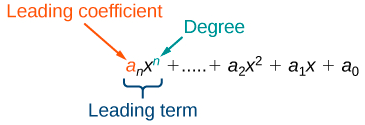
6. Perform operations in several variables

A polynomial is an expression that can be written in the form

anxn + … + a2x2 + a2x + a0

where n is a positive integer and an, …, a0 are real numbers and an ≠ 0.

Each real number ai is call a coefficient. The number a0 that is not multiplied by a variable is called a constant. Each product aixi is a term of a polynomial. The highest power of the variable that occurs in the polynomial is called the degree of a polynomial. The leading term is the term with the highest power, and its coefficient is called the leading coefficient.



A polynomial containing only one term, such as 5x4, is called a monomial. A polynomial containing two terms, such as 2x − 9, is called a binomial. A polynomial containing three terms, such as −3x2 + 8x − 7, is called a trinomial.

**Objective 1:** Given a polynomial expression, identify the degree and leading coefficient.

1. Find the highest power of *x* to determine the degree. (If you have more than one variable in the term, add the degree of the variables to determine the total degree of that term.)

2. Identify the term containing the highest power of *x* to find the leading term.

3. Identify the coefficient of the leading term.

Example #1: Identify the degree and leading coefficient of the polynomial.

A. 3 + 2x2 – 4x3

B. 5t5 – 2t3 + 7t

C. 6p – p3 – 2

D. 8x2 – 4x2y4 + 7xy3 – 2y2 + 3

**Objective 2:** Adding and subtracting polynomials.

Adding and subtracting polynomials can be done by combining like terms. Like terms are ones that contain the same variables raised to the same exponents. For example, 5x2 and -2x2 are like terms and can be added to get 3x2. But 3x and 3x2 are not like terms and cannot be added together.

When you are given multiple polynomials to add or subtract:

1. Combine the like terms.

2. Simplify and write in standard form, which means the highest power first, decreasing down until the constant is remaining.

Example #2: Add or subtract the polynomials.

A. (12x2 + 9x – 21) + (4x3 + 8x2 – 5x + 20)

B. (7x4 – x2 + 6x + 1) – (5x3 – 2x2 + 3x + 2)

C. (2x3 + 5x2 – x + 1) + (2x2 – 3x – 4)

D. (-7x3 – 7x2 + 6x – 2) – (-4x3 – 6x2 – x + 7)

**Objective 3:** Multiplying polynomials.

1. When multiplying polynomials you must use the distributive property to multiply each term in the first polynomials to each term in the second polynomial.

2. Combine like terms.

3. Simplify the polynomial.

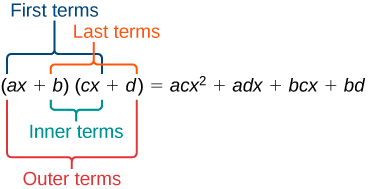
Example #3: Multiply polynomials and simplify your answer.

A. (2x + 1)(3x2 – x + 4)

B. (3x + 2)(x3 – 4x2 + 7)

**Objective 4:** Multiplying binomials using the FOIL method.

A shortcut method (which is actually using the distribution property) is used when multiplying two binomials. It is called the FOIL method and stands for First, Outer, Inner, and Last terms of each binomial.



The process of using the FOIL method.

1. Multiply the first terms of each binomial.

2. Multiply the outer terms of each binomial.

3. Multiply the inner terms of each binomial.

4. Multiply the last terms of each binomial.

5. Add the products.

6. Combine like terms and simplify.

Example #4: Multiply the binomials using the FOIL method.

A. (2x - 18)(3x + 3)

B. (x + 7)(3x - 5)

**Objective 5:** Use special products in polynomial multiplication.

* A perfect square trinomial is shown in the form of (a + b)2 or (a – b)2. To find the product:
  1. Square the first term of the binomial.
  2. Square the last term of the binomial.
  3. Double the product of the two terms.
  4. Add and simplify.

(a + b)2 = a2 + 2ab + b2

(a – b)2 = a2 – 2ab + b2

* The difference of squaresis shown in the form of (a + b)(a – b), where the terms are the same but the signs are opposite. This is also known as a conjugate pair. Since the signs are different, this causes the middle term to drop out. To find the product:
  1. Square the first term of the binomial.
  2. Square the last term of the binomial.
  3. Subtract the square of the last term from the square of the first term. (These should cancel each other out.)

(a + b)(a – b) = a2 – b2

Example #5: Multiply the binomials using the special products.

A. (4x + 3)(4x - 3)

B. (3x – 8)2

C. (x + 6)2

D. (4x + 1)2

E. (x – 7)(x + 7)

F. (x – )2

**Objective 6:** Perform operations in several variables.

When multiplying polynomials with several variables, the same rules apply as multiplying with one variable.

Example #6: Multiply the polynomials that contain several variables.

A. (x + 4)(3x – 2y - 5)

B. (3a – 1)(2a + 7b – 9)

OpenStax College Algebra, College Algebra. OpenStax CNX. Aug 2, 2019 http://cnx.org/contents/9b08c294-057f-4201-9f48-5d6ad992740d@11.1.