4.3 Multiply Polynomials

To find the product of two monomials, we multiply the coefficients together and use the product rule for exponents to multiply any exponents. For example, \((8x^4)(-3x^7) = (8)(-3) \cdot x^4 \cdot x^7 = -24x^{11}\). To multiply a monomial by a polynomial with more than one term, we need to use the distributive property multiple times.

When we find the product of any two polynomials, we just multiply each term of the first polynomial by each term of the second polynomial then simplify.

Objective 3: Multiply two binomials

The FOIL Method
When we find the product of two binomials, we can use a technique known as the FOIL method. FOIL is an acronym which stands for First, Outside, Inside and Last. We illustrate the FOIL method by finding the product of the binomials \(3x + 5\) and \(2x + 7\).

\[
(3x + 5)(2x + 7) = 6x^2 + 21x + 10x + 35 .
\]

The product of the First terms: \((3x)(2x) = 6x^2\)
The product of the Outside terms: \((3x)(7) = 21x\)
The product of the Inside terms: \((5)(2x) = 10x\)
The product of the Last terms: \((5)(7) = 35\)

We now simplify by combining like terms: \(6x^2 + 21x + 10x + 35 = 6x^2 + 31x + 35\). Therefore, \((3x + 5)(2x + 7) = 6x^2 + 31x + 35\).

4.3.9 Multiply the binomials.
Special Products

Let $a$ and $b$ represent any real number or algebraic expression, then

\[(a + b)(a - b) = a^2 - b^2\]  \hspace{1cm} \text{Difference of two squares}

\[(a + b)^2 = a^2 + 2ab + b^2\]  \hspace{1cm} \text{Squaring a binomial}

\[(a - b)^2 = a^2 - 2ab + b^2\]

\[(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3\]  \hspace{1cm} \text{Cubing a binomial}

\[(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3\]

4.3.16 Find the product.

4.3.18 Find the product

**Objective 4: Multiply two or more polynomials**

To multiply two polynomials, multiply each term of the first polynomial by each term of the second polynomial. Combine like terms.

4.3.24 Multiply.