Instruction

Prerequisite Skills

This lesson requires the use of the following skills:

- factoring a polynomial by the greatest common factor (A–SSE.2)
- factoring binomials using the difference of two squares pattern (A–SSE.2)
- factoring trinomials with $a = 1$ (A–SSE.3a★)

Introduction

When a trinomial has a leading coefficient of 1, it is relatively straightforward to factor. When the leading coefficient is greater than 1, the process becomes somewhat more complex; however, the basic principle remains the same. Factoring trinomials is essentially reversing the distribution. When the resulting factors are multiplied, their product must equal the original expression.

Key Concepts

Factoring by Grouping

- Sometimes more complex polynomials can be factored by grouping.
- When a polynomial contains four or more terms, a common binomial factor may emerge once terms are grouped together and common factors are factored out of each group. For example, the polynomial $6x^2 + 24x + 5x + 20$ can be grouped into $(6x^2 + 24x) + (5x + 20)$. When the common factors are factored out of each group, the result is $6x(x + 4) + 5(x + 4)$. Since both groups contain the same binomial, $(x + 4)$, the Distributive Property can be used to rewrite this as $(6x + 5)(x + 4)$.
- Recall that the Distributive Property states that $a(b + c) = a \cdot b + a \cdot c = a(b + c)$.

Factoring Trinomials when $a > 1$

- When the leading coefficient of a trinomial is greater than 1, first determine if there are any common factors that can be factored out.

Instruction

- If there are no common factors (or if there is still a leading coefficient greater than 1 after the common factor has been factored out), use the following steps to factor a trinomial of the form $ax^2 + bx + c$:

Factoring a Trinomial of the Form $ax^2 + bx + c$

1. List all the possible factors for the product of a times c (including negative factors).
2. Find the set of factors whose sum equals b.
3. Rewrite bx as the sum of two terms, using the factors found in step 2 as the coefficients of the terms.
4. Factor the new polynomial by grouping.

- To determine if a polynomial was factored correctly, distribute the factors. The result must equal the original polynomial.
- Note that not all polynomials can be factored.

Common Errors/Misconceptions

- neglecting to factor out common factors first
- forgetting to consider negative factors
- confusing the signs of factors and terms
- incorrectly rearranging a polynomial in an attempt to factor by grouping