Specialized Factoring Techniques

- Common Factors
- The Sum and Difference of Cubes
- Grouping to Find a Common Factor
- Quartic Expressions Factored as Trinomials
- Grouping to get the Difference of Squares

Let's Start with a quick refresher!

Common Factor (Should be your first option)

$$12x^7y^8 + 24x^9y^4$$

$12x^7y^4(y^4 + 2x^2)$

Simple Trinomials

$x^2 - 5x + 6$

$-2 \times -3 = 6$
$-2 + -3 = -5$

$(x-2)(x-3)$

Using Decomposition:

$x^2 - 5x + 6$

$-2 \times -3 = 6$
$-2 + -3 = -5$

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

$x(x-2) - 3(x-2)$

$(x-2)(x-3)$

Trinomial Decomposition

$4x^2 + 5x - 6$

$-3 \times 8 = -24$

$-3 + 8 = 5$

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

$4x(x+2) - 3(x+2)$

$(x+2)(4x-3)$

Difference of Squares

$$a^2 - b^2 = (a - b)(a + b)$$

$81x^2 - 49b^2$

$(9x + 7b)(9x - 7b)$ (conjugates)

Common Factor

$$x^3 - x^2 - 12x$$

$x(x^2 - x - 12)$ Factored out an x

$x(x-4)(x+3)$ Simple Trinomial $-4 \cdot 3 = -12$, $-4 + 3 = -1$

Difference of Cubes

$$a^3 - b^3 = (a-b)(a^2 + ab + b^2)$$

$x^3 - 8$

$(x-2)(x^2+2x+4)$

$27x^3 - 64$

$(3x-4)(9x^2+12x+16)$

Sum of Cubes

$$a^3 + b^3 = (a+b)(a^2 - ab + b^2)$$

$x^3 + 27$

$(x+3)(x^2 - 3x + 9)$

$64x^3 + 125$

$(4x+5)(16x^2 - 20x + 25)$

Grouping to Find a Common Factor

A common factor can sometimes be found for specific groups of terms in a polynomial expression. The expression is written in the necessary order and each group of terms is then factored, leaving a common factor in brackets, which in turn is factored.

$(x^3 - 2x^2)(-16x + 32)$

$x^2(x-2) - 16(x-2)$

$(x-2)(x^2-16)$

$(x-2)(x-4)(x+4)$

$(8x^5 - 40x^4 + 32x^3)(-x^2 + 5x - 4)$

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

Simple Tri → $(x^2-5x+4)(8x^3-1)$ ← Diff of Cubes

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

Homework

Finish worksheet

Quartic Expressions Factored as Trinomials

$$x^4 - 5x^2 + 4$$

$$4x^4 - 37x^2 + 9$$

Grouping to Get the Difference of Squares

If a polynomial expression can be grouped in the form $(x+m)^2-n^2$, then it can be factored as the difference of squares.

$$x^4 + 5x^2 + 9$$

$$x^4 - 6x^2 + 1$$