MPM 2D | Class Notes
Mr. Kempe | Unit 3, Lesson 8

Factoring Extensions

We can use the techniques for factoring trinomials (simple trinomial, decomposition) on expressions that don't quite look like trinomials!

Example 1: Use trinomial factoring on non-quadratics.

a) Factor $x^2 - 13x + 36$

M: 36 **A:** -13 **N:** -9, -4

$= (x - 9)(x - 4)$

b) Factor $x^4 - 13x^2 + 36$

This trinomial has higher exponents that we are used to. To show it has the same pattern as a regular trinomial, we'll make a substitution:

Let $\mathbf{a} = x^2$, which means that $\mathbf{a^2} = (x^2)^2 = x^4$.

$x^4 - 13x^2 + 36$
$= a^2 - 13a + 36$ This fits our normal pattern. **M:** 36 **A:** -13 **N:** -9, -4
$= (a - 9)(a - 4)$
$= (x^2 - 9)(x^2 - 4)$ Now that we've factored, we put x^2 back in.
$= (x - 3)(x + 3)(x - 2)(x + 2)$ Two differences of squares.

c) Factor $(3k - 1)^2 - 13(3k - 1) + 36$

Same idea! Let $a = (3k - 1)$.

$(3k - 1)^2 - 13(3k - 1) + 36$
$= a^2 - 13a + 36$
$= (a - 9)(a - 4)$
$= ((3k - 1) - 9)((3k - 1) - 4)$ Now that we've factored, we put $(3k - 1)$ back in.
$= (3k - 10)(3k - 5)$ Simplify inside the brackets.

d) Factor $x^2 - 13xy + 36y^2$

This has an extra variable, but we can use the same rule. **M:** $36y^2$ **A:** -13y **N:** -9y, -4y

$= (x - 9y)(x - 4y)$

Example 2: Factoring by Grouping.

Factoring by grouping is a jump start on decomposition – we have an even number of terms (usually 4) and we common factor the first pair and last pair.

a) $2x^2 - 4x - 7x + 14$
$= 2x(x - 2) - 7(x - 2)$
$= (x - 2)(2x - 7)$

b) $ab - 2b + 3ac - 6c$
$= b(a - 2) + 3c(a - 2)$
$= (a - 2)(b + 3c)$

c) $x^3 - 5x^2 - 9x + 45$
$= x^2(x - 5) - 9(x - 5)$
$= (x - 5)(x^2 - 9)$
$= (x - 5)(x - 3)(x + 3)$ Difference of squares!

d) $x^3 - 5x^2 - 8x - 48$
$= x^2(x - 5) - 8(x + 6)$

The brackets do not match, so this **cannot be factored** using this method.

Example 3: Combining Strategies

Factor: $d^2 - 4d + 4 - f^2 - 12f - 36$

We have two different trinomials here, so let's work with one variable at a time.

$\mathbf{d^2 - 4d + 4} - f^2 - 12f - 36$	This is a perfect square trinomial.
$= (d - 2)^2 - f^2 - 12f - 36$	
$= (d - 2)^2 - (f^2 + 12f + 36)$	Common factor out -1.
$= (d - 2)^2 - (\mathbf{f^2 + 12f + 36})$	This is also a perfect square trinomial.
$= (d - 2)^2 - (f + 6)^2$	This is a difference of squares!
$= [(d - 2) - (f + 6)][(d - 2) + (f + 6)]$	Simplify the brackets.
$= [d - f - 2 - 6][d + f - 2 + 6]$	
$= [d - f - 8][d + f + 4]$	Whew!

Practice: pg. 236 #6f, 7c, 8f, 9, 10, 14*, 17*