MPM 2D
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Class Notes
Unit 3, Lesson 5

Factoring Part 1

(Common Factoring and Simple Trinomial Factoring)

Example 1: The answer to an "expand and simplify" question is $8x^2-16x$. What was the question?

There are lots of possibilities! The key thing is to find something that can be *divided out* of both terms.

$2(4x^2-8x)$ $\qquad$ $2x(4x-8)$
$4(2x^2-4x)$ $\qquad$ $4x(2x-4)$
$8(x^2-2x)$ $\qquad$ $8x(x-2)$

Factoring is a process that "reverses" the distributive property. **Common factoring** is when we try to remove the **greatest common factor** from each term.

Example 2: What is the greatest common factor (GCF) of the following?

a) 3 and 6 (3)
b) 16 and 24 (8)
c) 39 and 52 (13)
d) $5x^2$ and $10x$ ($5x$)

Example 3: Common factor each expression.

a) $7x - 14$
$= 7(x - 2)$

b) $3x^2 - 9x$
$= 3x(x - 3)$

c) $15x^2y + 12xy^2$
$= 3xy(5x + 4y)$

d) $3x(x - 2) - 7(x - 2)$
$= (x - 2)(3x - 7)$

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Example 4: The answer to an expand and simplify problem is $x^2+7x+10$. What was the question?

This expression has no common factors, so it may appear that we are stuck. Let's have a look at one of our examples from the previous lesson, when we expanded a pair of binomials:

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

$= x^2 + 5x + 6$

The final result looks similar to what we have above. How can we reverse this? Let's start with the end result, and think about where the pieces came from.

$x^2 + 5x + 6$

The x^2 came from $x \cdot x$. This was from our pair of *x*'s.
The 6 came from $2 \cdot 3$, which where the two constants in the brackets.
The 5x came from adding 2x and 3x.

Let's return to our question, $x^2+7x+10$.
It starts with x^2, so our brackets must look something like (x + __)(x + __).
The 10 is a product of two numbers. It could be $1 \cdot 10$, or maybe $2 \cdot 5$.
The $7x$ is the sum of two terms. Could be $x + 6x$, $2x + 5x$, or $3x + 4x$ (or $0x + 7x$, $-1x + 8x$…)

There's only one pair of numbers that come from the brackets, so we need a match! The pair must be **2 and 5.**

Therefore $x^2+7x+10=(x+2)(x+5)$. (If you don't believe it, expand out the right side to check!)

This suggests a general procedure for factoring! To factor a trinomial of the form $x^2 + bx + c$, we look for **two numbers that add to give *b* and multiply to give *c*.** These numbers become the constants in our binomials!

Example 5: Factor each trinomial.

a) $x^2+9x+18$ **M**ultiplies to 18 **A**dds to 9 **N**umbers: 3 and 6
$= (x + 3)(x + 6)$

b) $g^2-8g+15$ **M:** 15 **A:** -8 **N:** -3 and -5
$= (g - 3)(g - 5)$

c) $z^2-3z-40$ **M:** -40 **A:** -3 **N:** -8 and 5
$= (z - 8)(z - 5)$

d) $p^2+17p-18$ **M:** -18 **A:** 17 **N:** -1 and 18
$= (p - 1)(p + 18)$

Don't forget that we learned how to common factor. You should always try common factoring first!

Example 6: Factor.

a) $6x^2 - 24x + 18$
$= 6(x^2 - 4x + 3)$ M: 3 A: -4 N: -1 and -3
$= 6(x - 1)(x - 3)$

b) $2x^3 - 4x^2 - 30x$
$= 2x(x^2 - 2x - 15)$ M: -15 A: -2 N: -5 and 3
$= 2x(x - 5)(x + 3)$

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