What's Going On?

Checking In	A Handy Trick
Minds on	Expanding... again!
Action!	Breaking up is hard to do!
Consolidation	That Little Guy?

Learning Goal - I will be able to factor trinomials in the form $ax^2 + bx + c$.

F.F.M.

It's back!

Factor Fully.

$4x^2 + 8x - 60$

$= 4(x^2 + 2x - 15)$

Common Factor if possible

$= 4(x+5)(x-3)$

Find two integers that sum to 2 and multiply to -15.

Checking In

What's the Pattern with the Signs?

Second term positive, third term positive

$x^2 + 10x + 25 = (x+5)(x+5)$
$= (x+5)^2$

Second term negative, third term positive

$x^2 - 8x + 12 = (x-6)(x-2)$

Second term positive, third term negative

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

Second term negative, third term negative

$x^2 - 3x - 10 = (x+2)(x-5)$

- When the second *and* third terms in the trinomial are positive, we know that our integers are **both positive**.

- When the second term in the trinomial is negative and the third term is positive we know that our integers are **both negative**.

- When the second term in the trinomial is positive and third term is negative, we know that the larger integer will be positive and the smaller integer will be negative.

- When the second *and* third terms in the trinomial are negative, we know that the larger integer will be negative and the smaller integer will be positive.

Minds on

Expanding... Again!

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

$(2x + 3)(x + 4)$ Nothing fancy... just FOIL it!

$$= 2x^2 + 8x + 3x + 12$$

$$= 2x^2 + 11x + 12$$

Minds on

So... $(2x + 3)(x + 4)$

when expanded is: $2x^2 + 11x + 12$

This means that if you were asked to factor $2x^2 + 11x + 12$, you ***should*** end up with $(2x + 3)(x + 4)$.

But **how** would you factor it?

Minds on

Let's look back at the expansion for a moment...

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

$= 2x^2 + 8x + 3x + 12$ ← What if I asked you to factor this 4-termed polynomial?

Factor by Grouping!

Minds on

Factor by Grouping!

$$(2x^2 + 8x) + (3x + 12)$$

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

Binomial Common Factors

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

Minds on

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

$= 2x^2 + 8x + 3x + 12$ So we can factor from here.

$= 2x^2 + 11x + 12$ But we can't seem to factor from here.

So the question is, how do we get from the red step to the green step?!

Action!

Breaking Up Is Hard To Do!

$2x^2 + 11x + 12$

$= 2x^2 + 8x + 3x + 12$ ← If we can get to here, we can factor by grouping.

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

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

So how did we get from the red step to the green step?

To get to that second step, we **broke up** the +11x into +8x and +3x

But how did we know to break it up into +8x and +3x?
Why not +1x and +10x **or** +2x and +9x **or** -52x and +63x?

Action!

Breaking Up Is Hard To Do!

$2x^2 + 11x + 12$

$= 2x^2 + 8x + 3x + 12$

To get to that second step, we **broke up** the +11x into +8x and +3x

But how did we know to break it up into +8x and +3x?
Why not +1x and +10x **or** +2x and +9x **or** -52x and +63x?

We had to find two numbers that added up to 11 (OBVIOUSLY!)

and multiplied to give 24! (obviously?)

Action!

Breaking Up Is Hard To Do!

We had to find two numbers that added up to 11 (OBVIOUSLY!) and multiplied to give 24! (obviously?)

$(2x + 3)(x + 4)$ Look back at the expansion...

$= (2x)(1x) + (2x)(4) + (3)(1x) + (3)(4)$

Now take a closer look at the coefficients <u>before</u> we simplified!

$= (2x)(1x) + (2x)(4) + (3)(1x) + (3)(4)$

(2, 4, 3, 1)

(2, 1, 3, 4)

All of the coefficients on the First and Last terms appear on the two middle terms!

So if we multiplied the two sets together, the products would be **<u>the same</u>**!

Action!

Breaking Up Is Hard To Do?

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

$= 2x^2 + 8x + 3x + 12$

8 x 3
= 24

2 x 12
= 24

$= 2x^2 + 11x + 12$ ⟶ So to get from here

To here...

We need to break up 11x into two terms where the coefficients add to 11 and multiply to give 2 x 12 = **24**

Factoring $ax^2 + bx + c$

To factor trinomials in the form $ax^2 + bx + c$

1. Always common factor first if possible!

2. Break up the middle term
   - Replace the middle term (*bx*) by two terms whose coefficients have a sum of b and a product of (a x c)

3. Factor by grouping
   - Group **pairs** of terms and remove a common factor from each
   - Then common binomial factor

Factor $6x^2 + 13x - 5$

1. There is no factor common to all three terms.

2. Find two numbers that sum to +13 and multiply to -30 (+6 **x** -5)

Factors of -30	Sum
+1, -30	-29
-1, +30	+29
+2, -15	-13
-2, +15	+13

We break up 13x into -2x and +15x

3. Factor $(\mathbf{6x^2 - 2x}) + (\mathbf{15x - 5})$

Factor by grouping

$= 2x(3x-1) + 5(3x-1)$

Binomial common factor

$= (3x-1)(2x+5)$

Factor $6x^2 - 13x + 6$

1. There is no factor common to all three terms.

2. Find two numbers that sum to -13 and multiply to 36 (+6 **x** +6)

*We know both are negative

Factors of 36	Sum
-1, -36	-37
-2, -18	-20
-3, -12	-15
-4, -9	-13

We break up -13x into -4x and -9x

3. Factor $(\mathbf{6x^2 - 4x})(\mathbf{- 9x + 6})$

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

Factor out -1

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

CF

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

Factoring $ax^2 + bxy + cy$

To factor trinomials in the form $ax^2 + bx + c$

1. Always common factor first if possible!

2. Break up the middle term
   - Replace the middle term (*bxy*) by two terms whose coefficients have a sum of b and a product of a x c.

3. Factor by grouping
   - Group **pairs** of terms and remove a common factor from each
   - Then common binomial factor

Consolidation

That little guy?
I wouldn't worry about that little guy.

Factor $4x^2 - 5xy - 6y^2$.

Consolidation

Homework

WRITE IN YOUR LOG

Pg. 163

1-5 (a, d, f)

AND 4(n, o, r)

5(h, i)

Challenge Problem

Prove that if a trinomial in the form $ax^2 + bx + c$ $(a \neq 1)$ can be factored into a product of two binomials the middle term can be broken up into two terms where the coefficients sum to b and multiply to (a x c).