Factoring trinomials **NAME:**
Part 2: Reverse FOIL method

This method is essentially a way to write the information we need in an organized way. I call it Reverse FOIL because it helps to understand how FOIL works when multiplying two binomials. (A binomial is a polynomial with two terms like "$x + 4$".)

Consider our first example of a FOIL problem reproduced below. Watch carefully where the four terms on line 2 come from and how they combine to make the three terms on line 3. Factoring simply goes the opposite way.

$$(1x+2)(3x+4) \qquad \text{line 1}$$

$$= 3x^2 + 4x + 6x + 8 \qquad \text{line 2}$$

F O I L

$$= 3x^2 + 10x + 8 \qquad \text{line 3}$$

This $3x^2$ came from the multiplication of $1x$ and $3x$, the **F** bits of FOIL.

Where did the $10x$ and 8 come from?

Now, let's think through this process backwards. Say we are given $3x^2 + 10x + 8$ and are asked to factor it. The next page goes through the thought process that we need.

$3x^2 + 10x + 8$

$= (\_\_ + \_\_)(\_\_ + \_\_)$

1. Set up two sets of parentheses we will fill...

2. Think about two things that multiply to get $3x^2$…

Well, $3x$ times x makes $3x^2$…

$= (3x + \_\_)(x + \_\_)$

3. Now we need two numbers that multiply to 8…

Possible factors of 8	
1 and 8	-1 and -8
2 and 4	-2 and -4

4. We try the various pairs of numbers in the open spots until we stumble upon the one that works…

Which one would FOIL out to our original $3x^2 + 10x + 8$?

$(3x+1)(x+8)$ OR $(3x+8)(x+1)$ OR $(3x+2)(x+4)$ OR $(3x+4)(x+2)$

What is the difference between these first two? Why do we need to check them both?

Yes! Yes! Yes! Finally, we got it! FOIL this out to make sure it does equal our original trinomial.

Let's do another example. Let's start with $2x^2 + 5x - 12$ and see if we can factor it. We'll start off by writing the two sets of parentheses that we know must be a part of it.

$$2x^2 + 5x - 12 = (\qquad)(\qquad)$$

Then we need to think about the term $2x^2$. Again, recall this term would be formed by multiplying the **First** terms in the two binomials. So let's try $2x$ and x for these terms. So we write them in.

$$2x^2 + 5x - 12 = (2x \qquad)(x \qquad)$$

Now, we need two numbers that multiply to make -12. These will be the **Last** terms in our answer. Factors of -12 are listed below.

Possible factors of -12		
-1 and 12	-2 and 6	-3 and 4
-12 and 1	-6 and 2	-4 and 3

You can simply put each pair into the parentheses and check it to see if the pair works. Once you find one pair that works, you can stop. So try $(2x-1)(x+12)$ but that doesn't multiply to make $2x^2 + 5x - 12$, so that's not right. Try $(2x-2)(x+6)$ and so on. You will find that only $(2x-3)(x+4)$ works.

Try a guided example.
Factor $3x^2 + 11x - 20$. First, fill in the **First** terms in the parentheses. They should multiply to make $3x^2$ and both contain an x.

$$3x^2 + 11x - 20 = (\qquad)(\qquad)$$

Now write down the factors of -20.

Possible factors of -20		

Try each pair of factors in the parentheses to see which one works. Some parentheses are provided below. Stop when you find the pair that works.

$3x^2 + 11x - 20 = (3x \qquad)(x \qquad)$????
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Use the Reverse FOIL method to factor these expressions. It is always wise to first factor out a GCF from **all** terms if one exists.

a.) $2x^2 - 9x - 18$

b.) $4x^2 - 4x - 15$ (This is more complicated. The parentheses could be written as $(4x \quad)(x \quad)$ or $(2x \quad)(2x \quad)$. You'll have to try them both and see which eventually works.)

c.) $2x^2 + 10x + 12$