Factoring Trinomials

Factoring trinomials is the inverse of FOIL because in factoring, you start with a trinomial and end with 2 binomials while with FOIL, you start with 2 binomials and end with a trinomial.

Let's look at the specific steps needed to be successful at factoring trinomials.

Examples:

$x^2 - 10x + 24$

1) First see if there is a GCF (Greatest Common Factor) other than 1 that can be factored from this trinomial. If not, move on to the next step.

2) Write out 2 parentheses and determine what 2 terms multiply together to give us x^2 (x and x). Write these 2 terms in each parentheses (Leave a space for the other term in your binomials).

(x)(x)

3) Look at the sign of the last term in the trinomial to narrow down the signs of the factors. Since the last term is +24, the factors will either both be positive or both be negative.

4) Use the middle term of the trinomial to determine the signs of the factors. Since the middle term is -10, both factors will be negative.

Add the signs of the factors inside the parentheses:

(x -)(x -)

5) Now determine what 2 factors multiply together to get 24 and add together to get 10.

Factor Pairs of 24: 1 and 24, 2 and 12, 3 and 8, 4 and 6

The only factors that sum up to 10 when both are the same sign is 4 and 6, so those are the numbers that will fill our parentheses.

(x - 4)(x - 6)

Let's try another example, working through the same steps.

$x^2 - x - 56$

Since there is no GCF other than 1 that can be factored out, we can write the 2 parentheses with x as the first term in each (since $x * x = x^2$).

(x)(x)

Since the last term in the trinomial is negative, the signs of our factors have to be positive and negative. The sign of the MIDDLE term now will tell us whether the bigger factor goes to the binomial with the minus or plus sign. Here, it would be the minus sign since the middle term is negative.

Input the signs into the parentheses to get:

$$(x - \quad)(x + \quad)$$

Now, we have to find 2 factors of 56 that have a difference of 1.

Factor Pairs of 56: 1 and 56, 2 and 28, 4 and 14, 7 and 8

The only factor pair that will give us a difference of 1 is 7 and 8. Input those numbers into the parentheses, keeping in mind that because the middle term of the trinomial was negative, the 8 goes in the binomial with the minus sign.

$$(x - 8)(x + 7)$$

Let's try one more example in this format.

$$x^2 + 13x + 12$$

Since there is no GCF to be factored out, first write the 2 parentheses with x as the first terms in the factored binomials.

Then look at the sign of the last term. It is positive meaning our factors are both positive or both negative. The sign of the middle term is positive, so both factors are positive.

Find 2 factors of 12 that sum up to 13 (1 and 12) and input them into the parentheses.

$$\mathbf{(x + 1)(x + 12)}$$

$$\mathbf{2x^2 - 8x - 24}$$

For this trinomial, there is a GCF greater than 1 that can be factored out. Factor out a 2 from this trinomial to leave us with:

$$\mathbf{2(x^2 - 4x - 12)}$$

Now follow the same steps as before. Write out 2 parentheses with x as the first term in each binomial.

Remember the 2 at the front!

2(x)(x)

The sign of the last term in the trinomial is negative so the signs of the factors are positive and negative. The bigger factor will be attached to the binomial with the minus sign because the middle term's sign is negative. Write the signs in the parentheses.

2(x -)(x +)

Finally, determine what 2 factors of 12 have a difference of 4.

Factor Pairs of 12: 1 and 12, 2 and 6, 3 and 4

The 2 factors of 12 that have a difference of 4 are 2 and 6. Input those factors into the parentheses, remembering that 6 goes with the minus sign.

2(x - 6)(x + 2)

Tips for Solving Problems:

1. Follow the steps outlined in this lesson! Make sure to first factor out a GCF if possible in the trinomial, so it will be easier to factor.

2. If the sign of the last term is POSITIVE, you are finding 2 factors that SUM up to that value. If the sign of the last term is NEGATIVE, you are finding 2 factors whose DIFFERENCE is that value (signs for the factors are already taken care of before this step).

3. If you want to check to see if you did your factoring correctly, FOIL out the 2 binomials. If you do not get the original trinomial after Foiling, check your work to make sure you did not make any mistakes. Make sure your factors add up to the correct middle term in the given trinomial or try different factors.