**Factoring Difficult Trinomials**

1

First, we must determine what makes a trinomial "hard" or difficult to factor. One example of a difficult trinomial to factor is one where the coefficient of the quadratic term is not 1 and which cannot be factored into all three terms. For example, let's look at the trinomial 3x2 + 10x + 8.

2

The coefficient in the quadratic term, 3, is not a common factor of the other two coefficients, 10 and 8. However, we can use a process called the decomposition method to factor this trinomial. We begin by multiplying the first coefficient, 3, by the last coefficient, 8. I will use the symbol \* to express multiplication throughout this article.

3

Now, we must look at the coefficient in the middle term of the trinomial, which is 10. The goal here is to determine what numbers will multiply to get 24 and add up to 10. The way we know whether the two numbers add up to 10 or subtract to make 10 is the sign between the second and third terms in the trinomial.3x2 + 10x + 8Since the sign between 10x and 8 is an addition sign we know that the two factors of 24 must add up to make 10.

4

So, we list the factors that multiply to make 24.

 24 \* 1 = 24

 12 \* 2 = 24

 8 \* 3 = 24

 6 \* 4 = 24

Now, which of these two factors add up to make 10?

 24 + 1 = 25

 12 + 2 = 14

 8 + 3 = 11

 6 + 4 = 10

6 and 4 are the correct answer. Now, we know that 6 and 4 make up the middle term in the trinomial 3x2 + 10x + 8We can now express the trinomial in four terms as 3x2 + 6x + 4x + 8

5

Now, we take the four terms and separate them into two parts, using the addition sign in the middle as the dividing line. So we have:

3x2 + 6x and 4x + 8

We are now going to find the common factor in both parts. First, let’s take a look at 3x2 + 6x. We can see that 3x is a common factor in 3x2 and 6x. So, it can now be expressed as 3x (x + 2). Next, let’s look at 4x + 8. The common factor here is the number 4. So now we get 4 (x +2).

6

Now we put the two parts back together again.

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

What we have are two identical expressions inside the brackets in (x + 2). If you do not have identical expressions, you know that you made a mistake somewhere along the line. The expression (x + 2) is our first binomial. The second can be expressed using our two coefficients, which are 3x and 4, thus we can write it as (3x + 4).So, the trinomial 3x2 + 10x + 8 can be factored into the binomials (x + 2)(3x + 4). But how can we be sure this is correct?

7

We can use the FOIL method to check to make sure that we factored correctly. FOIL is an acronym which expresses the order in which we multiply the terms within the two binomials and stands for First, Inner, Outer, and Last. So, we look at the binomial (x + 2)(3x + 4).

This leaves us with: 3x2 + 4x + 6x + 8 = 3x2 + 10x + 8.The answer checks out. Good job.

1. Is your trinomial hard? 🡪 a ≠ 1
2. Multiply the a value with the c value
3. Compare the a(c) value to b. What values will multiply to give you a(c) and add to give you b.
4. Make factor trees.
5. Split your B value and remove common factors.
6. Reconstruct your binomials.
7. Check! (FOIL)