

# Algebra,

## *Been there – Done that*

# Factoring

## *Mathematical Systems*

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Algebra, Been there –Done that is a newsletter that links algebra to previously learned concepts and skills or outside experiences

Factoring – the process of changing a polynomial expression that is essentially a sum into an expression that is essentially a product.

Factoring polynomials is not much different than finding the prime factors of composite numbers done in earlier grades. What has to happen in both situations is students have to look at the problem at hand, then using their background knowledge, identify patterns, then select a method to rewrite the composite number as a product.

Let's look at a couple of examples. If I asked a student to find the prime factors of 117, the first thing many students would do is check to see if 117 is divisible by numbers they are very familiar, such as 2, 5, and 10. Since 117 is not even and does not end in 0 or 5, they students will deduce that they can't use those numbers.

Now, they will have to look for other ways of finding factors. Hopefully, rather than using trial and error and dividing, they would use the rules of divisibility. Since the sum of the digits of 117 is 9, we know that 117 is divisible by 3 and by 9.

Always try to use the Distributive Property first.

So  $117 = 9 \times 13$ , factoring the 9, we have  $117 = 3^2 \times 13$

Polynomial factoring uses the same type of reasoning. That is, you look at a polynomial and determine if there are common factors, much like a student would have done by checking if a number was divisible by 2, 5, or 10. In algebra, we would factor out those common factors using the Distributive Property.

*Check – Binomial?*  
If yes, use the Difference of Two Squares.

Once that was accomplished, a student would look for a method to factor the rest of the polynomial. With composite numbers, students determined which rule of divisibility might apply.

*Check - Trinomial?*  
If yes, is  $a = 1$ ?  
If yes, use the Addition Method.

Once students' factored using the Distributive Property, they would then determine if the polynomial was a binomial, trinomial, or other.

If  $a \neq 1$ , use Trial and Error.

If the expression was a binomial, students would try to use the Difference of Two Squares to factor.

If the expression was a trinomial, students would look at the leading coefficient, often referred to as  $a$ , and if  $a = 1$ , they would factor using the Addition Method.

If they had a trinomial and  $a \neq 1$ , the students would try a method called Trial & Error.

If not a binomial or trinomial, use Grouping

And finally, if the expression was not a binomial or trinomial, students would try and factor by Grouping.

Finding prime factors of composite numbers is made a lot easier by knowing the Rules of Divisibility. Factoring polynomials is made a lot easier by knowing the five factoring methods; Distributive Property, Difference of Two Squares, Addition Method, Trial & Error, and Grouping.

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