Study Guide

Factoring
03/01/2012

Factoring
Consider the following equation:

$$3 \times 4 = 12$$

The numbers 3 and 4 are said to be factors of the number 12. This concept of factoring is not reserved for numbers, but may be extended to polynomials as well.

Factoring is the breaking up of quantities into products of their component factors. One way to think of factoring is as the opposite or inverse of multiplying.

A polynomial is a term or sum of terms. Each term is either a number or a product of a number and one or more variables.

A monomial is a polynomial with one term.

A binomial is a polynomial with two terms.

A trinomial is a polynomial with three terms.

Consider the following polynomial:

[illegible]

A typical question on factoring will include a polynomial like the one above. Notice that 4y is a common factor of each term of the polynomial.

Step 1: Factor out the 4y by dividing each term of the trinomial by 4y.

[illegible]

Step 2: The trinomial in parentheses can be factored further. Since the coefficient of the "y squared" term is equal to 1, focus on the last term, in this case, -5. If factors of -5 can be found that ADD up to the coefficient of the middle term (in this case, 4) the trinomial can be factored. Two factors of -5 are 5 and -1, and when ADDED together the result is equal to the coefficient of the middle term, 4. Notice how these numbers are put together to construct the fully factored trinomial:

$(4y)(y + 5)(y - 1)$

To check the result, use the rules for multiplying polynomials and you should have the original polynomial when finished.

Sometimes factoring must be done by grouping. The polynomial given below may appear impossible to factor at first, but if you examine the steps you will see a ngt.h3(y)20(nomi)-3(a)4(ls as)-9midd equt be dito fa

$$15x^2 + 20xy + 18nx + 24ny$$
$$\text{Step 1: } 5x(3x + 4y) + 18nx + 24ny$$
$$\text{Step 2: } 5x(3x + 4y) + 6n(3x + 4y)$$
$$\text{Step 3: } (5x + 6n)(3x + 4y)$$

<u>Step 1:</u> (5x) is a common term to both 15x and 20xy. Factor it out of only those two terms.
<u>Step 2:</u> (6n) is a common term of both 18nx and 24ny. Factor it out of only those two terms.
<u>Step 3:</u> Notice that the quantity (3x + 4y) is a common factor of 5x and 6n. The expression is rewritten to indicate this, and the polynomial is completely factored.

A special type of polynomial expresses the difference of two perfect squares. Polynomials of this type are factored easily once the rule is remembered.

$$x^2 - 36$$
$$(x + 6)(x - 6)$$

Since each term in the polynomial is a perfect square, the square root of each term (in this case x and 6 respectively) will be used in the following way. The original polynomial is factored as (x + 6)(x - 6). Notice that if these terms are multiplied together, the original polynomial is formed. Polynomials that are in the "difference of squares" form may always be factored as the sum of the square roots times the difference of the square roots.