Basic Factoring

Ok...factoring is the process of changing a number or expression to multiplication.

Let's "factor" the number 12. Well that's easy. We could factor it as $2 \quad 6$. Or perhaps $3 \quad 4$. Now, if we use only prime numbers (2,3,5,7,11,etc) as the factors, then we say that we have performed "prime factorization" and this is usually what we want. So, the prime factorization of 12 would be $2 \quad 2 \quad 3$.

We factor in algebra also. There are several factoring "techniques" used to factor algebraic expressions.

The first method often taught is called **Common Monomial Factoring** and is basically using the distributive property backwards. Recall the distributive property.
$a \ b \quad c \qquad ab \quad ac$
So, backwards it would be $ab \quad ac \qquad a \ b \quad c$. Notice the answer is expressed as a multiplication problem as it should be.

Here are some examples of common monomial factoring!

$6a \quad 6b \qquad 6 \ a \quad b$ We have "factored out" the 6.

$3x^4 \quad 6x^2 \quad 15x \qquad 3x \ x^3 \quad 2x \quad 5$ Here we have factored out the "common monomial" $3x$.

The next factoring method we will review is what I call **F**.**O**.**I**.**L Backwards**. Recall the F.O.I.L Method is a method for multiplying out two binomials. F.O.I.L. stands for First, Outer, Inner, Last. When we multiply $x \quad 2 \quad x \quad 3$ for example, we multiply x by x (the First two), then the x by the 3 (the Outer two), then 2 by x (the Inner two), and finally the 2 by the 3 (the Last two). Here is what we get: $x \quad 2 \quad x \quad 3 \qquad x^2 \quad 3x \quad 2x \quad 6$
$x^2 \quad 5x \quad 6$.
So...to factor $x^2 \quad 5x \quad 6$ we do some mental gymnastics (think about F.O.I.L. backwards) to get $x \quad 2 \quad x \quad 3$ as our answer.

Here are a couple of examples for you to look at.

$x^2 \quad 4x \quad 12 \qquad x \quad 6 \quad x \quad 2$

$6x^2 \quad 11x \quad 35 \qquad 2x \quad 7 \quad 3x \quad 5$

Sometimes these take a bit of effort. Sometimes an expression cannot be factored. In this case, as in General Math we say our expression is **Prime**.

The Difference of Two Squares is a ”special” F.O.I.L. Backwards technique. Watch this.

$x^2 \quad 81 \qquad x \quad 9 \quad x \quad 9$ and how about $4x^2 \quad 9 \qquad 2x \quad 3 \quad 2x \quad 3$ Get it?

Trinomial Squares is another popular type. Watch this.

$x^2 \quad 6x \quad 9 \qquad x \quad 3 \quad x \quad 3 \qquad x \quad 3^{\,2}$

and how about $4x^2 \quad 20x \quad 25 \qquad 2x \quad 5 \quad 2x \quad 5 \qquad 2x \quad 5^{\,2}$ Get it?

So...remember...factoring means changing an expression into multiplication. There are some basic techniques used to accomplish this task as I have attempted to review above. There are also some ”advanced” factoring techniques which we will save for another ”lesson”. Of course there are many uses for factoring. I am sure you have seen some in your pre-calculus classes. We will use factoring quite a bit in calculus!

Here are a few basic factoring practice problems for you to do.

Factor $x^2 \quad 6x \quad 8$

Factor $6x^3 \quad 18x^2 \quad 12x$ Hint: Use Common Monomial Factoring first, then F.O.I.L. Backwards.

Factor $x^2 \quad 25$

Factor $x^2 \quad 12x \quad 36$

Factor $6x^2 \quad 13x \quad 28$