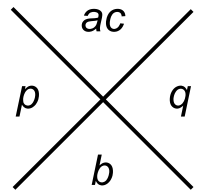
Factoring Techniques

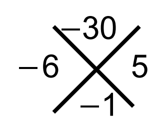
In order to factor a quadratic equation of the form $ax^2 + bx + c$ first factor out any common factors, and if necessary factor out a negative 1 to make the value of *a* positive. Then find two numbers, we'll call them *p* and *q*, such that $p \cdot q = ac$ and $p + q = b$. This can be organized as a diamond:



Now, if $a = 1$, then the factorization of the quadratic is $(x + p)(x + q)$. However, if $a \neq 1$, then we will factor by grouping by separating the linear term of the quadratic into two pieces as follows:

Rewrite $ax^2 + bx + c$ as $ax^2 + px + qx + c$ using the values of *p* and *q* that you obtained in the diamond organizer. Then factor the greatest common factor from the first two terms of the expression, and then factor the greatest common factor from the second two terms of the expression. If done correctly, you can then factor out the common term and arrive at your final factorization. In words, this sounds confusing, so here is a worked example:

Factor: $4x^2 - 2x - 30$



First factor the common factor of 2 out to obtain $2(2x^2 - x - 15)$. Now looking only at the expression inside the parentheses, we can use the diamond organizer from above:

Thus we can rewrite $2x^2 - x - 15$ as $2x^2 - 6x + 5x - 15$. Now, factoring as described above, we factor the greatest common factor out of the first two terms and the last two terms:

$2x^2 - 6x + 5x - 15$
$2x(x - 3) + 5(x - 3)$

Now since both parts of the expression contain the common factor of $x - 3$, we can factor that our to obtain $(x - 3)(2x + 5)$. Finally, recalling the common factor of 2 that we factored out at the beginning of the problem, our final factorization is $2(x - 3)(2x + 5)$.