Factoring Quadratic Trinomials (a ≠ 1)

Level 1 - Factor expressions by splitting and grouping
Level 2 - Factor expressions by first removing a GCF
Level 3 - Factor expressions involving higher order trinomials

Remember:
A quadratic trinomial is expressed in the form $\mathbf{y = ax^2 + bx + c}$.

When the coefficient in front of $\mathbf{x^2}$ (the leading coefficient, **a**) is **not 1**, we use the "split and group" method.

Step 1:	multiply **a** and **c** together
Step 2:	Find two numbers that add to give ***b*** and multiply to give ***ac***
Step 3:	Split the b term into two terms using the numbers from step 2. We should now have four terms.
Step 4:	Group the first two terms and the last two terms. Factor out a GCF from each group.
Step 5:	Factor out the common binomial to give the final, factored expression.

Example #1

$6x^2 - x - 12$

$a \cdot c = -72$
$b = -1$

two numbers that multiply to give -72 *and add to give* -1 *are*:

$-9, +8$

split the **b** *term*:
$6x^2 - 9x + 8x - 12$

group the first and last pairs of terms:
$(6x^2 - 9x) + (8x - 12)$

take a GCF out of each group:
$3x(2x - 3) + 4(2x - 3)$

factor out the common binomial:

$(2x - 3)(3x + 4)$

Example #2

$2x^2 - 7x + 3$

$a \cdot c = +6$
$b = -7$

two numbers that multiply to give $+6$ *and add to give* -7 *are*:

$-1, -6$

split the **b** *term*:
$2x^2 - 1x - 6x + 3$

group the first and last pairs of terms:
$(2x^2 - 1x) + (-6x + 3)$

take a GCF out of each group:
$x(2x - 1) - 3(2x - 1)$

factor out the common binomial:

$(2x - 1)(x - 3)$

Example #3

$6x^3 + 9x^2 - 15x$

First, we can factor out a GCF:
$3x(2x^2 + 3x - 5)$

now we factor the expression inside the brackets:

$a \cdot c = -10$
$b = +3$

two numbers that multiply to give -10 *and add to give* $+3$ *are*:
$+5, -2$

$2x^2 + 5x - 2x - 5$
$(2x^2 + 5x) + (-2x - 5)$
$x(2x + 5) - 1(2x + 5)$

factor out the common binomial:

$(2x + 5)(x - 1)$

Remember the GCF we had factored out initially:

$3x(2x + 5)(x - 1)$