Factoring a Polynomial of the Form: $ax^2 + bx + c$

To Factor any Trinomial

1. Factor out the Greatest Common Factor. If there is a common factor, be sure to include it as part of the final factorization.
2. Determine if the trinomial $ax^2 + bx + c$ is factorable by finding two numbers m and n such that $m \cdot n = a \cdot c$ and $m + n = b$ (where a is the leading coefficient, c is the last coefficient, and b is the coefficient of the middle term). If m and n do not exist, we conclude that the trinomial will not factor.
3. Replace the middle term, bx, by the sum of mx and nx.
4. [Factor this four-term polynomial by grouping.]
   Place parentheses around the first and second terms and around the third and forth terms. Factor out what is common to each pair.
5. Factor out the common quantity of each term and place the remaining factors from each term in a second parenthesis.

Note: if $a \cdot c$ is positive, then *m* and *n* both have the same sign as b;
if $a \cdot c$ is negative, then *m* and *n* have different signs and the one with the greater absolute value has the same sign as b.

Consider:
$6x^2 + 13x + 6$ … find m and n so that $m \cdot n = a \cdot c$ or +36 **and** $m + n = b$ or +13, in this case.
What two factors when multiplied together equal +36, but when added equal +13? 9 & 4
Now replace the 13x term with mx + nx to get $6x^2 + mx + nx + 6$.
What does this look like now? $6x^2 + 9x + 4x + 6$
Factor this by grouping into: $(2x + 3)(3x + 2)$

Factor: $6y^2 + 17y + 12$ $m \cdot n = 6 \cdot 12 = 72$ and $m + n = 17$ $m = 9$ and $n = 8$
Rewrite: $6y^2 + 9y + 8y + 12$
Factor by grouping: $3y(2y + 3) + 4(2y + 3)$ Factors: $(2y + 3)(3y + 4)$

Factor: $6y^2 - y - 12$ $m \cdot n = 6 \cdot (-12) = -72$ and $m + n = -1$ $m = -9$ and $n = 8$
Rewrite: $6y^2 - 9y + 8y - 12$
Factor by grouping: $3y(2y - 3) + 4(2y - 3)$ Factors: $(2y - 3)(3y + 4)$

TRY:

$4x^2 + 11x + 6$

$2y^2 + 3y - 2$

$8x^2 - 14x + 3$

$7y^2 - 17y + 6$