FACTORING TRINOMIALS OF THE FORM $ax^2 + bx + c$ USING GROUPING

Example: $18x^2y + 21xy - 9y$

Where possible, factor out the greatest common monomial factor from the trinomial.

$3y (6x^2 + 7x - 3)$

Test the trinomial for factorability:
  if $b^2 - 4ac$ is a perfect square, it can be factored

$7^2 - 4 \cdot 6 \cdot (-3) = 49 - (-72) = 121$
121 is a perfect square, therefore the trinomial is factorable.

If factorable:
- Find the <u>key number</u> by multiplying a & c.

$6 \cdot (-3) = -18$

- Factor ac so that the sum of the two key-number factors $= b$.

$ac = -18$	$b = 7$
$(9) \cdot (-2)$	$9 + (-2)$

- Replace the middle term's numerical coefficient with the sum of the above factors.

$3y (6x^2 + \underline{9x - 2x} - 3)$

- Factor by grouping.

$3y [3x (2x + 3) - (2x + 3)]$
$= 3y (3x - 1) (2x + 3)$

SPECIAL FACTORIZATIONS

Examples

Difference of two Squares:
  $a^2 - b^2 = (a - b)(a + b)$

$81c^2 - 4a^2 = (9c - 2a)(9c + 2a)$

Perfect Square Trinomial:
  $a^2 + 2ab + b^2 = (a + b)^2$
  $a^2 - 2ab + b^2 = (a - b)^2$

$4x^2 + 20x + 25 = (2x + 5)^2$
$4x^2 - 20xy + 25y^2 = (2x - 5y)^2$

Sum of two Cubes:
  $F^3 + L^3 = (F + L)(F^2 - FL + L^2)$

$8x^3 + 27y^3 = (2x + 3y)(4x^2 - 6xy + 9y^2)$

Difference of two Cubes:
  $F^3 - L^3 = (F - L)(F^2 + FL + L^2)$

$8x^3 - 27y^3 = (2x - 3y)(4x^2 + 6xy + 9y^2)$