Factoring Polynomials

1. If the polynomial has a greatest common factor GCF other than 1, factor out the greatest common factor.
   Examples: $3x^3 + 9x^2 - 12x = \mathbf{3x}(x^2 + 3x - 4) = 3x(x+4)(x-1)$ and $12a^2b^2 - 3ab = \mathbf{3ab}(4ab-1)$

2. If the polynomial is a binomial (two terms), then see if it is the **difference of two squares**.
   $(a^2 - b^2) = (a - b)(a + b)$. **Example**: $4x^2 - 9 = (2x-3)(2x+3)$. The sum of squares, $a^2 + b^2$, won't factor.

3.

a. If the polynomial is a trinomial, then check to see if it is a *perfect square* trinomial which will factor into the square of a binomial. **Examples**: $9x^2 + 12x+4 = (3x+2)^2$ $9x^2 - 12x+4 = (3x-2)^2$	**b.** If it is not a perfect square trinomial, use the **ac** method to factor $\mathbf{a}x^2 + \mathbf{b}x + \mathbf{c}$ by grouping. • Look at the product **ac.** Think of a pair of numbers **m,n** whose product is **ac** and whose sum is **b**. (A list of possible number pairs may help.) * If a =1, the solution is $(x \pm m)(x \pm n)$. **Example**: $x^2 - 9x+20 = (x-4)(x-5)$. * If $a \neq 1$, rewrite the polynomial so the middle term (**bx**) is **mx + nx**. • **Example**: $\boxed{5x^2 - 22x - 15}$. **ac** =75. Since 3*25 = −75 and 3 −25= −22, **bx** becomes 3x−25x. The expression becomes $\boxed{5x^2 + 3x - 25x - 15}$. Factor this by grouping as in the next section.

4. Other polynomials: If it has more than three terms, try to factor it by grouping.
   a. Group two terms together which can be factored further
   b. Use the distributive property in reverse to factor out common terms.
   c. Write the factors as the multiplication, or product, of binomials.
   Example continued from above: $\boxed{5x^2 + 3x - 25x - 15} = x(5x+3) - 5(5x+3) = (x-5)(5x+3)$

5. Checks: Can any of the factors be factored further? Does multiplying the factors give the original expression?