Factoring Polynomials

To factor a polynomial, ask yourself the following questions:

FIRST: Does the polynomial have a common factor? If YES, then ask the following questions:

1. What is the largest number that will divide into the coefficients of all the terms evenly?
2. Does every term contain the same variable? If so, factor out the variable to the smallest exponent.
3. Look at what you have. Can you factor further?

SECOND: Is the polynomial a binomial? If YES, only the following can be factored.

1. Is it the difference of two squares? Can it be written in the form $(a)^2 - (b)^2$? If so, factor it using the formula

$$(a)^2 - (b)^2 = (a + b)(a - b)$$

2. Is it the sum or difference of two cubes? Can it be written in the form $(a)^3 + (b)^3$ or $(a)^3 - (b)^3$? If so, use the formulas

$$(a)^3 - (b)^3 = (a - b)(a^2 + ab + b^2)$$
$$(a)^3 + (b)^3 = (a + b)(a^2 - ab + b^2)$$

Remember **SOAP** (**S**- Same sign, **O**-Opposite sign, **AP**- Always Positive)

REMEMBER: $(a)^2 + (b)^2$ **does not factor!!!!!!**

THIRD: Is it a trinomial? If YES, does it fit the patterns for the formulas

$$(a)^2 + 2(a)(b) + (b)^2 = (a + b)^2$$
$$(a)^2 - 2(a)(b) + (b)^2 = (a - b)^2$$

If it does not fit either of these two patterns, factor to the product of two binomials by trial and error ("reverse FOIL"). Remember to read your trinomial for clues to aid you in factoring.

Last term positive means signs are alike:
- -middle term positive, both positive
- -middle term negative, both negative

Last term negative means signs are opposite.

FOURTH: Does it have four or more terms? If YES, then try grouping.

FIFTH: Look at your answer. Have you factored completely? Ask yourself the four questions again about any of the factors in your answer.