Factor the Difference of Two Squares

\[ a^2 - b^2 = (a + b)(a - b) \]

Example 1  Factor each difference of squares.

a.  \( x^2 - 64 \)  
b.  \( 121 - m^2 \)

c.  \( 16a^2 - 81b^2 \)  
d.  \( 16m^4 - 25n^4 \)

Factor the Sum and Difference of Two Cubes

\[ a^3 + b^3 = (a + b)(a^2 - ab + b^2) \]
\[ a^3 - b^3 = (a - b)(a^2 + ab + b^2) \]

Example 2  Factor using the formulas for sum or difference of two cubes.

a.  \( y^3 - 64 \)  
b.  \( 125 + 8x^3 \)

c.  \( 64a^3 + 343b^3 \)  
d.  \( 27p^3 - 8q^3 \)
General Procedure for Factoring a Polynomial

1. **Factor out** the GCF from the entire polynomial (if other than 1)
2. If a binomial, determine whether it is the sum and difference of two squares, or a sum or a difference of two cubes.
3. If a trinomial, factor using the appropriate methods for trinomials.
4. If more than three terms, try factoring by grouping.
5. Check to see if any of the factors may be factored further.

Example 3  Factor completely.

a. \(6m^3 + 8m^2 - 6m\)  
b. \(5n^2 + 30n + 45\)

c. \(3p^3 - 24pq^3\)  
d. \(12x^2 - 3x + 8x - 2\)

e. \(4w^3 - 2w^2 - 64w + 32\)  
f. \(5x^2 - 45x^3y^2\)

g. \(10c^3 + 10,000\)  
h. \(30 - 15x + 24x - 12x^2\)