

# Factoring Using Special Product Formulas

## Difference of Two Squares:

Formula:  $x^2 - y^2 = (x + y)(x - y)$

Example 1:  $a^2 - 16$   
 $a^2 - 4^2$   
 $(a + 4)(a - 4)$

Example 2:  $9a^2 - 64$   
 $(3a)^2 - 8^2$   
 $(3a + 8)(3a - 8)$

**NOTE: The SUM of Two Squares is NOT factorable.**

## Difference and Sum of Two Cubes:

Formulas: **S O AP**  
 $x^3 - y^3 = (x - y)(x^2 + xy + y^2)$   
 $x^3 + y^3 = (x + y)(x^2 - xy + y^2)$

**Use SOAP to remember the signs when factoring cubes:  
Same -- Opposite -- Always Positive.**

Example 1:  $a^3 - 8$   
 $a^3 - 2^3$   
 $(a - 2)(a^2 + 2a + 2^2)$   
 $(a - 2)(a^2 + 2a + 4)$

Example 2:  $8a^3 + 27b^6$   
 $(2a)^3 + (3b^2)^3$   
 $(2a + 3b^2)[(2a)^2 - (2a \cdot 3b^2) + (3b^2)^2]$   
 $(2a + 3b^2)(4a^2 - 6ab^2 + 9b^4)$

## Perfect Square Trinomials (Used in Completing the Square):

Formulas:  $x^2 + 2xy + y^2 = (x + y)^2$   
 $x^2 - 2xy + y^2 = (x - y)^2$

Example 1:  $9a^2 + 6ab + b^2$   
 $(3a)^2 + 2(3a)(b) + (b)^2$   
 $(3a + b)^2$

Example 2:  $25a^4 - 20a^2b + 4b^2$   
 $(5a^2)^2 - 2(5a^2)(2b) + (2b)^2$

$$(5a^2 - 2b)^2$$

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**M-F3**