

FACTORIZING SPECIAL PRODUCTS

Difference of two squares

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

Example: $9x^2 - 25$ *In this example, a is 3x and b is 5*

$$(3x)^2 - (5)^2 = (3x + 5)(3x - 5)$$

Sum of two squares

Rule: $a^2 + b^2 = \text{NOT FACTORABLE}$

Square of a binomial sum

Rule: $a^2 + 2ab + b^2 = (a + b)^2$

Example: $9y^2 + 12y + 4$ *In this example, a is 3y and b is 2*

$$(3y)^2 + 2(3y)(2) + (2)^2 = [(3y) + (2)]^2$$

$$= (3y + 2)^2$$

Use FOIL to Check: $(3y + 2)(3y + 2) = 9y^2 + 6y + 6y + 4$

Square of a binomial difference

Rule: $a^2 - 2ab + b^2 = (a - b)^2$

Example: $16x^2 - 40x + 25$ *In this example, a is 4x and b is 5*

$$(4x)^2 - 2(4x)(5) + (5)^2 = [(4x) - (5)]^2$$

$$= (4x - 5)^2$$

Use FOIL to Check: $(4x - 5)(4x - 5) = 16x^2 - 20x - 20x + 25$

Sum of two cubes

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

Example: $64x^3 + 27y^3$ *In this example, a is 4x and b is 3y*

$$(4x)^3 + (3y)^3 = [(4x) + 3y] [(4x)^2 - (4x)(3y) + 3y^2]$$

$$= (4x + 3y)(16x^2 - 12xy + 9y^2)$$

Difference of two cubes

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

Example: $x^3 - 125$ *In this example, a is x and b is 5*

$$x^3 - 5^3 = (x - 5)(x^2 + (x)(5) + 5^2)$$

$$(x - 5)(x^2 + 5x + 25)$$

Difference of two squares with a GCF

Rule: $ca^2 - cb^2 = c(a + b)(a - b)$

Example: $75x^2 - 48$ *In this example, a is 5x, b is 4, and c is 3*

$$3(5x)^2 - 3(4)^2 = 3[(5x)^2 - (4)^2]$$

$$3(25x^2 - 16) = 3(5x + 4)(5x - 4)$$