

Special Products & Factoring Patterns

Some products occur often enough in mathematical work that one should be familiar with their result. These products are called special products. Alternatively, given the result of a special product, one should be able to recognize how to rewrite the expression or equation as a product or factors. The list below shows several special products and factoring patterns. In each example, a , b , c , and d are real numbers.

Difference of Two Squares

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

Squares of Binomials (Perfect Square Binomials)

$$(x + a)^2 = (x + a)(x + a) = x^2 + 2ax + a^2$$

$$(x - a)^2 = (x - a)(x - a) = x^2 - 2ax + a^2$$

Miscellaneous Trinomials

$$(x + a)(x + b) = x^2 + (a + b)x + ab$$

$$(ax + b)(cx + d) = acx^2 + (ad + bc)x + bd$$

Cubes of Binomials (Perfect Cube Binomials)

$$(x + a)^3 = (x + a)(x + a)(x + a) = x^3 + 3ax^2 + 3a^2x + a^3$$

$$(x - a)^3 = (x - a)(x - a)(x - a) = x^3 - 3ax^2 + 3a^2x - a^3$$

Difference of Two Cubes

$$x^3 - a^3 = (x - a)(x^2 + ax + a^2)$$

Sum of Two Cubes

$$x^3 + a^3 = (x + a)(x^2 - ax + a^2)$$