Factoring Rules Cheat Sheet

Start with a common factor

Take out the GCF $12x^3 - 18x^2 = 6x^2(2x - 3)$

Then group if useful

$ax + ay + bx + by = (a + b)(x + y)$

Check **multiply the factors back**

A common factor can hide a square, a cube or a trinomial pattern.

Square patterns

Difference of squares $a^2 - b^2 = (a - b)(a + b)$

Perfect square, plus $a^2 + 2ab + b^2 = (a + b)^2$

Perfect square, minus $a^2 - 2ab + b^2 = (a - b)^2$

Check the middle term before calling a trinomial a perfect square.

Factor a trinomial

Leading coefficient 1 $x^2 + 5x + 6 = (x + 2)(x + 3)$

Split the middle term

$6x^2 + 11x + 3 = 6x^2 + 9x + 2x + 3$

Group and factor $6x^2 + 11x + 3 = (3x + 1)(2x + 3)$

For $ax^2 + bx + c$, seek two integers with product ac and sum b when possible.

Cubes and higher powers

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

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

Treat x^2 as a single term

$x^4 - 5x^2 + 4 = (x^2 - 1)(x^2 - 4)$

Keep factoring when a factor still matches a simpler pattern.

Choose a quadratic method

Factors are visible $x^2 - 7x + 12 = (x - 3)(x - 4)$

Already a square $(x - 1)^2 = 9 \Rightarrow x = 4 \text{ or } -2$

Complex pair $x^2 + 9 = 0 \Rightarrow x = \pm 3i$

Use the quadratic formula when factoring is not convenient. Set the equation equal to zero first.

Distribute, then collect

Multiply both terms $3(2x - 5) = 6x - 15$

Collect like terms $6x - 15 - 4x = 2x - 15$

Check with $x = 2$ $2(2) - 15 = -11$

Combine like terms only when their variable parts and exponents match.