

Simplifying Rational Expressions - Quick Guide

Use the same process every time: Restrict -> Factor -> Cancel -> Rewrite -> Check

1 Find restrictions first

Set the ORIGINAL denominator equal to zero. Keep those values excluded even if a factor cancels.

2 Factor completely

Look for GCF, difference of squares, trinomials, grouping, and sign reversal such as $2 - x = -(x - 2)$.

3 Cancel common factors only

Cancel factors that multiply the whole numerator and denominator. Never cancel individual terms in a sum or difference.

4 Rewrite the simplified form

Write the remaining expression cleanly. Reduce numerical coefficients when possible.

5 Keep every original restriction

A cancelled factor creates a hole; it does not make the excluded x-value valid again.

Worked example

Simplify and keep restrictions:

$$\frac{x^2 - 5x + 6}{x^2 - 9}$$

Restrictions: $x \neq 3, -3$

Factor: $(x - 2)(x - 3) / [(x - 3)(x + 3)]$

Cancel: the common factor $(x - 3)$

Final: $(x - 2)/(x + 3)$, with $x \neq 3, -3$

Common mistake: cancelling terms instead of factors

In $(x + 3)/x$, the x does not cancel because $x + 3$ is a sum, not a product containing x as a factor.

Factoring reminders

- GCF: $6x^2 + 9x = 3x(2x + 3)$
- Difference of squares: $a^2 - b^2 = (a - b)(a + b)$
- Trinomial: $x^2 + bx + c = (x + m)(x + n)$ when $m+n=b$ and $mn=c$
- Sign reversal: $2 - x = -(x - 2)$