

# Rationalizing Denominators



Level 1 - Rationalize the monomial denominator of an expression

Level 2 - Rationalize the binomial denominator of an expression

Level 3 - Rationalize the binomial denominator containing variables

When we say rationalize the denominator, we mean rewriting a fraction so that the denominator does not contain a radical (root). Fractions are considered “simplified” in math only if the denominator is rational (no roots).

Monomial Denominator	Binomial Denominator
$\frac{1}{\sqrt{b}}$	$\frac{1}{a + \sqrt{b}}$
If the denominator has one radical term, multiply the top and bottom by the radical.	If the denominator is a binomial with at least one radical term, multiply the top and bottom by the conjugate of the binomial denominator.
$\frac{1}{\sqrt{b}} \cdot \frac{\sqrt{b}}{\sqrt{b}} = \frac{\sqrt{b}}{b}$	$\frac{1}{a + \sqrt{b}} \cdot \frac{a - \sqrt{b}}{a - \sqrt{b}} = \frac{a - \sqrt{b}}{a^2 - b}$

Example #1	Example #2	Example #3	Example #4
$\frac{5}{\sqrt{3}}$	$\frac{1}{2\sqrt{3x}}$	$\frac{2}{1 - \sqrt{2}}$	$\frac{2 - \sqrt{x}}{\sqrt{x} - 2}$
$\frac{5}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}}$	$\frac{1}{2\sqrt{3x}} \cdot \frac{\sqrt{3x}}{\sqrt{3x}}$	$\frac{2}{1 - \sqrt{2}} \cdot \frac{1 + \sqrt{2}}{1 + \sqrt{2}}$	$\frac{2 - \sqrt{x}}{\sqrt{x} - 2} \cdot \frac{\sqrt{x} + 2}{\sqrt{x} + 2}$
$\frac{5\sqrt{3}}{(\sqrt{3})^2}$	$\frac{\sqrt{3x}}{2 \cdot (\sqrt{3x})^2}$	$\frac{2(1 + \sqrt{2})}{1 + \sqrt{2} - \sqrt{2} - (\sqrt{2})^2}$	$\frac{2\sqrt{x} + 4 - \sqrt{x^2} - 2\sqrt{x}}{(\sqrt{x})^2 - (2)^2}$
$\frac{5\sqrt{3}}{3}$	$\frac{\sqrt{3x}}{2 \cdot 3x}$	$\frac{2 + 2\sqrt{2}}{1 - 2}$	$\frac{4 \cdot x}{x - 4}$
$\frac{5\sqrt{3}}{3}$	$\frac{\sqrt{3x}}{6x}$	$-2 - 2\sqrt{2}$	$\frac{-1(x - 4)}{x - 4}$
			$-1$

**Remember:**

- Always multiply by the exact radical or conjugate needed to clear the denominator.
- Simplify the denominator first (using difference of squares) before simplifying the numerator.
- If variables are present, treat them like regular numbers and simplify at the end.