

Rationalizing Binomial Radicals

Rationalize each denominator and simplify completely.

Binomial Numerators

Rationalize the denominator using its conjugate. Multiply the binomials in the numerator, simplify all radical products, and combine like terms.

1. $\frac{1+\sqrt{3}}{2-\sqrt{3}}$

3. $\frac{3+\sqrt{5}}{4-\sqrt{5}}$

5. $\frac{2\sqrt{3}+1}{4-\sqrt{3}}$

7. $\frac{2\sqrt{3}+\sqrt{5}}{4-\sqrt{3}}$

2. $\frac{2+\sqrt{2}}{3-\sqrt{2}}$

4. $\frac{\sqrt{3}+2}{5-\sqrt{3}}$

6. $\frac{3+2\sqrt{5}}{5-\sqrt{5}}$

8. $\frac{2\sqrt{3}+14\sqrt{15}}{\sqrt{5}+4}$

Simplify or Factor Before Rationalizing

Before rationalizing, look for radicals that can be simplified and common factors that can be factored out. Then rationalize using the simplest form of the denominator.

1. $\frac{1+\sqrt{8}}{3-\sqrt{2}}$

3. $\frac{\sqrt{7}+2}{6-2\sqrt{3}}$

5. $\frac{\sqrt{2}+\sqrt{3}}{10\sqrt{3}-2}$

7. $\frac{4+2\sqrt{3}}{8-4\sqrt{3}}$

2. $\frac{2+\sqrt{3}}{6-2\sqrt{3}}$

4. $\frac{\sqrt{12}+1}{4-2\sqrt{3}}$

6. $\frac{3+\sqrt{14}}{4\sqrt{7}-2}$

8. $\frac{\sqrt{18}+\sqrt{8}}{6-2\sqrt{2}}$

Variables & Repeated Radical Expressions

Assume $x \geq 0$ and all denominators are non-zero. Treat repeated radical expressions as single terms when identifying conjugates.

1. $\frac{1+\sqrt{x}}{2-\sqrt{x}}$

3. $\frac{5+\sqrt{10x+1}}{\sqrt{10x+1}+2}$

5. $\frac{2\sqrt{x}+3}{\sqrt{x}-4}$

7. $\frac{2+\sqrt{3x+1}}{2\sqrt{3x+1}-5}$

2. $\frac{2+\sqrt{x+1}}{3-\sqrt{x+1}}$

4. $\frac{6-\sqrt{3x+2}}{2\sqrt{3x+2}+4}$

6. $\frac{3x+\sqrt{8x}}{\sqrt{8x}+15}$

8. $\frac{2\sqrt{x+1}+4}{\sqrt{x+1}-2}$