Pre-Calculus 11 Radicals

Lesson 4 Dividing Radicals

Rationalizing the Denominator (Monomials)

When a fraction is multiplied by 1, its value does not change. This strategy can be applied to a quotient with a radical in the denominator.

For example, $\frac{2}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{3}$

The denominator is now an integer. This process is called ***rationalizing the denominator***. Of the two expressions, $\frac{2\sqrt{3}}{\sqrt{3}}$ is considered simplified form.

When we simplify radicals, we never want to leave an answer with a radical in the denominator. ***Always rationalize the denominator.***

Examples

Simplify and rationalize the denominator

1. $\frac{5}{\sqrt{2}}$ $\left(\frac{\sqrt{2}}{\sqrt{2}}\right)$

$\frac{5\sqrt{2}}{2}$

2. $\frac{4}{2\sqrt{7}}$

$\frac{2}{\sqrt{7}}\left(\frac{\sqrt{7}}{\sqrt{7}}\right)$

$\frac{2\sqrt{7}}{7}$

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3. $\frac{\sqrt{12}}{\sqrt{x}}$ $\left(\frac{\sqrt{x}}{\sqrt{x}}\right)$ $x \geq 0$

$\frac{\sqrt{12x}}{x}$

$\frac{\sqrt{4 \cdot 3x}}{x}$

$\frac{2\sqrt{3x}}{x}$

4. $\frac{5\sqrt{7}+3}{\sqrt{7}}$ $\left(\frac{\sqrt{7}}{\sqrt{7}}\right)$

$\frac{5(7) + 3\sqrt{7}}{7}$

$\frac{35 + 3\sqrt{7}}{7}$

5. $\frac{6\sqrt{2}-4\sqrt{3}}{\sqrt{18}}$

$\frac{6\sqrt{2} - 4\sqrt{3}}{\sqrt{9 \cdot 2}}$

← simplify complex radicals first

$\frac{(6\sqrt{2} - 4\sqrt{3})}{3\sqrt{2}}\left(\frac{\sqrt{2}}{\sqrt{2}}\right)$

$\frac{6(2) - 4\sqrt{6}}{3(2)}$

$\frac{12 - 4\sqrt{6}}{6}$

divide each term by 2

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

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Rationalizing the Denominator (Binomials)

To rationalize a denominator containing a binomial we use a difference of squares. The binomial that you multiply by is called the CONJUGATE.

same terms, opposite signs

$\sqrt{3}+\sqrt{2}$ has a conjugate of $\sqrt{3}-\sqrt{2}$

$2\sqrt{3}-3\sqrt{5}$ has a conjugate of $2\sqrt{3}+3\sqrt{5}$

Examples

Simplify the following radicals

1. $\frac{2}{(\sqrt{5}-\sqrt{2})}\left(\frac{\sqrt{5}+\sqrt{2}}{\sqrt{5}+\sqrt{2}}\right)$

$\frac{2\sqrt{5}+2\sqrt{2}}{5+\cancel{\sqrt{10}}-\cancel{\sqrt{10}}-2}$

$\frac{2\sqrt{5}+2\sqrt{2}}{3}$

2. $\frac{(\sqrt{2}+1)}{(\sqrt{2}-1)}\left(\frac{\sqrt{2}+1}{\sqrt{2}+1}\right)$

$\frac{2+\sqrt{2}+\sqrt{2}+1}{2+\cancel{\sqrt{2}}-\cancel{\sqrt{2}}-1}$

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

$3+2\sqrt{2}$

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6, 9, 10a, b
Mult Choice #1, 2