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Simplifying Radicals

$\sqrt[\text{index}]{\text{radicand}}$ radical

A square root radical is simplified, or in its simplest form, when the radicand has no square factors.

What is a "square factor"?

a factor that is a perfect square, such as: ... 4, 9, 16, 25, 36, ...

Properties of Square Roots:

* Product Property: $\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$
* Quotient Property: $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$

Let's simplify the following radicals.

1) $\sqrt{20} = \sqrt{4 \cdot 5} = \sqrt{4} \cdot \sqrt{5} = 2 \cdot \sqrt{5} = 2\sqrt{5}$

2) $\sqrt{\frac{18}{25}} = \frac{\sqrt{18}}{\sqrt{25}} = \frac{\sqrt{9 \cdot 2}}{5} = \frac{\sqrt{9} \cdot \sqrt{2}}{5} = \frac{3\sqrt{2}}{5}$

3) $\sqrt{12} = \sqrt{4 \cdot 3} = \sqrt{4} \cdot \sqrt{3} = 2 \cdot \sqrt{3} = 2\sqrt{3}$

4) $\sqrt{48} = \sqrt{16 \cdot 3} = \sqrt{16} \cdot \sqrt{3} = 4 \cdot \sqrt{3} = 4\sqrt{3}$

5) $\sqrt{300} = \sqrt{100 \cdot 3} = \sqrt{100} \cdot \sqrt{3} = 10 \cdot \sqrt{3} = 10\sqrt{3}$

6) $\sqrt{\frac{56}{16}} = \frac{\sqrt{56}}{\sqrt{16}} = \frac{\sqrt{4 \cdot 14}}{4} = \frac{\sqrt{4} \cdot \sqrt{14}}{4} = \frac{2\sqrt{14}}{4} = \frac{\sqrt{14}}{2}$

Two radical expressions that have the same index and the same radicand are called like radicals.

You can combine like radicals!

7a) $\sqrt{2} + 3\sqrt{2} = 4\sqrt{2}$

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Now let's simplify some radical expressions.

8) $\sqrt{8} + \sqrt{2}$

$\sqrt{4} \cdot \sqrt{2} + \sqrt{2}$

$2\sqrt{2} + \sqrt{2}$

$3\sqrt{2}$

9) $\sqrt{32} - \sqrt{8}$

$\sqrt{16} \cdot \sqrt{2} - \sqrt{4} \cdot \sqrt{2}$

$4\sqrt{2} - 2\sqrt{2}$

$2\sqrt{2}$

10) $\sqrt{2}(\sqrt{12} - \sqrt{3})$

$\sqrt{2}(\sqrt{4} \cdot \sqrt{3} - \sqrt{3})$

$\sqrt{2}(2\sqrt{3} - \sqrt{3})$

$\sqrt{2}(\sqrt{3})$

$\sqrt{6}$

11) $\sqrt{8}(5\sqrt{8} + \sqrt{2})$

$\sqrt{4} \cdot \sqrt{2}(5\sqrt{4} \cdot \sqrt{2} + \sqrt{2})$

$2\sqrt{2}(5 \cdot 2 \cdot \sqrt{2} + \sqrt{2})$

$2\sqrt{2}(10\sqrt{2} + \sqrt{2})$

$2\sqrt{2}(11\sqrt{2})$

$22\sqrt{4}$

$22 \cdot 2$

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To multiply radicals, multiply the numbers in front of the radicals and multiply the radicands.

7b) $2\sqrt{2} \cdot 3\sqrt{2} = 6\sqrt{4} = 6 \cdot 2 = 12$

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Write the radical in simplest form.

1. $\sqrt{45}$

Simplify the radical expression.

2. $\sqrt{20}+\sqrt{5}$

Perform the indicated operation on the polynomials.

3. $(2x^3-4x+12)+(6x^2-8x^3-2)$

4. $(-3x^2+10x-3)-(-3x^2-2x+4)$

5. $(2x^2-4x)(-5x^2+x-3)$

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Write the radical in simplest form.

1. $\sqrt{45}$ $\quad \sqrt{9\cdot 5}=\sqrt{9}\cdot\sqrt{5}=3\sqrt{5}$

Simplify the radical expression.

2. $\sqrt{20}+\sqrt{5}$ $\quad \sqrt{4\cdot 5}+\sqrt{5}=\sqrt{4}\cdot\sqrt{5}+\sqrt{5}$

$=2\cdot\sqrt{5}+\sqrt{5}=3\sqrt{5}$

Perform the indicated operation on the polynomials.

3. $(2x^3-4x+12)+(6x^2-8x^3-2)$

$2x^3-4x+12+6x^2-8x^3-2$

$-6x^3+6x^2-4x+10$

4. $(-3x^2+10x-3)-(-3x^2-2x+4)$

$\cancel{-3x^2}+10x-3\cancel{+3x^2}+2x-4$

$12x-7$

5. $(2x^2-4x)(-5x^2+x-3)$

	$-5x^2$	x	-3
$2x^2$	$-10x^4$	$2x^3$	$-6x^2$
$-4x$	$20x^3$	$-4x^2$	$12x$

$-10x^4+22x^3-10x^2+12x$