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Operations with Radical Expressions

Addition

Subtraction

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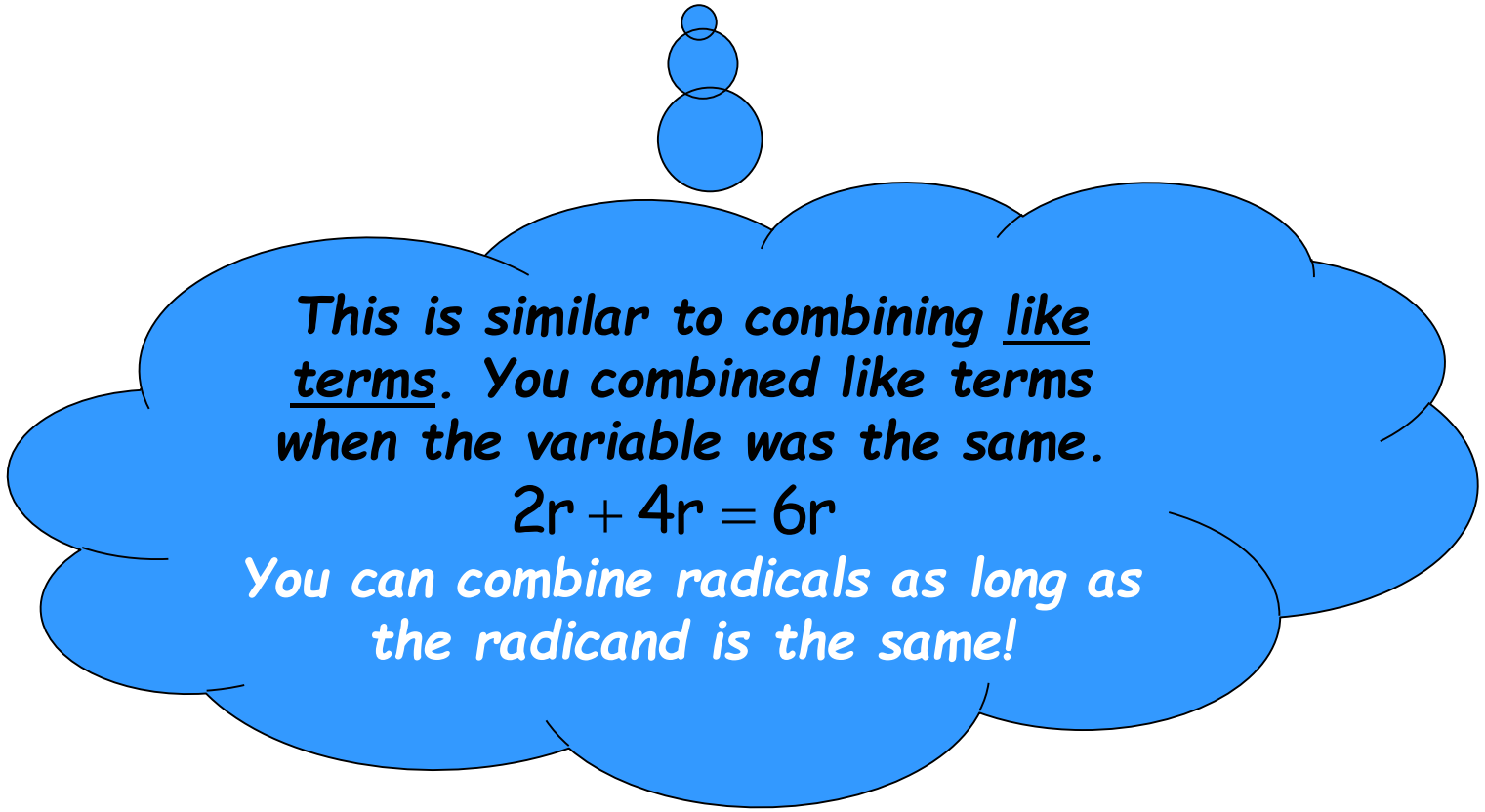
You can use the distributive property to simplify ***sums*** and ***differences*** of radical expressions ***when the expressions have the <u>same</u> radicand.***

$$2\sqrt{3} + 4\sqrt{3}$$

$$(2+4)\sqrt{3}$$

$$6\sqrt{3}$$



This is similar to combining <u>like terms</u>. You combined like terms when the variable was the same.

$$2r + 4r = 6r$$

You can combine radicals as long as the radicand is the same!

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You can use the distributive property to simplify ***sums*** and ***differences*** of radical expressions ***when the expressions have the <u>same</u> radicand.***

$$\sqrt{5} - 3\sqrt{5}$$

$$(1-3)\sqrt{5}$$

$$-2\sqrt{5}$$

You may need to simplify a radical before you simplify the expression.

$$4\sqrt{3} - \sqrt{27}$$

$$4\sqrt{3} - \sqrt{9 \cdot 3}$$

$$4\sqrt{3} - 3\sqrt{3}$$

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

$$\sqrt{3}$$

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Simplify the radical expression.

Example 1 $3\sqrt{7}-5\sqrt{7}+2\sqrt{7}$

Example 2 $8\sqrt{5}+\sqrt{125}$

Example 3 $3\sqrt{12}+5\sqrt{75}$

Example 4 $12\sqrt{5}+3\sqrt{7}+6\sqrt{7}-8\sqrt{5}$

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Simplify the radical expression.

Example 1

$$3\sqrt{7}-5\sqrt{7}+2\sqrt{7}$$

$$(3-5+2)\sqrt{7}$$

$$0\sqrt{7}$$

$$0$$

Example 2

$$8\sqrt{5}+\sqrt{125}$$

$$8\sqrt{5}+\sqrt{25\cdot 5}$$

$$8\sqrt{5}+5\sqrt{5}$$

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

$$13\sqrt{5}$$

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Simplify the radical expression.

Example 3

$$3\sqrt{12}+5\sqrt{75}$$

$$3\sqrt{4\cdot 3}+5\sqrt{25\cdot 3}$$

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

$$6\sqrt{3}+25\sqrt{3}$$

$$31\sqrt{3}$$

Example 4

$$12\sqrt{5}+3\sqrt{7}+6\sqrt{7}-8\sqrt{5}$$

$$12\sqrt{5}-8\sqrt{5}+3\sqrt{7}+6\sqrt{7}$$

$$(12-8)\sqrt{5}+(3+6)\sqrt{7}$$

$$4\sqrt{5}+9\sqrt{7}$$

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Simplify the radical expression.

1) $\sqrt{20}+2\sqrt{5}-3\sqrt{5}$

$\sqrt{4\cdot5}+2\sqrt{5}-3\sqrt{5}$

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

$(2+2-3)\sqrt{5}$

$\sqrt{5}$

2) $2\sqrt{20}+3\sqrt{45}+\sqrt{180}$

$2\sqrt{4\cdot5}+3\sqrt{9\cdot5}+\sqrt{36\cdot5}$

$2\cdot2\sqrt{5}+3\cdot3\sqrt{5}+6\sqrt{5}$

$4\sqrt{5}+9\sqrt{5}+6\sqrt{5}$

$(4+9+6)\sqrt{5}$

$19\sqrt{5}$

You may need to simplify a radical before you simplify the expression.

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Simplify the radical expression.

3) $4\sqrt{54}+2\sqrt{24}-\sqrt{150}$

$4\sqrt{9\cdot 6}+2\sqrt{4\cdot 6}-\sqrt{25\cdot 6}$

$4\cdot 3\sqrt{6}+2\cdot 2\sqrt{6}-5\sqrt{6}$

$12\sqrt{6}+4\sqrt{6}-5\sqrt{6}$

$(12+4-5)\sqrt{6}$

$11\sqrt{6}$

4) $4\sqrt{12}-6\sqrt{48}-5\sqrt{24}$

$4\sqrt{4\cdot 3}-6\sqrt{16\cdot 3}-5\sqrt{4\cdot 6}$

$4\cdot 2\sqrt{3}-6\cdot 4\sqrt{3}-5\cdot 2\sqrt{6}$

$8\sqrt{3}-24\sqrt{3}-10\sqrt{6}$

$(8-24)\sqrt{3}-10\sqrt{6}$

$-16\sqrt{3}-10\sqrt{6}$

You may need to simplify a radical before you simplify the expression.

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Simplify the radical expression.

5) $6\sqrt{27}+8\sqrt{12}+2\sqrt{75}$

$6\sqrt{9\cdot 3}+8\sqrt{4\cdot 3}+2\sqrt{25\cdot 3}$

$6\cdot 3\sqrt{3}+8\cdot 2\sqrt{3}+2\cdot 5\sqrt{3}$

$18\sqrt{3}+16\sqrt{3}+10\sqrt{3}$

$(18+16+10)\sqrt{3}$

$44\sqrt{3}$

Need common denominators.

6) $\sqrt{3}+\sqrt{\frac{1}{3}}$

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

$\frac{3}{3}\cdot\sqrt{3}+\frac{\sqrt{3}}{3}$

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

$\frac{4\sqrt{3}}{3}$ or $\frac{4}{3}\sqrt{3}$

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Simplify the radical expression.

7) $\sqrt{12}+\sqrt{\frac{1}{3}}$

$\sqrt{4\cdot 3}+\frac{\sqrt{1}}{\sqrt{3}}$

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

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

$\frac{6\sqrt{3}}{3}+\frac{\sqrt{3}}{3}$

$\frac{7\sqrt{3}}{3}$ or $\frac{7}{3}\sqrt{3}$

8) $\sqrt{54}-\sqrt{\frac{1}{6}}$

$\sqrt{9\cdot 6}-\frac{\sqrt{1}}{\sqrt{6}}$

$3\sqrt{6}-\frac{\sqrt{1}}{\sqrt{6}}\cdot\frac{\sqrt{6}}{\sqrt{6}}$

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

$\frac{18\sqrt{6}}{6}-\frac{\sqrt{6}}{6}$

$\frac{17\sqrt{6}}{6}$ or $\frac{17}{6}\sqrt{6}$

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Simplify the radical expression.

9) $\sqrt{125}-2\sqrt{\frac{1}{5}}+\sqrt{\frac{1}{3}}$

$\sqrt{25\cdot 5}-2\frac{\sqrt{1}}{\sqrt{5}}+\frac{\sqrt{1}}{\sqrt{3}}$

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

$5\sqrt{5}-2\frac{1}{\sqrt{5}}\left(\frac{\sqrt{5}}{\sqrt{5}}\right)+\frac{1}{\sqrt{3}}\left(\frac{\sqrt{3}}{\sqrt{3}}\right)$

$\left(\frac{5}{5}\right)5\sqrt{5}-2\frac{\sqrt{5}}{5}+\frac{\sqrt{3}}{3}$

$\frac{25\sqrt{5}}{5}-2\frac{\sqrt{5}}{5}+\frac{\sqrt{3}}{3}$

$\frac{23\sqrt{5}}{5}+\frac{\sqrt{3}}{3}$