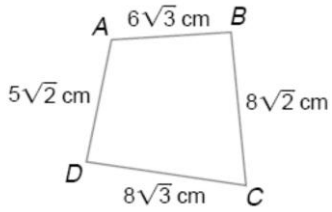
Operations with Radical Expressions

To find the exact perimeter of quadrilateral *ABCD*, you need to add radical expressions.



Perimeter of ABCD = $6\sqrt{3}+8\sqrt{2}+5\sqrt{2}+8\sqrt{3}$
The question here, can we simplify this expression? What are the conditions to add radical expressions?

Rule 1: Radical expressions with the same radicands can be added or subtracted in the same way that monomials are added or subtracted. Similar radicals have the same radicand. We add them as like terms.

Monomials	Radical Expressions
$5x+3x=(5+3)x=8x$	$6\sqrt{2}+4\sqrt{2}=(6+4)\sqrt{2}=10\sqrt{2}$
$8y-4y=(8-4)y=4y$	$9\sqrt{3}-5\sqrt{3}=(9-5)\sqrt{3}=4\sqrt{3}$
$8y-3x$ can't subtract because they are not like terms	$4\sqrt{2}+7\sqrt{3}$ can't add because the numbers under root sign are different

Notice that the Distributive Property was used to simplify each radical expression.
Example 1: Simplify each expression.

1) $6\sqrt{7}+4\sqrt{7}-12\sqrt{7}$

$$6\sqrt{7}+4\sqrt{7}-12\sqrt{7}$$
$$=(6+4-12)\sqrt{7}$$
$$=-2\sqrt{7}$$

2) $-4\sqrt{50}+7\sqrt{2}+5\sqrt{32}$

$$-4\sqrt{50}+7\sqrt{2}+5\sqrt{32}$$
$$=-4\sqrt{2\times5^2}+7\sqrt{2}+5\sqrt{2\times4^2}$$
$$=-20\sqrt{2}+7\sqrt{2}+20\sqrt{2}$$
$$=(-20+7+20)\sqrt{2}$$
$$=7\sqrt{2}$$

3) $11\sqrt{48}-9\sqrt{18}+8\sqrt{27}-5\sqrt{50}$

$$
\begin{aligned}
&11\sqrt{48}-9\sqrt{18}+8\sqrt{27}-5\sqrt{50}\\
&=11\sqrt{3\times 4^2}-9\sqrt{2\times 3^2}+8\sqrt{3\times 3^2}-5\sqrt{2\times 5^2}\\
&=44\sqrt{3}-27\sqrt{2}+24\sqrt{3}-25\sqrt{2}\\
&=44\sqrt{3}+24\sqrt{3}-27\sqrt{2}-25\sqrt{2}\\
&=(44+24)\sqrt{3}+(-27-25)\sqrt{2}\\
&=68\sqrt{3}-52\sqrt{2}
\end{aligned}
$$

The expression $68\sqrt{3}-52\sqrt{2}$ cannot be simplified for the following reasons:

- The radicands are different.
- There are no common factors.
- Each radicand is in simplest form.