Adding and Subtracting Surds

When you simplified basic algebraic expressions, you had to follow the rule that you could only combine like terms. Surds are the same, we can only combine same surds when we either add or subtract them.

Example

$$7\sqrt{7} - 3\sqrt{7} = 4\sqrt{7}$$

If I have integers included in the sum, I can group them, but cannot combine them with the surd

Example

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

$$9 + 3\sqrt{3}$$

We may need to simplify before we combine common terms

Example

$$3\sqrt{27} + 2\sqrt{18} + 3\sqrt{8} - \sqrt{75}$$

First expand

$$3\sqrt{9 \times 3} + 2\sqrt{9 \times 2} + 3\sqrt{4 \times 2} - \sqrt{25 \times 3}$$

$$3\sqrt{9}\sqrt{3} + 2\sqrt{9}\sqrt{2} + 3\sqrt{4}\sqrt{2} - \sqrt{25}\sqrt{3}$$

Now simplify

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

$$9\sqrt{3} + 6\sqrt{2} + 6\sqrt{2} - 5\sqrt{3}$$

$$4\sqrt{3} + 12\sqrt{2}$$

<u>Exercise A</u>

1) $\sqrt{8} + \sqrt{18}$
2) $\sqrt{20} + \sqrt{45}$
3) $2\sqrt{28} + 3\sqrt{63}$
4) $3\sqrt{45} + 4 + 2\sqrt{80} + 2$
5) $2\sqrt{363} + 7 + 7 + 2\sqrt{108}$
6) $\sqrt{20} + \sqrt{32} + \sqrt{45} + \sqrt{8}$
7) $\sqrt{45} + \sqrt{75} + \sqrt{27} + \sqrt{20}$
8) $2\sqrt{108} + 3\sqrt{50} + 2\sqrt{12} + 2\sqrt{18}$
9) $\sqrt{90} + 3\sqrt{28} + \sqrt{63} + 2\sqrt{40}$
10) $\sqrt{32} + 3\sqrt{72} + 3\sqrt{12} + 2\sqrt{27}$
11) $\sqrt{80} - \sqrt{20}$
12) $\sqrt{48} - \sqrt{27}$
13) $2\sqrt{32} - 3\sqrt{8}$
14) $3\sqrt{50} - 5 - 4 - 2\sqrt{32}$

15) $2\sqrt{147} - 3 - 2\sqrt{48} - 5$
16) $\sqrt{32} - \sqrt{20} - \sqrt{45} - \sqrt{8}$
17) $\sqrt{72} - \sqrt{48} - \sqrt{18} - \sqrt{27}$
18) $2\sqrt{99} - 3\sqrt{125} - 3\sqrt{20} - 2\sqrt{44}$
19) $4\sqrt{40} - 4\sqrt{90} - 2\sqrt{20} - 3\sqrt{45}$
20) $5\sqrt{200} - 5\sqrt{28} - 3\sqrt{63} - 2\sqrt{18}$
21) $\sqrt{128} - \sqrt{20} - \sqrt{45} + \sqrt{72}$
22) $\sqrt{18} - \sqrt{50} + \sqrt{125} - \sqrt{45}$
23) $\sqrt{32} + \sqrt{98} - \sqrt{147} - \sqrt{48}$
24) $\sqrt{8} - \sqrt{98} + 8 + \sqrt{108} - 5 + \sqrt{75}$
25) $\sqrt{242} + \sqrt{75} + \sqrt{50} - \sqrt{363}$
26) $\sqrt{176} + \sqrt{117} - 5 - \sqrt{275} + 5 + \sqrt{52}$

Exercise **B**

What is the perimeter of this shape ?
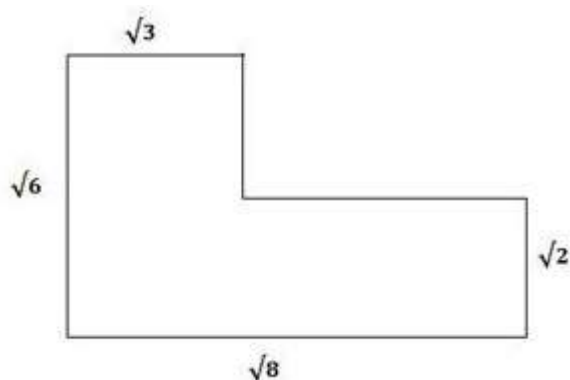
Answers

Exercise A

1) $5\sqrt{2}$
2) $5\sqrt{5}$
3) $13\sqrt{7}$
4) $6 + 17\sqrt{5}$
5) $14 + 34\sqrt{3}$
6) $5\sqrt{5} + 6\sqrt{2}$
7) $5\sqrt{5} + 8\sqrt{3}$
8) $16\sqrt{3} + 21\sqrt{2}$
9) $7\sqrt{10} + 9\sqrt{7}$
10) $22\sqrt{2} + 12\sqrt{3}$
11) $2\sqrt{5}$
12) $\sqrt{3}$
13) $2\sqrt{2}$
14) $7\sqrt{2} - 9$
15) $6\sqrt{3} - 8$
16) $2\sqrt{2} - 5\sqrt{5}$
17) $3\sqrt{2} - 7\sqrt{3}$
18) $2\sqrt{11} - 21\sqrt{5}$
19) $-4\sqrt{10} - 13\sqrt{5}$
20) $44\sqrt{2} - 19\sqrt{7}$
21) $14\sqrt{2} - 5\sqrt{5}$
22) $-2\sqrt{2} + 2\sqrt{5}$
23) $23\sqrt{2} - 11\sqrt{3}$
24) $-5\sqrt{2} + 11\sqrt{3} + 3$
25) $16\sqrt{2} - 6\sqrt{3}$
26) $-\sqrt{11} + 5\sqrt{13}$

Answer – Exercise B

$4\sqrt{2} + 2\sqrt{6}$