Adding and subtracting surds

Year 10 Maths
Advanced

Learning Objectives

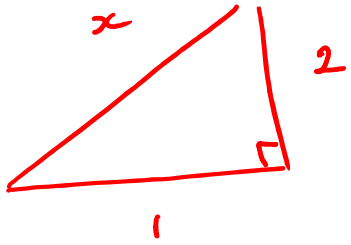
By the end of the lesson I would hope that you have an understanding and be able to apply to questions the following concepts:

- Understand how to add and subtract surds
- Understand the conditions in which you can add and subtract surds

Recap

In the previous lesson we looked at how we can simplify surds and how to turn them back into the root of a positive integer.

This lesson we're going to look at how to add and subtract surds. This process is made much easier if we have the simplified versions of the surds.



$$\sqrt{72}$$

$$= \sqrt{36 \times 2}$$

$$= \sqrt{36} \times \sqrt{2}$$

$$= 6\sqrt{2}$$

Adding and subtracting surds

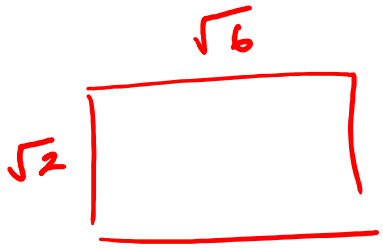
It is important to note that, like with algebra and indices, there are certain conditions which must be met before you can add or subtract surds.

With **fractions** you can only add fractions when the denominators are the same

With **indices** you can only multiply or divide them when the base numbers are the same

With algebra you can only add and subtract **like terms**.

With **surds** you can only add or subtract when the number under the root signs are the same. These are, effectively, like terms.



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

$a^2 \times a^4 = a^6$

$3x^2 + x^2 = 4x^2$

Examples of adding and subtracting surds

Simplify the following:

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

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

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

$= 6\sqrt{3}$

$4\sqrt{6} + 3\sqrt{2}$

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

$\sqrt{6} + 5\sqrt{2}$

Examples have been extracted, with permission, from the Cambridge Essential Mathematics Series of textbooks

Simplifying surds to then add and subtract

Remember that Barry doesn't like to make things easy for you.

We always need to check, with each surd, if it's possible to simplify it. All surds should be written in simplified form.

The same was true with fractions.

In a later lesson I'll also tell you that we're not allowed surds to be placed in the denominator of a fraction.

$$3\sqrt{2} - \sqrt{8}$$

$$= 3\sqrt{2} - \sqrt{4 \times 2}$$

$$= 3\sqrt{2} - \sqrt{4} \times \sqrt{2}$$

$$= 3\sqrt{2} - 2\sqrt{2}$$

$$= \underline{\underline{\sqrt{2}}}$$

Examples of simplifying surds to add and subtract them

Simplify the following surds

$7\sqrt{2} - \sqrt{8}$

$2\sqrt{3} - 2\sqrt{27} + 3\sqrt{12}$

- $7\sqrt{2} - \sqrt{8}$

$= 7\sqrt{2} - \sqrt{4 \times 2}$

$= 7\sqrt{2} - \sqrt{4} \times \sqrt{2}$

$= 7\sqrt{2} - 2\sqrt{2}$

$= 5\sqrt{2}$

$2\sqrt{3} - 2\sqrt{27} + 3\sqrt{12}$

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

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

$= 2\sqrt{3} - 6\sqrt{3} + 6\sqrt{3}$

$= 2\sqrt{3}$

Examples have been extracted, with permission, from the Cambridge Essential Mathematics Series of textbooks