What are Surds?

Surds are irrational numbers that can't be simplified into a whole number or a simple fraction, and they are usually written as roots. For example, √2 (square root of 2) is a surd because it cannot be simplified into a whole number.

Why do we use Surds?

Sometimes, when you calculate square roots, you do not get a perfect whole number, and instead of giving a decimal approximation, we express the answer as a surd to keep it exact.

How to Simplify Surds

To simplify a surd, you look for the largest perfect square factor inside the root and take it outside. For example:

$\sqrt{50} = \sqrt{(25 \times 2)} = \sqrt{25} \times \sqrt{2} = 5\sqrt{2}$

Here, 25 is a perfect square, so we take it out of the root.

Adding and Subtracting Surds

You can add or subtract surds only if they have the same radical part (the part under the root). For example:

$3\sqrt{2} + 5\sqrt{2} = (3 + 5)\sqrt{2} = 8\sqrt{2}$

But if the surds are different, like √2 and √3, you cannot simplify by adding or subtracting.

Multiplying Surds

To multiply surds, multiply the numbers under the roots together, then simplify if possible:

$\sqrt{2} \times \sqrt{8} = \sqrt{(2 \times 8)} = \sqrt{16} = 4$

Rationalizing the Denominator

If you have a surd in the denominator, you should rationalize it to remove the surd. For example:

Example: $1 / \sqrt{3}$

Multiply numerator and denominator by √3:

$(1 \times \sqrt{3}) / (\sqrt{3} \times \sqrt{3}) = \sqrt{3} / 3$

Now the denominator is rational (no surd).

Summary:

- Surds represent exact irrational numbers as roots.
- To simplify surds, take out perfect squares.

- You can only add or subtract like surds.
- Multiply surds by multiplying under the root together.
- Rationalize the denominator to remove surds from the bottom of fractions.

Understanding surds is important for your IGCSE Maths exam, and practicing these steps will help you become confident with them.