AQA · GCSE · MATHEMATICS • EXERCISE SHEET

1.3.3 Surds

Name: _____ Class: _____ Date: _____

KEY WORDS surd

<!– Session 2 native-skill companion –>

Objective

Practise surds within the labelled native lessons. Public original tasks; locally authored answer guidance.

1 Key knowledge and worked examples

■ Exact surds and rationalising denominators · Higher

Extract square factors: $\sqrt{(a^2b)}=a\sqrt{b}$ for $a\geq0, b\geq0$. Add only matching root parts. Multiply roots with nonnegative radicands. To rationalise a denominator, multiply numerator and denominator by the same suitable root or conjugate.

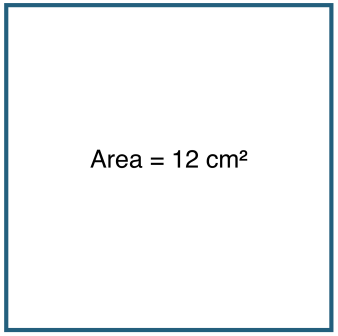
$$\sqrt{12}+\sqrt{27}=5\sqrt{3}, \quad \frac{6}{\sqrt{3}}=2\sqrt{3}$$

The side is $\sqrt{12}=\sqrt{(4\times3)}=2\sqrt{3}$ cm. Thus $\sqrt{12}+\sqrt{27}=2\sqrt{3}+3\sqrt{3}=5\sqrt{3}$. Also $6/\sqrt{3}=6\sqrt{3}/3=2\sqrt{3}$. For $1/(2+\sqrt{3})$, multiply by $(2-\sqrt{3})/(2-\sqrt{3})$: the denominator becomes $4-3=1$, giving $2-\sqrt{3}$. A circle of radius 3 has exact area 9π; a decimal is an approximation.

$\sqrt{(a+b)}$ generally differs from $\sqrt{a}+\sqrt{b}$. Match the radicand before collecting terms. Rationalising changes the form, not the value; multiplying only the denominator changes the value.

AQA N8 Higher requires exact surds and rationalisation. Foundation retains exact fractions and multiples of π; do not assign this surd lesson to Foundation.

An exact root describes the square



Original native-lesson illustration; labels belong to its worked example.

2 Practice

2.1 (Higher) Find the coefficient of $\sqrt{3}$ in $\sqrt{12}$.

2.2 (Higher) Find the coefficient of $\sqrt{3}$ in $\sqrt{12}+\sqrt{27}$.

2.3 (Higher) Find the coefficient of $\sqrt{3}$ in $6/\sqrt{3}$.

3 Exam-style questions

3.1 Decide whether this claim is true. Justify with a concrete calculation or counterexample: For every pair of positive numbers, $\sqrt{(a+b)}=\sqrt{a}+\sqrt{b}$.

Solutions

2.1 $12=4\times3$, so $\sqrt{12}=2\sqrt{3}$.

2.2 $\sqrt{12}=2\sqrt{3}$ and $\sqrt{27}=3\sqrt{3}$; add coefficients $2+3=5$.

2.3 Multiply by $\sqrt{3}/\sqrt{3}$: $6\sqrt{3}/3=2\sqrt{3}$.

3.1 False. Set $a=b=1$: $\sqrt{(1+1)}=\sqrt{2}$, whereas $\sqrt{1}+\sqrt{1}=2$. Their squares are 2 and 4.

Local review guidance: show the chosen method; give the checked result; explain the condition or failed shortcut. This is authored classroom guidance.