

Exercise walk-through

1.3.3

Surds

AQA · GCSE · Mathematics

14. Indices, surds, standard form and bounds (N7–N9, N14–N16)

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Bounds (N16, H): upper bound of a length 9 m to the nearest metre is 9.5; in calculations, for positive inputs, an upper product bound uses upper input bounds and an upper quotient bound uses upper numerator divided by lower denominator. Check signs first; these shortcuts need not hold for negative inputs. Track strict endpoints; give the answer to an appropriate degree of accuracy (often the bound width decides).

19. Checklist before you call this topic done

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Four operations on fractions/mixed numbers and negatives without a calculator; BIDMAS traps. Prime decomposition $\rightarrow$ HCF/LCM; product rule for counting (H). Index laws including negative and fractional; simplify and rationalise surds (H). Standard form arithmetic; rounding and error intervals; upper/lower bounds through a formula (H). FDP conversions including recurring decimals (H); percentage multipliers and reverse percentages.

40. Indices, surds and standard form · Higher

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$0.000072 = 7.2 \times 10^{-5}$. Also $16^{(3/4)} = (16^{(1/4)})^3 = 2^3 = 8$. Simplify $\sqrt{72} = 6\sqrt{2}$, then rationalise $1/\sqrt{2} = \sqrt{2}/2$. Useful powers include $3^3 = 27$, $4^3 = 64$, $5^3 = 125$, $15^2 = 225$ and $10^6 = 1,000,000$. Integer laws give $2^0 = 1$, $2^{-3} = 1/8$ and $(2^3)^2 = 2^6 = 64$. For standard-form multiplication, $(3 \times 10^5)(4 \times 10^{-3}) = 12 \times 10^2 = 1.2 \times 10^3$. Division gives $(6 \times 10^5)/(2 \times 10^2) = 3 \times 10^3$. For addition, first align exponents: $3 \times 10^4 + 2 \times 10^3 = 3.2 \times 10^4$. For a positive base, $a^{(m/n)} = (\text{the } n\text{th root of } a)^m$. Thus $27^{(2/3)} = 3^2 = 9$ and $16^{(-1/2)} = 1/4$.

Exercises 2.1·2.3

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

Exercises 2.1·2.3

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

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

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

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

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

3 Exam-style questions

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

Exercise 3.1

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

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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.