Exercise walk-through

# 1.3.3
# Surds

AQA · GCSE · Mathematics

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

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

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

## Checklist before you call this topic done

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

## Indices, surds and standard form · Higher

0.000072=7.2×10^(-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, $(3\times10^5)(4\times10^{(-3)})=12\times10^2=1.2\times10^3$. Division gives $(6\times10^5)/(2\times10^2)=3\times10^3$. For addition, first align exponents: $3\times10^4+2\times10^3=3.2\times10^4$. For a positive base, a^(m/n)=(the nth 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 $6/\sqrt{3}$.

# Exercises 2.1·2.3

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

**2.1** $12=4\times3$, 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 $6/\sqrt{3}$.

**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, $\sqrt{(a+b)}=\sqrt{a}+\sqrt{b}$.

# Exercise 3.1

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

**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.