Exercise walk-through

E1.3
Powers and roots

IGCSE Mathematics

You must be able to

- recall squares to 15^2 and the cubes of 1–5 and 10
- find square roots and cube roots
- evaluate expressions combining powers and roots

1 The method

Method — Powers and roots

- **Power** : $2^5 = 32$. **Square root** : $\sqrt{169} = 13$. **Cube root** : $\sqrt[3]{8} = 2$.
- **Worked:** $5^2 \times \sqrt[3]{8} = 25 \times 2 = 50$.
- Recall squares $(1\text{–}15)$ and cubes $(1, 2, 3, 4, 5, 10)$.

Answer shapes: M1 a correct method, **A1** the correct answer.

Exercises 2.1·2.3

2.1 Work out $\sqrt{196}$. [1]

2.2 Work out $\sqrt[3]{27} + 4^2$. [2]

2.3 Work out $\sqrt{144} - \sqrt[3]{64}$. [2]

Exercises 2.1·2.3

2.1 Work out $\sqrt{196}$. [1]

2.1

- $\sqrt{196} = \mathbf{14}$

2.2 Work out $\sqrt[3]{27} + 4^2$. [2]

2.2

- $\sqrt[3]{27} = 3$ and $4^2 = 16$
- $3 + 16 = \mathbf{19}$

2.3 Work out $\sqrt{144} - \sqrt[3]{64}$. [2]

2.3

- $\sqrt{144} = 12$, $\sqrt[3]{64} = 4$
- $12 - 4 = \mathbf{8}$

Exercises 3.1·3.3

3.1 Work out $3^3 - \sqrt{121}$. [2]

3.2 Work out $\sqrt{169} \times \sqrt[3]{125}$. [2]

3.3 Work out the value of $\sqrt{2^2 + 3^2 + 6^2}$. [2]

Exercises 3.1·3.3

3.1 Work out $3^3 - \sqrt{121}$. [2]

3.1

- $3^3 = 27$, $\sqrt{121} = 11$
- $27 - 11 = \mathbf{16}$

3.2 Work out $\sqrt{169} \times \sqrt[3]{125}$. [2]

3.2

- $\sqrt{169} = 13$, $\sqrt[3]{125} = 5$
- $13 \times 5 = \mathbf{65}$

3.3 Work out the value of $\sqrt{2^2 + 3^2 + 6^2}$. [2]

3.3

- $2^2 + 3^2 + 6^2 = 4 + 9 + 36 = 49$
- $\sqrt{49} = \mathbf{7}$

Exercise 3.4 (a)

3.4 A cube has a volume of 2 197 cm^3.

(a) Find the length of one edge, and hence the total surface area of the cube. [4]

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(a)

- edge $= \sqrt[3]{2197} = \mathbf{13}$ cm
- surface area $= 6 \times 13^2 = 6 \times 169 = \mathbf{1014}$ $\text{cm}^{\mathbf{2}}$

Exercise 3.4 (b)

3.4 A cube has a volume of 2 197 cm^3.

(b) A second cube has edges twice as long. Write down the ratio of the surface areas and the ratio of the volumes of the two cubes, and explain how you obtained them. [4]

Exercise 3.4 (b)

3.4 A cube has a volume of 2 197 cm^3.

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(b)

- lengths $1 : 2$, so areas $1^2 : 2^2 = \mathbf{1} : \mathbf{4}$
- volumes $1^3 : 2^3 = \mathbf{1} : \mathbf{8}$
- area squares the length ratio; volume cubes it

Exercise 3.4 (c)

3.4 A cube has a volume of 2 197 cm^3.

(c) Without a calculator, show that $\sqrt[3]{\frac{64}{125}} \times \sqrt{\frac{81}{16}} = \frac{9}{5}$. [4]

Exercise 3.4 (c)

3.4 A cube has a volume of 2 197 cm^3.

(c) Without a calculator, show that $\sqrt[3]{\frac{64}{125}} \times \sqrt{\frac{81}{16}} = \frac{9}{5}$. [4]

(c)

- $\sqrt[3]{\frac{64}{125}} = \frac{4}{5}$
- $\sqrt{\frac{81}{16}} = \frac{9}{4}$

$$\frac{4}{5} \times \frac{9}{4} = \mathbf{\frac{9}{5}}$$