

C1.3 Powers and roots

Name: _____ Class: _____ Date: _____ **Total: 20 marks**

KEY WORDS cube root 立方根 • square root 平方根 • area 面积 • volume 体积 • power 幂

Objective

Use powers and roots to solve Core IGCSE Mathematics problems.

You must be able to:

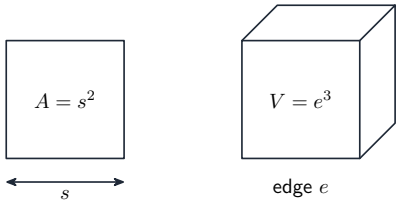
- Evaluate squares, cubes and their roots
- Distinguish a negative base from a negative sign outside a power
- Recover a positive length from an area or volume

1 Key knowledge and worked examples

■ Key knowledge: Powers and roots

A power repeats multiplication, not addition. $a^2 = a \times a$ and $a^3 = a \times a \times a$. The square root is the nonnegative number whose square is the given value. A cube root can be negative. Learn squares from 1 to 15 and cubes of 1, 2, 3, 4, 5 and 10. Brackets decide whether a minus sign is part of the base.

■ Worked example: Powers and roots



Find $(-3)^2 + \sqrt[3]{64}$.

- Square the whole bracket: $(-3)^2 = (-3)(-3) = 9$.
- Since $4^3 = 64$, $\sqrt[3]{64} = 4$.
- Thus $Q = (-3)^2 + \sqrt[3]{64} = 9 + 4 = 13$. By contrast, $-3^2 = -(3^2) = -9$.

■ Method check

Brackets decide whether a minus sign is squared: $(-a)^2$ is positive, while $-a^2$ is the negative of a square. A physical side length is positive.

2 Practice

2.1 Find 12^2 and $\sqrt{225}$. [2]

2.2 Find 5^3 and $\sqrt[3]{-27}$. [2]

2.3 Calculate 3^4 and $\sqrt[4]{16}$. [2]

2.4 Calculate $2^3 \times \sqrt{49}$. [2]

3 Exam-style questions

3.1 Apply the powers and roots methods below. Show working and include units where appropriate.

(a) A square has area 196 cm^2 . Find its side length. [2]

(b) A cube has volume 1000 cm^3 . Find its edge length. [2]

(c) Find the sum of the square perimeter and the total length of the 12 cube edges. [2]

3.2 A square tile has area 144 cm^2 . A cube has volume 216 cm^3 .

(a) Find the tile side and cube edge, stating which root is needed for each. [3]

(b) A student claims that $(-4)^2 = -4^2$. Calculate both expressions and explain the role of the brackets. [3]
