

The Panda Math Tutor

Powers and Roots

IGCSE Mathematics

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1 Introduction to Powers and Roots

Note

Powers (also called indices or exponents) and roots are essential tools in mathematics. They allow us to express repeated multiplication concisely and to reverse this process. These concepts are heavily tested in IGCSE examinations and are vital for algebra, number theory, and scientific applications.

In this chapter, we will explore:

- Understanding powers (indices) — [Section 2](#)
- The laws of indices — [Section 3](#)
- Square roots and cube roots — [Section 4](#)
- Fractional and negative indices — [Section 5](#)
- Standard form (scientific notation) — [Section 7](#)
- Applications to real-world problems — [Section 9](#)

2 Powers (Indices)

Definition

A **power** (or **index**) tells us how many times a number is multiplied by itself. We write a^n where:

- a is called the **base**
- n is called the **index** (or exponent or power)

$$a^n = \underbrace{a \times a \times a \times \cdots \times a}_{n \text{ times}}$$

Example: $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

Note**Key Terminology:**

- a^2 is read as “ a squared”
- a^3 is read as “ a cubed”
- a^n is read as “ a to the power of n ”

Example

Evaluate each of the following:

(a) 4^3 (b) $(-3)^3$ (c) -3^4 (d) 10^5

Solution:

(a) $4^3 = 4 \times 4 \times 4 = 64$
(b) $(-3)^3 = (-3) \times (-3) \times (-3) = -27$
(c) $-3^4 = -(3 \times 3 \times 3 \times 3) = -81$
(d) $10^5 = 100\,000$

Warning

Common Mistake: Confusing $(-3)^4$ and -3^4 !

- $(-3)^4 = (-3) \times (-3) \times (-3) \times (-3) = +81$ (the negative is **INSIDE** the bracket)
- $-3^4 = -(3 \times 3 \times 3 \times 3) = -81$ (the negative is **OUTSIDE** — only the 3 is raised to the power)

Rule of thumb:

- A **negative base raised to an even power** gives a **positive** result
- A **negative base raised to an odd power** gives a **negative** result

Preview ends here

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