The Panda Math Tutor

Powers and Roots

IGCSE Mathematics

The Panda Math Tutor

Prepared by

Nikolas Agisilaou

Quality Mathematics Education for Students

Contents

1 Introduction to Powers and Roots **2**

2 Powers (Indices) **2**

3 Laws of Indices **4**
3.1 Law 1: Multiplying Powers (Same Base) . . . 5
3.2 Law 2: Dividing Powers (Same Base) . . . 5
3.3 Law 3: Power of a Power . . . 6
3.4 Law 4: Zero Index . . . 7
3.5 Law 5: Negative Indices . . . 7

4 Roots **8**
4.1 Square Roots . . . 9
4.2 Cube Roots . . . 10

5 Fractional Indices **11**

6 Combined Index Problems **13**

7 Standard Form (Scientific Notation) **15**

8 Surds (Introduction) **17**

9 Real-World Applications **19**
9.1 Worked Problems . . . 19

10 Summary **20**

11 Additional Resources **22**
11.1 Tips for Success in IGCSE Exams . . . 22
11.2 Common Exam Questions . . . 22

The Panda Math Tutor

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

The Panda Math Tutor

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:

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

The Panda Math Tutor

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

20 more pages are in the full pack.

Powers and Roots — Main Notes — €9.99

Buy the pack and the complete PDF lands in your inbox.

Personal study use only — please don't resell or share.