

E1.7 Indices I

Name: _____ Class: _____ Date: _____

Total: 9 marks**KEY WORDS** indices 指数 • laws of indices 指数定律 • power 幂 • prime factor 质因数 • factor 因数

Objective

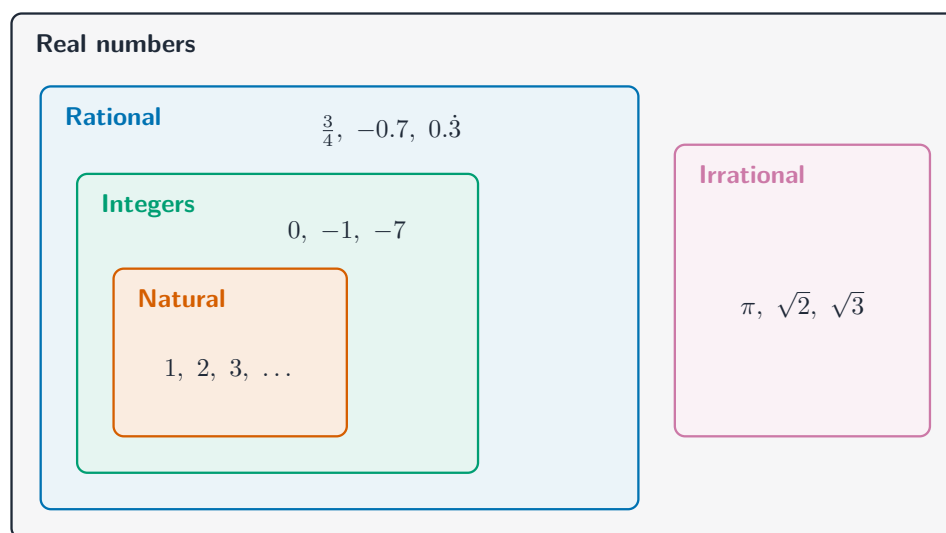
Build the skills to answer Extended exam questions on **indices** 指数 — the **laws of indices** 指数定律, and **zero, negative and fractional** 零、负、分数 powers.

You must be able to:

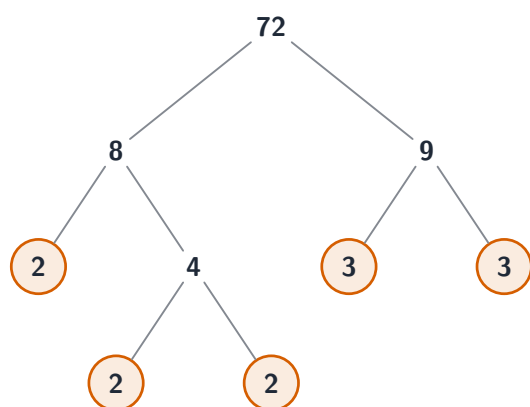
- use $a^m \times a^n = a^{m+n}$, $a^m \div a^n = a^{m-n}$, $(a^m)^n = a^{mn}$
- evaluate a^0 , a^{-n} and $a^{\frac{m}{n}}$
- simplify expressions with indices

1 Worked examples

■ Laws of indices



Add powers to multiply; subtract to divide



$$72 = 2^3 \times 3^2$$

Indices appear when a number is written in prime factors

$$a^m \times a^n = a^{m+n} \quad a^m \div a^n = a^{m-n} \quad (a^m)^n = a^{mn}$$

$$a^0 = 1 \quad a^{-n} = \frac{1}{a^n} \quad a^{\frac{m}{n}} = \left(\sqrt[n]{a}\right)^m$$

- **Worked:** $2^{-3} \times 2^4 = 2^1 = 2$; $(2^3)^2 = 2^6 = 64$; $8^{-\frac{2}{3}} = \frac{1}{(\sqrt[3]{8})^2} = \frac{1}{4}$.

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

2 Practice

2.1 Simplify $x^5 \times x^3$. [1]

2.2 Work out the value of 2^{-3} . [1]

2.3 Work out the value of $81^{\frac{1}{2}}$. [1]

3 Exam-style questions

3.1 Simplify $(2a^2)^3$. [2]

3.2 Work out the value of $27^{\frac{2}{3}}$. [2]

3.3 Work out the value of $16^{-\frac{1}{2}}$. [2]

Solutions

Marking: **M1** a correct method, **A1** the correct answer.

2.1 $x^5 \times x^3 = x^8$.

2.2 $2^{-3} = \frac{1}{2^3} = \frac{1}{8}$.

2.3 $81^{\frac{1}{2}} = \sqrt{81} = 9$.

3.1 $(2a^2)^3 = 2^3 a^6 = 8a^6$.

3.2 $27^{\frac{2}{3}} = (\sqrt[3]{27})^2 = 3^2 = 9$.

3.3 $16^{-\frac{1}{2}} = \frac{1}{16^{\frac{1}{2}}} = \frac{1}{\sqrt{16}} = \frac{1}{4}$.