

Exercise walk-through

Indices I ■ E1.7

eXercise

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

Method — Laws of indices

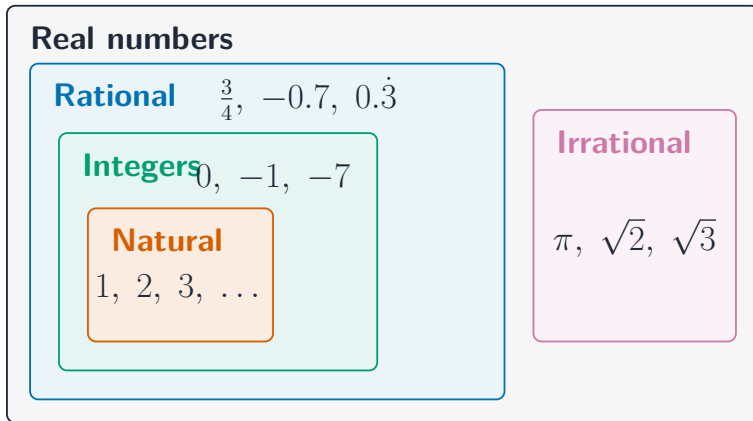
$$a^m \times a^n = a^{m+n} \quad a^m \div a^n = a^{m-n} \quad (a^m)^n = a^{mn}$$

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

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

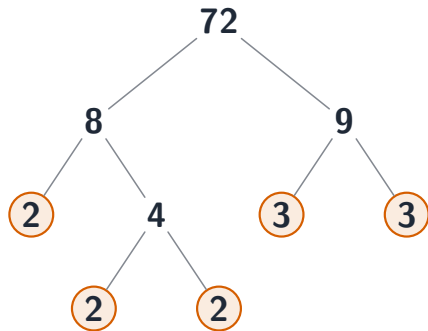
Answer shapes: **M1** a correct method, **A1** the correct answer.

Method — Laws of indices



Each kind of number sits inside the next

Method — Laws of indices



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

Indices appear when a number is written in prime factors

Practice 2.1 ■ 1 mark

Simplify $x^5 \times x^3$.

Solution 2.1

Worked steps

$$x^5 \times x^3 = x^8 \quad \text{B1}.$$

Practice 2.2 ■ 1 mark

Work out the value of 2^{-3} .

Solution 2.2

Worked steps

$$2^{-3} = \frac{1}{2^3} = \frac{1}{8} \text{ B1.}$$

Practice 2.3 ■ 1 mark

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

Solution 2.3

Worked steps

$$81^{\frac{1}{2}} = \sqrt{81} = 9 \quad \text{B1}.$$

Exam-style 3.1 ■ 2 marks

Simplify $(2a^2)^3$.

Solution 3.1

Method: Laws of indices

Worked steps

$$(2a^2)^3 = 2^3 a^6 = 8a^6 \quad \text{M1} \quad \text{A1} \quad \text{for } 2^3 \text{ or } a^6; \text{ for } 8a^6.$$

Exam-style 3.2 ■ 2 marks

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

Solution 3.2

Worked steps

$$27^{\frac{2}{3}} = (\sqrt[3]{27})^2 = 3^2 = 9 \quad \text{M1} \quad \text{A1} \quad \text{for } \sqrt[3]{27} = 3; \text{ for } 9.$$

Exam-style 3.3 ■ 2 marks

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

Solution 3.3

Worked steps

$$16^{-\frac{1}{2}} = \frac{1}{16^{\frac{1}{2}}} = \frac{1}{\sqrt{16}} = \frac{1}{4} \quad \text{M1} \quad \text{A1} \quad \text{for } \frac{1}{\sqrt{16}}; \text{ for } \frac{1}{4}.$$