

Exercise walk-through

C1.7

Indices I

IGCSE Mathematics

You must be able to

- Use zero and negative integer indices
- Apply product, quotient and power rules
- Separate index laws for products from ordinary addition

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The method

Method — Key knowledge: Indices I

For a nonzero base, $a^0 = 1$ and $a^{-n} = 1/a^n$. Same-base multiplication adds indices; division subtracts them. A power of a power multiplies indices. These rules need the same base: $2^3 \times 3^2$ cannot be combined by adding the indices.

Exercises 2.1·2.3

2.1 Find 9^0 and 2^{-3} . [2]

2.2 Calculate $3^2 \times 3^3$. [2]

2.3 Calculate $2^3 \div 2^5$. [2]

Exercises 2.1·2.3

2.1 Find 9^0 and 2^{-3} . [2]

2.1

- Zero index gives **1**; $2^{-3} = 1/2^3 = 1/8$.

2.2 Calculate $3^2 \times 3^3$. [2]

2.2

- Add indices: $Q = 3^{2+3} = 3^5 = \mathbf{243}$.

2.3 Calculate $2^3 \div 2^5$. [2]

2.3

- Subtract indices: $Q = 2^{3-5} = 2^{-2} = 1/4$.

Exercise 2.4

2.4 Calculate $(5^2)^2$.

[2]

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[2]

2.4

- Multiply indices: $Q = 5^{2 \times 2} = 5^4 = \mathbf{625}$.

Exercise 3.1 (a)

3.1 Apply the indices i methods below. Show working and include units where appropriate.

(a) Write $10^4 \times 10^{-2}$ as one power of 10.

[2]

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(a) Write $10^4 \times 10^{-2}$ as one power of 10.

[2]

(a)

- $Q = 10^{4+(-2)} = \mathbf{10^2}.$

Exercise 3.1 (b)

3.1 Apply the indices i methods below. Show working and include units where appropriate.

(b) Write $10^2 \div 10^5$ as one power of 10.

[2]

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3.1 Apply the indices i methods below. Show working and include units where appropriate.

(b) Write $10^2 \div 10^5$ as one power of 10.

[2]

(b)

- $R = 10^{2-5} = \mathbf{10^{-3}}.$

Exercise 3.1 (c)

3.1 Apply the indices i methods below. Show working and include units where appropriate.

(c) Calculate $10^4 \times 10^{-2} + 10^2 \div 10^5$.

[2]

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3.1 Apply the indices i methods below. Show working and include units where appropriate.

(c) Calculate $10^4 \times 10^{-2} + 10^2 \div 10^5$. [2]

(c)

- $S = 100 + 0.001 = \mathbf{100.001}.$

Exercise 3.2 (a)

3.2 Let $A = 2^5 \times 2^{-2}$ and $B = 2^0 + 2^{-2}$.

(a) Calculate A and B, giving B as an exact fraction.

[3]

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[3]

(a)

- For A, use $a^m a^n = a^{m+n}$: $A = 2^{5-2} = \mathbf{8}$.
- For B, $B = 1 + 1/4 = \mathbf{5/4}$.

Exercise 3.2 (b)

3.2 Let $A = 2^5 \times 2^{-2}$ and $B = 2^0 + 2^{-2}$.

(b) A student writes $A + B = 2^{5-2+0-2}$. Explain the error and calculate the correct total. [3]

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(b)

- The rule for multiplying powers does not apply to the plus sign between A and B.
- Use the evaluated values: $S = A + B = 8 + 5/4 = \mathbf{37/4}$.