

Exercise walk-through

C2.4

Indices II

IGCSE Mathematics

You must be able to

- Apply integer index laws to algebraic products and quotients
- Simplify coefficients separately from powers
- Find an unknown integer exponent by matching powers

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The method

Method — Key knowledge: Indices II

Index rules apply to letters as well as numbers. $a^m a^n = a^{m+n}$, $a^m / a^n = a^{m-n}$ and $(a^m)^n = a^{mn}$. Raise a numerical coefficient to the outside power too. Nonzero values have zero power 1 and negative powers are reciprocals. To solve a simple index equation, express both sides with the same base; logarithms are not needed.

Exercises 2.1·2.3

2.1 Simplify x^3x^4 . [2]

2.2 Simplify $15a^6/(5a^2)$ for $a \neq 0$. [2]

2.3 Simplify $(2y^3)^2$. [2]

Exercises 2.1·2.3

2.1 Simplify x^3x^4 . [2]

2.1

- Add powers: x^7 .

2.2 Simplify $15a^6/(5a^2)$ for $a \neq 0$. [2]

2.2

- Divide coefficients and subtract indices: $3a^4$.

2.3 Simplify $(2y^3)^2$. [2]

2.3

- Square both factors: $4y^6$.

Exercise 2.4

2.4 Solve $3^n = 81$.

[2]

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[2]

2.4

- $81 = 3^4$, so $n = 4$.

Exercise 3.1 (a)

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

(a) Simplify $4x^{-2} \times 3x^5$ for $x \neq 0$.

[2]

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(a) Simplify $4x^{-2} \times 3x^5$ for $x \neq 0$. [2]

(a)

- $Q = (4 \times 3)x^{-2+5} = \mathbf{12x^3}.$

Exercise 3.1 (b)

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

(b) Divide your answer by $6x$ and simplify.

[2]

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

(b) Divide your answer by $6x$ and simplify. [2]

(b)

- $R = 12x^3/(6x) = \mathbf{2x^2}.$

Exercise 3.1 (c)

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

(c) Find the resulting value when $x = -2$.

[2]

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

(c) Find the resulting value when $x = -2$.

[2]

(c)

- $R = 2(-2)^2 = 2(4) = 8.$

Exercise 3.2 (a)

3.2 For $x \neq 0$, let $E = (3x^2)^2/(9x^{-1})$.

(a) Simplify E fully and calculate it when $x = -2$.

[3]

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(a) Simplify E fully and calculate it when $x = -2$.

[3]

(a)

- Numerator is $9x^4$, so $E = x^{4-(-1)} = \mathbf{x^5}$.
- At $x = -2$, $E = (-2)^5 = -\mathbf{32}$.

Exercise 3.2 (b)

3.2 For $x \neq 0$, let $E = (3x^2)^2/(9x^{-1})$.

(b) Find the integer n for which $2^{n+1} = 64$. Explain why logarithms are unnecessary. [3]

Exercise 3.2 (b)

3.2 For $x \neq 0$, let $E = (3x^2)^2/(9x^{-1})$.

(b) Find the integer n for which $2^{n+1} = 64$. Explain why logarithms are unnecessary. [3]

(b)

- Rewrite $64 = 2^6$.
- Match exponents: $n + 1 = 6$, so $n = \mathbf{5}$.
- Both sides can be written with base 2.