C2.4 Indices II

Name: _____ Class: _____ Date: _____ **Total: 20 marks**

KEY WORDS indices • equation • base • coefficient

Objective

Use indices ii to solve Core IGCSE Mathematics problems.

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

1 Key knowledge and worked examples

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.

Worked example: Indices II

coefficient: cube	index: multiply	(3x squared) cubed

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

- Cube both factors: $Q = 3^3(x^2)^3 = 27x^6$.
- In division, $12a^5/(3a^{-2}) = (12/3)a^{5-(-2)} = 4a^7$ for $a \neq 0$.
- Since $2^5 = 32$, the equation $2^x = 32$ gives $x = 5$.

Method check

Apply a power to both the coefficient and each factor. Division subtracts indices, including when the divisor has a negative index.

2 Practice

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]

2.4 Solve $3^n = 81$. [2]

3 Exam-style questions

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]

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

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

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

(a) Simplify E fully and calculate it when x = -2. [3]

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