17 September 2025

Week 4, Day 3-4

ALGEBRAIC INDICES

LO: To apply the laws of indices in simplifying expressions.

Laws of Indices – True or False?

03:00

Mental Math

Level 1 | Level 2 | Level 3 | Level 4 | Exam-Style | Game | Description | Help | More Indices

Arrange the given statements involving indices to show whether they are true or false.

TRUE   **FALSE**

$$\frac{x^7}{x^3} \equiv x^4$$

$$x^8 \div x^4 \equiv x^2$$

$$x^2 \times x^3 \equiv x^5$$

$$x^8 \div x^5 \equiv x^3$$

$$(x^3)^4 \equiv x^{12}$$

$$(x^3)^4 \equiv x^7$$

$$\frac{x^6}{x^3} \equiv x^2$$

Clear   Refresh Page

GCSE/iGCSE Assessment Objective Specification – Foundation/Higher

✓	identify square numbers and cube numbers
B ✓	calculate squares, square roots, cubes and cube roots
C ✓	use index notation and index laws for multiplication and division of positive and negative integer powers including zero

C ✓	use index notation for positive and negative integer powers (including zero)	$a \times a \times a = a^3$
D ✓	use index **laws** in simple cases	$a^{-5} = \dfrac{1}{a^5}$; $a^0 = 1$
		$x^m \times x^n = x^{m+n}$ $x^m \div x^n = x^{m-n}$ $(x^m)^n = x^{mn}$

A	use **index** notation involving fractional, negative and zero powers

| C | use index **laws** to simplify and evaluate numerical expressions involving integer, fractional and negative powers | Evaluate: $\sqrt[3]{8^2}$, $625^{-\frac{1}{2}}$, $\left(\dfrac{1}{25}\right)^{\frac{3}{2}}$ |

ALGEBRAIC INDICES

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Starter

05:00

$p^3 \times p^x = p^9$

(a) Find the value of x.

$(7^2)^y = 7^{10}$

(b) Find the value of y.

$100^a \times 1000^b$ can be written in the form 10^w

(c) Show that $w = 2a + 3b$

Starter - Answers

$$p^3 \times p^x = p^9$$

3 + 6 = 9
x = 6

(a) Find the value of x.

$$100^a \times 1000^b$$ can be written in the form 10^w

(c) Show that $w = 2a + 3b$

$$(7^2)^y = 7^{10}$$

2 x 5 = 10
x = 5

(b) Find the value of y.

$100^a = 10^{2a}$
$1000^b = 10^{3b}$
$10^{2a} + 10^{3b} = 10^w$
**Bases are same,
equate the powers**
2a + 3b = w

02:00

Law 1: Product Law

$$a^m a^n = a^{m+n}$$

1.) $a^3 b^2 \cdot ab$

$= a^{3+1} b^{2+1}$

$= a^4 b^3$

2.) $2x^3 y^2 \cdot 4xy^3$

$= 8x^4 y^5$

Law 2: Quotient Law

$$\frac{a^m}{a^n} = a^{m-n}$$

3.) $\dfrac{10a^3 b}{2b}$

$= 5a^3$

4.) $\dfrac{-20x^4 y^3}{4x^4 y^2}$

$= -5y$

When multiplying two powers with the same base, just add the indices.

When dividing two powers with the same base, just subtract the indices.

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02:00

Law 3: Power Law

$$(a^m)^n = a^{mn}$$

5.) $(a^3 b^2)^3$

$= a^9 b^6$

6) $(2^2 a^3 x^4)^2$

$= 2^4 a^6 x^8$

$= 16 a^6 x^8$

Powers with different bases

7.) $a^2 x^2 z^2 = (axz)^2$

8.) $(3^2 a^2 b^3 y^2) = b(3aby)^2$

$$a^n b^n = (ab)^n$$

To simplify any power of power, simply multiply the indices.

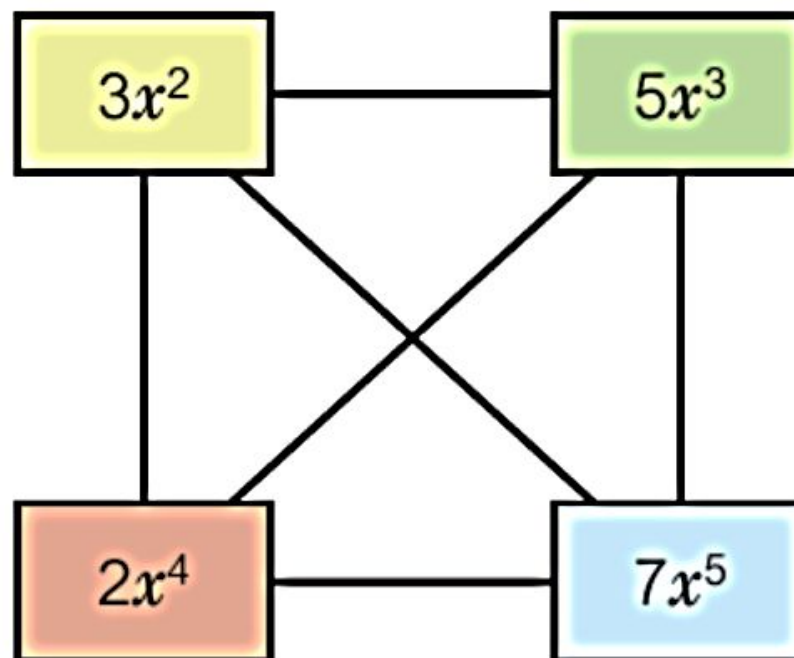To simplify power of different bases, simply multiply the indices on each base.

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Mini Plenary

05:00

Multiply each pair of expressions linked by a line.

ALGEBRAIC INDICES

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Mini Plenary - Answers

Multiply each pair of expressions linked by a line.

$$3x^2 \times 5x^3 = 15x^5$$

$$3x^2 \times 7x^5 = 21x^7$$

$$3x^2 \times 2x^4 = 6x^6$$

$$5x^3 \times 7x^5 = 35x^8$$

$$5x^3 \times 2x^4 = 10x^7$$

$$7x^5 \times 2x^4 = 14x^9$$

Least Common Multiple (LCM)

LO: To find the least common multiple using Venn diagram.

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C ✅	use index notation for positive and negative integer powers (including zero)	$a \times a \times a = a^3$
		$a^{-5} = \dfrac{1}{a^5} \; ; \; a^0 = 1$

D ✅	use index laws in simple cases	$x^m \times x^n = x^{m+n}$
		$x^m \div x^n = x^{m-n}$
		$(x^m)^n = x^{mn}$

A	use index notation involving fractional, negative and zero powers

C	use index laws to simplify and evaluate numerical expressions involving integer, fractional and negative powers	Evaluate: $\sqrt[3]{8^2}$, $625^{-\frac{1}{2}}$, $\left(\dfrac{1}{25}\right)^{\frac{3}{2}}$

Simplify

Task 1:

a $x^7 \times x^9 = x^\square$

b $z^{12} \div z^4 = z^\square$

c $(v^4)^2 = v^\square$

Work out the missing power.

a $y^2 \times y^\square = y^8$

b $n^\square \div n^3 = n^6$

c $(w^\square)^3 = w^{18}$

CORE TASK

Task 2: Simplify

a $\dfrac{12a^8}{4a^3} = 3a^\square$

b $\dfrac{25b^7}{5b^4}$

c $\dfrac{30n^3}{6n}$

d $\dfrac{18t^5}{3t^4}$

e $\dfrac{3p^5 \times 8p^3}{2p}$

f $\dfrac{5x^3 \times 6x}{3x}$

Task 3:

Problem-solving This is part of Teri's homework.
Her pen has leaked ink onto her page.
Work out the numbers underneath the blobs of ink.

Simplify these.

a $\dfrac{5y^5 \times 9y^3}{3y^{\blacksquare}} = \blacksquare y^2$

b $\dfrac{4y^{\blacksquare} \times \blacksquare y^7}{6y^5} = 8y^4$

Challenge

Simplify
a $(4x^2)^2 = 4^2 \times (x^2)^2 = \square x^{\square}$ b $(2y^3)^2$ c $(3z^4)^3$

d $\left(\dfrac{x^2}{4}\right)^3 = \dfrac{(x^2)^3}{4^3} = \dfrac{x^6}{\square}$ e $\left(\dfrac{y^4}{7}\right)^2$ f $\left(\dfrac{z^5}{3}\right)^3$

Discussion Which of these are the same?

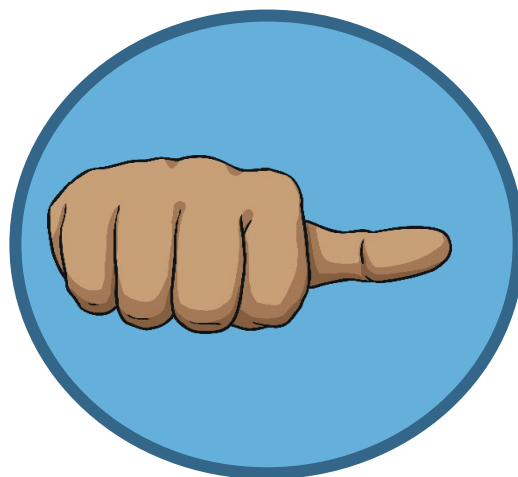$(4x^2)^2$ $-4x^4$ $-(4x)^4$ $(-4x^2)^2$ $4x^4$

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Self Check

Secure

Met

Working Towards