Laws of indices

Starter

1. **(Review of last lesson)**
   Factorise: (a) $48d^3 - 32d^2$ (b) $54a^3b^2 + 30a^2b^3$

2. With a partner, decide whether the answer of the following is A, B, C or D. Justify your answer with working or an explanation.

(a)	$a^4 \times a^3$	**A.**	$7a$	**B.**	a^{12}	**C.**	a^7	**D.**	$12a$
(b)	$a^6 \div a^2$	**A.**	a^8	**B.**	a^3	**C.**	3	**D.**	a^4
(c)	$(a^2)^3$	**A.**	$3a^2$	**B.**	a^6	**C.**	a^8	**D.**	a^5
(d)	5^0	**A.**	5	**B.**	1	**C.**	0	**D.**	-5
(e)	$2^3 \times 2^4$	**A.**	4^{12}	**B.**	2^{12}	**C.**	4^7	**D.**	2^7

Notes

From the starter, the laws of indices can be stated:

- $a^x \times a^y = a^{x+y}$ when ***multiplying***, ***add*** the indices
- $a^x \div a^y = a^{x-y}$ when ***dividing***, ***subtract*** the indices
- $(a^x)^y = a^{xy}$ when ***raised to a power***, ***multiply*** the indices

Zero index (anything divided by itself is 1): $a^0 = 1$

E.g. 1 Simplify: (a) $x^3 \times x^8$ (b) $a^4 \times a$ (c) $y^7 \div y^2$

(d) $(x^6)^3$ (e) $(a^2)^7 \times a^5 \times a^0$ (f) $\dfrac{15a^{15}}{5a^5}$

Working: (a) $x^3 \times x^8 = x^{3+8} = x^{11}$

E.g. 2 Find the value of x in the following expressions:

(a) $8^{10} \times 8^x = 8^{12}$ (b) $(2^5)^x = 2^{20}$

Working: (a) $8^{10} \times 8^x = 8^{12} \Rightarrow 8^{10+x} = 8^{12}$

Equating powers of 8: $10 + x = 12 \Rightarrow x = 2$

E.g. 3* Simplify: (a) $\dfrac{(a^3)^6 \times a^7}{a^{10}}$ (b) $\dfrac{(y^5)^7 \div y^{12}}{y^6 \times y^{10}}$ (c) $(2a^6)^3$

Working: (a) $\dfrac{(a^3)^6 \times a^7}{a^{10}} = \dfrac{a^{18} \times a^7}{a^{10}} = \dfrac{a^{25}}{a^{10}} = a^{15}$

Video: Laws of indices

Solutions to Starter and E.g.s

Exercise

9-1 class textbook:	p40 M2.6 Qu 1ace, 2ace, 3ace…, 4ace…, 5ace…, 6, 7ace, 8, 9ace…, 10ace, 11ace, 12-15
A*-G class textbook:	p36 M2.6 Qu 1ace, 2ace, 3ace…, 4ace…, 5ace…, 6ace…, 7, 8ace, 9, 10ace…, 11ace, 12ace, 13-16
9-1 homework book:	p12 M2.6 Qu 1-8
A*-G homework book:	p9 M2.6 Qu 1-7

Summary

The laws of indices are:

- $a^x \times a^y = a^{x+y}$ when ***multiplying***, ***add*** the indices
- $a^x \div a^y = a^{x-y}$ when ***dividing***, ***subtract*** the indices
- $(a^x)^y = a^{xy}$ when ***raised to a power***, ***multiply*** the indices

Zero index: $a^0 = 1$