

Laws of indices

Starter

1. (Review of last lesson)

Factorise: (a) $48d^3 - 32d^2$ (b) $54a^3b^2 + 30a^2b^3$

Working: (c) $48d^3 - 32d^2 = 16d^2(3d - 2)$
 (e) $54a^3b^2 + 30a^2b^3 = 6a^2b^2(9a + 5b)$

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 |

- Working:** (a) **C** $a^4 \times a^3 = (a \times a \times a \times a) \times (a \times a \times a) = a^7$
- (b) **D** $a^6 \div a^2 = \frac{a \times a \times a \times a \times \cancel{a} \times \cancel{a}}{\cancel{a} \times \cancel{a}} = a^4$
- (c) **B** $(a^2)^3 = a^2 \times a^2 \times a^2 = a^{2+2+2} = a^6$
- (d) **B** For example, $5^3 \div 5^3 = \frac{\cancel{5} \times \cancel{5} \times \cancel{5}}{\cancel{5} \times \cancel{5} \times \cancel{5}} = 1$.
 But $a^3 \div a^3 = a^{3-3} = a^0$ so $5^0 = 1$
- (e) **D** $2^3 \times 2^4 = (2 \times 2 \times 2) \times (2 \times 2 \times 2 \times 2) = 2^7$

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) $\frac{15a^{15}}{5a^5}$

- Working:** (a) $x^3 \times x^8 = x^{3+8} = x^{11}$
- (b) $a^4 \times a = a^{4+1} = a^5$
- (c) $y^7 \div y^2 = y^{7-2} = y^5$
- (d) $(x^6)^3 = x^{6 \times 3} = x^{18}$
- (e) $(a^2)^7 \times a^5 \times a^0 = a^{2 \times 7} \times a^5 \times 1 = a^{14} \times a^5 = a^{14+5} = a^{19}$
- (f) $\frac{15a^{15}}{5a^5} = 3a^{15-5} = 3a^{10}$

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: $10 + x = 12 \Rightarrow x = 2$

(b) $(2^5)^x = 2^{20} \Rightarrow 2^{5x} = 2^{20}$
Equating powers of 2: $5x = 20 \Rightarrow x = 4$

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

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

(b) $\frac{(y^5)^7 \div y^{12}}{y^6 \times y^{10}} = \frac{y^{35} \div y^{12}}{y^{16}} = \frac{y^{23}}{y^{16}} = y^7$

(c) $(2a^6)^3 = 2^3 \times (a^6)^3 = 8a^{6 \times 3} = 8a^{18}$

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