

WA8MNAA1

Algebraic techniques

Core + Challenge

Index Laws: Multiplying and Dividing Powers — Marking Key

I can multiply and divide powers with the same base, including terms with coefficients and pronumerals.

For tutors and parents. Award method marks for correct working even if the final answer is wrong.

Marks summary

Section A Fluency: 16 Section B Core: 22 Section C Reasoning: 9 Section D Challenge: 11 **Total: 58**

Fluency: 1 mark each; accept an equivalent unsimplified answer for half credit at tutor's discretion.

A Fluency *answers and working*

/ 16 marks

Q	Answer	Working
1	2^7	$3 + 4 = 7$
2	5^4	$6 - 2 = 4$
3	a^8	$5 + 3 = 8$
4	x^7	$10 - 3 = 7$
5	m^7	$m = m^1; 1 + 6 = 7$
6	7^7	$7 = 7^1; 8 - 1 = 7$
7	$6a^7$	$3 \times 2 = 6; 4 + 3 = 7$
8	$3y^5$	$15 \div 5 = 3; 9 - 4 = 5$
9	$20p^7$	$4 \times 5 = 20; 2 + 5 = 7$
10	$-12k^7$	$-2 \times 6 = -12; 3 + 4 = 7$
11	a^9	$2 + 3 + 4 = 9$
12	$4t$	$20 \div 5 = 4; t^1 = t$
13	32	$2^5 = 32$
14	1000	$10^3 = 1000$
15	a^7b^3	add indices of a, then of b
16	$3x^3y^3$	$18 \div 6; 5 - 2; 4 - 1$

B

Core *answers, working and marks*

/ 22 marks

Q	Answer	Working / sample response	Marks
1	$3^6 = 729$	$4 + 2 = 6$ $3^6 = 729$ <i>1 mark: 3^6</i> <i>1 mark: 729</i>	2
2	$2^{19} = 524\,288$	$2^{10} \times 2^9 = 2^{19}$ $2^{19} = 524\,288$ <i>1 mark: 2^{19}</i> <i>1 mark: 524 288</i>	2
3	$12x^5 \text{ cm}^2$	$4x^3 \times 3x^2 = 12x^5$ <i>1 mark: 12</i> <i>1 mark: x^5</i>	2
4	$5^3 = 125$ cartons	$5^6 \div 5^3 = 5^3$ $5^3 = 125$ <i>1 mark: 5^3</i> <i>1 mark: 125</i>	2
5	(a) $n = 7$ (b) $k = 8$	(a) $12 - 5 = 7$ (b) $11 - 3 = 8$ <i>1 mark each</i>	2
6	$24a^7b^9$	$6 \times 4 = 24$ a: $5 + 2 = 7$; b: $3 + 6 = 9$ <i>1 mark: 24</i> <i>1 mark: a^7b^9</i>	2
7	$5x^5y^3$	$40 \div 8 = 5$ x: $8 - 3 = 5$; y: $5 - 2 = 3$ <i>1 mark: 5</i> <i>1 mark: x^5y^3</i>	2
8	$30a^7 \text{ cm}^3$	V = length $\times$ width $\times$ height $2a^2 \times 3a \times 5a^4$ $= 30a^7$ ($2 + 1 + 4 = 7$) <i>1 mark: product</i> <i>1 mark: 30</i> <i>1 mark: a^7</i>	3
9	4	$2^5 \times 2^3 = 2^8$ $2^8 \div 2^6 = 2^2 = 4$ <i>1 mark: 2^2</i> <i>1 mark: 4</i>	2

Index Laws: Multiplying and Dividing Powers · WA8MNA1

Q	Answer	Working / sample response	Marks
10	2^{13}	$8 = 2^3$, so $8^3 = 2^3 \times 2^3 \times 2^3 = 2^9$ $4 = 2^2$, so $4^2 = 2^2 \times 2^2 = 2^4$ $2^9 \times 2^4 = 2^{13}$ <i>1 mark: 2^9</i> <i>1 mark: 2^4</i> <i>1 mark: 2^{13}</i>	3

C

Reasoning *sample answers and marking criteria*

/ 9 marks

Q	Answer	Working / sample response	Marks
1	3^9	She multiplied the bases ($3 \times 3 = 9$). The base stays the same; only the indices are added: $3^4 \times 3^5 = 3^9$. <i>1 mark: explains error</i> <i>1 mark: 3^9</i>	2
2	7 factors of a	$(a \times a \times a) \times (a \times a \times a \times a)$ is a multiplied by itself 7 times, which is a^7 . <i>1 mark: expanded form</i> <i>1 mark: counts 7 factors</i>	2
3	False	The bases are different, so the index law does not apply. $2^3 \times 3^2 = 8 \times 9 = 72$, but $6^5 = 7776$. <i>1 mark: false</i> <i>1 mark: reason</i>	2
4	Two factors cancel, leaving six	$x^8 \div x^2 = (x \times x \times x \times x \times x \times x \times x \times x) \div (x \times x)$ Two x's cancel from top and bottom, leaving 6 factors: x^6 . You subtract the indices ($8 - 2$); you do not divide them ($8 \div 2$). <i>1 mark: expanded form</i> <i>1 mark: cancelling</i> <i>1 mark: subtract, not divide</i>	3

D

Challenge *solutions and marking criteria*

/ 11 marks

Q	Answer	Working / sample response	Marks
1	$n = 4$	$9 = 3 \times 3$, so $9^4 = 3^2 \times 3^2 \times 3^2 \times 3^2 = 3^8$ $27 = 3 \times 3 \times 3$, so 27^n has $3n$ factors of 3: $27^n = 3^{3n}$ $3^8 \times 3^{3n} = 3^{20}$, so the indices add: $8 + 3n = 20$, $n = 4$ <i>1 mark: base 3</i> <i>1 mark: $8 + 3n = 20$</i> <i>1 mark: $n = 4$</i>	3
2	3^{20}	$2^{30} = 2^3 \times 2^3 \times \dots$ (ten times) $= 8^{10}$ $3^{20} = 3^2 \times 3^2 \times \dots$ (ten times) $= 9^{10}$ $9^{10} > 8^{10}$, so 3^{20} is larger <i>1 mark: 8^{10}</i> <i>1 mark: 9^{10}</i> <i>1 mark: conclusion</i>	3

Index Laws: Multiplying and Dividing Powers · WA8MNAA1

Q	Answer	Working / sample response	Marks
3	$4a^3b$	$12a^7b^4 \times 5ab^3 = 60a^8b^7$ $60a^8b^7 \div 15a^5b^6 = 4a^3b$ <i>1 mark: $60a^8b^7$</i> <i>1 mark: $4a^3b$</i>	2
4	9	Last digits of $7^1, 7^2, 7^3, 7^4 \dots$ are 7, 9, 3, 1, then repeat every 4 $2026 = 4 \times 506 + 2$ So 7^{2026} ends like 7^2 , in 9 <i>1 mark: cycle of 4</i> <i>1 mark: remainder 2</i> <i>1 mark: 9</i>	3