

WA7MNAA1

Algebraic techniques

Core + Challenge

Index Notation and Powers of 10 — Marking Key

I can write, expand, evaluate and compare numbers in index notation, including powers of 10.

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: 9 **Total: 56**

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	32	$2 \times 2 \times 2 \times 2 \times 2 = 32$
2	81	$3 \times 3 \times 3 \times 3 = 81$
3	125	$5 \times 5 \times 5 = 125$
4	10 000	1 followed by 4 zeros
5	49	7×7
6	1	$1 \times 1 \times \dots = 1$
7	64	$4 \times 4 \times 4$
8	72	$8 \times 9 = 72$
9	5^4	four factors of 5
10	$2^3 \times 3^2$	three 2s, two 3s
11	10^6	six zeros
12	$6 \times 6 \times 6 \times 6$	four factors of 6
13	3	$4000 = 4 \times 1000 = 4 \times 10^3$
14	4	$3 \times 10\,000 = 3 \times 10^4$
15	700	7×100
16	1024	$2^5 \times 2^5 = 32 \times 32$

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B

Core answers, working and marks

/ 22 marks

Q	Answer	Working / sample response	Marks
1	$2^6 = 64$	$1 \rightarrow 2 \rightarrow 4 \rightarrow \dots$ doubles 6 times: 2^6 1 mark: 2^6 1 mark: 64	2
2	$2^9 = 512$	Square 1 has $2^0 = 1$, square 2 has $2^1 \dots$ so square 10 has 2^9 1 mark: 2^9 1 mark: 512	2
3	2^5 , by 7	$2^5 = 32$; $5^2 = 25$ 1 mark: both values 1 mark: 2^5 by 7	2
4	30 507	$30\,000 + 500 + 7$ 1 mark: place values 1 mark: 30 507	2
5	$4^3 = 64 \text{ cm}^3$	$4 \times 4 \times 4$ 1 mark each	2
6	$3^4 = 9^2 = 81$; $4^3 = 2^6 = 64$	81, 64, 64, 81 1 mark: all four values 1 mark each equal pair	3
7	7	$15 \times 10\,000\,000 = 15 \times 10^7$ 1 mark: 10 000 000 1 mark: 7	2
8	1000 times (10^3)	$1\,000\,000 \div 1000 = 1000$ 1 mark: working 1 mark: 1000	2
9	$3^5 = 243$	Round n: 3^n 1 mark: 3^5 1 mark: 243	2
10	10 000	$(2 \times 5) \times (2 \times 5) \times (2 \times 5) \times (2 \times 5) = 10^4 = 10\,000$ 1 mark: pairing 1 mark: 10^4 1 mark: 10 000	3

C Reasoning *sample answers and marking criteria*

/ 9 marks

Q	Answer	Working / sample response	Marks
1	81 vs 12	3^4 is repeated multiplication ($3 \times 3 \times 3 \times 3 = 81$); 3×4 is repeated addition ($3 + 3 + 3 + 3 = 12$). <i>2 marks: clear explanation</i>	2
2	$2^3 = 8$	She multiplied base $\times$ index. $2^3 = 2 \times 2 \times 2 = 8$. <i>1 mark: explanation</i> <i>1 mark: 8</i>	2
3	5^{10}	$5^{10} = (5^2)^5 = 25^5$, and 25^5 is bigger than 10^5 because $25 > 10$. ($5^{10} = 9\,765\,625$) <i>1 mark: 5^{10}</i> <i>2 marks: reasoning</i>	3
4	Each $\times 10$ adds a zero	Each factor of 10 moves the digits one place left, adding one zero. <i>2 marks: explanation</i>	2

D Challenge *solutions and marking criteria*

/ 9 marks

Q	Answer	Working / sample response	Marks
1	8	2, 4, 8, 16, 32, 64, 128, 256 $\rightarrow$ 8 factors <i>1 mark: method</i> <i>1 mark: 8</i>	2
2	1	Last digits of $3^1, 3^2, \dots$ repeat 3, 9, 7, 1 (every 4). 20 is a multiple of 4, so the last digit is 1. <i>1 mark: pattern</i> <i>1 mark: cycle of 4</i> <i>1 mark: 1</i>	3
3	$8^2, 4^3, 2^6$	All equal 64 <i>2 marks: all three (1 mark for two)</i>	2
4	2^{10} , by 24	$1024 - 1000 = 24$ <i>1 mark each</i>	2