

WA7MNAA2

Algebraic techniques

Core + Challenge

Prime Factorisation — Marking Key

I can write whole numbers as products of prime factors using index notation, and use prime factors to solve problems.

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	prime	29 has no factors other than 1 and 29
2	composite	$51 = 3 \times 17$
3	composite	$57 = 3 \times 19$
4	prime	61 has no factors other than 1 and 61
5	$2^2 \times 3$	$12 = 2^2 \times 3$
6	2×3^2	$18 = 2 \times 3^2$
7	$2 \times 3 \times 5$	$30 = 2 \times 3 \times 5$
8	$2^2 \times 3^2$	$36 = 2^2 \times 3^2$
9	$3^2 \times 5$	$45 = 3^2 \times 5$
10	$2^4 \times 3$	$48 = 2^4 \times 3$
11	$2^2 \times 3 \times 5$	$60 = 2^2 \times 3 \times 5$
12	$2^3 \times 3^2$	$72 = 2^3 \times 3^2$
13	$2^2 \times 3 \times 7$	$84 = 2^2 \times 3 \times 7$
14	$2 \times 3^2 \times 5$	$90 = 2 \times 3^2 \times 5$
15	$2^2 \times 5^2$	$100 = 2^2 \times 5^2$
16	$2 \times 3^2 \times 7$	$126 = 2 \times 3^2 \times 7$

B

Core *answers, working and marks*

/ 22 marks

Q	Answer	Working / sample response	Marks
1	$2^2 \times 3 \times 5$	$6 \times 10 = 2 \times 3 \times 2 \times 5$; $4 \times 15 = 2 \times 2 \times 3 \times 5$ <i>1 mark each tree</i> <i>1 mark: $2^2 \times 3 \times 5$</i>	3
2	120	$8 \times 3 \times 5 = 120$ <i>1 mark: working</i> <i>1 mark: 120</i>	2
3	41, 43, 47, 53, 59	Check each odd number for factors 3 and 7 <i>2 marks: all five (1 mark for 3–4)</i>	2
4	12	$36 = 2^2 \times 3^2$; $60 = 2^2 \times 3 \times 5$; $\text{HCF} = 2^2 \times 3 = 12$ <i>1 mark: both factorisations</i> <i>1 mark: 12</i>	2
5	No – $91 = 7 \times 13$	$91 \div 7 = 13$ <i>1 mark: no</i> <i>1 mark: 7×13</i>	2
6	180	$4 \times 9 \times 5$ <i>1 mark: working</i> <i>1 mark: 180</i>	2
7	8:36 am	$12 = 2^2 \times 3$; $18 = 2 \times 3^2$; $\text{LCM} = 2^2 \times 3^2 = 36$ <i>1 mark: factorisations</i> <i>1 mark: LCM 36</i> <i>1 mark: 8:36 am</i>	3
8	1, 2, 3, 6, 7, 14, 21, 42	The number is 42; combine the primes in every way <i>2 marks: all eight (1 mark for six)</i>	2
9	$2^2 \times 3^2$ (36) and $3^4 \times 7^2$ (3969)	A square number has all even indices <i>1 mark each</i>	2
10	$2^3 \times 5^3$	$1000 = 10^3 = (2 \times 5)^3$ <i>1 mark: working</i> <i>1 mark: $2^3 \times 5^3$</i>	2

C

Reasoning *sample answers and marking criteria*

/ 9 marks

Q	Answer	Working / sample response	Marks
1	Every other even number has 2 as a factor	Any even number above 2 can be divided by 1, 2 and itself, so it has at least three factors. <i>2 marks: explanation</i>	2
2	1 has only one factor	A prime has exactly two different factors. 1 has only one factor (1). <i>2 marks</i>	2

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Q	Answer	Working / sample response	Marks
3	$2^2 \times 3^2$	4 and 9 are not prime. $4 = 2 \times 2$ and $9 = 3 \times 3$, so $36 = 2^2 \times 3^2$. <i>1 mark: explanation</i> <i>1 mark: $2^2 \times 3^2$</i>	2
4	It can be split into two equal halves	$2^2 \times 3^4 = (2 \times 3^2) \times (2 \times 3^2) = 18 \times 18 = 324$. Even indices let the primes split into two identical groups. <i>1 mark: example 324</i> <i>2 marks: general reason</i>	3

D

Challenge *solutions and marking criteria*

/ 9 marks

Q	Answer	Working / sample response	Marks
1	84	It needs $2^2 \times 3 \times 7 = 84$ <i>1 mark: 2^2</i> <i>1 mark: 84</i>	2
2	2; 144	$72 = 2^3 \times 3^2$. Multiply by 2 to make $2^4 \times 3^2 = 144 = 12^2$. <i>1 mark: 2</i> <i>1 mark: 144</i>	2
3	2520	Need 2^3 (for 8), 3^2 (for 9), 5 and 7: $8 \times 9 \times 5 \times 7 = 2520$ <i>1 mark: 2^3 and 3^2</i> <i>1 mark: includes 5 and 7</i> <i>1 mark: 2520</i>	3
4	25 and 49	Only squares of primes have exactly three factors (1, p, p^2): 5^2 and 7^2 . <i>1 mark: 25 and 49</i> <i>1 mark: squares of primes</i>	2