

WA7MNAA2

Algebraic techniques

Core + Challenge

# Prime Factorisation

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

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_ / 56

## Key idea

A **prime** has exactly two factors (1 and itself): 2, 3, 5, 7, 11, 13, ... 1 is **not** prime.

**Factor tree:**  $24 = 6 \times 4 = 2 \times 3 \times 2 \times 2$ . Write the primes in order with index notation:  $24 = 2^3 \times 3$

**Repeated division:** divide by the smallest prime that works (2, then 3, then 5, ...) until you reach 1.

Any starting pair gives the **same** prime factorisation ( $24 = 8 \times 3$  or  $2 \times 12 \rightarrow 2^3 \times 3$  either way).

A

**Fluency** *practise the skill*

/ 16 marks

Q1–4: prime or composite? Q5–16: write as a product of prime factors in index form.

- |                                    |                   |
|------------------------------------|-------------------|
| 1. Is 29 prime or composite? _____ | 9. $45 =$ _____   |
| 2. Is 51 prime or composite? _____ | 10. $48 =$ _____  |
| 3. Is 57 prime or composite? _____ | 11. $60 =$ _____  |
| 4. Is 61 prime or composite? _____ | 12. $72 =$ _____  |
| 5. $12 =$ _____                    | 13. $84 =$ _____  |
| 6. $18 =$ _____                    | 14. $90 =$ _____  |
| 7. $30 =$ _____                    | 15. $100 =$ _____ |
| 8. $36 =$ _____                    | 16. $126 =$ _____ |

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**B****Core** *apply the skill to problems*

/ 22 marks

- 1 Complete two different factor trees for 60: one starting with  $6 \times 10$  and one starting with  $4 \times 15$ . Show that both give the same prime factorisation. [3 marks]

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Answer: \_\_\_\_\_

- 2 A number's prime factorisation is  $2^3 \times 3 \times 5$ . What is the number? [2 marks]

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Answer: \_\_\_\_\_

- 3 List all the prime numbers between 40 and 60. [2 marks]

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Answer: \_\_\_\_\_

- 4 Use prime factors to find the highest common factor (HCF) of 36 and 60. [2 marks]

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Answer: \_\_\_\_\_

- 5 Is 91 prime? Explain. [2 marks]

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Answer: \_\_\_\_\_

- 6 Write  $2^2 \times 3^2 \times 5$  as an ordinary number. [2 marks]

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Answer: \_\_\_\_\_

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- 7 Bus A leaves every 12 minutes and bus B every 18 minutes. Both leave at 8:00 am. Use prime factors to find when they next leave together. [3 marks]

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Answer: \_\_\_\_\_

- 8 A number's prime factorisation is  $2 \times 3 \times 7$ . List **all** of its factors. [2 marks]

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Answer: \_\_\_\_\_

- 9 Which of these are square numbers?  $2^2 \times 3^2$   $2^3 \times 5^2$   $3^4 \times 7^2$  [2 marks]

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Answer: \_\_\_\_\_

- 10 Write 1000 as a product of prime factors in index form. [2 marks]

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Answer: \_\_\_\_\_

**C Reasoning** *explain, justify and check*

/ 9 marks

- 1 Explain why 2 is the only even prime number. [2 marks]

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- 2 Sam says 1 is a prime number. Explain why he is wrong. [2 marks]

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- 3 Liam wrote the prime factorisation of 36 as  $4 \times 9$ . Explain his mistake and correct it. [2 marks]

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- 4 Explain why a number whose prime factorisation has only **even** indices must be a square number. Use  $2^2 \times 3^4$  as an example. [3 marks]

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**D Challenge** *multi-step and problem-solving*

/ 9 marks

- 1 Find the smallest number that has 2, 3 and 7 as prime factors **and** is a multiple of 4. [2 marks]

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Answer: \_\_\_\_\_

- 2 What is the smallest whole number you can multiply 72 by to get a square number? What is the square? [2 marks]

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Answer: \_\_\_\_\_

- 3 Find the smallest number that can be divided exactly by every whole number from 1 to 10. [3 marks]

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Answer: \_\_\_\_\_

- 4 Find all two-digit numbers that have exactly three factors. Explain the pattern. [2 marks]

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Answer: \_\_\_\_\_

**How did I go?**Fluency \_\_\_\_ / 16   Core \_\_\_\_ / 22   Reasoning \_\_\_\_ / 9   Challenge \_\_\_\_ / 9   **Total \_\_\_\_ / 56**

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