



eClassroom

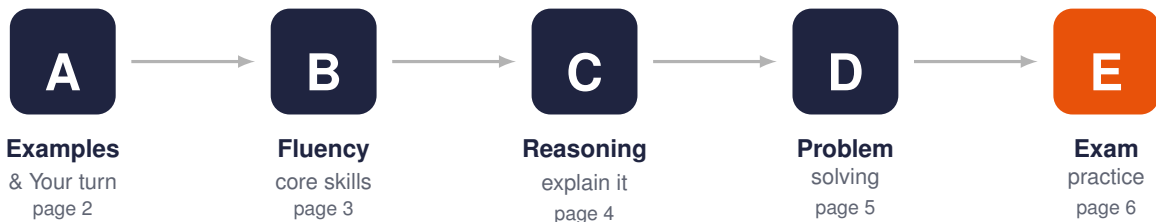
GCSE MATHEMATICS • NUMBER

Factors, Multiples & Primes

Worked Solutions

Pearson Edexcel GCSE (1MA1) & International GCSE (4MA1) • No calculator

Full worked solutions for the free Factors, Multiples and Primes worksheet, GCSE and iGCSE Maths



Tap a section to jump straight to it

Full worked solutions for every question on the Factors, Multiples & Primes worksheet, in the same order and with the same question numbers.

How to mark your work. Tick each step you got right, not just the final answer. In the exam, method marks are given for correct working even when the final answer is wrong. If you lost marks, find the *first* line where your working is different from ours. That is the thing to fix.

In Section E: **M** = method mark, **P** = process mark, **A** = accuracy mark, **B** = independent mark, **C** = communication mark.

Question sheet

Number revision engine

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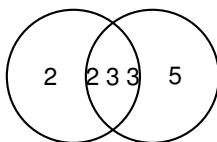
A**Your turn answers**

Compare each line of your working with the solution.

FOUNDATION

A1 $150 = 2 \times 75 = 2 \times 3 \times 25 = 2 \times 3 \times 5 \times 5$ $2 \times 3 \times 5^2$

A2 $36 = 2 \times 2 \times 3 \times 3$ $90 = 2 \times 3 \times 3 \times 5$



HCF = $2 \times 3 \times 3 = 18$ LCM = $2 \times 2 \times 3 \times 3 \times 5 = 180$

A3 Multiples of 15: 15, 30, 45, **60** Multiples of 20: 20, 40, **60** 60 minutes after 10 00 is **11 00**

HIGHER

A4 Lower powers of the shared primes: HCF = $2^3 \times 5 = 40$

Higher power of every prime: LCM = $2^4 \times 5^2 \times 7^2 \times 11$

A5 2^1 needs one more 2. 3^3 needs one more 3. 5^2 is already even. $2 \times 3 = 6$ Check: $1350 \times 6 = 8100 = 90^2$

A6 Write the numbers as $9a$ and $9b$: $9 \times a \times b = 378$, so $a \times b = 42$

Pairs with no common factor: 1×42 , 2×21 , 3×14 , 6×7

These give 9 and 378, 18 and 189, 27 and 126, 54 and 63. Only the last pair are both two-digit numbers.

54 and 63

A7 $(4+1) \times (1+1) = 5 \times 2 = 10$ factors They are 1, 2, 4, 8, 16, 7, 14, 28, 56, 112



B**Fluency solutions**

One mark for each correct part unless stated. The notes in italics explain why each sequence was chosen.

FOUNDATION

- B1** (a) **1, 2, 3, 6, 9, 18** (b) **1, 2, 3, 4, 6, 9, 12, 18, 36** (c) **1, 29** (d) **1**

36 is a square number, so it has an odd number of factors. 29 is prime, so it has exactly two. The number 1 has only one factor, which is why it is not prime.

- B2** (a) **7, 14, 21, 28, 35** (b) **54, 60, 66** (c) **23, 29, 31, 37** (d) **53 and 59** ($51 = 3 \times 17$ and $57 = 3 \times 19$)

- B3** (a) **$2^3 \times 3$** (b) **$2 \times 3^2 \times 5$** (c) **$2^2 \times 7^2$** (d) **97 is prime**, so it cannot be split any further.

- B4** (a) **6** (b) **1** (c) **16** (d) $56 = 2^3 \times 7$, $98 = 2 \times 7^2$: $2 \times 7 =$ **14**

In (b) the numbers share no prime factors, so the HCF is 1. In (c) 16 is a factor of 48, so the HCF is 16 itself.

- B5** (a) **12** (b) **35** (c) **18** (d) $28 = 2^2 \times 7$, $42 = 2 \times 3 \times 7$: $2^2 \times 3 \times 7 =$ **84**

In (b) the numbers share no factors, so the LCM is their product. In (c) 18 is already a multiple of 6.

HIGHER

- B6** (a) $2^2 \times 3 =$ **12** (b) **$2^3 \times 3^3 \times 5 \times 7$** (c) $2 \times 3 =$ **6** (d) **$2^3 \times 3^3 \times 5^2 \times 7$**

- B7** (a) Every power is even, so $N = (2^2 \times 3 \times 5)^2$. $\sqrt{N} = 2^2 \times 3 \times 5 =$ **60**

- (b) 2^3 needs a 2 and 3^1 needs a 3: $2 \times 3 =$ **6**

- (c) For a cube every power must be a multiple of 3. 2^2 needs 2, 3^1 needs 3^2 , 5^4 needs 5^2 : $2 \times 9 \times 25 =$ **450**

- (d) $(3+1) \times (2+1) =$ **12**

- B8** (a) $6 \times 90 = 540$ $540 \div 18 =$ **30** (b) $5 \times 175 = 875$ $875 \div 25 =$ **35**



C

Reasoning solutions

Your wording can be different. Check that your reason makes the same point.

FOUNDATION

- C1** **No.** A prime number has exactly two factors. The number 1 has only one factor.
- C2** 10 is not prime, because $10 = 2 \times 5$. $140 = 2 \times 7 \times 2 \times 5 = 2^2 \times 5 \times 7$
- C3** (a) **2** is prime and even. (b) $2 + 3 = 5$, which is odd. (Any example using 2 works.)
- C4** (a) **1, 2, 4, 8, 16**
 (b) Factors come in pairs that multiply to make the number: 1×16 and 2×8 . For a square number, the square root pairs with itself (4×4), so it is only counted once. That leaves an odd number of factors.
- C5** Primes have no factors except 1 and themselves, so p and q share no prime factors. The smallest number that is a multiple of both must contain both p and q , which is $p \times q$.

HIGHER

- C6** (a) $12 = 2^2 \times 3$. N contains 2^3 and 3, so **yes**. (b) $9 = 3^2$. N contains only one 3, so **no**.
 (c) $28 = 2^2 \times 7$. N contains 2^3 and 7^2 , so **yes**.
- C7** $90 = 2 \times 3^2 \times 5$ $630 = 2 \times 3^2 \times 5 \times 7$
 The LCM contains a 7 that is not in 90, so x must contain a 7. x needs nothing else, because 90 supplies the rest. **$x = 7$**
- C8** (a) **1, p , p^2 , q , pq , p^2q** (b) $(2+1) \times (2+1) = 9$
- C9** Let the numbers be n and $n+1$. Any common factor of two numbers is also a factor of their difference. The difference is $(n+1) - n = 1$, and the only factor of 1 is 1. So the HCF is 1. **proved**



D**Problem solving solutions**

There is often more than one correct method. Any complete, correct method scores full marks.

FOUNDATION

D1 $16 = 2^4$ $28 = 2^2 \times 7$ $\text{LCM} = 2^4 \times 7 = 112 \text{ minutes} = 1 \text{ hour } 52 \text{ minutes}$ **9 22 am**

D2 LCM of 12 and 9 is 36 $36 \div 12 = 3$ $36 \div 9 = 4$ **3 packs of sausages and 4 packs of rolls**

D3 (a) $90 = 2 \times 3^2 \times 5$ $126 = 2 \times 3^2 \times 7$ $\text{HCF} = 2 \times 3^2 =$ **18 cm**

(b) $90 \div 18 = 5$ $126 \div 18 = 7$ $5 + 7 =$ **12 pieces**

D4 Multiples of 12 between 40 and 100: 48, 60, 72, 84, 96 Only 60 is a factor of 180 ($180 \div 60 = 3$).
60

D5 LCM of 6, 10 and 15 is 30 seconds 5 minutes = 300 seconds $300 \div 30 =$ **10 times**

HIGHER

D6 Take the highest power of each prime needed: $8 = 2^3$, $9 = 3^2$, 5, 7 $2^3 \times 3^2 \times 5 \times 7 =$ **2520**

D7 For a cube every power must be a multiple of 3. 2^3 is fine, 3^2 needs one more 3, 5^1 needs 5^2 . $k =$
 $3 \times 25 =$ **75**

D8 Write the numbers as $10a$ and $10b$: $10 \times a \times b = 700$, so $a \times b = 70$
Pairs with no common factor: 1×70 , 2×35 , 5×14 , 7×10 Only $10 \times 7 = 70$ and $10 \times 10 = 100$ are
both between 60 and 110 **70 and 100**

D9 The dots touch again after a number of teeth that is a multiple of both 18 and 30. LCM = 90 teeth
Gear A: $90 \div 18 =$ **5 turns** Gear B: $90 \div 30 =$ **3 turns**

D10 The number of factors is found by adding 1 to each power and multiplying. Ways to make 12:
 12 gives $2^{11} = 2048$ 6×2 gives $2^5 \times 3 = 96$ 4×3 gives $2^3 \times 3^2 = 72$ $3 \times 2 \times 2$ gives $2^2 \times 3 \times 5 = 60$
Using the smallest primes with the biggest powers on the smallest primes, the smallest is **60**



E

Exam practice solutions

Marks are shown on the right of each line.

FOUNDATION

Foundation and Higher crossover

- E1** (a) $1, 2, 3, 5, 6, 10, 15, 30$ B2 (B1 for at least four correct and none wrong)
 (b) $41, 43 \text{ or } 47$ B1
-
- E2** $396 = 2 \times 198 = 2 \times 2 \times 99$ M1
 $= 2 \times 2 \times 3 \times 3 \times 11$ A1
 $2^2 \times 3^2 \times 11$ A1 index form
-
- E3** (a) $78 = 2 \times 3 \times 13$ $130 = 2 \times 5 \times 13$ M1
 $2 \times 13 = 26$ A1
 (b) $14 = 2 \times 7$ $35 = 5 \times 7$ M1
 $2 \times 5 \times 7 = 70$ A1
-
- E4** $35 = 5 \times 7$ $50 = 2 \times 5^2$ M1
 LCM = $2 \times 5^2 \times 7 = 350$ minutes A1
 350 minutes = 5 hours 50 minutes 11 50 am A1

HIGHER

- E5** (a) $2^3 \times 3^2$ M1
 $= 72$ A1
 (b) $2^4 \times 3^5 \times 5 \times 7$ M1 A1
-
- E6** (a) $2200 = 22 \times 100 = 2 \times 11 \times 2^2 \times 5^2$ M1 M1
 $2^3 \times 5^2 \times 11$ A1
 (b) 2^3 needs one more 2 and 11^1 needs one more 11 M1
 $2 \times 11 = 22$ A1
-
- E7** Powers of 2: the lower is 3 and the higher is 5. B has 2^3 , so A has 2^5 . M1
 Powers of 3: the lower is 1 and the higher is 2. A has 3^2 , so B has 3^1 . M1
 $x = 5, y = 1$ A1



-
- E8** $\text{HCF} \times \text{LCM} = n \times 36$ *M1*
 $12 \times 180 = 2160$ $n = 2160 \div 36$ *M1*
 $n = 60$ *A1* Check: $60 = 2^2 \times 3 \times 5$ and $36 = 2^2 \times 3^2$ give HCF 12 and LCM 180
-
- E9** A number that leaves remainder 1 is one more than a common multiple of 4, 5 and 6 *P1*
LCM of 4, 5 and 6 is 60 *P1*
 $60 + 1 = 61$ *A1*
-

