Cambridge (CIE) IGCSE Maths: Core

Your notes

Prime Factors, HCF & LCM

Contents

- Prime Factor Decomposition
- HCF & LCM

© 2026 Save My Exams, Ltd.

Your notes

Prime factor decomposition

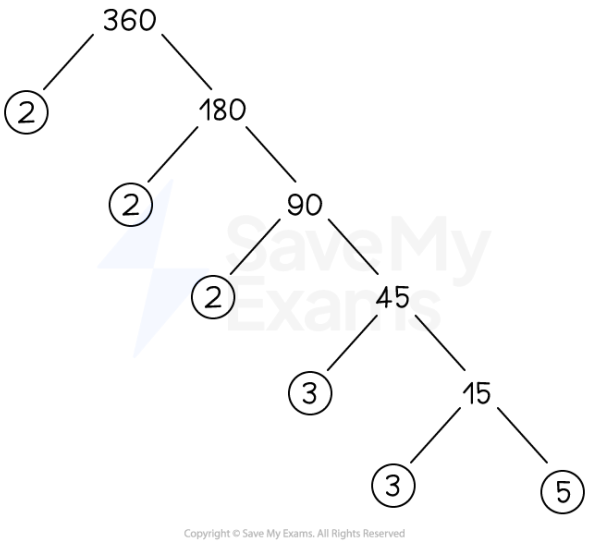
What are prime factors?

- A **factor** of a given number is a value that divides the given number exactly, with no remainder
  - e.g. 6 is a factor of 18
- A **prime** number is a number which has exactly two **factors;** itself and 1
  - e.g. 5 is a prime number, as its only factors are 5 and 1
  - You should remember the first few prime numbers:
    - 2, 3, 5, 7, 11, 13, 17, 19, ...
- The **prime factors** of a number are therefore all the primes which multiply to give that number
  - e.g. The prime factors of 30 are 2, 3, and 5
    - $2 \times 3 \times 5 = 30$

How do I find prime factors?

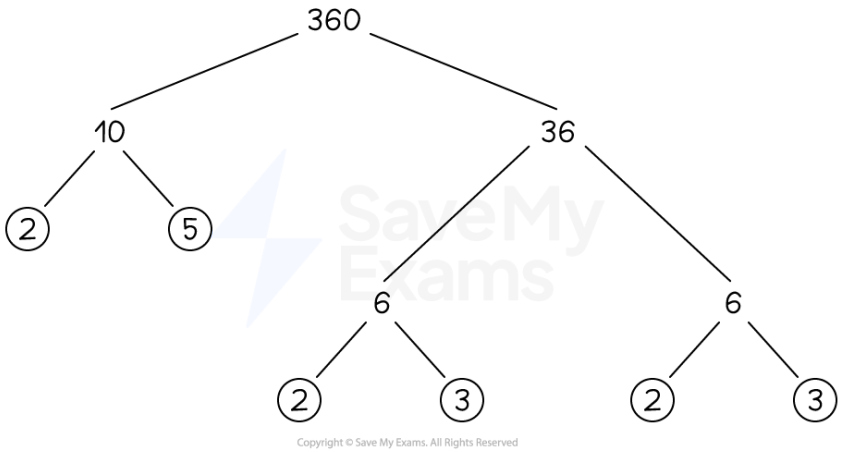
- Use a **factor tree** to find prime factors
  - Split the number up into a **pair of factors**
  - Then split each of those factors up into **another pair**
  - Continue splitting up factors along each "branch" until you get to a **prime number**
    - These can not be split into anything other than 1 and themselves
    - It helps to **circle the prime** numbers at the end of the branches
- One way to split each number up is by dividing it by the **smallest possible prime number**
  - This gives a prime factor at each stage

© 2026 Save My Exams, Ltd.



Copyright © Save My Exams. All Rights Reserved

- Another way to split each number up by dividing by **easy numbers** such as 10
  - These do not need to be prime numbers
  - You will need to split any non-prime numbers into pairs of factors
  - These trees can get messy



Copyright © Save My Exams. All Rights Reserved

- The number will always end up with the **same numbers circled** no matter which pairs of numbers you choose
- A number can be uniquely written as a **product of prime factors**
  - Write the prime factors as a multiplication, in ascending order
    - $360 = 2 \times 2 \times 2 \times 3 \times 3 \times 5$
  - This can then be written more concisely using powers
    - $360 = 2^3 \times 3^2 \times 5$

Your notes

Your notes

Examiner Tips and Tricks

Exam questions on this topic will ask you to express a number as a product of its prime factors. You should simplify your final answer by using indices. You need to show your working clearly to gain full marks.

Worked Example

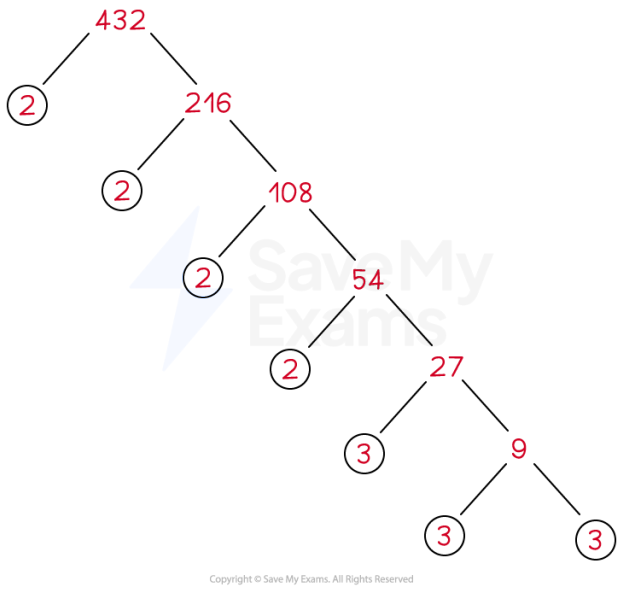
Express 432 as the product of its prime factors. Show your working clearly.

Answer:

Create a factor tree
Start with 432 and choose any two numbers that multiply together to make 432

- 2 and 216 is an obvious pair

Continue to split non-prime numbers into pairs of factors



Copyright © Save My Exams. All Rights Reserved

The answer will be the same regardless of the factors chosen in the first step

Write the prime numbers out as a product

$$432 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3$$

Any repeated prime factors can be written as a power

$$432 = 2^4 \times 3^3$$

Your notes

Highest common factor (HCF)

What is the highest common factor (HCF) of two numbers?

- A **common factor** of two numbers is a value that **both numbers** can be divided by, leaving no remainder
  - **1** is always a common factor of any two numbers
  - Any **factor** of a **common factor** will also be a common factor of the original two numbers
    - 6 is a common factor of 24 and 30
    - Therefore 1, 2 and 3 are also common factors of 24 and 30
- The **highest** common factor is the largest common factor of the two numbers
  - The highest common factor is useful when simplifying fractions or factorising expressions

How do I find the highest common factor (HCF) of two numbers?

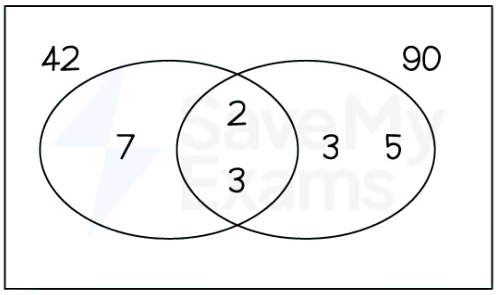
- To find **common factors**:
  - write out the **factors** of each number in a list
  - identify the numbers that appear in **both** lists
- The **highest** common factor will be the **largest factor** that appears in **both** lists

How can I use a Venn diagram to find the highest common factor (HCF) of two numbers?

- Write each number as a **product of its prime factors**
  - $42 = 2 \times 3 \times 7$ and $90 = 2 \times 3 \times 3 \times 5$
- Find the prime factors that are **common** to **both numbers** and put these in the **centre of the Venn diagram**
  - 42 and 90 both have a prime factor of 2
    - Put 2 in the centre of the diagram
  - Although 3 appears twice in the prime factors of 90, it appears once in the prime factors of 42
    - Put a single 3 in the centre of the diagram

© 2026 Save My Exams, Ltd.

- If there are no common prime factors, put a 1 in the centre of the diagram
- Put the **remaining prime factors** in the respective regions
  - 7 would go in the region for 42
  - 3 and 5 would go in the region for 90
- The **highest common factor** is the **product** of the **numbers in the centre**
  - The HCF of 42 and 90 is 2×3, which is 6
- If there are no common prime factors then the HCF is 1



Copyright © Save My Exams. All Rights Reserved

How can I use the powers of prime factors to find the highest common factor (HCF) of two numbers?

- Write each number as a **product of the powers of its prime factors**
  - $24 = 2^3 \times 3$ and $60 = 2^2 \times 3 \times 5$
- Find all **common** prime factors and identify the **highest power** that appears in both numbers
  - The highest power of 2 in both is 2^2
    - 2^2 is a common factor
  - The highest power of 3 in both is 3^1
    - 3 is a common factor
  - No other prime number appears in both
- The **highest common factor** is the **product** of the common powers of primes
  - The HCF of 24 and 60 is $2^2 \times 3$ which is 12

Examiner Tips and Tricks

The highest common factor of two numbers could be one of the numbers!

E.g. The highest common factor of 4 and 12 is 4.

Your notes

Your notes

Worked Example

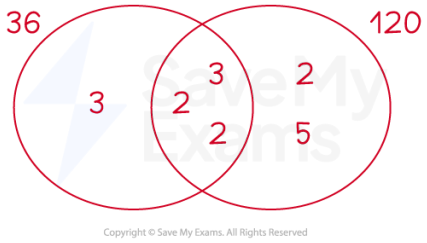
Find the highest common factor of 36 and 120.

Answer:

Write both numbers as a product of prime factors

$$36 = 2 \times 2 \times 3 \times 3 = 2^2 \times 3^2$$
$$120 = 2 \times 2 \times 2 \times 3 \times 5 = 2^3 \times 3 \times 5$$

Write the prime factors in a Venn diagram



Copyright © Save My Exams. All Rights Reserved

Multiply the common prime factors in the centre

$$HCF = 2 \times 2 \times 3$$

Alternatively, list the factors for each number

$$36: 1, 2, 3, 4, 6, 9, \underline{12}, 18, 36$$
$$120: 1, 2, 3, 4, 5, 6, 8, 10, \underline{12}, 15, 20, 24, 30, 40, 60, 120$$

Another alternative is to find the highest common powers of primes

2^2 and 3^1 are the highest common powers of primes

$$HCF = 2^2 \times 3^1$$

HCF = 12

Lowest common multiple (LCM)

What is the lowest common multiple (LCM) of two numbers?

- A **common multiple** of two numbers is a number that appears in **both** of their times tables
  - The **product** of the original two numbers is always a common multiple (but not necessarily the lowest)
  - **Any multiple** of a **common multiple** will **also be a common multiple** of the original two numbers

- 30 is a common multiple of 3 and 10
- Therefore 60, 90, 120, ... are also common multiples of 3 and 10

- The **lowest common multiple** is the smallest common multiple between two numbers
  - This is useful when finding a common denominator and when adding or subtracting fractions

How do I find the lowest common multiple (LCM) of two numbers?

- To find the **lowest common multiple** of two numbers:
  - write out the first few **multiples** of each number
  - identify the multiples that appear in **both** lists
    - If there are **none** then write out the **next few multiples** of each number until you find a common multiple
- The **lowest common multiple** will be the **smallest** multiple that appears in **both** lists

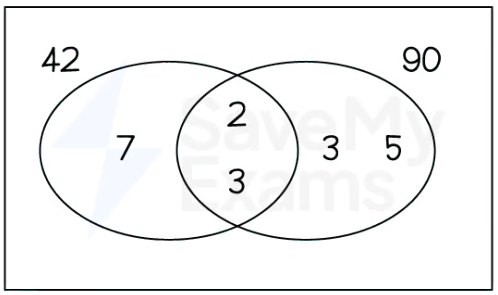
How can I use a Venn diagram to find the lowest common multiple (LCM) of two numbers?

- Write each number as a **product of its prime factors**
  - $42 = 2 \times 3 \times 7$ and $90 = 2 \times 3 \times 3 \times 5$
- Find the prime factors that are **common** to **both numbers** and put these in the **centre of the Venn diagram**
  - 42 and 90 both have a prime factor of 2
    - Put a 2 in the centre of the diagram
  - Although 3 appears twice in the prime factors of 90, it appears once in the prime factors of 42
    - Put a single 3 in the centre of the diagram
  - If there are no common prime factors then put a 1 in the centre of the diagram
- Put the **remaining prime factors** in the respective regions
  - 7 would go in the region for 42
  - 3 and 5 would go in the region for 90
- The **lowest common multiple** is the **product** of **all the numbers in the circles**
  - The LCM of 42 and 90 is $7 \times 2 \times 3 \times 3 \times 5$, which is 630



Your notes

© 2026 Save My Exams, Ltd.



Copyright © Save My Exams. All Rights Reserved

Your notes

How can I use the powers of prime factors to find the lowest common multiple (LCM) of two numbers?

- Write each number as a **product of the powers of its prime factors**
  - $72 = 2^3 \times 3^2$ and $540 = 2^2 \times 3^3 \times 5$
- Find the **highest power** of **each and every** prime that appears in either number (they do **not** have to be **common** primes)
  - 2^3 is the highest power of 2 shown (from 72)
  - 3^3 is the highest power of 3 shown (from 540)
  - 5^1 is the highest power of 5 shown (from 540)
    - Note: 5 is not a common prime in 72 and 540, but it is still needed for the LCM
- The **lowest common multiple** is the **product** of these **highest powers**
  - The LCM of 72 and 540 is $2^3 \times 3^3 \times 5$, which is 1080

Examiner Tips and Tricks

The lowest common multiple of two numbers could be one of the numbers!

E.g. The lowest common multiple of 4 and 12 is 12.

Worked Example

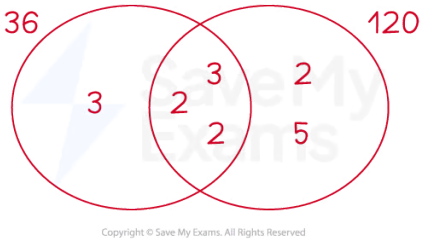
Find the lowest common multiple of 36 and 120.

Answer:

Write both numbers as a product of prime factors

$$36 = 2 \times 2 \times 3 \times 3 = 2^2 \times 3^2$$
$$120 = 2 \times 2 \times 2 \times 3 \times 5 = 2^3 \times 3 \times 5$$

Write the prime factors in a Venn diagram



Copyright © Save My Exams. All Rights Reserved

Multiply all the prime factors in the diagram

$$LCM = 3 \times 2 \times 2 \times 3 \times 2 \times 5$$

An alternative method is to write out the multiples

36: 26, 72, 108, 144, 180, 216, 252, 288, 324, 360, 396, ...
120: 120, 240, 360, 480, ...

Another alternative method is to find the highest powers of each and every prime that appears
Then multiply these together

$$2^3 \times 3^2 \times 5^1$$

LCM = 360

Your notes