

## LCM & HCF

### What is HCF and LCM?

The **HCF and LCM** are two abbreviations for the **highest common factor** (HCF) and the **lowest common multiple** (LCM).

- The **HCF** is the largest integer (whole number) that two or more numbers can be divided by.

Other names for this include the greatest common divisor (GCD) and the greatest common factor (GCF).

For example, find the HCF of 88 and 1212.

Let's start by writing the factors of 88 and 1212.

**Factors of 88:** 1, 2, 4, 8 1, 2, 4, 8

**Factors of 1212:** 1, 2, 3, 4, 6, 12 1, 2, 3, 4, 6, 12

There are several numbers that occur in both lists (1, 2, (1, 2, and 4).4).

The highest positive integer that occurs in each list is 4,4, and so the **highest common factor** of 88 and 1212 is **4**.

- The **LCM** is the smallest integer that is a multiple of two or more composite numbers (exists within the multiplication table of each number). Another name for this is the least common multiple.

For example, find the LCM of 88 and 1212.

Let's start by writing the first 1212 multiples of 88 and 1212.

### Multiples

**of 88:** 8, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88, 96 8, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88, 96

### Multiples

**of 1212:** 12, 24, 36, 48, 60, 72, 84, 96, 108, 120, 132, 144 12, 24, 36, 48, 60, 72, 84, 96, 108, 120, 132, 144

There are several values that occur in both lists (24, 48, 72, (24, 48, 72, and 96).96). The lowest of these is 24,24, hence the **lowest common multiple** of 88 and 1212 is 2424.

### Prime factor decomposition

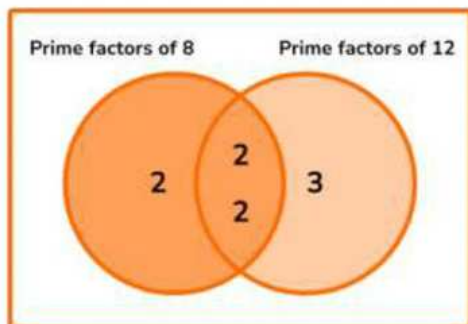
To calculate the **HCF or LCM** of two or more numbers, we can write out a **list of factors or multiples** as we have above, however this approach can be very time consuming and can be complicated when dealing with factors and multiples of large numbers (33 digit numbers in particular).

We can therefore utilise **prime factors** to calculate these values.

The **fundamental theorem of arithmetic** states that every positive integer is either a prime number, or can be written as a product of its prime factors. **Every number has a unique set of prime factors.**

By presenting prime factors within a **Venn diagram**, we can quickly determine both the HCF and LCM of the two or more numbers in the question.

For example,



$$8=2 \times 2 \times 2=2 \times 2 \times 2$$

$$12=2 \times 2 \times 3=2 \times 2 \times 3$$

The **intersection** of the two circles contains the **highest common factor** where we **multiply the values within the intersection together**.

Here, the HCF of 88 and 1212 is equal to  $2 \times 2=4$ .

The **union** of the two circles contains the **lowest common multiple** where we **multiply the values within both circles together**.

Here, the LCM of 88 and 1212 is equal to  $2 \times (2 \times 2) \times 3 = 24$ .  $2 \times (2 \times 2) \times 3 = 24$ .

Notice that the values for the HCF and LCM match those values previously mentioned using the alternative method.

Furthermore, as the lowest common multiple is calculated by multiplying all of the factors together within the Venn diagram, the lowest common multiple can be found by multiplying the highest common factor by the remaining prime factors.

$$\text{LCM} = \text{HCF} \times \text{remaining prime factors} \quad \text{LCM} = \text{HCF} \times \text{remaining prime factors}$$

This allows us to solve problems where we are given the HCF and LCM of two numbers and we need to determine the original two numbers.

### **How to calculate the highest common factor**

In order to calculate the highest common factor of two or more numbers:

1. **State the product of prime factors for each number, not in index form.**
2. **Write all the prime factors for each number into a Venn diagram.**
3. **Multiply the prime factors in the intersection to find the HCF.**

**EXERCISE**

**1. Find the greatest number that will divide 43, 91 and 183 so as to leave the same remainder in each case.**

- A. 4
- B. 7
- C. 9
- D. 13

**2. The H.C.F. of two numbers is 23 and the other two factors of their L.C.M. are 13 and 14. The larger of the two numbers is:**

- A. 276
- B. 299
- C. 322
- D. 345

**3. Six bells commence tolling together and toll at intervals of 2, 4, 6, 8, 10 and 12 seconds respectively. In 30 minutes, how many times do they toll together ?**

- A. 4
- B. 10
- C. 15
- D. 16

**4. Let N be the greatest number that will divide 1305, 4665 and 6905, leaving the same remainder in each case. Then sum of the digits in N is:**

- A. 4
- B. 5
- C. 6

D. 8

**5. The greatest number of four digits which is divisible by 15, 25, 40 and 75 is:**

A. 9000

B. 9400

C. 9600

D. 9800

**Answer Key**

1. A

2. C

3. D

4. A

5. C

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