

Real Numbers — Class 10 Maths

CBSE Chapter 1 · Unit I Number Systems · 6 of 80 marks · NCERT Exercises 1.1 and 1.2

Every composite number is a unique product of primes · and for **two** numbers, $\text{HCF} \times \text{LCM} = \text{their product}$

The chapter in four ideas

The idea	What the exam does with it
Fundamental Theorem of Arithmetic	Explain why $7 \times 11 \times 13 + 13$ is composite; why 6^n can never end in 0
HCF and LCM by prime factorisation	1-mark MCQ, or a 2-mark find-the-LCM in Section B
$\text{HCF} \times \text{LCM} = \text{the product}$	Find one from the other — and verify your own answer. Two numbers only
Irrationality proofs	A 3-mark proof by contradiction in Section C, for $\sqrt{2}$, $\sqrt{3}$ or $\sqrt{5}$

Two board favourites, one line each. $6^n = 2^n \times 3^n$, and any number ending in 0 must have 5 as a factor — 6^n has none, so it can never end in 0. And $7 \times 11 \times 13 + 13 = 13 \times (77 + 1) = 13 \times 78$, a product of several primes, so it is composite.

Reading HCF and LCM off the primes

HCF = the primes the numbers **share**, each at its **lowest** power. **LCM** = **every** prime that appears, each at its **highest** power.

$26 = 2 \times 13$ and $91 = 7 \times 13$, so the only shared prime is 13: **HCF = 13**, and **LCM = $2 \times 7 \times 13 = 182$** .

Check it, every time: $13 \times 182 = 2366$, and $26 \times 91 = 2366$. If those two numbers disagree, one of the factorisations is wrong. The check is only valid for **two** numbers — see page 2.

The proof that earns all three marks

An irrationality proof is a fixed skeleton, and each line of it is worth marks. To prove $\sqrt{5}$ is irrational: **suppose it is rational**, so $\sqrt{5} = p/q$ with **p and q coprime** and q not 0. Square, rearrange, and show 5 divides both p and q — which contradicts coprime. Therefore $\sqrt{5}$ is irrational.

The word that carries the marks is “coprime”. Leave it out and there is no contradiction to reach, so the proof cannot be completed however tidy the algebra looks. Write the closing sentence too — naming the contradiction is a mark.

Where this sits in NCERT and CBSE

Sections	1.2 The Fundamental Theorem of Arithmetic · 1.3 Revisiting Irrational Numbers
Exercises	Exercise 1.1 (7 questions) and Exercise 1.2 (3 questions) — ten in the whole chapter
The numbering trap	Section 1.1 is a bare Introduction with no exercise, so §1.2 is examined by Ex 1.1 and §1.3 by Ex 1.2
Removed	Euclid's division lemma (old §1.2, old Ex 1.1) and decimal expansions of rational numbers (old §1.4, old Ex 1.4). Old editions still print both

CBSE scope, verbatim: “Fundamental Theorem of Arithmetic - statements after reviewing work done earlier and after illustrating and motivating through examples, Proofs of irrationality of $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$.” Unit marks are 6 / 20 / 6 / 15 / 12 / 10 / 11 = 80; chapter-wise percentage tables online are unofficial estimates.

Key takeaways

- ✓ Four ideas, ten NCERT questions, **6 marks** — the best return per hour in the paper.
- ✓ HCF takes the **common** primes at their **lowest** power; LCM takes **all** of them at their **highest**.
- ✓ $\text{HCF} \times \text{LCM} = \text{the product}$ is a **two-number** rule. It fails for three, and that is the trap.
- ✓ In an irrationality proof, **“coprime”** is not decoration — it is the line the contradiction needs.
- ✓ **Decimal expansions and Euclid's division lemma are off the syllabus.** Do not spend hours there.
- ✓ The board names **$\sqrt{2}$, $\sqrt{3}$ and $\sqrt{5}$** , so drill those three and their combinations.

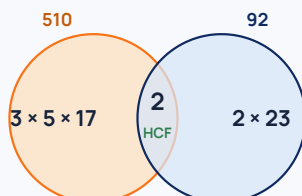
Real Numbers — the questions, done properly

Every number below is checked. Two NCERT exercises, three marks a proof, and the one shortcut that has a limit.

NCERT EX 1.1 Q2(ii) · 3 MARKS

Find the LCM and HCF of 510 and 92, and verify that $\text{LCM} \times \text{HCF} = \text{the product of the two numbers}$.

Step 1 — factorise. $510 = 2 \times 3 \times 5 \times 17$ and $92 = 2^2 \times 23$. **Step 2 — HCF.** The only shared prime is 2, at its lowest power: $\text{HCF} = 2$. **Step 3 — LCM.** Every prime at its highest power: $2^2 \times 3 \times 5 \times 17 \times 23 = 23460$.



The two circles are **the two numbers** — $510 = 2 \times 3 \times 5 \times 17$ and $92 = 2^2 \times 23$. The overlap is the **HCF**; everything drawn, multiplied together, is the **LCM**.

Step 4 — check. $2 \times 23460 = 46920$, and $510 \times 92 = 46920$. They agree, so the factorisations are right.

NCERT EX 1.2 Q1 · 3 MARKS

Prove that $\sqrt{5}$ is irrational.

What you write

Suppose, on the contrary, that $\sqrt{5}$ is rational. Then $\sqrt{5} = p/q$, where p and q are integers, $q \neq 0$, and **p and q are coprime**.

So $q\sqrt{5} = p$, and squaring, $5q^2 = p^2$. Hence 5 divides p^2 , and therefore 5 divides p .

Write $p = 5r$. Then $5q^2 = 25r^2$, so $q^2 = 5r^2$, and by the same argument 5 divides q .

So 5 divides both p and q , contradicting that they are coprime. **Therefore $\sqrt{5}$ is irrational.**

Why it earns the mark

Sets up the contradiction. Without “coprime” there is nothing to contradict.

Uses the theorem: a prime dividing a square divides the number.

The second divisibility — this is the half students drop.

Naming the contradiction and closing is itself a mark.

Same skeleton, every time. Replace 5 with 2 or 3 and the four lines are unchanged. For $3 + 2\sqrt{5}$, assume the whole expression is rational and rearrange to make $\sqrt{5}$ the subject — the contradiction is then the result you just proved.

NCERT EX 1.1 Q3(i) · THE TRAP

Find the HCF and LCM of 12, 15 and 21. $12 = 2^2 \times 3$, $15 = 3 \times 5$, $21 = 3 \times 7$. The only shared prime is 3, so **HCF = 3**; taking every prime at its highest power, **LCM = $2^2 \times 3 \times 5 \times 7 = 420$** .

Do not verify this one with the product rule. $\text{HCF} \times \text{LCM} = 3 \times 420 = 1260$, while $12 \times 15 \times 21 = 3780$. Nothing is wrong with the answer — the rule simply does not extend past two numbers.

WHERE THE MARKS ACTUALLY GO

- ▶ A factorisation written as $510 = 2 \times 255$ is unfinished — take it all the way down to primes.
- ▶ In a proof, the assumption line and the closing sentence are marks. Skipping to the algebra loses both.
- ▶ If the question says *verify*, the verification line is part of the answer, not rough work.
- ▶ Read HCF or LCM carefully. A perfect LCM scores nothing on a question that asked for the HCF.

NOW TRY THESE TWO

- Given that $\text{HCF}(306, 657) = 9$, find $\text{LCM}(306, 657)$. (Ex 1.1 Q4 — the product rule, used forwards.)
- Prove that $3 + 2\sqrt{5}$ is irrational. (Ex 1.2 Q2 — the skeleton above, one rearrangement first.)

Answer to 1: $\text{LCM} = (306 \times 657) / 9 = 22338$.

Turn four ideas into six certain marks

- ▶ **Chapter 1 is free on examfront** — and Chapter 1 is Real Numbers, so you can start right here.
- ▶ **Mistake identification** tells you whether you lost the mark to a factorisation slip or a missing proof line.
- ▶ **Anytime tests** on any topic, the moment you finish learning it.
- ▶ **Weekly tests** to keep the earlier chapters from going cold.
- ▶ **Full mock tests** before the exam, in board conditions and to the board's timing.

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