

MATHEMATICS • CLASS 10

CHAPTER 1

Real Numbers

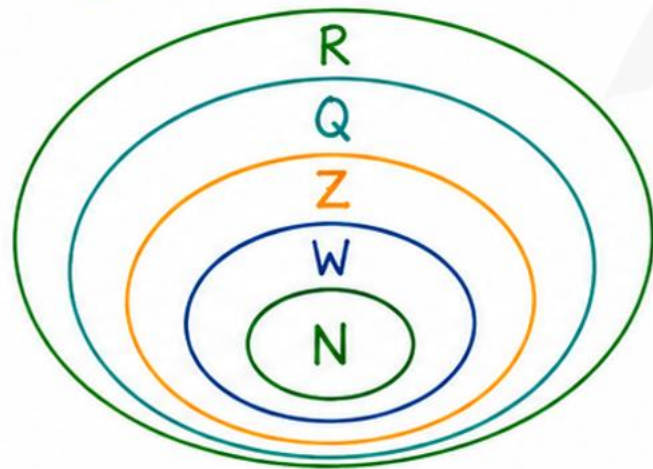
CHAPTER NOTES



REAL NUMBERS: THE BIG PICTURE

NUMBER SETS

- Natural numbers $N = \{1, 2, 3, \dots\}$
- Whole numbers $W = \{0, 1, 2, 3, \dots\}$
- Integers $Z = \{\dots, -2, -1, 0, 1, 2, \dots\}$
- Rational numbers Q : numbers expressible as $\frac{p}{q}$, where p, q are integers and $q \neq 0$.

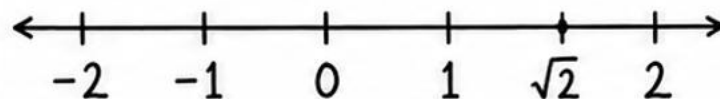


REAL NUMBERS

- Real numbers R = rational numbers + irrational numbers.
- Every real number has a position on the number line.
- Irrational numbers cannot be written as $\frac{p}{q}$.

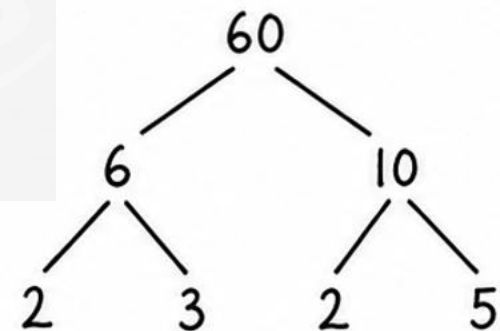
Examples:

$$\sqrt{2}, \sqrt{3}, \sqrt{5}, \pi$$



PRIME FACTORISATION

- A prime number has exactly two positive factors: 1 and itself.
- A composite number has more than two positive factors.
- 1 is neither prime nor composite.



$$60 = 2^2 \times 3 \times 5$$

Prime factorisation is the basic tool used in this chapter for HCF, LCM and irrationality proofs.

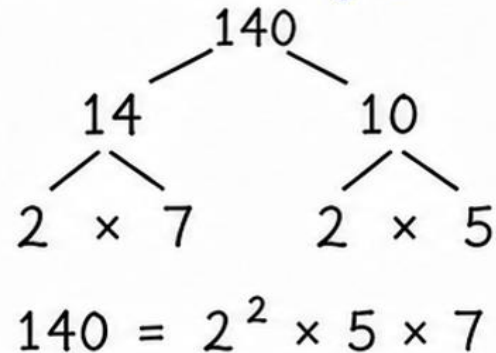
FUNDAMENTAL THEOREM OF ARITHMETIC

THEOREM - Fundamental Theorem of Arithmetic

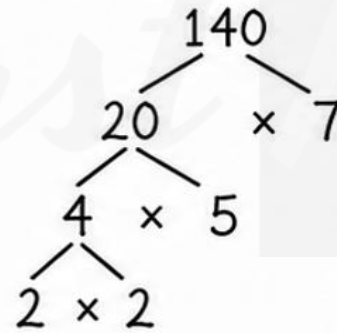
Every composite number can be expressed as a product of prime numbers, and this factorisation is unique apart from the order of the prime factors.

EXISTENCE

- Repeatedly split a composite number into smaller factors.
- Continue until every factor is prime.



UNIQUENESS



Both trees give the same prime factors: 2, 2, 5, 7.
Only their order changes.

For a composite number n :

$$n = p_1^{a_1} \times p_2^{a_2} \times \dots \times p_k^{a_k}$$

$p_1 < p_2 < \dots < p_k$ are primes;
 $a_1, a_2, \dots, a_k$ are positive integers.

BOARD NOTE:

Use prime factorisation to calculate HCF and LCM and to prove irrationality results.

HCF AND LCM BY PRIME FACTORISATION

Write each positive integer as a product of prime powers. Then compare the exponents of common primes.

HCF — TAKE SMALLER POWERS

- HCF is the greatest positive integer that divides each given number exactly.

$$a = 2^3 \times 3^2 \times 5$$

$$b = 2^2 \times 3 \times 7$$

- Common primes: 2 and 3

$$\text{HCF}(a, b) = 2^2 \times 3 = 12$$

	2	3	5	7
a:	3	2	1	0
b:	<u>2</u>	<u>1</u>	0	1

LCM — TAKE GREATER POWERS

- LCM is the smallest positive integer divisible by each given number.

$$a = 2^3 \times 3^2 \times 5$$

$$b = 2^2 \times 3 \times 7$$

$$\text{LCM}(a, b) = 2^3 \times 3^2 \times 5 \times 7 = 2520$$

	2	3	5	7
a:	<u>3</u>	<u>2</u>	<u>1</u>	0
b:	2	1	0	<u>1</u>

- ① Prime-factorise each number.
- ② For HCF, choose the lowest power of every common prime.
- ③ For LCM, choose the highest power of every prime appearing.

For two positive integers a and b :

$$\text{HCF}(a, b) \times \text{LCM}(a, b) = a \times b$$

This relation is for two positive integers and is a useful check.



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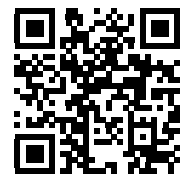


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