

Chapter: Real Numbers

1. Introduction

Real numbers include all the numbers that can be represented on the number line. They consist of rational numbers and irrational numbers. Real numbers are widely used in mathematics and everyday life.

2. Types of Real Numbers

- Natural Numbers (N): 1, 2, 3, ...
- Whole Numbers (W): 0, 1, 2, 3, ...
- Integers (Z): ..., -2, -1, 0, 1, 2, ...
- Rational Numbers (Q): Numbers that can be expressed in the form p/q where $q \neq 0$.
- Irrational Numbers: Numbers that cannot be expressed as p/q , e.g., $\sqrt{2}$, π .

3. Euclid's Division Lemma

Euclid's Division Lemma states that for any two positive integers a and b , there exist unique integers q and r such that: $a = bq + r$, where $0 \leq r < b$.

This lemma is the basis of the Euclid's Division Algorithm which is used to find the HCF (Highest Common Factor) of two numbers.

4. Fundamental Theorem of Arithmetic

The Fundamental Theorem of Arithmetic states that every composite number can be expressed as a product of prime numbers, and this factorization is unique except for the order of factors.

5. HCF and LCM

HCF (Highest Common Factor) is the greatest number that divides two or more numbers exactly. LCM (Least Common Multiple) is the smallest number that is a multiple of two or more numbers.

Relation between HCF and LCM for two numbers a and b: $\text{HCF} \times \text{LCM} = a \times b$.

6. Decimal Expansion of Rational Numbers

The decimal expansion of a rational number either terminates or repeats. If the denominator of a rational number (in lowest form) has only factors 2 and/or 5, then its decimal expansion terminates; otherwise, it is non-terminating repeating.

7. Summary

In this chapter, we studied different types of real numbers, Euclid's Division Lemma, the Fundamental Theorem of Arithmetic, HCF and LCM, and the decimal expansion of rational numbers. These concepts form the foundation for higher mathematics.