

CHAPTER 0

REVIEW OF ALGEBRA

01. Sets of Real Numbers

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A set is determined by its elements. Neither rearrangements neither nor repetitions in a listing affects the set. A *set* A is said to be a subset of *set* B if and only if every element of A is also an element of B .

For example, if $A = \{6, 8, 10\}$ and $B = \{6, 8, 10, 12\}$, then A is a subset of B . However, B is not a subset of A . There is exactly one set which contains no elements. It is called the empty set and is denoted by \emptyset .

1 Real Numbers

Real numbers are a set of numbers which encompass all the possible numbers that can be represented on a continous number line. Real numbers may contain various type of numbers. Such as:

1. Rational numbers

These are the numbers that can be expressed as **ratio of two numbers** (where the denominator is not 0). **They can have terminating decimal representations**, for instances are

- $\frac{3}{4} = 0.75$,
- $\frac{1}{5} = 0.4$,
- or non-terminating and repeating decimal numbers. Such as
 - $\frac{1}{3} = 0.33333 \dots$,
 - $-\frac{4}{11} = 0.363636 \dots$,
 - and $\frac{2}{15} = 0.13333 \dots$

2. Irrational Numbers

These are the numbers that cannot be expressed as a ratio of two integers. The decimal expansion are **non-terminating** and **non-repeating**. Irrational numbers cannot be written as an integer divided by integer. Examples:

- π (pi)

- e (Euler)
- $\sqrt{2}$
- $\sqrt{3}$
- $\sqrt{5}$
- φ (Golden Ratio)

3. Integers:

This is a subset of rational numbers that include zero, positive whole numbers (natural numbers), and their negatives.

Examples: $\dots, -2, -1, 0, 1, 2, \dots$

4. Whole Numbers:

These include all natural numbers along with zero.

5. Natural Numbers:

Also known as counting numbers. These starts from 1 and go on indefinitely (1, 2, 3, \dots)

