

# CHAPTER 0

## REVIEW OF ALGEBRA

### 01. Sets of Real Numbers

Exercised by: Rizal Bimanto

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 continuous 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
  - $\frac{1}{3} = 0.3333 \dots$ ,
  - $-\frac{4}{11} = 0.363636 \dots$ ,
  - and  $\frac{2}{15} = 0.1333 \dots$

### 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:

- $\pi$  (pi)
- $e$  (Euler)
- $\sqrt{2}$
- $\sqrt{3}$
- $\sqrt{5}$
- $\varphi$  (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, ...)

