

## Unit 2: Real and Complex Numbers

### Overview

#### Natural Numbers:

The numbers 1, 2, 3, ... which we use for counting certain objects are called natural numbers or positive integers. The set natural numbers is denoted by  $N$ .

$$\text{i.e. } N = \{1, 2, 3, \dots\}$$

#### Whole Numbers:

If we include 0 in the set of natural number, the resulting set is the set of whole numbers, denoted by  $W$ ,

$$\text{i.e. } W = \{0, 1, 2, 3, \dots\}$$

#### Integers:

The set of integers consist of positive integers, 0 and negative integers and is denoted by  $Z$  i.e.  $Z = \{\dots, -3, -2, -1, 0, 1, 2, 3, \dots\}$

#### Rational Numbers:

All numbers of the form  $\frac{p}{q}$  where  $p, q$  are integers and  $q$  is not zero are called rational numbers. The set of rational numbers is denoted by  $Q$ ,

$$\text{i.e. } Q = \left\{ \frac{p}{q} \mid p, q \in Z \wedge q \neq 0, (p, q) = 1 \right\}$$

#### Irrational Numbers:

The numbers which cannot be expressed as quotient of integers are called irrational numbers. The set of irrational numbers is denoted by  $Q'$ ,

$$\text{i.e. } Q' = \left\{ x \mid x \neq \frac{p}{q}, p, q \in Z \wedge q \neq 0 \right\}$$

The union of the set of rational numbers and irrational numbers is known as the set of real numbers. It is denoted by  $R$ ,

$$\text{i.e. } R = Q \cup Q'$$

#### Types of Rational Numbers:

##### (i) Terminating Decimal Fractions

The decimal fraction in which there are finite number of digits in its decimal part is called a terminating decimal fraction. For example  $\frac{2}{5} = 0.4$  and  $\frac{3}{8} = 0.375$ .

**(ii) Recurring and Non-terminating Decimal Fractions:**

The decimal fraction (non-terminating) in which some digits are repeated again and again in the same order in its decimal part is called recurring decimal fraction.

For example  $\frac{2}{9} = 0.2222\dots$  and  $\frac{4}{11} = 0.363636\dots$

**Concept of Radicals and Radicands:**

In the radical  $\sqrt[n]{a}$ , the symbol  $\sqrt{\phantom{x}}$  is called the radical sign,  $n$  is called the index of the radical and the real number  $a$  under the radical sign is called the radicand or base.

**Base and Exponent:**

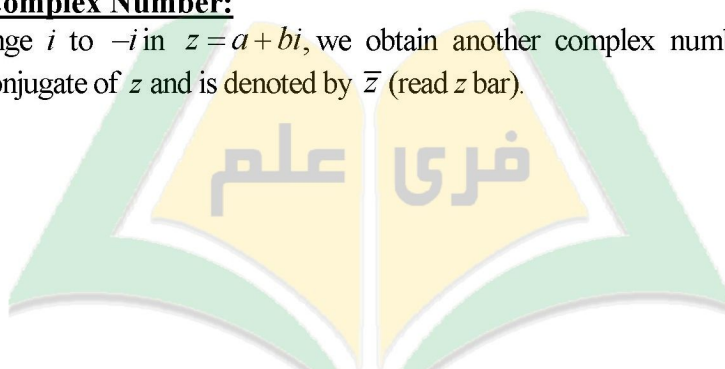
In the exponential notation of (read as  $a$  to the  $n$ th power) we call ' $a$ ' as the base and ' $n$ ' as the exponent or the power to which the base is raised.

**Definition of a Complex Number:**

A number of the form  $z = a + bi$  where  $a$  and  $b$  are real numbers and  $i = \sqrt{-1}$ , is called a complex number and is represented by  $z$  i.e.,  $z = a + ib$

**Conjugate of a Complex Number:**

If we change  $i$  to  $-i$  in  $z = a + bi$ , we obtain another complex number  $a - bi$  called the complex conjugate of  $z$  and is denoted by  $\bar{z}$  (read  $z$  bar).



**Last Updated: September 2020**

Report any mistake at [freeilm786@gmail.com](mailto:freeilm786@gmail.com)