Revision Notes

Class-9 Mathematics

Chapter 1 – Number Systems

- **Real numbers and imaginary number** together form number systems.
- We will discuss imaginary numbers in higher classes, let us restrict our discussion to real numbers
- **Real numbers** are the set of natural numbers, whole numbers, integers, rational and irrational numbers. Denoted by R
- **Natural numbers:**
- These are **counting numbers** from starting from 1.
- The set $\{1,2,3,4,5,6,7....\}$ is called natural numbers.
- Denoted by N
- **Whole numbers**:
- These are the set of **natural numbers including** 0.
- The set $\{0,1,2,3,4,5,6....\}$ is called whole numbers.
- Denoted by W
- **Integers:**
- These are the **set of negative numbers, positive numbers and** 0 excluding fractions.
- The set $\{....-3,-2,-1,0,1,2,3....\}$ is called integers.
- Denoted by Z
- **Rational numbers:**
- These are those number which can be **expressed in the form of fraction** i.e., $\frac{p}{q}$ where p and q are integers and $q \neq 0$.
- For example: $\frac{3}{5}, \frac{-2}{9}, \frac{-3}{4}$, etc.
- Denoted by Q
- There are **infinitely** many rational numbers between any two rational numbers.
- **Irrational numbers:**
- These are those which are not rational i.e., which **cannot be expressed**

in the form of $\frac{p}{q}$ where p and q are integers and $q \neq 0$.

- For example: $\sqrt{2}, \sqrt{3}, \sqrt{5},$ etc.

Real Numbers and their Decimal Expansions

There are two cases of decimal expansions

1. **Remainder becomes zero**

- Decimal expansion of numbers whose remainder becomes zero after some step is called terminating.
- For example: $\frac{7}{8} = 0.875$, the remainder becomes zero after some steps

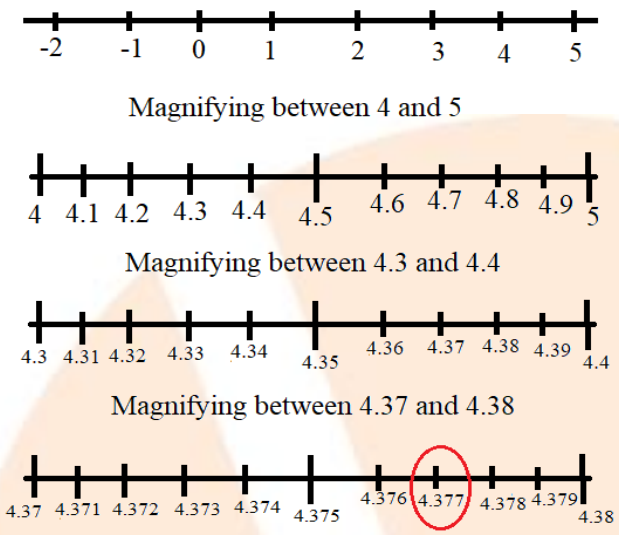
2. **Remainder never become zero**

- Decimal expansion of numbers whose remainder never becomes zero after some step is called non-terminating.
- It is further divided into non-terminating recurring and non-terminating non-recurring.
- **Non-terminating recurring** means numbers which keep on repeating the same value after decimal point.
- For example: $\frac{9}{11} = 0.818181....$
- **Non-terminating non-recurring** means numbers which do not keep on repeating the same value after decimal point but remainder never become zero.
- For example: value of $\pi = 3.141592653589793283....$
- **Decimal expansion of rational numbers** is either terminating or non terminating recurring.
- **Decimal expansion of irrational numbers** is non-terminating non recurring.

Representing Real Number on Number Line

- Representation of real number on number line can be done by the process of **successive magnification**.
- For example: If we want to locate 4.377 on the number line we proceed by successive magnification i.e., 4.37 lies between 4 and 5 then loca 4.37 between 4.36 and 4.38 further divide this portion into ten equal

parts then 4.377 will lie between 4.376 and 4.378. The number line is shown below



Operations on Real Numbers

- Real number can be added, subtracted, multiplied and divided.
- For example:

Add $2+\sqrt{3}$ and $2-2\sqrt{3}$

$2+\sqrt{3}+2-2\sqrt{3}$

$=4-\sqrt{3}$

Subtract $2+\sqrt{3}$ and $2-2\sqrt{3}$

$\left(2+\sqrt{3}\right)-\left(2-2\sqrt{3}\right)$

$=2+\sqrt{3}-2+2\sqrt{3}$

$=3\sqrt{3}$

Multiply $2\sqrt{2}$ and $3\sqrt{3}$

$2\sqrt{2}\times 3\sqrt{3}$

$=2\times 3\times \sqrt{2}\times \sqrt{3}$

$=6\sqrt{6}$

Divide $10\sqrt{15}$ by $\sqrt{5}$

$$\frac{10\sqrt{15}}{\sqrt{5}}=\frac{10\sqrt{3}\times\sqrt{5}}{\sqrt{5}}=10\sqrt{3}$$

- Some common facts of operation on real numbers are

1. The **sum or difference** of a rational number and an irrational number is irrational.
2. The **product or quotient** of a non-zero rational number with an irrational number is irrational.
3. If we add, subtract, multiply or divide two irrationals, then the result may be rational or irrational.

Rationalizing denominator

- When denominator is **irrational** then the process of converting the denominator rational is **called rationalizing denominator.**
- It is obtained by multiplying numerator and denominator by the irrational term present in denominator but with opposite sign.
- For example: Rationalizing $\frac{1}{\sqrt{2}+3}$

$$\frac{1}{\sqrt{2}+3}\times\frac{\sqrt{2}-3}{\sqrt{2}-3}$$
$$=\frac{\sqrt{2}-3}{\left(\sqrt{2}\right)^2-3^2}$$
$$=\frac{\sqrt{2}-3}{2-9}$$
$$=\frac{\sqrt{2}-3}{-7}$$

Laws of Exponents for Real Numbers

There are some laws of exponent for real numbers such as

a. $x^m.x^n=x^{m+n}$

b. $\frac{x^m}{x^n}=x^{m-n}$

c. $\left(x^m\right)^n=x^{mn}$

d. $x^m y^m=\left(xy\right)^m$