B.B.S.S. Sec. School.
Class IX

Maths

Ch-1 NUMBER SYSTEMS.

1) Classification of numbers:

(i) Natural Numbers:— The counting numbers are called the natural numbers, e.g. 1, 2, 3, 4, 5, ------- 100 ... 999 ...

(ii) Whole Numbers: If we include '0' in the list of natural numbers i.e. 0, 1, 2, 3, 4, 5, ------- . These numbers are called whole numbers. It is represented by the symbal W.

(iii) Integers: The collection of negative integers and whole numbers is called 'integers'. these are represented by the symbal Z.
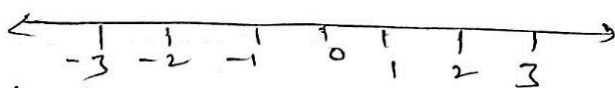
(iv) Rational Numbers:—

The numbers which can be written in the form of $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

for example, $\frac{5}{7}$, $\frac{3}{4}$, 0, 1, 2, 4, -3, -4 ------- .

Ex 1.1 ① Yes, '0' is a rational number.

$\therefore \ 0 = \frac{0}{1} \Rightarrow$ here denominator $q \neq 0$

$\therefore \ 0$ is a rational number.

② $\frac{3}{5} \Rightarrow \frac{3}{5}$ we can write it as $\frac{3 \times 6}{5 \times 6} = \frac{18}{30}$

$\frac{4}{5} \Rightarrow \frac{4}{5}$ we can write it as $\frac{4 \times 6}{5 \times 6} = \frac{24}{30}$

we know that $18 < 19 < 20 < 21 < 22 < 23$

$\Rightarrow \frac{19}{30}, \frac{20}{30}, \frac{21}{30}, \frac{22}{30}$ and $\frac{23}{30}$ are required rational numbers.

Homework! Ex 1.1 — Q.2 and Q.4.

Assignment :

Q.1 Write the smallest and greatest natural number.

Q.2 Write four rational numbers between 4 and 5.

Q.3 Write five rational numbers between $\frac{3}{4}$ and $\frac{2}{3}$.

Q.4 Represent $-\frac{3}{4}$ on number line.

② Decimal representation of rational numbers

A rational number can be expressed as a decimal number.

(i) Terminating decimal :-

The rational number with a finite decimal part are known as finite or terminating decimal for example $\frac{3}{4} = 0.75$

$$\frac{1}{8} = 0.125$$

$$
\begin{array}{r}
4)\,30\ (0.75 \\
\underline{28} \\
20 \\
\underline{20} \\
\times
\end{array}
$$

$$
\begin{array}{r}
8)\,10\ (0.125 \\
\underline{8} \\
20 \\
\underline{16} \\
40 \\
\underline{40} \\
\times
\end{array}
$$

(ii) Non terminating repeating decimal :-

Sometimes we face the situation that the division process never comes to an end it means then if always remainder. The remainder starts repeating after certain number of steps in these cases, a block of digit repeats. such decimals are called non terminating repeating decimal. for example

① $\frac{1}{3} = 0.3333\cdots$
$\Rightarrow 0.\overline{3}$

④ $0.123123123\cdots$

③ <u>**Irrational numbers :-**</u>

A number 's' is called irrational if it can not be written in the form of $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

for example ! $\sqrt{2}, \sqrt{3}, \sqrt{5}, \sqrt{15}, \pi$ ----- etc

Non termination non repeating decimal numbers also can not written in the form of $\frac{p}{q}$ therefore these are also irrational numbers.

for example   0.10100100001 ------,

0.2022002220002222 ------,

<u>Ex1.2</u> Qi① we know that real number is either rational or irrational. So we can say that every irrational number is a real number. Here the given statement is true.
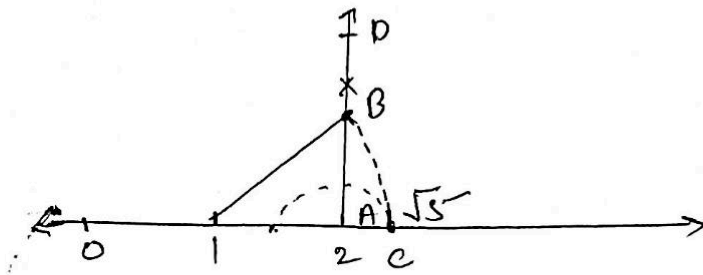
④ Since every real number can be represented on a number line. Thus every point on the number line is of the form $\sqrt{m}$ where m is natural number is correct.

<u>Q.2</u>   square root of all posative integers are irrational number is not correct. Such of

$$\sqrt{16} = 4 \text{ which is a rational number}$$

$$\sqrt{25} = 5 \quad '' \quad '' \quad '' \quad ''$$

P.TO.

Construction: (i) Take $OA = 2$ units and draw perpendicular AB on A.

(ii) Cut $AB = 1$ unit ($~~OA = AB~~$) and join OB.

(iii) By taking O as centre and OB as radius draw an arc which intersect the number line at C.

Hence $OC = \sqrt{5}$

∴ point C represents $\sqrt{5}$ on number line.

Proof In Rt $\triangle OAB$

$$OB^2 = OA^2 + AB^2$$
$$OB^2 = (2)^2 + (1)^2$$
$$OB^2 = 4 + 1$$
$$\underline{OB = \sqrt{5}}$$

Assignment:- (1) Write properties of rational and irrational number.

② Represent $\sqrt{2}, \sqrt{3}, \sqrt{7}, \sqrt{11}$ on number line.

③ Write three irrational number between $\sqrt{3}$ and $\sqrt{5}$

④ Write six rational number between 3 and 5.

P.TO

Converting a non-terminating recurring decimal number ①
into $\frac{p}{q}$-form.

Algorithm:— ① Equate the given decimal number as x.

② write the decimal number in decimal form by removing bar from the top of repeating digit. for example

$0.\overline{6} = 0.6666\cdots$

③ $0.\overline{14} = 0.141414\cdots$

If the repeating decimal has one place repetition multiply by 10, a two place repetion multiply by 100 and so on.

④ Subtract the number obtain in step ① from the number obtain from ③.

⑤ write the number in simplest form.

Ex1.3 Q① (iii) $\frac{1}{11} = 0.0909\cdots$

$\frac{1}{11} = 0.\overline{09}$

(Non-terminating and repeating)

(iv) $4\frac{1}{8} = \frac{33}{8} = 4.125$

(Terminating)

$11)\overline{100}(0.0909\cdots$
$\quad\quad 99$
$\quad\quad\overline{100}$
$\quad\quad99$
$\quad\quad\overline{1}$

$8)\overline{33}(4.125$
$\quad 32$
$\quad\overline{10}$
$\quad8$
$\quad\overline{20}$
$\quad 16$
$\quad\overline{40}$
$\quad 40$
$\quad\overline{2}$

Q.3 ① Let $x = 0.\overline{6}$
Then
$x = 0.66666\cdots\cdots -①$
on multiplying equation ① by 10
$10x = 6.6666\cdots -①$
on subtracting ① by ①
$10x - x = 6.66666\cdots - 0.66666\cdots$
$9x = 6$
$x = \frac{6^2}{9^3} = \frac{2}{3}$ Ans

Q.2

$$\frac{5}{7} = 0.714\cdots$$

$$\frac{9}{11} = 0.818\cdots$$

∴ Three rational number between

$\frac{5}{7}$ and $\frac{9}{11}$ are

0.72072007200072······

0.75075000750006 75···

0.76076000760000 76···

$$7) \overline{50} (0.719$$
$$\underline{49}$$
$$\frac{10}{7}$$
$$\frac{30}{28}$$
$$2$$

$$11) \overline{90} (0.818$$
$$\underline{88}$$
$$\frac{20}{11}$$
$$\frac{90}{88}$$
$$2$$

Home work : solve the following questions.

Q1 (I) (IV) (V) (VI)

Q.2

Q3 (II) (III)

Q.4, 5, 6 7, 8.

Assignment :—

① write the following numbers in decima

form (I) $\frac{5}{6}$ (II) $3\frac{4}{5}$ (III) $\frac{15}{8}$ (IV) $\frac{7}{3}$.

② Express the following in the form of $\frac{p}{q}$ $(q \neq 0)$

(I) $0.\overline{7}$ (II) $0.\overline{46}$ (III) $0.\overline{728}$ (IV) 0.5

③ classify the following numbers as rational or irr

(I) $\sqrt{17}$ (II) $\sqrt{625}$ (III) 0.3678 (IV) π (V) 0.110110011000