LORD BUDDHA NATIONAL PUBLIC SCHOOL, JAUNPUR

CLASS - IX SUBJECT - MATHS

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CHAPTER - NUMBER SYSTEM

Natural Numbers → Counting numbers are known as natural numbers. E.g. → 1, 2, 3 . . . etc.

Whole Numbers → All numbers together with 0 form the collection of whole Numbers.

E.g. → 0, 1, 2, 3 . . . etc.

NOTE # → Every natural no. is a whole no.

→ 0 is a whole no. but not a natural no.

Integers → All natural numbers, 0 and negatives of natural numbers form the collection of all integers.

Rational Numbers → The number of the form $\frac{p}{q}$ where p and q are integers and $q \neq 0$, are known as rational numbers.

E.g. → $1, \frac{2}{3}, \frac{-3}{2}, \frac{5}{2}$ etc.

NOTE # → 0 is a rational no.

→ Every natural no. is a rational no.

→ Every integer is a rational no.

Equivalent Rational Numbers

We know that,

$\frac{1}{2} = \frac{1\times2}{2\times2} = \frac{1\times3}{2\times3} = \frac{1\times4}{2\times4} = \frac{1\times5}{2\times5} = \cdots$

$\Rightarrow \frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8} = \frac{5}{10} = \cdots$

These are known as equivalent rational numbers.

Simplest form of a Rational Number

A rational no. $\frac{p}{q}$ is said to be in simplest form, if p and q are integers having no common factor other than 1 and $q \neq 0$

Eg.→ The simplest form of each of $\frac{2}{4}, \frac{3}{6}, \frac{4}{8}$ etc is $\frac{1}{2}$.

Similarly, the simplest form of $\frac{6}{9}$ is $\frac{2}{3}$ & $\frac{95}{133}$ is $\frac{5}{7}$.

Representation of Rational Numbers on Real Line

Draw a line XY which extends endlessly in both the directions. Take a point O on it and let it represent 0 (zero).

Taking a fixed length, called unit length, mark off OA = 1 unit.

The midpoint B of OA denotes the rational no.

Divide the 3rd unit BC into 8 equal parts (as the given rational no. $2\frac{3}{8}$ has denominator 8) from B count the 3rd part out of 8 name it P (as the given rational no. $2\frac{3}{8}$ has numerator 3) ∴ P represents $2\frac{3}{8}$.

Some Important Results on Rational Numbers

(i) Let a and b be two rational no.s s.t. $x<y$. Then,

$\frac{1}{2}(x+y)$ is a rational no. lying between x and y.

E.g.→ Find a rational no. lying between $\frac{1}{3}$ and $\frac{1}{2}$.

Sol^n→ Let $x=\frac{1}{3}$ and $y=\frac{1}{2}$ clearly $x<y$.

A rational no. lying between x and y

$$=\frac{1}{2}(x+y) = \frac{1}{2}\left(\frac{1}{3}+\frac{1}{2}\right) = \frac{1}{2}\left(\frac{2+3}{6}\right)$$

$$=\frac{1}{2}\left(\frac{5}{6}\right)$$

$$=\frac{5}{12}$$

Hence, $\frac{5}{12}$ is a rational no. lying between $\frac{1}{3}$ and $\frac{1}{2}$.

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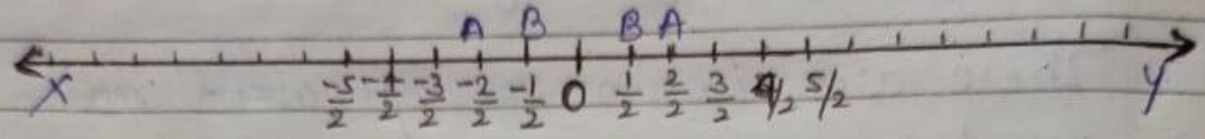
$\frac{1}{2}$. Starting from O, set off equal distances each equal to $OB = \frac{1}{2}$ unit.



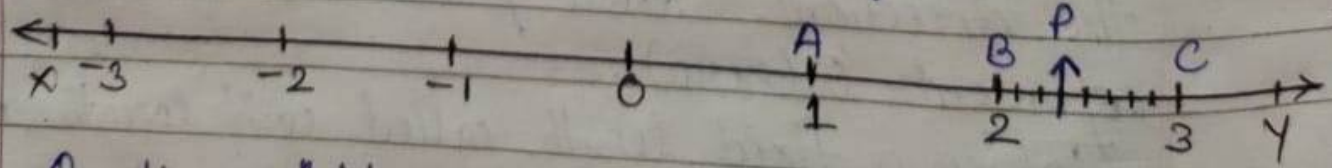
From the point O, on its right, the points at distances equal OB, 2OB, 3OB, 4OB etc, denote respectively the rational no. $\frac{1}{2}, \frac{2}{2}, \frac{3}{2}, \frac{4}{2}$ etc.

Similarly, from the point O, on its left, the points at distances equal to OB, 2OB, 3OB etc denote respectively the rational no. $\frac{-1}{2}, \frac{-2}{2}, \frac{-3}{2}$ etc.

Thus, each rational no. with 2 as denominator can be represented by some point on the number line.

E.g. → Represent $2\frac{3}{8}$ on number line.

Sol" → Draw a line XY and taking a fixed length as unit length represent integers on the line



On the right of O, take OA = 1 unit, then OB = 2 units

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∞
11 Let x and y be two rational numbers such that $x<y$
Suppose we want to find 'n' rational no.s between x and y.
Let $d = \frac{y-x}{n+1}$
Then, 'n' rational nos lying between x & y are -
$(x+d), (x+2d), (x+3d) \ldots (x+nd)$

Eg.→ Find five rational no.s between $\frac{3}{5}$ and $\frac{4}{5}$.

Sol^{n}→ Let $x = \frac{3}{5}$ $y = \frac{4}{5}$ $n = 5$.

$$d = \frac{y-x}{n+1} = \frac{\frac{4}{5}-\frac{3}{5}}{5+1} = \frac{1}{5} \times \frac{1}{6} = \frac{1}{30}$$

Then, required rational numbers are —
$(x+d), (x+2d), (x+3d), (x+4d)$ & $(x+5d)$

i.e., $\left(\frac{3}{5}+\frac{1}{30}\right), \left(\frac{3}{5}+\frac{2}{30}\right), \left(\frac{3}{5}+\frac{3}{30}\right), \left(\frac{3}{5}+\frac{4}{30}\right)$ & $\left(\frac{3}{5}+\frac{5}{30}\right)$

i.e., $\frac{19}{30}, \frac{20}{30}, \frac{21}{30}, \frac{22}{30}, \frac{23}{30}$

i.e. $\frac{19}{30}, \frac{2}{3}, \frac{7}{10}, \frac{11}{15}, \frac{23}{30}$ are the required rational numbers lying between $\frac{3}{5}$ & $\frac{4}{5}$

Exercise

1. Write five equivalent rational numbers of –

(a) $4/9$
(b) $3/2$
(c) $-\frac{1}{3}$
(d) $-4/5$
(e) $2\frac{2}{3}$
(f) $-5\frac{1}{2}$
(g) $5/7$
(h) $1/9$
(i) $-2/3$
(j) $\frac{3}{8}$

2. Express the following in simplest form:–

(a) $69/92$
(b) $473/645$
(c) $-1095/1168$
(d) $368/496$
(e) $148/185$
(f) $111/259$
(g) $-400/-640$
(h) $576/216$
(i) $-184/48$
(j) $35/1330$

3. Represent each of the following rational numbers on the number line –

(a) $-1\frac{5}{7}$
(b) 5
(c) $-3/7$
(d) $5/8$
(e) $\frac{8}{3}$
(f) 1.3
(g) -2.4
(h) $23/6$
(i) $-2\frac{1}{3}$
(j) -0.5

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3. Find a rational number lying between-

(i) $\frac{1}{4}$ and $\frac{1}{3}$

(ii) 1.3 and 1.4

(iii) -1 and $1/2$

(iv) $3/5$ and $2/3$

(v) 3 and $7/2$

(vi) $\frac{3}{8}$ and $\frac{2}{5}$

(vii) 0.75 and 1.2

(viii) $-\frac{3}{4}$ and $-2/5$

(ix) $5/3$ and $1/2$

(x) -1 and -2.2

4. Find six rational no.s between 3 and 4.

5. Find five rational no.s between $\frac{2}{5}$ and $\frac{3}{5}$.

6. Find four rational no.s between $\frac{3}{5}$ and $\frac{2}{3}$

7. Find nine rational numbers between 0 and 0.1

8. Find seven rational numbers between $\frac{1}{5}$ and $\frac{1}{4}$

9. Find five rational numbers between $\frac{2}{5}$ and $\frac{3}{4}$

10. Find six rational numbers between $\frac{3}{7}$ and $\frac{4}{7}$

11. Find 16 rational numbers between 2.1 and 2.2.

12. Find ten rational numbers between -1 and -2

13. Find ten rational numbers between $2\frac{2}{3}$ and $3\frac{2}{3}$

14. Find 16 rational numbers between 0.3 and 0.4.