

Tuesday

H. 29

Ex - 1

Rational Numbers

classmate

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1. Natural numbers → These number starts from 1 to infinitely
1, 2, 3, 4, ... ∞
2. Whole numbers → These starts from 0 to infinitely
0, 1, 2, 3, 4, ... ∞
3. Integers → It includes natural no and ~~that~~ their inverses.

-4 -3 -2 -1 0 1 2 3 4

4. ⇒ Such numbers which can be express in the form of $\frac{p}{q}$, where.

p and q both are integers and $q \neq 0$ are called Rational no.

* Properties of Rational Numbers

1. Closure Property

Addition ⇒ $\frac{a}{b} + \frac{c}{a} =$ a rational no.

$$\text{Ex} \Rightarrow \frac{3}{5} + \frac{4}{5} = \frac{7}{5}$$

(i) Subtraction $\Rightarrow \frac{a}{b} - \frac{c}{d} = \text{rational no.}$

$$\text{Ex} \Rightarrow \frac{5}{7} - \frac{2}{7} \Rightarrow \frac{5-2}{7} = \frac{3}{7}$$

(iii) Multiplication $\Rightarrow \frac{a}{b} \times \frac{c}{d} = \text{a rational no.}$

$$\text{Ex} \Rightarrow \frac{3}{2} \times \frac{5}{4} \Rightarrow \frac{15}{8}$$

(iv) Division $\Rightarrow \frac{a}{b} \div \frac{c}{d} = \text{a rational no.}$

$$(\text{if } c/d \neq 0) \quad \frac{2}{3} \div \frac{3}{4} = \frac{2}{3} \times \frac{4}{3} = \frac{8}{9}$$

2. Commutative Property

(i) Addition: For addition of two rational numbers in any order, the result is same. i.e., we can say that addition is commutative for rational no.

For any two rational no. a and b

$$= \frac{3}{5}, b = \frac{4}{2} = \frac{3}{5} + \frac{4}{2} = \frac{6+20}{10} = \frac{26}{10} \text{ L.H.S} \Rightarrow$$

$$\Rightarrow \frac{4}{2} + \frac{3}{5} = \frac{20+6}{10} = \frac{26}{10} \text{ R.H.S}$$

(ii) Addition: For two rational numbers subtraction is not commutative as for any two rational numbers a and b .

$$a - b \neq b - a$$

$$\text{If } a = \frac{5}{3}, b = \frac{2}{3} = \frac{5}{3} - \frac{2}{3} = \frac{2}{3} - \frac{5}{3}$$

$$\frac{3}{3} \neq \frac{-3}{3}$$

(iii) Multiplication: For two rational numbers multiplication is commutative as for any two rational numbers a and b .

$$a \times b = b \times a$$

$$\text{If } a = \frac{4}{4}, b = \frac{2}{3} = \frac{4}{4} \times \frac{2}{3} = \frac{2}{3} \times \frac{4}{4}$$

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

(iv) Division: Division is not commutative as for any two rational numbers

a and b

$$a \div b \neq b \div a$$

$$\text{If } a = \frac{2}{3}, b = \frac{3}{4}$$

$$\frac{2}{3} \div \frac{3}{4} = \frac{3}{4} \div \frac{2}{3}$$

$$\frac{2}{3} \times \frac{4}{3} = \frac{3}{4} \times \frac{3}{2}$$

$$\frac{8}{9} \neq \frac{9}{8}$$

3 Associative Property

(i) Addition :- For any three rational no. a, b and c addition is associative
 $a + (b + c) = (a + b) + c$

$$\text{If } a = \frac{2}{3}, b = \frac{3}{3}, c = \frac{4}{3}$$

$$\text{then } \Rightarrow \frac{2}{3} + \left(\frac{3}{3} + \frac{4}{3}\right) = \left(\frac{2}{3} + \frac{3}{3}\right) + \frac{4}{3}$$

$$\frac{2+3+4}{3} \Rightarrow \frac{9}{3} = \frac{2+3+4}{3} = \frac{9}{3}$$

(ii) Subtraction :- For any three rational numbers, a, b and c subtraction is not associative.

$$a \times (b \times c) = (a \times b) \times c$$

$$\text{If } a = \frac{4}{5}, b = \frac{3}{2}, c = \frac{1}{3}$$

$$\text{then } \frac{4}{5} \times \left(\frac{3}{2} \times \frac{1}{3}\right) = \left(\frac{4}{5} \times \frac{3}{2}\right) \times \frac{1}{3}$$

$$= \frac{4}{5} \times \frac{1}{2} = \frac{2}{5} \times \frac{1}{2}$$

$$\frac{2}{5} = \frac{2}{5}$$

$$\text{If } a = \frac{7}{2}$$

$$a - (b - c) = (a - b) - c$$

$$\text{If } a = \frac{7}{2}, b = \frac{3}{2}, c = \frac{1}{2}$$

$$\text{then } \frac{7}{2} - \left(\frac{3}{2} - \frac{1}{2}\right) = \left(\frac{7}{2} - \frac{3}{2}\right) - \frac{1}{2}$$

$$\frac{7}{2} - \frac{2}{2} = \frac{4}{2} - \frac{1}{2}$$

(iii) Multiplication :- For three rational no. a, b and c multiplication is associative.
 $a \times (b \times c) = (a \times b) \times c$

$$\text{If } a = \frac{4}{5}, b = \frac{3}{2}, c = \frac{1}{3}$$

$$\text{then } \frac{4}{5} \times \left(\frac{3}{2} \times \frac{1}{3}\right) = \left(\frac{4}{5} \times \frac{3}{2}\right) \times \frac{1}{3}$$

$$= \frac{4}{5} \times \frac{1}{2} = \frac{2}{5} \times \frac{1}{3}$$

$$\frac{2}{5} = \frac{2}{5}$$

(iv) Division :- Division is not associative for rational no. a, b, c and d

$$a \div (b \div c) \neq (a \div b) \div c$$

$$\text{If } a = \frac{2}{3} \quad b = \frac{3}{2} \quad c = \frac{1}{4}$$

$$\text{then } a \div (b \div c) = \left(\frac{2}{3} \div \frac{1}{4} \right) = \left(\frac{2}{3} \div \frac{3}{2} \right) \div \frac{1}{4}$$

$$\frac{2}{3} \div \left(\frac{4}{3} \times \frac{4}{1} \right) = \left(\frac{2}{3} \times \frac{2}{3} \right) \div \frac{1}{4}$$

$$\frac{2}{3} \div \frac{12}{2} = \frac{4}{9} \neq \frac{1}{4}$$

$$\frac{2}{3} \times \frac{2}{12} = \frac{4}{9} \times \frac{4}{1} \Rightarrow \frac{2}{18} \neq \frac{16}{9}$$

* Inverse

(i) Additive Inverse :- Additive ~~is~~ inverse of a rational number

$\frac{a}{b}$ is $-\frac{a}{b}$ and vice-versa

$$\text{ex} \rightarrow \frac{7}{9} = -\frac{7}{9}$$

(ii) Multiplicative Inverse :-

Multiplicative inverse of $\frac{a}{b}$ is $\frac{b}{a}$ and vice-versa

$$\frac{3}{5} = \frac{5}{3}$$

Ex-1 Rational numbers

Ex-1.1

Q.1 Using appropriate properties, find:

$$(i) -\frac{2}{3} \times \frac{3}{5} + \frac{5}{2} - \frac{3}{8} \times \frac{1}{2}$$

$$\rightarrow -\frac{2}{3} \times \frac{3}{5} - \frac{3}{8} \times \frac{1}{2} + \frac{5}{2} \text{ (Commutative property)}$$

$$\rightarrow -\frac{3}{5} \left(\frac{2}{3} + \frac{1}{8} \right) + \frac{5}{2} \text{ (Distributive property)}$$

$$\rightarrow -\frac{3}{5} \left(\frac{4+1}{8} \right) + \frac{5}{2}$$

$$\rightarrow -\frac{3}{5} \left(\frac{5}{8} \right) + \frac{5}{2}$$

$$\rightarrow -\frac{3}{8} + \frac{5}{2}$$

$$\frac{-1+5}{2} \rightarrow \frac{4}{2} \rightarrow 2$$

$$(ii) \frac{2}{5} + \left(\frac{3}{-7} \right) - \frac{1}{4} \times \frac{3}{2} + \frac{1}{10} \times \frac{2}{3}$$

$$\frac{2}{5} + \left(\frac{3}{-7} \right) + \frac{1}{14} \times \frac{2}{3} - \frac{1}{4} \times \frac{3}{2} \text{ Commutative property}$$

$$\frac{2}{5} \left(\frac{3+1}{-7} \right) - \frac{1}{4} \times \frac{3}{2} \text{ Distributive property}$$

$$\frac{2}{5} \left(\frac{-4+1}{14} \right) - \frac{1}{4}$$

$$\frac{2}{5} \left(\frac{-3}{14} \right) - \frac{1}{4} \quad -\frac{1}{4} \quad -\frac{1}{4}$$

$$-\frac{4-7}{28} \rightarrow \frac{-11}{28}$$

Q.2 Write the additive inverse of each of the following

$$(i) \frac{2}{3} \rightarrow -\frac{2}{3}$$

$$(ii) -\frac{5}{9} \rightarrow \frac{5}{9}$$

$$(iii) -\frac{7}{8} \rightarrow \frac{1}{8} \rightarrow \frac{6}{8}$$

$$(iv) \frac{1}{7} \rightarrow \frac{6}{7}$$

$$(v) \frac{19}{6} \rightarrow \frac{19}{6}$$

Q 3 Verify that $-(ax) = x$ for

(i) $x \rightarrow \frac{11}{5}$

LHS $-(x)$

$-\left(\frac{11}{5}\right)$

$\frac{11}{5} \rightarrow$ R.H.S $\rightarrow \frac{11}{5}$

(ii) $x \rightarrow \frac{-13}{17}$
 $-(x)$

$-\left\{-\left(\frac{-13}{17}\right)\right\}$

$-\left(\frac{13}{17}\right) \rightarrow \frac{-13}{17}$

R.H.S $\rightarrow \frac{-13}{17}$

$\frac{-13}{17}$ L.H.S = R.H.S

Q 4 Find the multiplicative inverse of the following

(i) $-13 = \frac{1}{-13}$

(v) $-1 \times \frac{-2}{5} = \frac{2}{5} = \frac{5}{2}$

(iii) $\frac{-13}{19} = \frac{19}{-13}$

(vi) $-1 = \frac{-1}{1} = -1$

(iii) $\frac{1}{5} = \frac{5}{1} = 5$

(iv) $\frac{-5}{8} \times \frac{-3}{7} = \frac{15}{56} = \frac{56}{15}$

Q 5 Name the property under multiplication used in each of the following:

(i) $\frac{-4}{5} \times 1 = 1 \times \frac{-4}{5}$ (1 is the multiplicative property identity)

(ii) $\frac{-13}{17} \times \frac{-2}{7} = \frac{-2}{7} \times \frac{-13}{17}$ (commutative property)

(iii) $\frac{-19}{29} \times \frac{29}{-19} = 1$ (Multiplicative inverse)

Q 6 Multiply $\frac{6}{13}$ by the reciprocal of $\frac{-7}{16}$

$\frac{6}{13}$ (recip of $\frac{-7}{16}$)

$\frac{6}{13} \times \frac{16}{-7} = \frac{96}{-91}$

Q 7 Tell what property allows you to compute

$\frac{1}{3} \times (6 \times \frac{4}{5})$ as $(\frac{1}{3} \times 6) \times \frac{4}{5}$

$(a \times b) \times c = a \times (b \times c)$
associative property

Q. 8 Is $\frac{8}{9}$ the multiplicative inverse of $-1\frac{1}{8}$?
Why or why not?

$$a = \frac{1}{a}, a \times \frac{1}{a} = 1$$

$$\frac{8}{9} \times \left(-1\frac{1}{8}\right) \neq$$

$$\frac{8}{9} \times \frac{-9}{8} = -1 \neq$$

Q. 9 Is 0.3 the multiplicative inverse of $3\frac{1}{3}$?
Why or why not?

$$a = \frac{1}{a}, a \times \frac{1}{a} = 1$$

$$0.3 \times 3\frac{1}{3} \neq$$

$$\frac{3}{10} \times \frac{10}{3} = 1 \neq$$

Q. 10 Write -

(i) The rational number that does not have a reciprocal

Ans: 0 (Zero)

(ii) The rational number that are equal to their reciprocal

Ans: 1 and -1

(iii) The rational number that is equal to its negative.

Ans: 0 (Zero)

Q. 11 Fill in the blanks:

(1) Zero has no reciprocal

(2) The numbers 1 and -1

(3) The reciprocal of -5 is $-\frac{1}{5}$.

(4) Reciprocal of $\frac{1}{x}$, where $x \neq 0$ is x

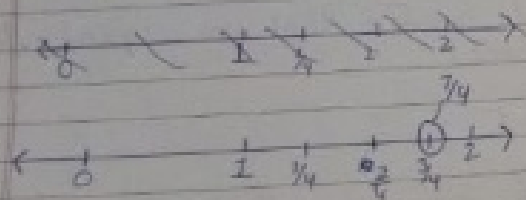
(5) The product of two rational no is always rational no.

(6) The reciprocal of a positive rational number is positive.

Ex-1.2

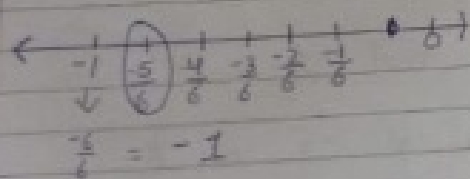
Q 80 Represent these numbers on the number line:

(i) $\frac{7}{4}$ $\frac{N}{D}$ $N > D$ $\frac{7}{4} = 1\frac{3}{4}$



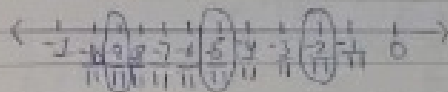
Q 81 Represent these no. on the no. line:

(i) $-\frac{5}{6}$ $\frac{N}{D}$ $N < D$ $0 \& -1$



Q 82 Represent $-\frac{2}{11}$, $-\frac{5}{11}$, $-\frac{9}{11}$ on the no. line

Ans $N < D \Rightarrow 0 \& 1 \Rightarrow 0 \& -1$



Q 83 Write five rational no. which are smaller than 2.

Ans $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, -\frac{1}{2}, -\frac{1}{3}$

Q 84 Find 10 rational no. between

$-\frac{2}{5}$ and $\frac{1}{2}$

$-\frac{2}{5} \times 2 = -\frac{4}{10} \times 2 = -\frac{8}{20}$ $-\frac{7}{20}, -\frac{6}{20}, -\frac{5}{20}, -\frac{4}{20}, -\frac{3}{20}$

$\frac{1}{2} \times 5 = \frac{5}{10} \times 2 = \frac{10}{20}$ $\frac{9}{20}, \frac{8}{20}, \frac{7}{20}, \frac{6}{20}, \frac{5}{20}$

∴

Q 85 Find five rational numbers between

(i) $\frac{2}{3}$ and $\frac{4}{5}$

Q. Find 10 rational no between $\frac{2}{3}$ and $\frac{3}{4}$

$$\frac{2 \times 5}{3 \times 5} = \frac{10 \times 3}{15 \times 3} = \frac{30}{45}$$

$$\frac{4 \times 3}{5 \times 3} = \frac{12 \times 3}{15 \times 3} = \frac{36}{45}$$

$$\frac{31}{45}, \frac{32}{45}, \frac{33}{45}, \frac{34}{45}$$

(ii) $-\frac{3}{2}$ and $\frac{5}{3}$

$$-\frac{3 \times 6}{2 \times 3} = \frac{-9}{6}$$

$$-\frac{8}{6}, -\frac{7}{6}, -\frac{6}{6}$$

$$\frac{5 \times 2}{3 \times 2} = \frac{10}{6}$$

$$\frac{5}{6}, \frac{4}{6}$$

(iii) $\frac{1}{4}$ and $\frac{1}{2}$

$$\frac{1 \times 6}{4 \times 6} = \frac{6}{24}$$

$$\frac{7}{24}, \frac{8}{24}, \frac{9}{24}, \frac{10}{24}$$

$$\frac{1 \times 2}{2 \times 2} = \frac{2}{4}$$

$$\frac{2 \times 6}{4 \times 6} = \frac{12}{24}$$

$$\frac{11}{24}$$

Q. Write 5 rational no greater than -2

-1, 0, 1, 2, 3

$\frac{1}{2}, \frac{1}{4}, \frac{1}{5}, \frac{6}{7}$

Q. Find 10 rational no between

$\frac{3}{5}$ and $\frac{3}{4}$

$$\frac{3 \times 4}{5 \times 4} = \frac{12 \times 4}{20 \times 4} = \frac{48}{80}$$

$$49, 50, 51, 52$$

$$\frac{3 \times 5}{4 \times 5} = \frac{15 \times 4}{20 \times 4} = \frac{60}{80}$$

$$53, 54, 55, 57, 58$$