

RATIONAL NUMBERS

DEFINITION – A number that can be expressed in the form of $\frac{p}{q}$, such that p and q are integers and $q \neq 0$, is known as a rational number.

Properties of Rational numbers

1. Closure property:- Rational numbers are closed under the operations of addition, subtraction and multiplication. Rational numbers are not closed under division as for any rational number, $a \div 0$ is not defined.
2. Commutative property:- The operations addition and multiplication are commutative for rational numbers. The operations subtraction and division are not commutative for rational numbers.
3. Associative property:- The operations addition and multiplication are associative for rational numbers. The operations subtraction and division are not associative for rational numbers.
4. The rational number “0” is the additive identity for rational numbers.
5. The rational number “1” is the multiplicative identity for rational numbers.
6. For a rational number $-\frac{a}{b}$, $\frac{a}{b} + \left(-\frac{a}{b}\right) = -\frac{a}{b} + \left(\frac{a}{b}\right) = 0$.
Hence $-\frac{a}{b}$ is additive inverse of $\frac{a}{b}$ and vice versa.
7. The reciprocal or multiplicative inverse of the rational number $\frac{a}{b}$ is $\frac{c}{d}$ if $\frac{a}{b} \times \frac{c}{d} = 1$.
Note: Zero has no reciprocal or reciprocal of zero is not defined.
8. Distributive Property :- For all rational numbers a,b and c
 $a(b + c) = ab + ac$ and $a(b - c) = ab - ac$.
(Hint - When you use distributive property, you split a product as a sum or difference of two products.)

$$\begin{aligned} \text{For example : } & \frac{2}{5} \times \left(\frac{-3}{7}\right) + \frac{3}{10} \times \left(\frac{-3}{7}\right) \\ & = \frac{-3}{7} \left\{ \frac{2}{5} + \frac{3}{10} \right\} = \frac{-3}{7} \left\{ \frac{4+3}{10} \right\} \\ & = \frac{-3}{7} \times \frac{7}{10} = \frac{-3}{10} \end{aligned}$$

Ex - 1.1

$$\begin{aligned} 1(ii) \quad & \frac{2}{5} \times \left(-\frac{3}{7}\right) + \frac{1}{14} \times \frac{2}{5} - \frac{1}{6} \times \frac{3}{2} \quad (\text{by commutative property}) \\ & = \frac{2}{5} \left[-\frac{3}{7} + \frac{1}{14} \right] - \frac{1}{6} \times \frac{3}{2} \quad (\text{by distributive property}) \\ & = \frac{2}{5} \left[\frac{-6+1}{14} \right] - \frac{3}{12} \\ & = \frac{2}{5} \left[\frac{-5}{14} \right] - \frac{1}{4} = \frac{2}{5} \times \frac{-5}{14} - \frac{1}{4} \\ & = -\frac{1}{7} - \frac{1}{4} = \frac{-4-7}{28} = \frac{-11}{28} \end{aligned}$$

$$\begin{aligned} 3.(ii) \quad & x = -\frac{13}{17} \quad (\text{given}) \\ \Rightarrow & -x = -\left(-\frac{13}{17}\right) \\ \Rightarrow & -x = \frac{13}{17} \\ \Rightarrow & -(-x) = -\frac{13}{17} \end{aligned}$$

Therefore $-(-x) = x$

Hence verified

$$\begin{aligned} 6. \quad & \frac{6}{13} \times \text{reciprocal of } \frac{-7}{16} \\ & = \frac{6}{13} \times \frac{16}{-7} \\ & = \frac{96}{-9} \end{aligned}$$

7. Associative property

$$9. \quad 3\frac{1}{3} = \frac{10}{3}$$

Product of 0.3 and $3\frac{1}{3}$

$$\begin{aligned} & = 0.3 \times \frac{10}{3} \\ & = \frac{3}{10} \times \frac{10}{3} = 1 \end{aligned}$$

Since the product is equal to 1,

0.3 is the multiplicative inverse of $3\frac{1}{3}$.

Practice questions

1. Write the additive inverse of the following:- (a) $\frac{13}{17}$ (b) $\frac{-21}{-8}$
2. Write the multiplicative inverse of the following:- (a) $\frac{-11}{28}$ (b) $\frac{7}{19}$
3. Do the questions given in the block TRY THESE (page no. 13)

CLASS ASSIGNMENT

(given on 13/04/20)

- 1.(a) Additive inverse of $\frac{13}{17}$ is $\frac{-13}{17}$
(do not write $\frac{13}{17} = \frac{-13}{17}$, write the whole statement)
(b) $\frac{-21}{-8} = \frac{21}{8}$, So additive inverse of $\frac{-2}{-8}$ is $\frac{-2}{8}$
2. (a) Multiplicative inverse of $\frac{-11}{28}$ is $\frac{28}{-11}$
(b) Multiplicative inverse of $\frac{7}{19}$ is $\frac{19}{7}$

TRY THESE (page no. 13)

- 3.(i) $\frac{7}{5} \left\{ \frac{-3}{12} + \frac{5}{12} \right\}$ (By distributive property)
$$= \frac{7}{5} \left\{ \frac{-3+5}{12} \right\} = \frac{7}{5} \times \frac{2}{12}$$
$$= \frac{7}{5} \times \frac{1}{6} = \frac{7}{30}$$
- (ii) $\frac{9}{16} \left\{ \frac{4}{12} + \frac{-3}{9} \right\}$ (By distributive property)
$$= \frac{9}{16} \left\{ \frac{1}{3} + \frac{-1}{3} \right\}$$
$$= \frac{9}{16} \times \left\{ \frac{1+(-1)}{12} \right\} = \frac{9}{16} \times \frac{0}{12} = \frac{9}{16} \times 0 = 0$$

Ex – 1.2

3. Five rational numbers which are smaller than 2 are

$$1, \frac{1}{2}, 0, -1, \text{ and } -\frac{1}{2}$$

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

LCM of 3 and 5 is 15

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

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

Now $\frac{10}{15} \times \frac{3}{3} = \frac{30}{45}$ and $\frac{12}{15} \times \frac{3}{3} = \frac{36}{45}$

Hence 5 rational numbers between $\frac{2}{3}$ and $\frac{4}{5}$ are $\frac{31}{45}, \frac{32}{45}, \frac{33}{45}, \frac{34}{45}$ and $\frac{35}{45}$

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

LCM of 4 and 2 is 4

Now $\frac{1}{4} = \frac{1}{4} \times \frac{6}{6} = \frac{6}{24}$ and $\frac{1}{2} \times \frac{12}{12} = \frac{12}{24}$

Hence 5 rational numbers between $\frac{1}{4}$ and $\frac{1}{2}$ are $\frac{7}{24}, \frac{8}{24}, \frac{9}{24}, \frac{10}{24}$ and $\frac{11}{24}$

6. Five rational numbers greater than -2 are $-1/4, -1/3, -1/2, -1$ and 0 .

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

LCM of 5 and 4 is 20

$$\frac{3}{5} = \frac{3}{5} \times \frac{4}{4} = \frac{12}{20} \text{ and } \frac{3}{4} = \frac{3}{4} \times \frac{5}{5} = \frac{15}{20}$$

Now $\frac{12}{20} \times \frac{4}{4} = \frac{48}{80}$ and $\frac{15}{20} \times \frac{4}{4} = \frac{60}{80}$

Hence 10 rational numbers between $\frac{3}{5}$ and $\frac{3}{4}$ are

$$\frac{49}{80}, \frac{50}{80}, \frac{51}{80}, \frac{52}{80}, \frac{53}{80}, \frac{54}{80}, \frac{55}{80}, \frac{56}{80}, \frac{57}{80} \text{ and } \frac{58}{80}$$

PRACTICE QUESTIONS

1. Represent the following on the number line:- (a) $\frac{5}{8}$ (b) $\frac{-8}{3}$ (c) $\frac{4}{9}$

(Note: Number line is to be drawn using pencil and ruler)

2. Find **6** rational numbers between $\frac{-3}{5}$ and $\frac{2}{3}$
3. Find the sum of $\frac{4}{17}$ and the reciprocal of $\frac{34}{19}$.
4. If $a = \frac{-3}{2}$, $b = \frac{4}{5}$ then verify that $a + b = b + a$ and name the property.
5. Using appropriate properties find :- $\frac{2}{5} \times \frac{-3}{7} - \frac{1}{14} - \frac{3}{7} \times \frac{3}{5}$

SELF ASSESSMENT

Answer the following:

Marks - 5

1. Product of two rational numbers is 1. If one of them is $\frac{10}{3}$, then the other no. is _____.
2. The reciprocal of $\frac{-2}{3} \times \frac{-7}{5}$ is _____.
3. $\frac{4}{8}$ lies between $\frac{1}{2}$ and 1. True or False ?
4. Sum of multiplicative inverse and additive inverse of 8 is _____.
5. $\frac{-15}{7} \div 0$ is _____.

ANSWER KEY

1. $\frac{3}{10}$ 2. $\frac{15}{14}$ 3. False 4. $\frac{-63}{8}$ 5. Not defined