Girls' High School and College, Prayagraj

Session: 2020-21

Class 8 (A,B,C,D,E)

Subject – Mathematics

Worksheet 6

Instructions : Parents kindly ensure that the child understands the given examples to solve the questions that follow. Students can also refer to class 8 Maths book or internet

Chapter – Rational Numbers (part 1)

Rational Number – If p and q are both integers and q ≠ 0, then $\frac{p}{q}$ is called a rational number.

Example $-\frac{3}{7}$ is a rational number as -3 and 7 both are integers and $7 \neq 0$

Remember

1. Zero can be written as $\frac{0}{1}, \frac{0}{2}, \frac{0}{-10}, \frac{0}{-13}$, etc. in each of these cases denominator $\neq 0$.

So 0 can be expressed as a fraction with a non $-$ zero denominator therefore zero is a rational number.

2. Every natural number, every whole number, every integer and every fraction is a rational number .
3. In the rational number $\frac{p}{q}$, where p and q are integers and q $\neq$ zero, integer p is called numerator and integer q is called the denominator.
   Example: In $-\frac{8}{15}$, numerator=-8 and denominator =15.
4. A rational number is positive if it's numerator and denominator have same signs.
   Thus
   (i) $\frac{5}{8}, \frac{-5}{-8}$, etc Is positive
   (ii) $\frac{-5}{8}, \frac{5}{-8}$ is negative
5. A rational number $\frac{p}{q}$ is said to be in standard form, if :
   (i) p and q have no common divisor (factor) other than one (1) and
   (ii) q is positive

Example : $\frac{3}{5}$ Is a rational number in standard form

PROPERTIES OF ADDITION OF RATIONAL NUMBERS.

1. **Closure property**

   If two rational numbers are added together, the result is always a rational number

   For example

   Addition of rational numbers $\frac{3}{4}$ and $\frac{5}{6}$

   $= \frac{3}{4} + \frac{5}{6} = \frac{9}{12} + \frac{10}{12} = \frac{9+10}{12} = \frac{19}{12}$, which is a rational number.

   Thus according to the closure property, if $\frac{a}{b}$ and $\frac{c}{d}$ are two rational numbers, then their addition $\frac{a}{b} + \frac{c}{d}$ Is also a rational number.

   We say, set of rational numbers is closed for addition.

2. **Commutativity**

   The addition of two rational numbers is commutative.

   According to commutative property of addition,if $\frac{a}{b}$ and $\frac{c}{d}$,

   are any two rational numbers then $\frac{a}{b} + \frac{c}{d} = \frac{c}{d} + \frac{a}{b}$.

   For Example

   Consider the rational numbers $-\frac{7}{12}$ and $\frac{5}{8}$.

   $\frac{-7}{12} + \frac{5}{8} = \frac{-14+15}{24} = \frac{1}{24}$

   $and\ \frac{5}{8} + \frac{-7}{12} = \frac{15-14}{24} = \frac{1}{24}$

   $\frac{-7}{12} + \frac{5}{8} = \frac{5}{8} + \frac{-7}{12}$

3. **Associativity**

   The addition of rational numbers is associative.

   According to this property, if $\frac{a}{b}, \frac{c}{d}$ and $\frac{e}{f}$ are any three rational numbers, then

   $\frac{a}{b} + \left[\frac{c}{d} + \frac{e}{f}\right] = \left[\frac{a}{b} + \frac{c}{d}\right] + \frac{e}{f}$

   For Example

   Consider the rational numbers $\frac{2}{3}, \frac{-5}{6}$ and $\frac{7}{12}$.

   $\frac{2}{3} + \left[\frac{-5}{6} + \frac{7}{12}\right] = \frac{2}{3} + \left[\frac{-10}{12} + \frac{7}{12}\right]$

   $= \frac{2}{3} + \frac{-3}{12} = \frac{8-3}{12} = \frac{5}{12}$

   And,

   $\left[\frac{2}{3} + \frac{-5}{6}\right] + \frac{7}{12} = \left[\frac{4}{6} + \frac{-5}{6}\right] + \frac{7}{12}$

   $= \frac{-1}{6} + \frac{7}{12} = \frac{-2+7}{12} = \frac{5}{12}$

   $= \frac{2}{3} + \left[\frac{-5}{6} + \frac{7}{12}\right] = \left[\frac{2}{3} + \frac{-5}{6}\right] + \frac{7}{12}$

4. **Existence of additive identity of rational numbers**

   Additive identity for rational numbers is zero(0)

   0+ a rational number = The same rational number +0.

   = The rational number itself

For example

$0 + \frac{-3}{5} = -\frac{3}{5} + 0 = -\frac{3}{5}$

5. **Existence of additive inverse of a rational number**

The negative of a rational number is called an additive inverse

The additive inverse of $\frac{3}{5} = -\frac{3}{5}$.

The sum of a rational number and is additive inverse = Additive identity.

Any rational number+ it's additive inverse = 0, the additive identity

For Example

$\frac{3}{5} + \left[-\frac{3}{5}\right] = 0$

Example 1

Add each pair of rational numbers, given below, and show that their addition is also a rational number:

(i) $\frac{7}{15}$ and $\frac{3}{5}$

(ii) $\frac{3}{8}$ and $\frac{-5}{12}$

Solution:

(i) $\frac{7}{15} + \frac{3}{5} = \frac{7}{15} + \frac{3x3}{5x3}$

$= \frac{7}{15} + \frac{9}{15}$

$= \frac{7+9}{15} = \frac{16}{15}$ which is a rational number.

(ii) $\frac{3}{8} + \frac{-5}{12} = \frac{3x3}{8x3} + \frac{-5x2}{12x2}$

$= \frac{9}{24} + \frac{-10}{24} = \frac{9-10}{24} = \frac{-1}{24}$ which is a rational number

Question 1 : Add each pair of rational numbers, given below, and show that their addition(sum) is also a rational number

(i) $\frac{-5}{8}$ and $\frac{3}{8}$

(ii) $\frac{5}{-26}$ and $\frac{8}{39}$

(iii) $\frac{5}{-6}$ and $\frac{2}{3}$

(iv) $\frac{7}{-18}$ and $\frac{8}{27}$

Example 2

Evaluate $\frac{3}{4}+\frac{5}{6}+\frac{-1}{4}+\frac{-7}{6}$

Solution

$$\frac{3}{4}+\frac{5}{6}+\frac{-1}{4}+\frac{-7}{6} = \left[\frac{3}{4}+\frac{-1}{4}\right]+\left[\frac{5}{6}+\frac{-7}{6}\right]$$

$$= \frac{3-1}{4}+\frac{5-7}{6}$$

$$= \frac{2}{4}+\frac{-2}{6}$$

$$= \frac{1}{2}-\frac{1}{3}$$

$$= \frac{3-2}{6} = \frac{1}{6}$$

Question 2 : Evaluate

(i) $\frac{3}{7}+\frac{-4}{9}+\frac{-11}{7}+\frac{7}{9}$

(ii) $\frac{2}{3}+\frac{-4}{5}+\frac{1}{3}+\frac{2}{5}$

Example 3

Use rational numbers $\frac{4}{9}$ and $\frac{-7}{12}$ to verify the commutative property for the addition of rational numbers.

Solution

$$\frac{4}{9}+\frac{-7}{12} = \frac{16-21}{36} = \frac{-5}{36}$$

And $\frac{-7}{12}+\frac{4}{9} = \frac{-21+16}{36} = \frac{-5}{36}$

Therefore, $\frac{4}{9}+\frac{-7}{12} = \frac{-7}{12}+\frac{4}{9}$

This verifies the commutative property for the addition of rational numbers.

Question 3: For each pair of rational numbers, verify commutative property of addition of rational numbers.

(i) $\frac{-8}{7}$ and $\frac{5}{14}$

(ii) $\frac{2}{-5}$ and $\frac{11}{-15}$

(iii) 3 and $\frac{-2}{7}$

Example 4

Use rational numbers $\frac{-4}{5}, \frac{7}{10}$ and $\frac{11}{-20}$ to verify the associative property of the addition of rational numbers.

Solution

Show that $\frac{-4}{5} + \left[\frac{7}{10} + \frac{11}{-20}\right] = \left[\frac{-4}{5} + \frac{7}{10}\right] + \frac{11}{-20}$

$$\frac{-4}{5} + \left[\frac{7}{10} + \frac{11}{-20}\right] = \frac{-4}{5} + \left[\frac{7}{10} + \frac{-11}{20}\right]$$

$$= \frac{-4}{5} + \left[\frac{14-11}{20}\right]$$

$$= \frac{-4}{5} + \frac{3}{20}$$

$$= \frac{-16+3}{20} = \frac{-13}{20}$$

And $\left[\frac{-4}{5} + \frac{7}{10}\right] + \frac{11}{-20} = \left[\frac{-4x2}{5x2} + \frac{7}{10}\right] + \frac{11}{-20}$

$$= \frac{-8+7}{10} + \frac{-11}{20}$$

$$= \frac{-1}{10} + \frac{-11}{20}$$

$$= \frac{-2-11}{20} = \frac{-13}{20}$$

Therefore, $\frac{-4}{5} + \left[\frac{7}{10} + \frac{11}{-20}\right] = \left[\frac{-4}{5} + \frac{7}{10}\right] + \frac{-11}{20}$

Question 4 : For each set of rational numbers, given below, verify the associative property of addition of rational numbers:

(i) $\frac{1}{2}, \frac{2}{3}$ and $-\frac{1}{6}$

(ii) $\frac{-7}{9}, \frac{2}{-3}$ and $\frac{-5}{18}$

Example 5

Write the additive inverse of:

(i) $\frac{3}{8}$

(ii) $\frac{-8}{15}$

Solution:

(i) The additive inverse of $\frac{3}{8}$ is $-\frac{3}{8}$

(ii) The additive inverse of $\frac{-8}{15}$ is $\frac{8}{15}$

QUESTION 5: Write the additive inverse of

(i) $\frac{-3}{8}$

(ii) $\frac{4}{-9}$

(iii) $\frac{-4}{-13}$

PROPERTIES OF SUBTRACTION OF RATIONAL NUMBERS

1. **Closure property**

   According to the closure property, if $\frac{a}{b}$ and $\frac{c}{d}$ are two rational numbers then $\frac{a}{b}-\frac{c}{d}$ is also a rational number. And so is $\frac{c}{d}-\frac{a}{b}$.

   For Example

   $\frac{3}{5}-\frac{5}{10}=\frac{3x2}{5x2}-\frac{5}{10}$

   $=\frac{6-5}{10}=\frac{1}{10}$, which is a rational number.

2. **Commutativity**

   If $\frac{a}{b}$ and $\frac{c}{d}$ are any two rational numbers then $\frac{a}{b}-\frac{c}{d} \neq \frac{c}{d}-\frac{a}{b}$ .Hence, the subtraction of rational numbers is not commutative.

   For Example

   Consider the rational numbers $\frac{-7}{12}$ and $\frac{5}{8}$

   $\frac{-7}{12}-\frac{5}{8}=\frac{-14-15}{24}=\frac{-29}{24}$

   And,

   $\frac{5}{8}-\left[\frac{-7}{12}\right]=\frac{5}{8}+\frac{7}{12}=\frac{15+14}{24}=\frac{29}{24}$

   Hence, $\frac{-7}{12}-\frac{5}{8} \neq \frac{5}{8}-(\frac{-7}{12})$

3. **Associativity.** **Pg6/8**

   The subtraction of rational numbers is not associative .i.e. if $\frac{a}{b}, \frac{c}{d}$ and $\frac{e}{f}$ are three rational numbers, then

$$\frac{a}{b}-\left[\frac{c}{d}-\frac{e}{f}\right] \neq \left[\frac{a}{b}-\frac{c}{d}\right]-\frac{e}{f}$$

For Example

Consider the rational numbers $\frac{2}{3}, \frac{-5}{6}$ and $\frac{7}{12}$.

$$\frac{2}{3}-\left[\frac{-5}{6}-\frac{7}{12}\right]=\frac{2}{3}-\left[\frac{-10}{12}-\frac{7}{12}\right]$$

$$=\frac{2}{3}-\left[\frac{-17}{12}\right]$$

$$=\frac{2}{3}+\frac{17}{12}$$

$$=\frac{8+17}{12}=\frac{25}{12}$$

And, $\left(\frac{2}{3}-\frac{-5}{6}\right)-\frac{7}{12}=\left(\frac{4}{6}+\frac{5}{6}\right)-\frac{7}{12}$

$$=\frac{9}{6}-\frac{7}{12}$$

$$=\frac{18}{12}-\frac{7}{12}=\frac{11}{12}$$

Therefore, $\frac{2}{3}-\left(\frac{-5}{6}-\frac{7}{12}\right) \neq \left(\frac{2}{3}-\frac{-5}{6}\right)-\frac{7}{12}$

Question 6: Evaluate

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

(ii) $\frac{-4}{9}-\frac{2}{-3}$

(iii) $\frac{5}{21}-\frac{-13}{42}$

Question 7: Subtract

(i) $\frac{5}{8}$ from $\frac{-3}{8}$

(ii) $\frac{8}{11}$ from $\frac{4}{11}$

(iii) $\frac{-9}{22}$ from $\frac{5}{33}$

Question 8: The sum of two rational numbers is $\frac{9}{20}$. If one of them is $\frac{2}{5}$, find the other.

Question 9: Which rational number should be added to $\frac{-7}{8}$ to get $\frac{5}{9}$?

Question 10: What should be subtracted from -2 to get $\frac{3}{8}$?

Question 11: Evaluate

(i) $\frac{3}{7}+\frac{-4}{9}-\frac{-11}{7}-\frac{7}{9}$

(ii) $\frac{4}{7}-\frac{-8}{9}-\frac{-13}{7}+\frac{17}{9}$

END.