Girls' High School & College, Prayagraj
Worksheet -7
Session-2020-2021
Class-8 (A, B, C, D, E)
Subject – Mathematics
Topic: Rational numbers (PART-II)

Instructions: Parents please ensure that the student spends enough time to understand the given examples before solving the questions that follow. They can refer to a text book of maths (class-8) for the given topic. They can also refer to internet for clear concept of the topic.

Multiplication of Rational numbers:

Properties 1 and 2

Closure property:

1. If any two rational numbers are multiplied together, the result is always a rational number.
   Example:Multiplication of $\frac{3}{4}$ and $\frac{5}{6}$ = $\frac{3}{4} \times \frac{5}{6}$ = $\frac{3 \times 5}{4 \times 6}$ = $\frac{5}{8}$ is a rational number.
   Multiplication of $-\frac{3}{8}$ and $\frac{5}{12}$ = $-\frac{3 \times 5}{8 \times 12}$ = $\frac{-5}{32}$

2. **Commutative property:**
   According to commutative property of multiplication, if $\frac{a}{b}$ and $\frac{c}{d}$ are two rational numbers then $\frac{a}{b} \times \frac{c}{d} = \frac{c}{d} \times \frac{a}{b}$
   Example: Consider the rational numbers - $\frac{7}{12}$ and $\frac{5}{8}$ = $-\frac{7}{12} \times \frac{5}{8}$ = - $\frac{35}{96}$ OR
   $\frac{5}{8} \times \frac{-7}{12}$ = $\frac{-35}{96}$

Question 1.

Evaluate:

1. $- \frac{14}{5} \times \frac{-6}{2}$

2. $\frac{7}{6} \times \frac{-18}{91}$

3. $- \frac{125}{72} \times \frac{9}{-5}$

4. $\frac{-11}{9} \times \frac{-51}{-44}$

5. $\frac{-16}{5} \times \frac{20}{8}$

Question 2: Multiply

1. $\frac{5}{6}$ and $\frac{8}{9}$

2. $\frac{2}{7}$ and $\frac{-14}{9}$

3. $\frac{-7}{8}$ and 4

4. $\frac{36}{-7}$ and $\frac{-9}{28}$

5. $\frac{3}{-2}$ and $\frac{-7}{3}$

6. $\frac{-1}{5}$ and $\frac{2}{9}$

7. $\frac{5}{-4}$ and $\frac{13}{-11}$

8. 3 and $\frac{-8}{15}$

9. $\frac{-7}{10}$ and $\frac{-8}{15}$

10. 34 and $\frac{-12}{17}$

Property 3:

Distributivity of multiplication over addition:

The multiplication of rational number is distributive over their addition / subtraction

Example

Consider any three numbers; $\frac{3}{4}, \frac{-4}{5}$ and $\frac{5}{6}$ then ; $\frac{3}{4} \times [\frac{-4}{5} + \frac{5}{6}] =$

$$\frac{3}{4} \times [\frac{-4 \times 6 + 5 \times 5}{30}]$$

$$= \frac{3}{4} \times (\frac{-24 + 25}{30}) = \frac{3}{4} \times \frac{1}{30} = \frac{3 \times 1}{4 \times 30} = \frac{1}{40}$$

OR

$$\frac{3}{4} \times \frac{-4}{5} + \frac{3}{4} \times \frac{5}{6} = \frac{3 \times -4}{4 \times 5} + \frac{3 \times 5}{4 \times 6} = \frac{-3}{5} + \frac{5}{8} = \frac{-3 \times 8 + 5 \times 5}{40} = \frac{-24 + 25}{40} = \frac{1}{40}$$

Question 3:

Evaluate:

1. $[\frac{2}{-3} \times \frac{5}{4}] + [\frac{5}{9} \times \frac{3}{-10}]$

2. $[2 \times \frac{1}{4}] - [\frac{-18}{7} \times \frac{-7}{15}]$

3. $[-5 \times \frac{2}{15}] - [-6 \times \frac{2}{9}]$

4. $[\frac{8}{5} \times \frac{-3}{2}] + [\frac{-3}{10} \times \frac{9}{16}]$

Property 4.

Multiplicative identity for rational numbers is one (1)

Example $\frac{5}{7} \times 1 = 1 \times \frac{5}{7} = \frac{5}{7}$

Question 4: Multiply each rational number by one (1)

1. $\dfrac{7}{-5}$
2. $\dfrac{-3}{-4}$
3. $\dfrac{-8}{13}$
4. $\dfrac{-6}{-7}$

Property 5: The reciprocal of a rational number is called its multiplicative inverse:

1. The multiplicative inverse of $\dfrac{3}{5}$ = the reciprocal of $\dfrac{3}{5} = \dfrac{5}{3}$
2. A rational number $\times$ its multiplicative inverse = 1

Example $\left[\dfrac{-5}{8}\right] \times \left[\dfrac{8}{-5}\right] = 1$

$\left[\dfrac{7}{-8}\right] \times \left[\dfrac{-8}{7}\right] = 1$

Question 5 (i): Write the reciprocal (multiplicative inverse)of each rational number given below:

1. 5
2. $\dfrac{-3}{4}$
3. $\dfrac{5}{11}$
4. $\dfrac{-7}{-8}$
5. $\dfrac{15}{-17}$

Question 5 (ii): Find reciprocal of:

1. $\dfrac{3}{5} \times \dfrac{2}{3}$
2. $\dfrac{-8}{3} \times \dfrac{13}{-7}$

3. $\dfrac{-3}{5} \times \dfrac{-1}{13}$

Question 6: Verify that: $(a + b) \times c = (a \times c + b \times c)$, if

   i. $a = \dfrac{4}{5}$, $b = \dfrac{-2}{-3}$ and c= -4

   ii.   a= 2, $b = \dfrac{4}{5}$, and $c = \dfrac{-3}{10}$

Question 7: Verify that $a \times (b-c) = (a \times b) - (a \times c)$; if

   i. $a = \dfrac{4}{5}$, $b = -\dfrac{7}{4}$ and c= 3

   ii. $a = \dfrac{3}{4}$, $b = \dfrac{8}{9}$ and c= -5

Question 8: Fill in the blanks:

1. The product of two positive rational numbers is always _____.
2. The product of two negative rational numbers is always _____.
3. Rational number 0 has _____ reciprocal.
4. The product of rational number and its reciprocal is _____.
5. If m is reciprocal of n, then the reciprocal of n is_____.

The Division Of Rational Numbers:-

1. **Closure property**:- If a rational number is divided by some non – zero rational number, the result is always a rational number.
   Example: $\dfrac{3}{4}$ and $\dfrac{5}{8}$ are two rational numbers. Since $\dfrac{5}{8} \neq 0$ then $\dfrac{3}{4} \div \dfrac{5}{8}$ is a rational number.
2. 0 and $\dfrac{5}{2}$ are two rational numbers and $\dfrac{5}{2} \neq 0$, then $0 \div \dfrac{5}{2} = 0 \times \dfrac{2}{5} = 0$ is a rational number.

Question 9 : Evaluate:

1. $1 \div \frac{1}{3}$
2. $3 \div \frac{3}{5}$
3. $0 \div \left(\frac{-4}{7}\right)$
4. $\frac{-3}{4} \div (-9)$
5. $\frac{8}{-5} \div \frac{24}{25}$
6. $\frac{3}{4} \div \left(\frac{-5}{12}\right)$
7. $-5 \div \left(\frac{-10}{11}\right)$
8. $\frac{-7}{11} \div \left(\frac{-3}{44}\right)$

Commutative property: Division of two different rational numbers is not commutative:

Example: If $\frac{a}{b}$ and $\frac{c}{d}$ are two non – zero rational numbers then $\frac{a}{b} \div \frac{c}{d} \neq \frac{c}{d} \div \frac{a}{b}$

The same can be verified with any pair of rational number.

Question 10 Divide:

i.   3 by $\frac{1}{3}$

ii.   0 by $\frac{7}{-9}$

iii.   2 by $\left(\frac{-1}{2}\right)$

iv. $\frac{-5}{8}$ by $\frac{1}{4}$

v. $\frac{-3}{4}$ by $\frac{-9}{16}$

Associativity: Division of rational number is not associative:

i.e. if $\frac{a}{b}, \frac{c}{d}$ and $\frac{e}{f}$ are rational numbers such that $\frac{c}{d} \neq 0$ and $\frac{e}{f} \neq 0$

then $\frac{a}{b} \div (\frac{c}{d} \div \frac{e}{f}) \neq (\frac{a}{b} \div \frac{c}{d}) \div \frac{e}{f}$

Example: the product of two rational numbers is = $\frac{8}{9}$ and one of them is - $\frac{5}{6}$ the other number = $\frac{8}{9} \div (-\frac{5}{6})$

$$= \frac{8}{9} \times (-\frac{6}{5}) = -\frac{8 \times 6}{9 \times 5}$$

$$= -\frac{8 \times 2}{3 \times 5} = -\frac{16}{15}$$

Question 11:

1. The product of two rational number is -2. If one of them is $\frac{4}{7}$, find the other.

2. m and n are two rational numbers such that $m \times n = -\frac{25}{9}$

(i)   if m= $\frac{5}{3}$, find n.

(ii)   if n= $-\frac{10}{9}$,find m.

3. By what number must $\frac{-3}{4}$ be multiplied so that the product is $-\frac{9}{16}$?

Inserting Of Rational Numbers Between:-

Method 1: If a and b are two rational numbers then $\frac{a+b}{2}$ is also a rational number and its value lies between a and b.

Example 1: Insert one rational number between 2 and 3

Solution: 2 and 3 = 2, $\frac{2+3}{2}$, 3= $\frac{5}{2}$ =2.5

$$= 2, 2.5, 3$$

The required rational number is 2.5

Example 2: Insert two rational numbers between 7 and 8.

Solution: 7 and 8= 7, $\frac{7+8}{2}$, 8

= 7, 7.5, 8.

$$= 7, \frac{7+7.5}{2}, 7.5, 8.$$

The required rational numbers are 7.25, 7.5

Example 3: insert three rational numbers between 3 and 4.

Solution : $3, \frac{3+4}{2}, 4$

$$= 3, 3.5, 4.$$

$$= 3, \frac{3+3.5}{2}, 3.5, \frac{3.5+4}{2}, 4$$

$$= 3, 3.25, 3.5, 3.75, 4.$$

The required rational numbers between 3 and 4 are = 3.25, 3.5, 3.75

Example 4: Insert five rational numbers $\frac{3}{4}$ and $\frac{7}{8}$

Step 1: Find L.C.M of 4 and 8 =8

Make denominator of $\frac{3}{4} = \frac{3\times2}{4\times2} = \frac{6}{8}$ and $\frac{7}{8} = \frac{7}{8}$

Step 2: Since five rational numbers are required, multiply the numerator and the denominator of each rational number (obtained in step 1) by 5+1=6

$$\therefore \frac{6\times6}{8\times6} = \frac{36}{48} \text{ similarly } \frac{7\times6}{8\times6} = \frac{42}{48}$$

Required rational numbers between $\frac{3}{4}$ and $\frac{7}{8}$ i.e. $\frac{36}{48}$ and $\frac{42}{48}$

$$= \frac{37}{48}, \frac{38}{48}, \frac{39}{48}, \frac{40}{48}, \frac{41}{48}$$

Question 12:

(i) Insert one rational number between:

1. 2 and 3.2
2. 7 and 8

(ii)Insert two rational numbers between :

1. 6 and 7
2. 4.8 and 6

(iii) Insert three rational numbers between:

1. 3 and 4
2. 10 and 12

(iv)Insert five rational numbers between $\frac{3}{5}$ and $\frac{2}{3}$

(v)Insert six rational numbers between $\frac{5}{6}$ and $\frac{8}{9}$

******END*****