CLASS 8
MATHEMATICS

CHAPTER : RATIONAL NUMBERS

https://youtu.be/NszAcjk0-kk

Natural Numbers	1,2,3,.....
Whole Numbers	0,1,2,3,....
Integers	......., -3,-2,-1,0,1,2,3,....
Rational Numbers	-2/1, 8/2, 0.5, -1.2, 0

Rational Number DEFINITION

Any number which can be represented in the form of p/q, where q is not equal to zero.

Examples of Rational Numbers

p	q	p/q	Rational/Not Rational
10	2	10/2=5	Rational
1	1000	1/1000= 0.001	Rational
50	2	50/2=25	Rational
7	0	7/0	Not Rational (q=0)

Standard Form of Rational Number

A rational number is said to be in standard form if (i) the denominator of the rational number is positive (ii)the numerator and denominator have no common factor other than one

Example : 36/42= 6/7 , 6/7 is in standard form

Positive and Negative Rational Numbers

Positive	Negative
If both the Nr. & Dr. are of the same sign	If Nr. & Dr. Are of opposite signs
Example : 7/9, 15/17, ⅗, -9/-11	Example : -⅖, -7/9, 1/-5

Properties of Addition of Rational Numbers

1. Closure Property :

   If a/b and c/d are any two Rational numbers, then a/b + c/d is also a Rational number.

   Example: ⅓ + ⅖
   L.C.M of 3 & 5 =15, so
   ⅓ + ⅖ = ((1×5)+(2×3))/15 =(5+6) /15
   =11/15
   Which is a Rational number

2. Commutative Property:

   If a/b and c/d are any two Rational numbers, then a/b +c/d = c/d+ a/b

   Example: ⅓ + ⅖
   L.C.M of 3 & 5 =15, so
   ⅓ + ⅖ = ((1×5)+(2×3))/15 =(5+6) /15
   =11/15 (i)
   Now ⅖+⅓
   LCM of 5 & 3=15, so
   ⅖+⅓=((2×3)+(1×5))/15=(6+5)/15
   =11/15 (ii)
   (i) = (ii)

3. Associative Property :

   If a/b, c/d and e/f are any three Rational numbers, then
   (a/b+c/d)+e/f = a/b+ (c/d+e/f)

   Example : (⅓ + ⅖) + ¾ =
   ((1×5)+(2×3))/15 + ¾ = (5+6)/15+¾
   =11/15+¾
   =(44+45)/60
   =89/60 (i)

now $\frac{1}{3}+(\frac{2}{5}+\frac{3}{4})= \frac{1}{3}+((2\times4)+(3\times5))/20$

$=\frac{1}{3}+(8+15)/20$

$=\frac{1}{3}+23/20$

$=(20+69)/60=89/60$ (ii)

(i)=(ii)

4. Additive Identity

   If a/b be any Rational number, then

   a/b+0=0+a/b=a/b, so zero is the additive Identity

   Example: $\frac{1}{2}+0=\frac{1}{2}$; $0+\frac{1}{2}=\frac{1}{2}$

5. Additive Inverse

   The additive Inverse of any Rational number a/b is (-a/b)

   i.e. a/b+(-a/b) =(-a/b)+a/b=0

   Example: $\frac{1}{3}+(-\frac{1}{3})=(1+(-1))/3=0/3=0$

Properties of Subtraction of Rational numbers

1. Closure Property :

   If p/q and r/s are any two Rational Numbers, then p/q-r/s is also a Rational number.

   Example: $2/5-\frac{1}{3}=((2\times3)-(1\times5))/15$

   $=(6-5)/15=1/15$, is a Rational number

2. Commutative Property:

   If p/q and r/s are any two Rational numbers, then

   P/q-r/s not equal to r/s-p/a

   Example: $\frac{2}{5}-\frac{1}{3}=(2\times3)-(1\times5))/15$

   $(6-5)/15=1/15$ (i)

   Now $\frac{1}{3}-\frac{2}{5}=((1\times5)-(2\times3)/15$

   $(5-6)/15=-1/15$ (ii)

   (i) not equal to (ii)

3. Associative Property

   If p/q, r/s and t/u are three Rational Numbers, then

   P/q-(r/s-t/u) not equal to (p/q-r/s)-t/u

   Example: $\frac{2}{5}-(\frac{1}{3}-3/7)=\frac{2}{5}-((1\times7)-(3\times3))/21$

   $=\frac{2}{5}-(7-9)/21$

   $=\frac{2}{5}-(-2/21)$

   $=\frac{2}{5}+2/21=(42+10)/105=52/105$ (i)

   $(2/5-\frac{1}{3})-3/7=(6-5)/15-3/7=1/15-3/7$

=(7-45)/105=-38/105 (ii)

(i) not equal to (ii)

4. Existence of Identity & Inverse under Subtraction
   In case of subtraction of Rational number p/a, p/q-0= p/q but 0-p/q=-p/q

   Therefore we cannot find any Rational number which can satisfy the definition of identity element.
   Since there is no identity, there cannot be an inverse under subtraction for Rational number.

Properties of Multiplication of Rational Numbers

1. Closure Property :
   If p/q and r/s are two Rational Numbers, then p/q×r/s is also a Rational number.
   1/3×2/5=2/15, is a Rational number.

2. Commutative Property:
   If p/q and r/s are two Rational, then
   P/q×r/s=r/s×p/q

   Example:
   1/3×2/5=2/15 & 2/5×1/3=2/15
   So, 1/3×2/5=2/5×1/3

3. Associative Property
   If p/q, r/s and t/u are three Rational Numbers, then
   P/q×(r/s×t/u)=(p/q×r/s)×t/u

   Example:
   1/3×(2/5×3/4)=1/3×6/20=6/60 (i)
   (1/3×2/5)×3/4=2/15×3/4=6/60 (ii)

   (i)=(ii)

4. Existence of Multiplicative Identity
   If p/q be any Rational number, then
   P/q×1=1×p/q=p/a, '1' is the multiplicative Identity.

   Example:
   3/4×1=1×3/4=¾

5. Existence of Multiplicative Inverse

If p/a be any non zero rational number, then q/p is its Multiplicative Inverse
Example:
3/4×4/3=1

6. Multiplication by '0'

If p/a be any Rational number then
P/q×0=0×p/q=0

7. Distributive property of Multiplication over addition and subtraction

If a/b,c/d and e/f be any three Rational numbers, then
a/b×(c/d+e/f)=a/b×c/d+a/b×e/f or
a/b×(c/d-e/f)=a/b×c/d-a/b×e/f

Properties of division of Rational numbers

1. Closure Property :

For any Rational number a/b, a/b÷0 is not defined
Example:
(i) 1/3÷2/5=1/3×5/2=⅚
(ii) 1/3÷0 is not defined

2. Commutative Property

If p/a and r/s are two Rational numbers, then
p/q÷r/s not equal to r/s÷p/a

Example:
1/3÷2/5=1/3×5/2=⅚ (i)
2/5÷1/3=2/5×3/1=6/5 (ii)
(i) not equal to (ii)

3. Associative Property

If p/a, r/s and t/u are three Rational numbers ,then
p/q÷(r/s÷t/u) not equal to (p/q÷r/s)÷t/u

Operations on Rational Numbers

Addition

Example 1: Add 5/9 and ½
Solution : 5/9+½=((5×2)+(1×9))/18=(10+9)/18
=19/18

Example 2: Add $-\frac{1}{2}$ & $\frac{3}{4}$
Solution:
$-\frac{1}{2}+\frac{3}{4}=((-1\times2)+(3\times1))/4=(-2+3)/4=\frac{1}{4}$

Subtraction

Example 1: subtract $\frac{1}{2}$ from 5/9
Solution:

$5/9-\frac{1}{2}=(10-9)/18=1/18$

Example 2. Subtract $-\frac{1}{2}$ from 7/9
Solution:

$7/9-(-\frac{1}{2})=7/9+\frac{1}{2}=(14+9)/18=23/18$

Multiplication

Example 1: Multiply $(-\frac{1}{3})\times5/6$
Solution :

$-1/3\times5/6=-5/18$

Example 2: Multiply $3/4\times0$
Solution:
$3/4\times0=0$

Division

Example 1: $-3/2\div5$
Solution: $-3/2\div5=-3/2\times1/5=-3/10$

How to represent Rational number on Number line

https://youtu.be/WynEmwOyMjE

https://youtu.be/SfhvqcG2aJc

Rational Number between two Rational Number

If a/b and c/d are two Rational Number, and a/b less then c/d then,

a/b, (a/b+c/d)/2, c/d

please refer Pg no.31, example 1 And example 2

Home work

Exercise 1.1	***Whole sums***
Exercise 1.2	***Qn. 1,2,5***
Exercise 1.3	***Qn. 1,2,3,6,7,8,9 10***
Exercise 1.4	***Qn. 1,2,3***
Exercise 1.5	***Qn. 3,4,5,6***
Exercise 1.6	***Qn. 1,2,3,4***