Rational Numbers Class 8 Notes - Chapter 1

The numbers which are involved in many mathematical applications such as addition, subtraction and multiplication which are inherently closed with many mathematical processes are called Rational numbers.

Introduction to Rational Numbers

In chapter Rational numbers for Class 8, we will learn the about rational numbers, its properties, how to represent rational number on a number line, and also to find rational numbers between any two rational numbers with the help of examples.

To know more about Rational Numbers, visit here.

Whole Numbers and Natural Numbers

Natural numbers are set of numbers starting from **1** counting up to **infinity**. The set of natural numbers is denoted as **'N'.**

Set of Natural Numbers (N) = {1,2,3,…………..}

Whole numbers are set of numbers starting from **0** and going up to **infinity**. So basically they are natural numbers with the zero added to the set. The set of whole numbers is denoted as 'W'.

Whole Numbers (W) = { 0,1,2,3,…………..}

Properties of Natural Numbers and Whole Numbers

Closure Property: Closure property is applicable for whole numbers in the case of **addition** and **multiplication** while it isn't in the case for subtraction and division. This applies to natural numbers as well.

Commutative Property: Commutative property applies for whole numbers and natural numbers in the case of **addition** and **multiplication** but not in the case of subtraction and division.

Associative Property: Associative property applies for whole numbers and natural numbers in the case of addition and multiplication but not in the case of subtraction and division.

To know more about Whole Numbers, visit here.

To know more about Natural Numbers, visit here.

Integers

In simple terms **Integers** are **natural numbers** and their **negatives.** The set of Integers is denoted as 'Z' or 'I'.

Set of Integer Numbers (Z) = {………….,-3, -2, -1, 0, 1,2,3,…………..}

Properties of Integers

Closure Property: Closure property applies to integers in the case of **addition, subtraction** and **multiplication** but not division.

Commutative Property: Commutative property applies to integers in the case of **addition** and **multiplication** but not subtraction and division.

Associative Property: Associative property applies to integers in the case of **addition** and **multiplication** but not subtraction and division.

To know more about Integers, visit here.

Rational Numbers

A **rational number** is a number that can be represented as a fraction of **two integers in the form of p/q** , where q must be non-zero. The set of rational numbers is denoted as Q.

For example: -5/7 is a rational number where -5 and 7 are integers. Even 2 is a rational number since it can be written as 2/1 where 2 and 1 are integers.

To know more about Rational Numbers, visit here.

Properties of Rational Numbers

Closure Property of Rational Numbers

For any two rational numbers a and b$a*b=c\in Q$ i.e. For two rational numbers say a and b the results of addition, subtraction and multiplication operations give a rational number. Since the sum of two numbers ends up being a rational number, we can say that the **closure property applies** to rational numbers in the case of **addition**.

For example : The sum of 2/3 + 3/4 = (8+9)/12 = 17/12 is also a rational number where 17 and 12 are integers. The difference between two rational numbers results in a rational number. Therefore, the **closure property applies** for rational numbers in the case of **subtraction**.

For example : The difference between 4/5 – 3/4 = (16-15)/20 = 1/20 is also a rational number where 1 and 20 are integers. The multiplication of two rational numbers results in a rational number. Therefore we can say that the **closure property applies** to rational numbers in the case of **multiplication** as well.

For example : The product of 1/2 × (-4/5) = (-4/10) = (-2/5) which is also a rational number where -2 and 5 are integers. In the case of the division of two rational numbers, we see that for a rational number a, a÷0 is not defined. Hence we can say that the **closure property does not apply** to rational numbers in the case of **division**.

Commutative Property of Rational Numbers

For any two rational numbers a and ba∗b=b∗a. i.e., the **Commutative property** is one where the **result** of an equation must **remain the same** despite the **change in the order of operands.** Given two rational numbers a and b, (a+b) is always going to be equal to (b+a). Therefore **addition** is **commutative** for rational numbers.

For example: 2/3 + 4/3 = 4/3 + 2/3

⇒ 6/3 = 6/3

⇒ 2 = 2

Considering the difference between two rational numbers a and b, (a−b) is never the same as (b−a). Therefore, **subtraction** is **not commutative** for rational numbers.

For example, 2/3 – 4/3 = -2/3

but 4/3 – 2/3 = 2/3

When we consider the product of two rational numbers a and b, (a×b) is the same as (b×a). Therefore, **multiplication** is **commutative** for rational numbers.

For example: 2/3 × 4/3 = 8/9

and

4/3 × 2/3 = 8/9

Considering the division of two numbers a and b, (a÷b) is different from (b÷a). Therefore **division** is **not commutative** for rational numbers.

For example: 2/3 is definitely different from 3/2.

Associative Property of Rational Numbers

For any three rational numbers a,b and c, (a∗b)∗c=a∗(b∗c). i.e., Associative property is one where the result of an equation must remain the same despite a change in the order of operators.

Given three rational numbers a,b and c, it can be said that :

(a+b) + c = a + (b+c). Therefore **addition** is **associative**.

(a−b) − c ≠ a − (b−c). Because (a-b) - c = a - b - c whereas a - (b - c) = a - b + c. Therefore we can say that **subtraction** is **not associative**.

(a×b) × c=a × (b×c). Therefore **multiplication** is **associative.** (a ÷ b) ÷ c ≠ (a ÷ b) ÷ c. Therefore **division** is **not associative**.

Example: 1/2 + (1/4 + 2/3) = (1/2 + 1/4) + 2/3

⇒ 17/12 = 17/12

Also,

1/2 x (1/4 x 2/3) = (1/2 x 1/4) x 2/3

⇒ 2/24 = 2/24

⇒1/12 = 1/12

Distributive Property of Rational Numbers

Given three rational numbers a,b and c, the **distributivity** of **multiplication** over **addition** and **subtraction** is respectively given as : a(b+c)=ab+aca(b−c)=ab−ac

Example: 1/2 x (1/2 + 1/4) = (1/2 x 1/2) + (1/2 x 1/4)

3/8 = 3/8

To know more about Properties of Rational Numbers, visit here.

Negatives and Reciprocals

Negation of a Number

For a rational number, a/b, a/b+0 = a/b, i.e., when zero is added to any rational number the result is the same rational number. Here '**0′** is known as an **additive identity** for rational numbers.

If (a/b) + (-a/b) = (-a/b) + (a/b) = 0, then it can be said that the **additive inverse** or **negative** of a rational number ab is −ab. Also, (−a/b) is the **additive inverse** or **negative** of a/b.

For example : The additive inverse of -21/8 is -(-21/8) = 21/8

Reciprocal of a Number

For any rational number a/b, a/b × 1 = a/b, i.e., When any rational numbers is multiplied by **'1'** ,the result is same rational number. Therefore **'1'** is called **multiplicative identity** for rational numbers.

If a/b × c/d = 1, then it can be said that the c/d is **reciprocal** or the **multiplicative inverse** of a rational number a/b. Also, a/b is reciprocal or the multiplicative inverse of a rational number c/d.

For example : The reciprocal of 2/3 is 3/2 as 2/3 × 3/2 = 1.

To know more about Reciprocal of a Number, visit here.

Representing on a Number Line

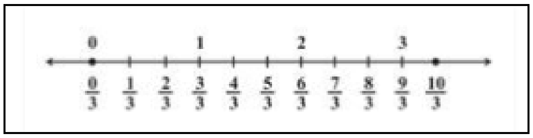
Representation of Rational Numbers on the Number Line

In order to represent a given rational number a/n, where a and n are integers, on the number line :

Step 1 : Divide the distance between two consecutive integers into 'n′ parts.

For example : If we are given a rational number 2/3, we divide the space between 0 and 1, 1 and 2 etc. into three parts.

Step 2: Label the rational numbers till the range includes the number you need to mark



Similar steps can be followed for negative rational numbers by repeating the steps in a negative direction.

To know more about Number Lines, visit here.

Rational Numbers between Two Rational Numbers

The number of rational numbers between any two given rational numbers **isn't definite**, unlike that of whole numbers and natural numbers.

For example : Between natural numbers 2 and 10 there are exactly 7 numbers but between 2/10 and 8/10 there are infinite numbers that could exist.

Method 1 Given two rational numbers, ensure both of them have the **same denominators**. Once there is a common denominator, we can pick out any rational number that lies in between.

Example: Find the rational numbers between ½ and ⅔.

LCM of denominators (2 and 3) = 6

½ x (3/3) = 3/6

⅔ x (2/2) = 4/6

We cannot find any number in between 3 and 4. So will multiply each rational number 3/6 and 4/6 by 10/10.

3/6 x 10/10 = 30/60

4/6 x 10/10 = 40/60

Hence, the rational numbers between 1/2 and 2/3 are 31/60, 32/60, 33/60, 34/60, 35/60, 36/60, 37/60, 38/60 and 39/60.

Method 2 Given two rational numbers, we can always find a rational number between them by calculating their **mean** or **midpoint**.

Example: Find the rational numbers between 3 and 4.

Mean of 3 and 4 = (3+4)/2 = 7/2

Mean of 3 and 7/2 = 13/4

Hence, the two rational numbers between 3 and 4 are 7/2 and 13/4.

To know more about Rational Numbers between Two Rational Numbers, visit here.

Frequently asked Questions on CBSE Class 8 Maths Notes Chapter 1: Rational Numbers

What are ‘Rational numbers’?

A number that can be represented as the quotient p/q of two integers such that q ≠ 0 is called as a rational number.

What are properties of ‘Rational numbers’?

1. Closure property 2. Commutative property 3. Associative property 4. Distributive property 5. Identity property 6. Inverse property

What is ‘Remainder theorem’?

The remainder theorem states that when a polynomial, f(x), is divided by a linear polynomial , x – a, the remainder of that division will be equivalent to f(a).