LITTERA PUBLIC SCHOOL

CLASS 8. CHAPTER 1 MATHS

RATIONAL NUMBER

Rational Number: A number is called rational if we can write the number in the form of p/q, where p and q are integers and q ≠ 0
i.e., 1 = 1/1, 2 = 2/1, 0 = 0/1 and 5/8 , −3/14 , 7/−15 are all rational numbers.

Between two rational numbers x and y, there exists a rational number x+y/2

We can find countless rational numbers between two rational numbers.

−x/y is called the additive inverse of x/y and vice-versa.

y/x is called the multiplicative inverse or reciprocal of x/y.

Rational number 0 is the additive identity for all rational numbers because a number does not change when 0 is added to it.

Rational number 1 is the multiplicative identity for all rational numbers because on multiplying a rational number with 1, its value does not change.

Rational numbers can be represented on a number line.

Properties on Rational Numbers
(i) Closure Property
Rational numbers are closed under :

Addition

$$eg.\ \frac{3}{5}+\frac{(-4)}{9} = \frac{27-20}{45} = \frac{7}{45}$$

which is a rational number.

Subtraction

$$\frac{5}{8}-\frac{3}{7} = \frac{35-24}{56} = \frac{11}{56}$$

$$\frac{2}{5}-\frac{3}{4} = \frac{8-15}{20} = \frac{-7}{20}$$

are rational numbers.

Multiplication:

$$\frac{-5}{7}\times\frac{2}{9} = \frac{-10}{63}$$

$$\frac{2}{3}\times\frac{5}{11} = \frac{10}{33}$$

are rational numbers.

Rational numbers are closed under addition subtraction and multiplication.

Division : eq. $-3/5 \div 2/3 = -9/10$, which is also a rational number. For any rational number a, a ÷ 0 is not defined. So, rational number are not closed under division.
However, if we exclude zero then the rational numbers are closed under division.

(ii) Commutativity:
Addition: Two rational numbers can be added in any order, i.e., commutativity holds for rational numbers under addition, i.e., for any two rational number a and b, a + b = b + a.

$$\frac{-3}{4}+\frac{5}{11} = \frac{-13}{44}$$

$$\frac{5}{11}+\left(\frac{-3}{4}\right) = -\frac{13}{44}$$

Subtraction:

$$\frac{2}{5}-\frac{5}{6} = \frac{12-25}{30} = \frac{-13}{30}$$

$$\frac{5}{6}-\frac{2}{5} = \frac{25-12}{20} = \frac{13}{30}$$

Hence, subtraction is not associative for rational numbers.

(iii) Multiplication: Multiplication is commutative for rational numbers. In general, a × b = b × a, for any two rational numbers a and b.

$$\frac{-3}{4}\times\frac{5}{6} = \frac{5}{6}\times\left(\frac{-3}{4}\right) = \frac{-15}{24}$$

Division:

$$\frac{-3}{7}\div\frac{2}{5} = \frac{-3}{7}\times\frac{5}{2} = \frac{-15}{14}$$

$$\frac{2}{5}\div\left(\frac{-3}{7}\right) = \frac{2}{5}\times\frac{7}{-3} = \frac{14}{-15}$$

$$\frac{-3}{7}\div\frac{2}{5} \neq \frac{2}{5}\div\left(\frac{-3}{7}\right)$$

Hence, division is not Cumulative for rational numbers.

(iii) Associativity:

Addition:

$$eg.\ \frac{-2}{5}+\left[\frac{3}{4}+\left(\frac{-7}{8}\right)\right] = \frac{-2}{5}+\left(\frac{-1}{8}\right) = \frac{-21}{40} = \left[\frac{-2}{5}+\frac{3}{4}\right]+\left(\frac{-7}{8}\right) = \frac{7}{20}-\frac{7}{8} = \frac{-21}{40}$$

So, addition is associative for rational numbers, i.e., for any three rational numbers a, b and c, a + (b + c) = (a + b) + c.

Subtraction:

eg. $$\frac{-3}{4}-\left[-\frac{5}{6}-\frac{2}{3}\right] = \frac{-3}{4}-\left(\frac{-9}{6}\right) = \left(-\frac{9}{6}\right) = \frac{9}{12} = \frac{3}{4}$$

and $$\left[\frac{-3}{4}-\left(\frac{-5}{6}\right)\right]-\frac{2}{3} = \frac{1}{12}-\frac{2}{3} = \frac{-7}{12}$$

i.e., $\frac{3}{4} \neq \frac{-7}{12}$.

Hence, subtraction is not associative for rational numbers.

Multiplication:

eg. $$\frac{-2}{3}\times\left(\frac{2}{5}\times\frac{6}{7}\right) = \frac{-2}{3}\times\frac{12}{35} = \frac{-24}{105} = \frac{-8}{35}$$

and $$\left(\frac{-2}{3}\times\frac{2}{5}\right)\times\frac{6}{7} = \frac{-4}{15}\times\frac{6}{7} = \frac{-24}{105} = \frac{-8}{35}$$

So, multiplication is associative for rational number, i.e., for any three rational numbers a, b and c, a × (b × c) = (a × b) × c.