Properties of Rational Number

- Numbers that can be expressed in the form $\frac{p}{q}$, where **p and q are integers** and **q≠0,** are known as **rational numbers**. The **collection of rational numbers** is denoted by **Q**. These **rational numbers** satisfies various **laws or properties** that are listed below:
- **Rational numbers** are **closed** under addition, subtraction and multiplication. If a, b are any **two rational numbers,** then and the sum, difference and product of these rational numbers is also a rational number, then we say that rational numbers satisfy the **closure law.**
- **Rational numbers** are **commutative** under addition and multiplication. If a, b are rational numbers, then:
  Commutative law under addition: a+b = b+a
  Commutative law under multiplication: axb = bxa
- **Rational numbers** are **associative** under addition and multiplication. If a, b, c are rational numbers, then:
  Associative law under addition: a+(b+c) = (a+b)+c
  Associative law under multiplication: a(bc) = (ab)c
- 0 is the **additive identity** for **rational numbers.**
- 1 is the **multiplicative identity** for **rational numbers**.
- The additive inverse of a **rational number** $\frac{p}{q}$ is $-\frac{p}{q}$, and the additive inverse of $-\frac{p}{q}$ **is** $\frac{p}{q}$.
- If $\frac{p}{q} \times \frac{a}{b} = 1$, then $\frac{a}{b}$ is the **reciprocal** or **multiplicative inverse** of $\frac{p}{q}$, and vice versa.
- For all rational numbers, p, q and r, $p(q+r) = pq + pr$ and $p(q-r) = pq - pr$, is known as the **distributive property**.

Closed Under

Type of Number	Addition (+)	Subtraction (-)	Multiplication (x)	Division (÷)
Whole Numbers	✓	✗	✓	✗
Integers	✓	✓	✓	✗
Rational Numbers	✓	✓	✓	✗

Commutative Under

Type of Number	Addition (+)	Subtraction (-)	Multiplication (x)	Division (÷)
Whole Numbers	✓	✗	✓	✗
Integers	✓	✗	✓	✗
Rational Numbers	✓	✗	✓	✗

Rational Numbers

Property	Addition (+)	Subtraction (-)	Multiplication (x)	Division (÷)
Closure	✓	✗	✓	✗
Commutative	✓	✗	✓	✗
Associative	✓	✗	✓	✗

Distributive property of multiplication over subtraction - Rational Numbers
$p(q-r) = pq - pr$ where p, q and r are **rational numbers.**

Distributive property of multiplication over addition - Rational Numbers
$p(q+r) = pq + pr$ where p, q and r are **rational numbers.**