

Rational Numbers

1. Natural numbers: Counting numbers 1, 2, 3, 4 etc are called natural numbers. The collection of natural numbers is denoted by N. That is, $N = \{1, 2, 3, 4, \dots\}$
2. Whole numbers: All natural numbers together with zero are called whole numbers. The collection of whole numbers is denoted by W. That is, $W = \{0, 1, 2, 3, 4, \dots\}$
3. Integers: Whole numbers together with negative natural numbers are called integers. The collection of integers is denoted by Z. That is, $Z = \{\dots, -4, -3, -2, -1, 0, 1, 2, 3, 4, \dots\}$
4. The numbers of the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$ are called rational numbers. For
 example $\frac{-3}{5}, \frac{7}{-11}, \frac{-13}{-213} \dots$ etc.
5. Rational numbers are closed under the operations of addition, subtraction and multiplication.
6. Rational numbers are commutative under the operations addition and multiplication.
7. Rational numbers are associative under the operations addition and multiplication.
8. The number 0 is the additive identity for rational numbers.
9. The number 1 is the multiplicative identity for rational numbers.
10. The additive inverse of the rational number $\frac{a}{b}$ is $-\frac{a}{b}$ and vice-versa.
11. The reciprocal or multiplicative inverse of the rational number $\frac{a}{b}$ is $\frac{c}{d}$ if $\frac{a}{b} \times \frac{c}{d} = 1$.
12. Multiplication is distributive over addition and subtraction of rational numbers. That is, for any three rational numbers a, b and c,
 $a \times (b + c) = a \times b + a \times c$ and $a \times (b - c) = a \times b - a \times c$
13. Rational numbers can be represented on a number line.
14. Between any two given rational numbers there are countless rational numbers.
15. There are two methods of finding rational numbers between the two given rational numbers:



First Method:

- a. Add the two rational numbers and divide the sum by 2 to get a new rational number. The rational number so obtained will lie between the given ones. (Note that here we get three consecutive rational numbers).
- b. To get another new rational number, divide the sum of any two consecutive rational numbers (obtained in above step) by 2.
- c. Repeat the above step as many times as per requirement of finding rational numbers between two rational numbers.

Second Method:

- a. Convert the denominator of both the fractions into the same denominator by taking LCM.
- b. Find the different values of integers which lie between the numerators of the two rational numbers having same denominator.
- c. The required rational numbers are obtained by taking the integers found in step 2 as numerator and keeping the denominator same as the LCM.
- d. If the new fractions do not have any number in between the given numerator, then multiply numerator as well as denominator of both the fractions by a suitable number and then find the rational numbers between them.

