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RATIONAL NUMBERS

Natural numbers: The numbers used for counting objects are called counting numbers or natural numbers. These are: 1, 2, 3, 4, ……

whole numbers: If we include 0 to natural numbers, we get whole numbers. Thus, 0, 1, 2, 3, 4, ….. are whole numbers.

Integers: If we include the negatives of natural numbers to the whole numbers, we get integers. Thus, ….., -3, -2, -1, 0, 1, 2, 3, …… are integers.
We see that we have extended the number system from natural numbers to whole numbers and then from whole numbers to integers.

Need for Rational Numbers

There are many situations which involve fractional numbers. To include such numbers, we need to extend our number system by introducing rational numbers.

What are Rational Numbers?

A number of the form p/q where p and q (≠0) are integers, is called a rational number.

Numerator and Denominator

In pq, the integer p is the numerator, and the integer q (≠0) is the denominator.
Thus in −37, the numerator is -3 and the denominator is 7.

Equivalent Rational Numbers

If we multiply the numerator and denominator of a rational number by the same non-zero integer, we obtain another rational number equivalent to the given rational number.

Positive and Negative Rational Numbers

A rational number whose numerator and denominator both are positive integers is called a positive rational number.
A rational number, whose numerator is a negative integer and denominator is a positive integer, is called a negative rational number. Similarly, if the numerator is positive integer and denominator, is a negative integer; is also a negative rational number.

Rational Numbers on a Number Line

Positive rational numbers are marked on the right of 0 on the number line whereas negative rational numbers are marked on the left of 0 on the number line.
The method of representation is the same as the method of representation of fractions on the number line.

Rational Numbers in Standard Form

A rational number is said to be in the standard form if its denominator is a positive integer and the numerator and the denominator have no common factor other than 1. Note that the negative sign occurs only in the numerator.
A rational number in standard form is said to be in its lowest form.

Reduction of a Rational Number to its Lowest Form

To reduce a rational number to its standard form (or lowest form), we divide its numerator and denominator by their HCF ignoring the negative sign, if any.
However, if there is a negative sign in the denominator, we divide by -HCF'.

Comparison of Rational Numbers

Two positive rational numbers can be compared exactly as we compare two fractions.
Two negative rational numbers can be compared by ignoring their negative signs and then reversing the order.
Comparison of a negative and a positive rational number is obvious as a negative rational number is always less than a positive rational number.

Rational Numbers Between Two Rational Numbers

There exist an unlimited number of rational numbers between any two rational numbers.

Operations on Rational Numbers

Addition

Addition of two rational numbers with same denominators: Two rational numbers with the same denominators can be added by adding their numerators, keeping the denominator same.

Addition of two rational numbers with different denominators: As in the case of fractions, we first find the LCM of the two denominators. Then we find the rational numbers equivalent to the given rational numbers with this LCM as the denominator. Now, we add the two rational numbers as in (A).

Additive Inverse

The additive inverse of the rational number p/q is –p/q