BASIC NUMERACY

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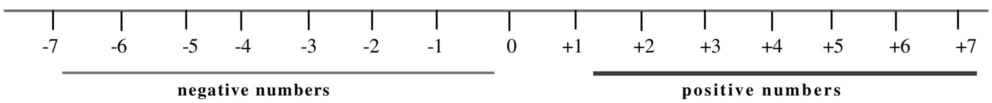
NUMBER SYSTEM

Classification of Numbers

What are 'numbers'?
Numbers are basically a symbol representing some quantity. In this section, we will discuss various types of numbers.

1. **Real Numbers :**

Those nurnbers which can be represented on the number line are called Real Numbers. For example, -7, 5, 1.33 etc.
Now, what is a number line?
A number line is used to represent the set of real numbers. A representation of the number line is gives below:



Properties **of Number Line**

- The number line goes on till infinity in both directions which is indicated by arrows above.
- Numbers greater than zero are called positive numbers and numbers which are less than zero are called negative numbers.
- 'zero' is neutral. It is neither positive nor negative.

2. **Imaginary Numbers :**

. Those numbers which cannot be represented on the number line are called Imaginary Numbers. These numbers can be imagined but we cannot physically perceive them. For example: $\sqrt{-2}$ $\sqrt{-5}$ etc. Basically the square root of all negative numbers are imaginary numbers.
$\sqrt{-1}$ is represented by the letter i' (iota).
Real and Imaginary numbers are combined to form complex numbers. For example: 3 + 4i is a complex number.
In this section, we will discuss only about Real Numbers as Imaginary Numbers ase out of the purview of the Civil Services Examination.
Real Numbers can be classified as Rational Numbers and Irrational Numbers.

3. **Rational Numbers :**

The numbers which can be represented in the form of $\frac{p}{q}$ where p and q are integers and **q =0, are** called Rational Numbers.

Every terminating decimal like 2.5 is a rational number as it can easily be represented in the form of as $\frac{p}{q}$ as $2.5 = \frac{25}{10} = \frac{5}{2}$

Also, every recurring decimal is also a rational number, like 0.333 .... which can be written as $\frac{1}{3}$ (in the $\frac{p}{q}$ form).

What is a Recurring Decimal?
A decimal in which a digit or set of digits is repeated continuously is called as a Recurring Decimal. Recurring decimals are written in a shortened form by marking dots on the first and *the lam,* **digit of the part which is repeated. The recurring nature of** a decimal can also be represented by placing a bar over the set of digit(s) that recur. For example,

$\frac{1}{3}$= 0.3333... = O.3 or $0.\overline{3}$

and $\underline{\mathbf{1}}$ = 0.142857142857.... 0.142857 =$0.\overline{142857}$

Recurring Decimals are of two types as Pure Recurring and Mixed Recurring.

A decimal is called Pure Recurring if all the digits after the decimal are recurring (or repeating) like $0.\overline{3}$.

A decimal is Mixed Recurring if some of the digits after the decimal point are not recurring like $0.1\overline{6}$ (in this case only the digit 6 is recurring and 1 is not recurring) as $\mathbf{0.1\overline{6} = 0.16666}$ As we have already discussed that every recurring decimal is a rational number as they can be represented in the $\frac{p}{q}$ form.

Before discussing the general rule to convert recurring decimals into fractions, we will **consider** a few examples, so that we can understand the rule easily.

What is the $\frac{p}{q}$ form **of** 0. 1 1 1 11.... (or $0.\overline{1}$)

Let $x = 0.11111 \ldots$ (or $0.\overline{1}$) (I)

Multiply equation (1) by 10

$10x = 1.111 \ldots$ (or $1.\overline{1}$) . (2)

Subtracting (1) from (2)

$9x = 1$

So, $x = \frac{1}{9}$

If $x = 0.313131 \ldots$ (or $0.\overline{31}$) (1)

Multiply equation (1) by 100

$100x = 31.3131 \ldots$ (or $31.\overline{31}$) •••• (2) Subtracting (1) from (2)

$99x = 31$

So, $\frac{31}{99}$

In the first example we have multiplied the equation by 10 and in the second e4ample by 100, as we need one more equation in ***which the*** recurring part ***is same, which is eliminated*** after the subtraction process.

Let us take one Mixed Recurring decimal

Let $x = 0.2\overline{3}$

$10x = 2.\overline{3} \ldots$ (1)

Now the right hand side (RHS) has become a pure recurring, so we can apply the same method that we have applied in pure recurring decimals.

Multiply equation (1) by 10

$100x = 23.\overline{3} \ldots$ (2)

As equation (1) and (2) have the same recurring part, so

Subtracting (1) from (2)