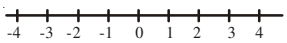
1
NUMBER SYSTEM

- **Natural Numbers (N):** Counting numbers 1, 2, 3, 4, ...Smallest natural number is 1
- **Whole Numbers (W):** Natural numbers including 0 i.e. 0, 1, 2, 3, 4 ..... Smallest whole number is 0
- **Integers (I):** Whole numbers including negatives of natural numbers i.e. .....-3, -2, -1, 0, 1, 2, 3 .....
- **Number Line :** Line on which numbers are represented i.e. 

- **Rational Numbers (Q):** Number p/q is a rational number if p and q are integers and $q \neq 0$.
- **Standard form of a rational number:** p/q is said to be in standard form if q is positive and p and q are co-primes.

Important Result : Every integer is a rational number but every rational number is not an integer. Every fraction is a rational number but vice-versa is not always true

- **Equivalent form of a rational number :** Two rational numbers $\frac{p}{q}$ and $\frac{r}{s}$ are said to be equivalent if $ps = rq$
- **Rational numbers on number line:** Every rational number can be represented on a number line. Coresponding to each rational number, there exists a unique point on the number line but converse is not always true.
- **Comparision of rational numbers :** Reduce the numbers with the same denominator and compare their numerators. On a number line the greater rational number lies to the right of the smaller.
- **Addition of rational numbers:**

  If $\frac{a}{b}$ and $\frac{c}{b}$ are two rational numbers then

  $\frac{a}{b}+\frac{c}{b}=\frac{a+c}{b}$. For $\frac{a}{b}$ and $\frac{c}{d}$,

  $\frac{a}{b}+\frac{c}{d}=\frac{ad+bc}{bd}$, for rational numbers p and q, $p + q = q+p$, for rational number p, $p+0=p=0+p$.
- **Subtraction of rational numbers:** For two rational numbers

  $\frac{a}{b}$ and $\frac{c}{b}$, $\frac{a}{b}-\frac{c}{b}, =\frac{a+(-c)}{b}$, for

  $\frac{a}{b}$ and $\frac{c}{d}=\frac{a}{b}-\frac{c}{d}=\frac{ad-bc}{bd}$, for p and q, $p - q \neq q-p$, for rational number p, $p -0 = p$
- **Multiplication of rational Numbers:** For two rational numbers $\frac{a}{b}$ and $\frac{c}{d}, \frac{a}{b}\times\frac{c}{d}=\frac{ac}{bd}$, for rational numbers p and q we have $p\times q = q \times p$, For rational number p, $p \times 0 = 0$, $p \times 1 = p$
- **Division of Rational numbers:** For two rational numbers

  $\frac{a}{b}$ and $\frac{c}{d}, \frac{a}{b}\div\frac{c}{d}=\frac{a}{b}\times\frac{d}{c}=\frac{ad}{bc}$

  For rational numbers p and q, $p \div q \neq q \div p$, for rational number p, $p \div 1 = p$, $p \div (-1) = -p$, $p \div p = 1$, $p \div (-p) = -1$
- **Decimal representation of rational numbers:** Process of expressing a rational number into decimal form is to carry out the process of long division using decimal.

Rational number is either a terminating decimal or a non-terminating repreating decimal.

- **Rational numbers between two rational numbers:** There exists infinitely many rational numbers between two rational numbers.

  A rational number between two rational numbers can be found by calculating the average of given numbers.
- **Irrational numbers:** A decimal expression which is neither terminating nor repeating represents an irrational number.

  Numbers other than rational numbers $\sqrt{2}, \sqrt{3}, \sqrt{5}.0.12345.....$, etc are examples of irrational numbers.
- **Real Numbers:** Rational and Irrational numbers together constitute the system of real.
- **Irrational number between two rational numbers:** If q_1 and q_2 are two rational numbers then an irrational number between them is $\sqrt{q_1 \times q_2}$, Where $q_1 \times q_2$ is not a perfect square. If $q_1 \times q_2$ is a perfect square, then take a number q between q_1 and q_2 such that $q_1 \times q$ or $q \times q_2$ are not perfect squares

  $\Rightarrow$ $\sqrt{q_1 \times q}$ or $\sqrt{q \times q_2}$ is the required irrational number.
- **Irrational number between a rational and irrational number or between two irrational numbers:** Average of both numbers
- **Rounding off numbers:** To round off a number to a given number of decimal places, observe the next digit in the decimal part of the number and proceed as under, if the digit is 5 or more than 5, we add 1 to the precedding digit .

  If the digit is less than 5, ignore it.

CHECK YOUR PROGRESS:

1. The rational number $\frac{-21}{49}$ in lowest terms is :

   (A) $\frac{3}{7}$ (B) $\frac{-3}{7}$ (C) $\frac{-7}{3}$ (D) -3

2. $3.\overline{4}$ can be written in the form $\frac{p}{q}$ as:

   (A) $\frac{13}{4}$ (B) $\frac{4}{3}$ (C) $\frac{9}{31}$ (D) $\frac{31}{9}$

3. Number of rational numbers which lie between 2 and 7 is :

   (A) 5 (B) 6 (C) 7 (D) Infinitely many

4. An irrational number lying between $\sqrt{3}$ and 3 is:

   (A) $\sqrt{4}$ (B) $\sqrt{10}$ (C) $\sqrt{5}$ (D) $2\sqrt{3}$

5. Which of the following is not a rational number?

   (A) $\frac{\sqrt{3}}{2}$ (B) 3 (C) $\frac{5}{2}$ (D) $\frac{-3}{5}$

6. Find two rational numbers between 1.23 and 1.24.
7. Simplify: $(\sqrt{32}\times\sqrt{50})\times\sqrt{72}\div 36\sqrt{8}$.
8. Find three irrational numbers between 3 and 4.
9. Represent the following rational numbers on number line

   (A) $\frac{7}{2}$ (B) $\frac{-18}{5}$

10. Represent the following irrational numbers on number line

    (A) $\sqrt{3}$ (B) $\sqrt{7}$

STRETCH YOURSELF :

1. By fnding the decimal representation of $\frac{22}{7}$, comment, is it rational or irrational? Find its apporoximate value up to three places of decimals.
2. Comment, 0 is a rational number or not. Justify your answer.

ANSWERS

CHECK YOUR PROGRESS:

1. B 2. D 3. D 4. C 5. A 6. 1.2325, 1.235 7. $\frac{10}{3}$

8. $2\sqrt{3}$, $\frac{3+2\sqrt{3}}{2}$, $\sqrt{3}+2$

STRETCH YOURSELF:

1. $\frac{22}{7}=3.\overline{142857}$, so it is a rational number, approximate value is 3.143.
2. Yes, Zero is a rational number because 0 can be written as $\frac{0}{\text{any non zero integer}}$