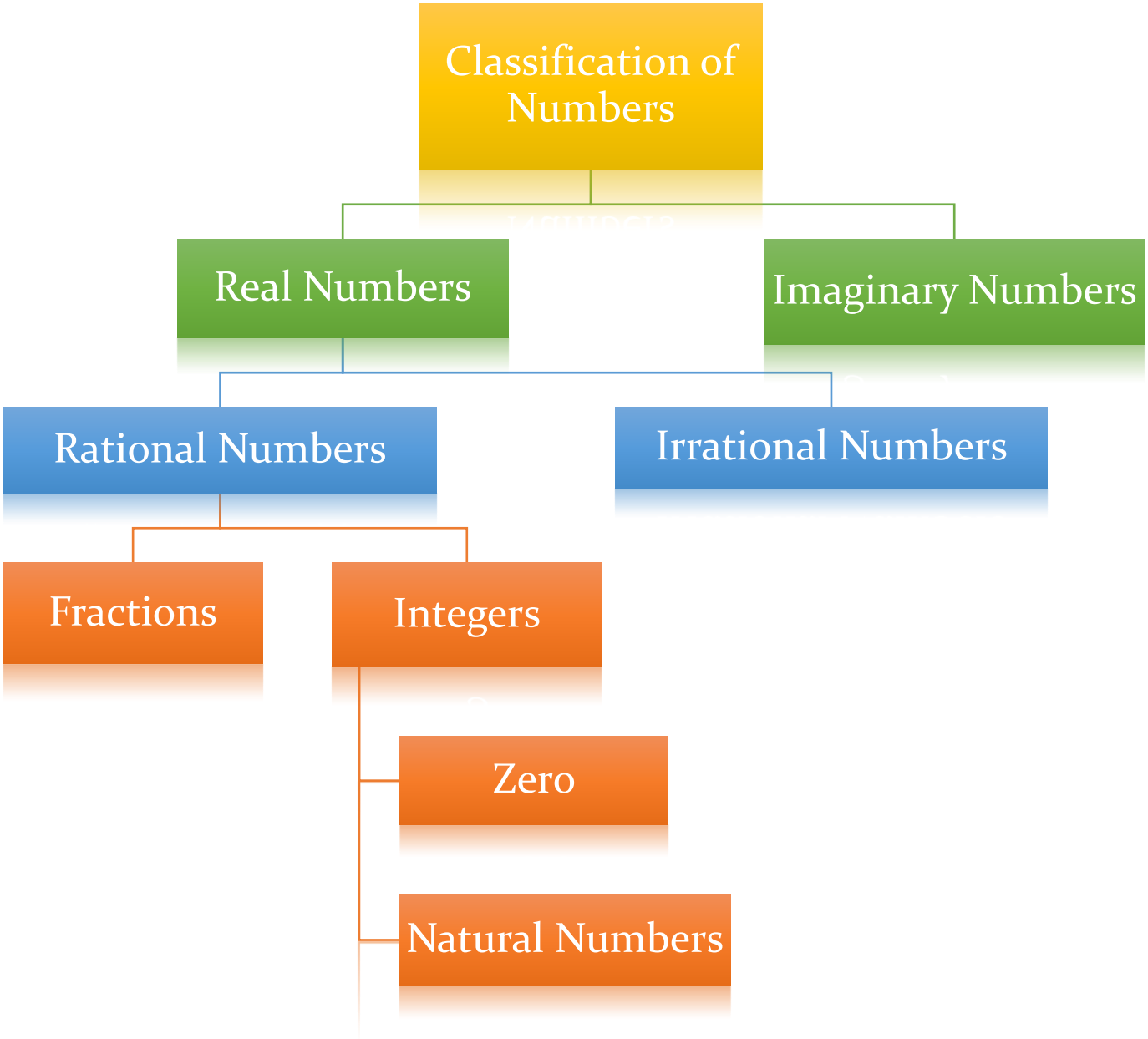

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1. Natural Numbers (N) : The counting numbers 1, 2, 3, ... are known as natural numbers. The collection of natural number is denoted by 'N' N = {1, 2, 3, 4...∞}

1. The set N is infinite i.e. it has unlimited members.
2. N has the smallest element namely '1'.
3. N has no largest element. i.e., give me any natural number, we can find the bigger number from the given number.
4. N does not contain '0' as a member. i.e. '0' is not a member of the set N.
5. If we go on adding 1 to each natural number ; we get next natural number.

2. Whole numbers (W) : The number '0' together with the natural numbers 1, 2, 3, ... are known as whole numbers. The collection of whole number is denoted by 'W' W = {0, 1, 2, 3, 4...∞}

1. The set of whole number is infinite (unlimited elements).
2. This set has the smallest members as '0'. i.e. '0' the smallest whole number. i.e., set W contain '0' as a member.
3. The set of whole numbers has no largest member.
4. Every natural number is a whole number but every whol number is not natural number.
5. Non-zero smallest whole number is '1'.

3. Integers (I or Z) : All natural numbers, 0 and negative of natural numbers are called integers. The collection of integers is denoted by Z or I. Integers (I or Z) : I or Z = {−∞, ... −3, −2, −1, 0, +1, +2, +3 .... +∞} Positive integers : {1, 2, 3...}, Negative integers : {.... −4, −3, −2, −1}

1. This set Z is infinite.
2. It has neither the greatest nor the least element.
3. Every natural number is an integer.
4. Every whole number is an integer.
5. The set of non-negative integer = {0, 1, 2, 3, 4,....}
6. The set of non-positive integer = {.....−4, − 3, − 2, −1, 0}

4. Rational numbers :– These are real numbers which can be expressed in the form of pq , where p and q are integers and q ≠ 0.

Ex. (2/3), (37/15), (-17/19), −3, 0, 10, 4.33, 7.123123123.....

1. All natural numbers, whole numbers & integer are rational numbers.
2. Every terminating decimal is a rational number.
3. Every recurring decimal is a rational number.
4. A non- terminating repeating decimal is called a recurring decimal.
5. Between any two rational numbers there are an infinite number of rational numbers.
6. This property is known as the density of rational numbers.
7. Every rational number can be represented either as a terminating decimal or as a non-terminating repeating (recurring) decimals.
8. Types of rational numbers :– (a) Terminating decimal numbers and (b) Non-terminating repeating (recurring) decimal numbers

5. Irrational numbers :– A number is called irrational number, if it can not be written in the form p q , where p & q are integers and q ≠ 0. All Non-terminating & Non-repeating decimal numbers are Irrational numbers.

Ex. $\sqrt{2}, \sqrt{3}, 3\sqrt{2}, 2+\sqrt{3}, \sqrt{2+\sqrt{3}}, \pi$, etc...

6. Real numbers :– The totality of rational numbers and irrational numbers is called the set of real number i.e. rational numbers and irrational numbers taken together are called real numbers. Every real number is either a rational number or an irrational number.

FINDING RATIONAL NUMBERS BETWEEN TWO NUMBERS

(A) 1st method : Find a rational number between x and y then, $\frac{x+y}{2}$ is a rational number lying between x and y.

(B) 2nd method : Find n rational number between x and y (when x and y is non fraction number) then we use formula.

$$\frac{x(n+1)}{n+1}, \frac{y(n+1)}{n+1}$$

(C) 3rd method : Find n rational number between x and y (when x and y is fraction Number) then we use formula

$$d = \frac{(y-x)}{n+1}$$

then n rational number lying between x and y are (x + d), (x + 2d), (x + 3d) .....(x + nd)

Remark : x = First Rational Number, y = Second Rational Number, n = No. of Rational Number

Ex. Find 3 rational number between 2 and 5.

Sol. Let, a = first rational number. b = second rational number n = number of rational number Here a = 2, b = 5

A rational number between 2 and 5 = $\frac{2+5}{2} = \frac{7}{2}$.

Second rational number between 2 and $\frac{7}{2} = \frac{2+\frac{7}{2}}{2} = \frac{11}{4}$

Third rational number between $\frac{7}{2}$ and $5 = \frac{\frac{3}{2}+5}{2} = \frac{17}{4}$

Hence, three rational numbers between 2 and 5 are : $2\left[\frac{7}{2}, \frac{11}{4}, \frac{17}{4}\right]5$ **Ans.**

RATIONAL NUMBER IN DECIMAL REPRESENTATION

Every rational number can be expressed as terminating decimal or non-terminating decimal.

1. Terminating Decimal : The word "terminate" means "end". A decimal that ends is a terminating decimal.

OR

A terminating decial doesn't keep going. A terminating decimal will have a finite number of digits after the decimal point.

$\frac{3}{4} = 0.75$, $\frac{8}{10} = 0.8$, $\frac{5}{4} = 1.25$, $\frac{25}{16} = 1.5625$

Ex. Express 7/8 in the decimal form by long division method.

Sol. We have,

$$
\begin{array}{r|l}
8 & 7.000 \\
\cline{2-2}
 & 64 \\
\cline{2-2}
 & 60 \\
 & 56 \\
\cline{2-2}
 & 40 \\
 & 40 \\
\cline{2-2}
 & 0
\end{array}
\quad 0.875
$$

$\therefore \quad \frac{7}{8} = 0.875$

2. Non terminating & Repeating (Recurring decimal) :– A decimal in which a digit or a set of finite number of digits repeats periodically is called Non-terminating repeating (recurring) decimals.

$\frac{5}{3} = 1.6666..... = 1.\overline{6}$ $\quad \frac{7}{11} = 0.636363..... = 0.\overline{63}$

$\frac{1}{999} = 0.001001001..... = 0.\overline{001}$

Ex. Find the decimal representation of (8/3)

Sol. By long division, we have

$$
\begin{array}{r|l}
3 & 8.0000 \\
\cline{2-2}
 & 6 \\
\cline{2-2}
 & 20 \\
 & 18 \\
\cline{2-2}
 & 20 \\
 & 18 \\
\cline{2-2}
 & 20 \\
 & 18 \\
\cline{2-2}
 & 20 \\
 & 18 \\
\cline{2-2}
 & 2
\end{array}
\quad 2.6666
$$

$\therefore \quad \frac{8}{3} = 2.6666... = 2.\overline{6}$

Q. What is zero Zero ?

✓ Zero is a number used in mathematics to describe no quantity or null quantity. It is also used as placeholder digit in many numbers .

The modern 0 symbol was invented in India in the 6-th century, used later by the Persians and Arabs and later in Europe.

Important facts about zero :

1) Zero is a number but it is neither positive nor negative number.
So it is not included in the set of positive number nor negative numbers.
But it is included in the set of non-negative numbers .

2) Zero is an even number

3) Zero is not a prime nor a composite number.
It cannot be prime because it has an infinite number of factors and cannot be composite because it cannot be expressed by multiplying prime numbers (0 must always be one of the factors)

N.B. :

Prime Numbers :

A prime number is a whole number greater than 1 whose only factors are 1 and itself. A factor is a whole numbers that can be divided evenly into another number. The first few prime numbers are 2, 3, 5, 7, 11, 13, 17, 19, 23 and 29. Numbers that have more than two factors are called composite numbers. The number 1 is neither prime nor composite.

Prime Numbers

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Composite Numbers :

A composite number is a positive integer that can be formed by multiplying two smaller positive integers. Equivalently, it is a positive integer that has at least one divisor other than 1 and itself.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100