Natural Numbers: Numbers which are used for counting the objects are called natural numbers. They are denoted by N.

\[ N = \{ 1, 2, 3 \ldots \} \]

All positive integers are natural numbers.

Whole numbers: When ‘zero’ is included in the natural numbers, they are known as whole numbers.

They are denoted by W.

\[ W = \{ 0, 1, 2, 3 \ldots \} \]

Integers: All natural numbers, zero and negatives of natural numbers are called as integers.

They are denoted by I.

\[ I = \{ \ldots \ldots , -3, -2, -1, 0, 1, 2, 3 \ldots \} \]

Rational numbers: The numbers which can be expressed in the form of \( \frac{p}{q} \) where P and Q are integers and \( q \neq 0 \) are called rational numbers.

They are called by Q.

E.g.: \( \frac{1}{2}, \frac{12}{8}, -6 \text{ (as } -6 = \frac{-6}{1} \text{)} \) etc.

Irrational numbers: The numbers which cannot be written in the form of \( \frac{p}{q} \) where P and Q are integers and \( q \neq 0 \) are called irrational numbers.

E.g.: \( \sqrt{3}, \sqrt{7}, \frac{2}{17} \) etc.

When these numbers are expressed in decimal form, they are neither terminating nor repeating.

E.g.: \( \frac{1}{7}, \frac{2}{17} \) etc.
Real numbers: Real numbers include both rational as well as irrational numbers.

Positive or negative, large or small, whole numbers or decimal numbers are all real numbers.

\[2,\quad 13.79,\quad -0.01,\quad \frac{2}{3}\text{ etc.}\]

Imaginary numbers: An imaginary number is a complex number that can be written as a real number multiplied by the imaginary unit ‘i’ which is defined by its property \(i^2 = -1\).

Note: Zero (0) is considered to be both real and imaginary number.

Prime number: A prime number is a natural number greater than 1 and is divisible only by 1 and itself.

\[2,\quad 3,\quad 5,\quad 7,\quad 11,\quad 13,\quad 17,\quad 19\text{ etc.}\]

Note: 2 is the only even prime number.

Composite Numbers: A number, other than 1, which is not a prime number is called a composite number.

\[4,\quad 6,\quad 8,\quad 9,\quad 10,\quad 12,\quad 14,\quad 15\text{ etc.}\]

Note: 1 is neither a prime number nor a composite number.

2 there are 25 prime numbers between 1 and 100.

To find whether a number is prime or not-

To check whether the number is prime or not,

1 We take an integer larger than the square root of the number. Let the number be ‘k’.

2 Test the divisibility of the given number by every prime number less than ‘k’.

3 If it is not divisible by any of them, then the given number is prime otherwise it is a composite number.

\[\text{E.g. = Is 881 a prime number?}\]

\[
\text{Sol- The appropriate square root of 881 is 30.}\]
Prime number less than 30 are 2, 3, 5, 7, 11, 13, 17, 19, 23, 29. 

881 is not divisible by any of the above numbers, so it is a prime minister.

**Co-prime numbers**: Two numbers are co-prime of their HCF is 1.

E.g. (2,3), (3,4), (5,7), (3,13) etc.

Even numbers: The number which is divisible by 2 is called even number.

E.g. – 2, 4, 6, 8………………

Odd numbers: The number which is not divisible by 2 is called odd number.

e.g.= 3, 5, 7, 9…………

Consecutive numbers: A series of numbers in which the succeeding number is greater than the preceding number by 1 is called a series of consecutive numbers.

i.e., Difference between two consecutive numbers is 1.

**Some Rules on Counting Numbers**

1. Sum of all the first \( n \) natural numbers

\[
\frac{n(n+1)}{2}
\]

**Q. Find the sum of first 20 natural numbers.**

Ans- Sum of 1 to 20

\[
\text{Sum of 1 to 20} = \frac{20(20+1)}{2} = 210
\]

**Q. Find the sum of numbers from 11 to 20.**
2. Sum of first $n$ odd numbers =

\[ n^2 \]

**Q. What is the sum of first 10 odd numbers?**

Ans- Sum of first 10 odd numbers = $(10)^2 = 100$

**Q. Find the sum of 9+11+13+……….+29**

Ans – $1+3+5+……….+29 = (15)^2 = 225$

(as there are 15 odd numbers from 1 to 29)

$1+3+5+7=(4)^2 = 16$

$9+11+13+29=225-16=209$

3. Sum of first $n$ even numbers

\[ n(n + 1) \]

**Q. What is the sum of even numbers between 1 and 50?**

Ans – No. of even numbers between 1 and 50 = \( \frac{50}{2} = 25 \)

Sum of even numbers between 1 and 50

\[ = 25(25+1) = 25 \times 26 = 650 \]

**Q. Find the value of 12+14+……….+30.**

Ans- (2+4+6+……….+30) has 15 even numbers
2+4+6+...........30=15(15+1)=240
Similarly 2+4+6+8+10= 5(5+1)=30
12+14............+30=240-30=210

4. Sum of squares of first n natural numbers

\[ \frac{n(n + 1)}{6} (2n + 1) \]

Q. what is the value of \(1^2 + 2^2 + ..........+10^2\) ?
Ans- \(1^2 + 2^2 + ..........+10^2\) ?
\[ \frac{10(10 + 1)}{6} (2\times10 + 1) \]
\[ = \frac{10\times11\times21}{6} = 385 \]

5. Sum of cubes of first n natural numbers.

\[ \left[ \frac{n(n + 1)}{2} \right]^2 \]

Q. What is the value of \(1^3 + 2^3 + .......+5^3\) ?
Ans- \(1^3 + 2^3 + .......+5^3\)
\[ = \left[ \frac{5(5 + 1)}{2} \right]^2 = \left[ \frac{5\times6}{2} \right]^2 = 225 \]

Divisibility Rules

• Divisibility by 2 : Number Whose last digit is either even or zero is divisible by 2.

• Divisibility by 3 : If the sum of the digits of a number is divisible by 3, the number is also divisible by 3.

• Divisibility by 4 : If the last two digits of a Number is divisible by 4 or the number having two or more zeros at the end, the numbers is divisible by 4.
• **Divisibility by 5**: If a number is divisible by 5 or 0, the number is divisible by 5.

• **Divisibility by 6**: If a number is divisible by both 2 and 3 the number is also divisible by 6.

• **Divisibility by 8**: If the last three digits of a number is divisible by 8 or the last three digits of a number are zeros, the number is divisible by 8.

  • **Divisibility by 9**: If the sum of all the digits of a number is divisible by 9, the number is also divisible by 9.

  • **Divisibility by 10**: The number which ends with zero is divisible by 10.

  • **Divisibility by 11**: If the sums of digits at odd and even places are equal or differ by a number divisible by 11, then the number is also divisible by 11.

• **Divisibility by 12**: The number which is divisible by both 3 and 4 is also divisible by 12.