**Arithmetic progression:** A sequence of numbers is called an *Arithmetic progression* if the difference between any two consecutive terms is always the same.

Nth term in AP: a +(n-1)d

Where a is first term and d is difference between two consecutive terms.

Sum of n terms = n/2(2a+(n-1)d)

i.e., avg of first and last multiplies by n

Sum of even terms – Sum of odd terms=n\*d/2

**Geometric progression:** A geometric sequence is a sequence such that any element after the first is obtained by multiplying the preceding element by a constant called the common ratio r.

Nth term in GP: ar^(n-1)

Sum of n terms = a(r^n)-1)/(r-1)

Sum till infinity=a/(1-r)

**Quadratic Equations:** ax^2 +bx +c=0

Discriminant D= b^2 -4ac

If D>0 two roots

D=0 same root

D<0 imaginary roots

Roots formula =(-b +/- sqrt(D))/2a

**Mean and Median:** Mean is average of n numbers.

Mean =Sum(n)/n

Median is the ***"middle"*** of a sorted list of numbers. If two middle number fin mean of those two that will be median. (n+1)/2 term is median.

**Prime Number:** A prime number is a whole number greater than 1, which is only divisible by 1 and itself.

1. Two is the only even Prime number.
2. Every prime number can be represented in form of 6n+1 or 6n-1 except 2 and 3, where n is natural number.
3. Two and Three are only two consecutive natural numbers which are prime too.
4. [Goldbach Conjecture:](https://en.wikipedia.org/wiki/Goldbach%27s_conjecture)Every even integer greater than 2 can be expressed as the sum of two primes.
5. [Fermat’s Little Theorem](https://en.wikipedia.org/wiki/Fermat's_little_theorem): If n is a prime number, then for every a, 1 <= a < n,

an-1 ≡ 1 (mod n)

OR

an-1 % n = 1

1. Two numbers are co-prime if GCD of them is 1.

A prime number is said to be **Special** prime number if it can be expressed as the sum of three integer numbers: two neighboring prime numbers and 1. For example, 19 = 7 + 11 + 1, or 13 = 5 + 7 + 1.

**LCM:** LCM (Least Common Multiple) of two numbers is the smallest number which can be divided by both numbers**.**

**GCD:** Greatest common divisor of two numbers.

The Euclidean algorithm is based on the principle that the greatest common divisor of two numbers does not change if the larger number is replaced by its difference with the smaller number. For example, 21 is the GCD of 252 and 105 (as 252 = 21 × 12 and 105 = 21 × 5), and the same number 21 is also the GCD of 105 and 252 − 105 = 147

Or by division method:

**Step I:** Treat the smallest number i.e., 12 as divisor and the bigger number i.e., 18 as dividend.

**Step II:** The remainder 6 becomes the divisor and the divisor 12 becomes the dividend.

**Step III:** Repeat this process till the remainder becomes zero. The last divisor is the H.C.F.

a x b = LCM(a, b) \* GCD (a, b)

**Binomial Coefficient:**

1. A [binomial coefficient](http://en.wikipedia.org/wiki/Binomial_coefficient) C(n, k) can be defined as the coefficient of X^k in the expansion of (1 + X)^n ,i.e., binomial theorem.
2. A binomial coefficient C(n, k) also gives the number of ways, disregarding order, that k objects can be chosen from among n objects; more formally, the number of k-element subsets (or k-combinations) of an n-element set.

nck=(n-1)ck+(n-1)c(k-1) from Pascal Triangle

ncn=1

nc0=1

**Modulo Arithmetic:**

(ab) mod p = ((a mod p) (b mod p)) mod p

(a+b)mod p= (a mod p + b mod p) mod p

**Modular Exponentiation** (Power in Modular Arithmetic)

Given three numbers x, y and p, compute (xy) % p.

**Modular multiplicative inverse**

Given two integers ‘a’ and ‘m’, find modular multiplicative inverse of ‘a’ under modulo ‘m’.

The modular multiplicative inverse is an integer ‘x’ such that.

a x ≡ 1 (mod m)

The value of x should be in {0, 1, 2, … m-1}, i.e., in the range of integer modulo m.

**Chinese remainder theorem:**