Mathematics

Back to school level Maths :)

Maths Basics-I

- Prime Numbers
- Divisors
- Prime Factorisation

Prime Numbers

Divisors?

Prime Factorisation?

Maths Basics-II

- GCD
- Euclid's Algorithm
- LCM
- GCD of N Numbers

GCD Brute Force

Euclid's Algorithm

GCD's of N Numbers

LCM Brute Force

LCM using GCD

Trailing Zeroes | Warmup

You are given input a number, and you want to find the number of trailing zeroes in the value of N! without computing N!

Maths Basics-III

- Fibonacci Series
- Arithmetic Progression
- Geometric Progression

Fibonacci Number

Write a program to compute the nth Fibonacci Number.
Fibonacci Series:

0, 1, 1, 2, 3, 5, 8 , ...

Arithmetic Progression

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a = 1 (the first term)
d = 4 (the "common difference" between terms)

AP Nth Term

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Nth term of an AP

$$a_n = a + (n-1)d$$

Arithmetic Progression

For example, 1, 5, 9, 13, 17, 21, 25, 29, 33, ...

a = 1 (the first term)
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Sum of N terms of an AP

$$S_n = n(2a + (n-1)d)/2$$

💡 AP Sum of N Terms

1, 5, 9, 13, 17, 21, 25, 29, 33, ...

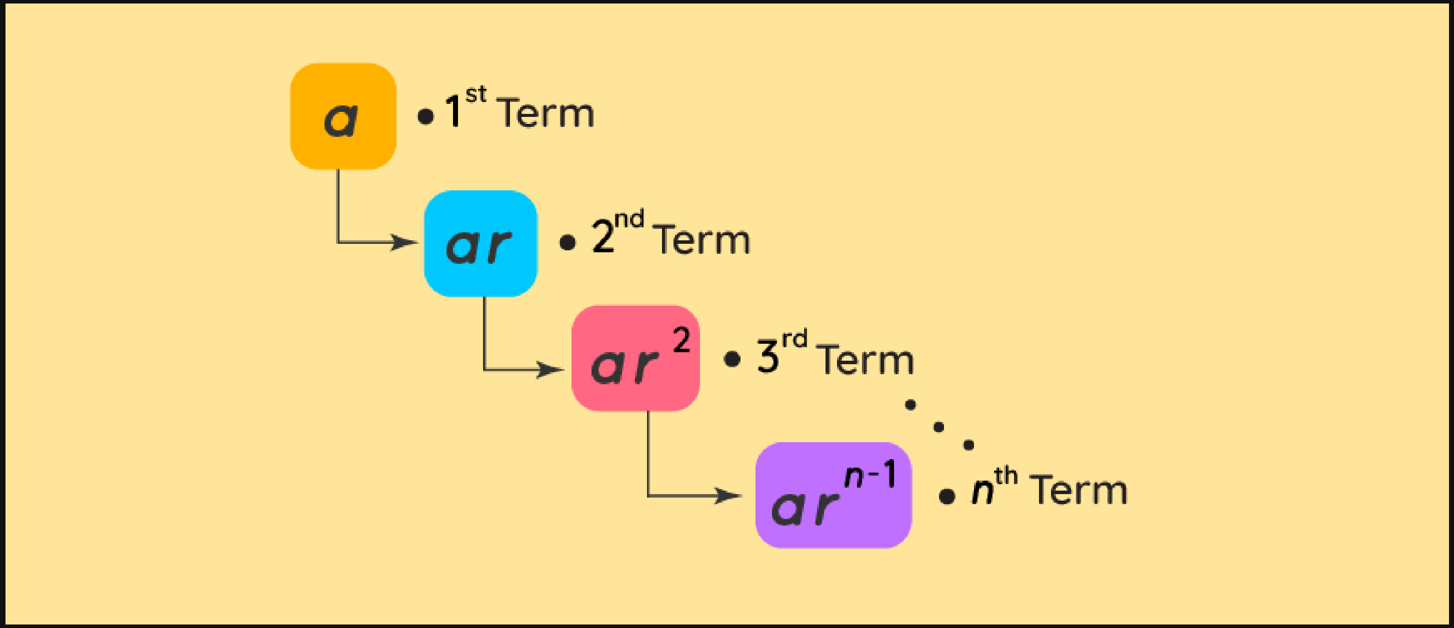
a = 1 (the first term)
d = 4 (the "common difference" between terms)

Sum of N terms of an AP

$$S_n = (n/2)*(2a + (n-1)d)$$

Geometric Progression

A geometric progression is a progression where every term bears a constant ratio to its preceding term.

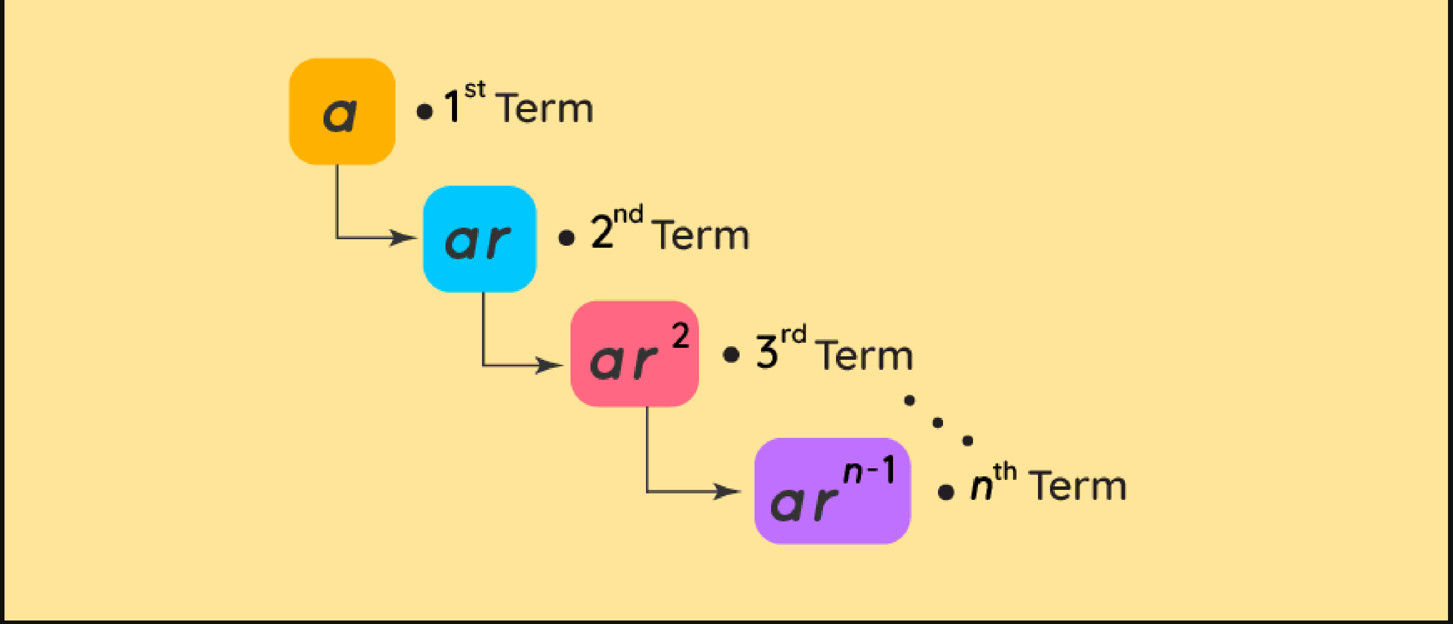


GP Nth Term

$a_n = ar^{n-1}$

where

- a is the first term
- r is the common ratio
- n is the number of the term which we want to find.



Finite Geometric Series

If the number of terms in a geometric progression is finite, then the sum of the geometric series is calculated by the formula:

$S_n = a(1-r^n)/(1-r)$ for $r \neq 1$, and

$S_n = an$ for $r = 1$

where

- a is the first term
- r is the common ratio
- n is the number of the terms in the series

Infinite Geometric Series

If the number of terms in a geometric progression is infinite, an infinite geometric series sum formula is used. In infinite series, there arise two cases depending upon the value of r. Let us discuss the infinite series sum formula for the two cases.

Case 1: When $|r| < 1$

$S_\infty = a/(1 - r)$

where

- a is the first term
- r is the common ratio

Case 2: $|r| > 1$

In this case, the series does not converge and it has no sum.

Maths Basics-IV

- Binomial Coefficients
- Permutation
- Combination

Combinatorics

Combinatorics is all about number of ways of choosing some objects out of a collection and/or number of ways of their arrangement.

Real Example

For example suppose there are five members in a club, let's say there names are A, B, C, D, and E, and one of them is to be chosen as the coordinator.

Clearly any one out of them can be chosen so there are 5 ways. Now suppose two members are to be chosen for the position of coordinator and co-coordinator. What is the number of ways to choose the two?

Permutation

Let's generalize it. Permutations of choosing R distinct objects out of a collection of N objects can be calculated using the following formula:

$$^{N}P_{R} = \frac{N!}{(N-R)!}$$

Combination

Combinations of choosing R distinct objects out of a collection of N objects can be calculated using the following formula

$$^{N}C_{R} = \frac{N!}{(N-R)! \times R!}$$

Basic Combinatorics Rules:

Suppose there are two sets A and B with finite elements.

1. The Rule of Product
   The product rule states that if there are X number of ways to choose one element from A and Y number of ways to choose one element from B, then there will be X×Y number of ways to choose two elements, one from A and one from B.
2. The Rule of Sum
   The sum rule states that if there are X number of ways to choose one element from A and Y number of ways to choose one element from B, then there will be X+Y number of ways to choose one element that can belong to either A or to B.

Binomial Coefficient

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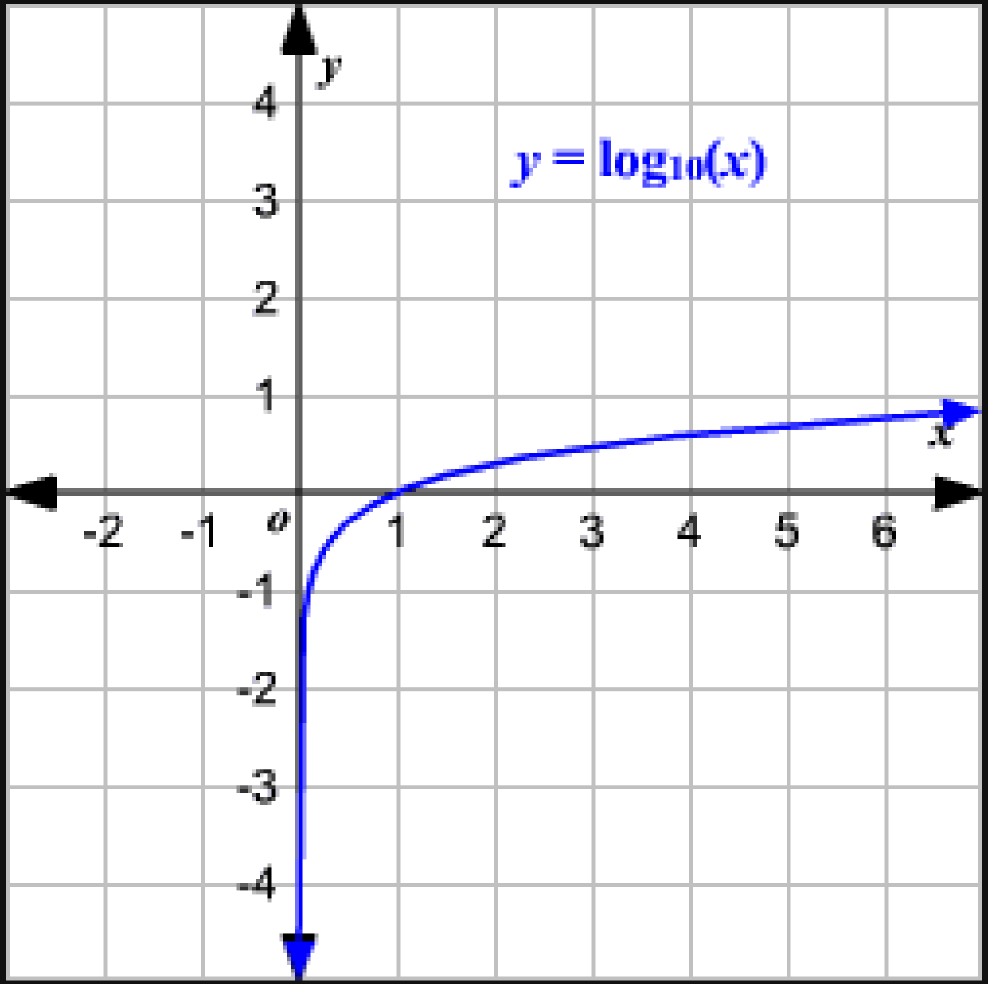
Choosing 3 Cats out of 5 Cats?

Maths Basics-V

- Logarithm



y
4
3
2
1
-1
-2
-3
-4
-2
-1
o
1
2
3
4
5
6
x
$y = \log_{10}(x)$