



## Educational material about mathematical sequences used on the website

The creator has studied and researched the documents. and related research as follows

### 1. Arithmetic Sequence

An arithmetic sequence is a sequence in which the difference between successive terms is constant.

General formula:

$$a_n = a_1 + (n - 1)d$$

Where:

- $a_n$  = n-th term
- $a_1$  = First term
- $d$  = Common Different
- $n$  = position of the term

### 2. Geometric Sequence

A geometric sequence is a sequence in which each term is obtained by multiplying the previous term by a constant ratio ( $r$ ).

General formula:

$$a_n = a_1 \cdot r^{n-1}$$

โดยที่:

- $a_n$  = n-th term
- $a_1$  = first term
- $r$  = Common Ratio
- $n$  = position of the term

### 3. Polynomial Sequence

A polynomial sequence is a sequence where each term  $a_n$  can be expressed as a polynomial in n.

General formula:

$$\begin{array}{ccccccc}
 a_1 & a_2 & a_3 & a_4 & a_5 & a_6 \\
 \vee & \vee & \vee & \vee & \vee & \vee \\
 d_1 & ? & ? & ? & ? & ? \\
 \vee & \vee & \vee & \vee & & \\
 d_2 & ? & ? & ? & & \\
 \vee & \vee & \vee & & & \\
 d_3 & d_3 & d_3 & & & \\
 \dots & & & & & 
 \end{array}$$

$$a_n = An^k + Bn^{k-1} + \cdots + Z$$

Here, k is the degree of the polynomial, which can be determined by repeatedly taking differences between consecutive terms until a constant difference is obtained.

General Formula:

$$a_n = \sum_{k=0}^{n-1} \binom{n-1}{k} \cdot d_k$$

where:

- $a_n$  = n-th term
- $d_0 = a_1$

### 4. Polynomial Division Sequence

Has a similar property to polynomial sequence, but involves multiplication.

The general formula of the n-th term of an polynomial division sequence can be written as:

$$a_n = \prod_{k=0}^{n-1} d_k^{\binom{n-1}{k}}$$

where:

- $a_n$  = n-th term
- $d_k$  = the first term of the row at the index k

## 5. ลำดับ harmonic อนิก

Definition: A harmonic sequence is a sequence  $a_n$  whose reciprocals  $b_n = \frac{1}{a_n}$  form an arithmetic sequence.

$$\frac{1}{a_1}, \frac{1}{a_2}, \frac{1}{a_3}, \dots, \frac{1}{a_n}$$

That is

$a_1, a_2, a_3, \dots, a_n$  is an arithmetic sequence (AP)

$$\frac{1}{a_1}, \frac{1}{a_2}, \frac{1}{a_3}, \dots, \frac{1}{a_n}$$

then its reciprocals form a harmonic sequence.

Thus, the  $n$ -th term of a harmonic sequence is:

$$\frac{1}{a_n} = \frac{1}{a_1 + (n - 1)d}$$

## 6. ลำดับเรียนเกิด

is a sequence that relies on previous terms for calculation, such as the Fibonacci sequence that is the sum of two previous terms.

$$a_n = a_{n-1} + a_{n-2}$$

## 7. ลำดับที่เกิดจากสูตร

### 7.1 Lagrange polynomial

A polynomial is a mathematical tool used to construct an interpolation curve that passes through all given data points. It provides an exact interpolation of each point.

Procedure:

1. Assume there are data points  $(x_0, y_0), (x_1, y_1), \dots, (x_n, y_n)$  with a total of  $n+1$  points.
2. Construct the polynomial (a polynomial of degree equal to the number of data points) that passes through all these points.

นิยาม:

Thus, the polynomial that passes through  $(x_0, y_0), (x_1, y_1), \dots, (x_n, y_n)$ , where  $x_0 < x_1 < \dots < x_n$ , is called the Lagrange polynomial.  $L(x) = \sum_{i=0}^n \left( y_i \cdot \prod_{j=0, j \neq i}^n \frac{x-x_j}{x_i-x_j} \right)$