

article includes other types of sequence problems for those who want to delve deeper into the subject.

A. Calculate the number of terms in a sequence.

We have the formula:

Number of terms in the sequence = Number of intervals + 1

If a sequence follows an arithmetic pattern, meaning each subsequent term is equal to the preceding term plus a constant d , then:

The number of terms in the sequence = (Largest term – Smallest term) : $d + 1$

For example , given the sequence of numbers 1, 3, 5, 7, 9, ..., 2007, find the number of terms in that sequence.

Solution

The rule of the sequence: the next number is 2 units greater than the previous number ? $d = 2$

The number of terms in the sequence is: $(2007 - 1) : 2 + 1 = 1004$ terms.

Answer: 1004 numbers

Example: How many terms are there in the following sequence: 11, 14, 17, 20, .., 92, 95, 98, 101?

Solution

The rule of the sequence: the next number is 3 units greater than the previous number ? $d = 3$

The number of terms in the sequence = $(101 - 11) : 3 + 1 = 31$ terms.

Answer: 31 numbers

B. Formula for calculating the sum of terms

Calculate the sum of the terms.

To calculate the sum of a series of numbers with an arithmetic progression, follow these two steps:

Step 1: Calculate the number of terms in the sequence.

Number of terms in a sequence = (largest term in the sequence – smallest term in the sequence) : difference between two consecutive terms in the sequence + 1

Step 2: Calculate the sum of the arithmetic sequence.

Sum of a sequence = (largest term in the sequence + smallest term in the sequence) x number of terms in the sequence : 2

Formula for calculating the average

Average = (sum of the numbers) : (number of terms)

Example: Given the sequence of numbers 2, 5, 8, 11, 14, 17, 20, 23, 26. Knowing that the numbers in the sequence are 3 apart, have 9 terms, the first term is 2, and the last term is 26, calculate the average of the sequence.

Solution

Applying the formula for calculating the sum of an arithmetic sequence above, we have:

$$\text{Total} = (2 + 26) \times 9 : 2 = 126$$

$$\text{Last digit} = 2 + 3 \times (9 - 1) = 26$$

$$\text{First number} = 26 - 3 \times (9 - 1) = 2$$

$$\text{Number of terms} = (26 - 2) : 3 + 1 = 9$$

$$\text{Average} = (2 + 5 + 8 + 11 + 14 + 17 + 20 + 23 + 26) : 9 = (2 + 26) : 2 = 14$$

Answer: 14

Example: Calculate the sum:

$$A = 1 + 2 + 3 + 4 + \dots + 2014.$$

Solution:

The number of terms in the above sequence is:

$$(2014 - 1) : 1 + 1 = 2014 \text{ (terms)}$$

So the total number of terms in the sequence is:

$$(2014 + 1) \times 2014 : 2 = 2029105$$

Answer: 2029105

Example: Calculate the sum of the numbers in the sequence: 2, 5, 8, 11, ..., 296.

Solution

The rule of the sequence: the next number is 3 units greater than the previous number ? $d = 3$

$$\text{Number of terms in the sequence} = (296 - 2) : 3 + 1 = 99 \text{ terms}$$

$$\text{The sum of the number sequence} = (296 + 2) \times 99 : 2 = 14751$$

Answer: 14751

Example: Calculate the sum of even numbers from 1 to 100.

Solution

The rule of the sequence: the next number is 2 units greater than the previous number ? $d = 3$

The number of terms in the sequence from 2 to 100 = $(100 - 2) : 2 + 1 = 50$ terms

The sum of the numbers from 2 to 100 = $(100 + 2) \times 50 : 2 = 2550$

Answer: 2550

Example: Calculate the sum of the numbers from 1 to 999

Solution

The rule of the number sequence: each subsequent number is one unit greater than the previous number ? $d = 1$

Number of terms in the sequence = $(999 - 1) : 1 + 1 = 999$ terms

The sum of the number sequence = $(999 + 1) \times 999 : 2 = 499500$

Answer: 499500

C. Formula for finding the nth term of a sequence following a pattern.

Formula for finding the last term of an arithmetic sequence

Find the last number in the sequence = First number + total distance

Formula for finding the first term of an arithmetic sequence

Find the first number in the sequence = Last number – total distance

In there:

Total distance = distance \times (n – 1)

Note: Two consecutive numbers have a space between them.

Therefore, the number of intervals between n numbers in the sequence is $n - 1$.

Example: Given the sequence of numbers: 1, 3, 5, 7, ... What is the 20th term of the sequence?

Solution

The given sequence is an odd sequence, so consecutive numbers in the sequence are separated by a difference of 2 units.

20 terms have the following number of intervals: $20 - 1 = 19$ (intervals)

The 19 numbers have the following number of units:

$$19 \times 2 = 38 \text{ (units)}$$

The last number is:

$$1 + 38 = 39$$

Answer: The 20th term of the sequence is 39.

Example: Find the first term of the sequence: ..., 24, 27, 30. Knowing that the sequence has 10 terms.

Solution

The number of intervals for 10 terms is:

$$10 - 1 = 9 \text{ (distance)}$$

The total distance is:

$$3 \times 9 = 27$$

The first term of the sequence is:

$$30 - 27 = 3$$

Answer: 3

Example: Find the 300th term of the sequence: 1; 3; 7; 13; 21; 31; ...

Solution

Find the pattern in the number sequence:

$$\text{First number: } 1 = 1 + 0 \times 1$$

$$\text{Second number: } 3 = 1 + 1 \times 2$$

$$\text{Third number: } 7 = 1 + 2 \times 3$$

$$\text{Fourth number: } 13 = 1 + 3 \times 4$$

$$\text{Fifth number: } 21 = 1 + 4 \times 5$$

$$\text{Sixth number: } 31 = 1 + 5 \times 6 \dots$$

In conclusion, the rule of the number sequence is: Each number is equal to the sum of 1 and the product of its ordinal number multiplied by the number immediately preceding it.

The 300th term of the sequence is:

$$1 + 300 \times 299 = 89,701$$

Answer: 89,701

Example: Write 50 odd numbers, the last one being 2017. Find the first number?

Solution

Rule: Two consecutive odd numbers differ by 2 units.

50 odd numbers have the following number of intervals:

$$50 - 1 = 49 \text{ (distance)}$$

49 distances have the following number of units:

$$49 \times 2 = 98 \text{ (units)}$$

The first number is:

$$2017 - 98 = 1919$$

Answer: The first number is 1919.

D. Other types of problems involving sequences

Find the pattern of the number sequence.

Solution method:

To solve this type of problem, we need to identify the pattern of the number sequence. Common patterns of number sequences include:

1. Each term (starting from the second term) is equal to the term immediately preceding it plus (or minus) the same natural number.
2. Each term (starting from the second term) is equal to the term immediately preceding it multiplied (or divided) by the same non-zero natural number.
3. Each term (starting from the third term) is equal to the sum of the two terms immediately preceding it.
4. Each term (starting from the fourth term) is equal to the sum of the three terms immediately preceding it.
5. Each term (starting from the second term) is equal to the term immediately preceding it plus the ordinal number of that term plus the same natural number.
6. Each term (starting from the third term) is equal to the product of the two terms immediately preceding it.
7. Each term (starting from the fourth term) is equal to the product of the three terms immediately preceding it.
8. Each term (starting from the second term) is equal to the term immediately preceding it multiplied by the term's ordinal number.

9. Each term is equal to the term's ordinal number multiplied by the number immediately following that ordinal number.

10. Each term (starting from the second term) is equal to the term immediately preceding it multiplied by a natural number d and then multiplied by the term's ordinal number.

Write the next three terms of the following sequence:

a) 1 ; 2 ; 3 ; 5 ; 8 ; 13 ;

b) 0; 2; 4; 6; 12; 22;

c) 1; 2; 6; 24; ...

Prize:

a)

Comment:

The third term of the sequence is: $3 = 1 + 2$.

The fourth term of the sequence is $5 = 2 + 3$.

The fifth term of the sequence is $8 = 3 + 5$.

Therefore, the rule of the sequence is: Each term (starting from the third term) is equal to the sum of the two terms immediately preceding it.

Applying this rule, we have the following terms:

$$8 + 13 = 21$$

$$13 + 21 = 34$$

$$21 + 34 = 55$$

So we get the sequence of numbers: 1, 2, 3, 5, 8, 13, 21, 34, 55

b)

The fourth term of the sequence is: $6 = 0 + 2 + 4$.

The fifth term of the sequence is $12 = 2 + 4 + 6$.

The sixth term of the sequence is $22 = 4 + 6 + 12$.

Therefore, the rule of the sequence is: Each term (starting from the fourth term) is equal to the sum of the three terms immediately preceding it.

Applying this rule, we have:

$$\text{The seventh term is } 6 + 12 + 22 = 40.$$

$$\text{The eighth term is } 12 + 22 + 40 = 74.$$

$$\text{The ninth term of the sequence is } 22 + 40 + 74 = 136.$$

The given sequence can also be written as: 0; 2; 4; 6; 12; 22; 40; 74; 136;

c)

We have:

$$7 = 2 + 2 + 3$$

$$13 = 7 + 3 + 3$$

$$20 = 13 + 4 + 3$$

Rule: Each term (starting from the second term) is equal to the term immediately preceding it plus the term's ordinal number plus 3.

1. The fifth term is: $20 + 5 + 3 = 28$
2. The sixth term is: $28 + 6 + 3 = 37$
3. The seventh term is $37 + 7 + 3 = 47$

The given sequence of numbers can also be written as 2; 7; 13; 20; 28; 37; 47;

Determine whether the number 'a' belongs to the given sequence.

Solution method:

- Identify the characteristics of the terms in the sequence.
- Check if number 'a' satisfies that characteristic.

Example 1 : Given the sequence of numbers: 2, 5, 8, 11, 14, 17,

Write the next three numbers in the sequence above.

Solution

We see:

$$2 + 3 = 5$$

$$5 + 3 = 8$$

$$8 + 3 = 11$$

....

Rule: From the second number onwards, each term is equal to the term immediately preceding it plus 3 units.

So the next three terms of the sequence are: $17 + 3 = 20$; $20 + 3 = 23$; $23 + 3 = 26$

The sequence of numbers above is written as 2, 5, 8, 11, 14, 17, 20, 23, 26, ...

The problem of numbering pages in a book, a sequence of letters.

Example 1: A person writes the phrase "TO QUOC VIET NAM" consecutively in a sequence:

TOQUOCVIETNAMTOQUOCVIETNAM

- a) What is the 2007th letter in the sequence?
- b) If it is counted that there are 50 T's in the sequence, how many O's and how many I's are there in that sequence?
- c) An counted 2007 'O's in the sequence. Was her count correct or incorrect?
- d) The letters in the sequence are colored in the order blue, red, purple, yellow, blue, red, purple, yellow, . What color is the 2007th letter in the sequence?

Prize:

- a) The phrase TO QUOC VIET NAM has 13 letters.

$$2007 \div 13 = 154 \text{ remainder } 5$$

So the 2007th letter in the sequence is the fifth letter. That letter is O.

- b) Each group of letters in TO QUOC VIET NAM has 2 T's, 2 O's, and 1 I'.

Therefore, if one counts 50 T's, then the sequence also contains 50 O's and 25 I's.

- c) He miscounted because the letter O in the sequence should be an even number.
- d) We have $2007 \div 4 = 501$ (remainder 3)

So the 2007th letter in the sequence is the 3rd letter. That letter is colored purple.

Applications of the formula for calculating the number of terms in practice.

1. Stack cups, chairs, bowls, or arrange them into a playing card house.
2. Seats in a stadium or auditorium are arranged in an arithmetic sequence.
3. The second hand on a clock moves in an arithmetic progression, as do the minute and hour hands.
4. The weeks in a month follow an arithmetic sequence, and so do the years. Each leap year can be determined by adding 4 to the previous leap year.
5. The number of candles blown out on a birthday increases in an arithmetic progression each year.

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