

Find A Formula For The Nth Term Of The Sequence That Begins 14.5, 16, 17.5, 19, 20.5 . Assume That The

Find A Formula For The Nth Term Of The Sequence That Begins 14.5, 16, 17.5, 19, 20.5 . Assume That The sequence follows a specific pattern, and discovering its formula involves understanding the nature of the sequence, identifying whether it is arithmetic, geometric, or another type, and then deriving a general expression for its nth term. In this comprehensive guide, we will explore the steps and methods to find the formula for the nth term of such sequences, with a focus on this particular sequence, which exhibits a consistent pattern of increasing values.

Understanding the Sequence: 14.5, 16, 17.5, 19, 20.5

Before attempting to find a formula, it is essential to analyze the given sequence carefully. Here, the sequence is:

- 1st term ($n=1$): 14.5
- 2nd term ($n=2$): 16
- 3rd term ($n=3$): 17.5
- 4th term ($n=4$): 19
- 5th term ($n=5$): 20.5

Key observations:

- The sequence appears to increase steadily.
- The differences between consecutive terms are constant:
 - $16 - 14.5 = 1.5$
 - $17.5 - 16 = 1.5$
 - $19 - 17.5 = 1.5$
 - $20.5 - 19 = 1.5$

Since the difference between each successive term is constant (1.5), this sequence is an arithmetic sequence.

What Is An Arithmetic Sequence?

An arithmetic sequence is a list of numbers where each term after the first is obtained by adding a fixed number, called the common difference (d), to the previous term.

Properties of an arithmetic sequence:

- The difference between consecutive terms is constant.

- The sequence can be expressed by a simple linear formula.

General form of an arithmetic sequence:

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

where:

- a_n = the n th term,
- a_1 = the first term,
- d = the common difference,
- n = the position of the term in the sequence.

Deriving the Formula for the Nth Term

Given the sequence:

$$14.5, 16, 17.5, 19, 20.5$$

Let's identify a_1 and d :

- First term, $a_1 = 14.5$
- Common difference, $d = 1.5$

Using the general formula:

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

Substituting the known values:

$$a_n = 14.5 + (n - 1) \times 1.5$$

Simplify:

$$a_n = 14.5 + 1.5n - 1.5$$

$$a_n = (14.5 - 1.5) + 1.5n$$

$$a_n = 13 + 1.5n$$

Therefore, the formula for the n th term of the sequence is:

$$\boxed{a_n = 1.5n + 13}$$

Verifying the Formula

Let's verify the formula with the initial terms:

- For $n=1$:

$a_1 = 1.5 \times 1 + 13 = 1.5 + 13 = 14.5$

- For $n=2$:

$a_2 = 1.5 \times 2 + 13 = 3 + 13 = 16$

- For $n=3$:

$a_3 = 1.5 \times 3 + 13 = 4.5 + 13 = 17.5$

- For $n=4$:

$a_4 = 1.5 \times 4 + 13 = 6 + 13 = 19$

- For $n=5$:

$a_5 = 1.5 \times 5 + 13 = 7.5 + 13 = 20.5$

The formula accurately generates the sequence's terms.

Applications and Importance of the Nth Term Formula

Understanding and deriving formulas for sequences like this is fundamental in many areas of mathematics and real-world applications, including:

- Predicting future terms in a sequence or pattern.
- Solving problems related to finance, physics, and engineering where sequences model real phenomena.
- Analyzing data trends and behaviors over time.
- Creating algorithms that require sequence calculations.

Steps to Find the Nth Term of Any Sequence

While the sequence above is arithmetic, sequences can be more complex. Here's a general approach to find the nth term:

1. Identify the Pattern

- Check if the sequence increases or decreases by a constant difference (arithmetic).
- Check for a constant ratio between terms (geometric).
- Look for other patterns, such as quadratic or exponential behaviors.

2. Calculate the Common Difference or Ratio

- For arithmetic sequences, subtract successive terms.
- For geometric sequences, divide successive terms.

3. Formulate the General Term

- Use the appropriate formula based on the pattern:

- Arithmetic: $a_n = a_1 + (n - 1) \times d$

- Geometric: $a_n = a_1 \times r^{n-1}$

4. Verify the Formula

- Plug in known values to ensure the formula produces the correct terms.

5. Use the Formula

- Calculate any term a_n directly without listing all previous terms.

Additional Tips for Deriving Sequence Formulas

- For sequences with non-linear patterns, explore quadratic or higher-degree polynomial formulas.

- Use difference tables to identify the pattern of differences (constant, linear, quadratic).

- When in doubt, plot the sequence to visualize the pattern.

Conclusion

In summary, the sequence 14.5, 16, 17.5, 19, 20.5 is an arithmetic sequence with a first term of 14.5 and a common difference of 1.5. The formula for its n th term is:

$$a_n = 1.5n + 13$$

This formula allows for quick computation of any term in the sequence and exemplifies the importance of recognizing patterns to derive general expressions. Whether dealing with simple or complex sequences, understanding how to find the n th term is an essential skill in mathematics that extends across various fields and applications.

Keywords: n th term formula, arithmetic sequence, sequence pattern, sequence formula derivation, mathematical sequences, sequence analysis, how to find the n th term, sequence pattern recognition, algebraic sequences

Frequently Asked Questions

What is the pattern in the sequence 14.5, 16, 17.5, 19, 20.5?

The sequence increases by 1.5 each time, indicating a linear pattern.

How can I find the nth term formula for the sequence 14.5, 16, 17.5, 19, 20.5?

Identify the first term and common difference, then use the formula: $a_n = a_1 + (n - 1)d$.

What is the first term (a_1) of this sequence?

The first term a_1 is 14.5.

What is the common difference (d) between terms in this sequence?

The common difference d is 1.5.

What is the general formula for the nth term of this sequence?

$a_n = 14.5 + (n - 1) \times 1.5$.

How do I verify the nth term formula for the sequence?

Plug in different values of n into the formula to see if it produces the sequence terms.

Can you give an example of calculating the 10th term using the formula?

Yes, $a_{10} = 14.5 + (10 - 1) \times 1.5 = 14.5 + 9 \times 1.5 = 14.5 + 13.5 = 28$.

Is this sequence arithmetic?

Yes, because each term increases by a constant difference of 1.5.

What if the sequence started with a different first term? How would the formula change?

You would update a_1 to the new first term, but the common difference remains the same, so the formula adjusts accordingly.

How can understanding this formula help in predicting future terms of the sequence?

Knowing the nth term formula allows you to calculate any term directly without listing all previous terms.

Additional Resources

Find A Formula For The Nth Term Of The Sequence That Begins 14.5, 16, 17.5, 19, 20.5

Introduction

Sequences are fundamental constructs in mathematics, providing a way to understand patterns, predict future terms, and analyze structures across various disciplines—from pure mathematics to applied sciences. One common challenge in sequence analysis is determining a general formula, specifically, an explicit formula for the n -th term, which allows direct computation of any term without generating all preceding ones.

In this article, we undertake a comprehensive investigation into a particular sequence: 14.5, 16, 17.5, 19, 20.5. Our goal is to derive a precise formula for the n -th term, explore its properties, and understand the nature of its progression. This case study exemplifies the process of pattern recognition, mathematical modeling, and formula derivation—an essential skill set within mathematical analysis and beyond.

Understanding the Sequence: Initial Observations

Let's first examine the sequence:

Term Number (n)	Term Value
1	14.5
2	16
3	17.5
4	19
5	20.5

At first glance, several features stand out:

- The sequence begins at 14.5 and increases with each subsequent term.
- The differences between successive terms are not constant but suggest a pattern.

Calculating the differences:

- $16 - 14.5 = 1.5$
- $17.5 - 16 = 1.5$
- $19 - 17.5 = 1.5$
- $20.5 - 19 = 1.5$

This indicates that the sequence exhibits constant first differences of 1.5.

Recognizing the Sequence Type: Arithmetic Progression

Given the constant difference, the sequence appears to be an arithmetic sequence. An arithmetic sequence is defined by a common difference, d , such that:

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

Where:

- a_n is the n -th term,
- a_1 is the first term,
- d is the common difference,
- n is the term number.

From the initial terms:

$$a_1 = 14.5, \quad d = 1.5$$

Therefore, a preliminary formula for the n -th term is:

$$a_n = 14.5 + (n - 1) \times 1.5$$

Verifying the Formula Against Known Terms

Let's verify this formula with the first five terms:

- For $n=1$:

$$a_1 = 14.5 + (1 - 1) \times 1.5 = 14.5 + 0 = 14.5$$

- For $n=2$:

$$a_2 = 14.5 + (2 - 1) \times 1.5 = 14.5 + 1.5 = 16$$

- For $n=3$:

$$a_3 = 14.5 + 2 \times 1.5 = 14.5 + 3 = 17.5$$

- For $n=4$:

$$a_4 = 14.5 + 3 \times 1.5 = 14.5 + 4.5 = 19$$

- For $n=5$:

$$a_5 = 14.5 + 4 \times 1.5 = 14.5 + 6 = 20.5$$

All terms match perfectly, confirming that the sequence is an arithmetic

progression with initial term 14.5 and common difference 1.5.

Formal Derivation of the nth Term Formula

Having identified the sequence as arithmetic, the general formula becomes:

$$\begin{aligned} & \backslash[\\ & a_n = a_1 + (n - 1)d \\ & \backslash] \end{aligned}$$

Substituting the identified values:

$$\begin{aligned} & \backslash[\\ & a_n = 14.5 + (n - 1) \times 1.5 \\ & \backslash] \end{aligned}$$

This formula allows direct computation of any term in the sequence, bypassing iteration through previous terms.

Additional Analysis: Sequence Properties and Implications

1. Explicit Formula:

$$\begin{aligned} & \backslash[\\ & a_n = 14.5 + 1.5(n - 1) \\ & \backslash] \end{aligned}$$

which simplifies to:

$$\begin{aligned} & \backslash[\\ & a_n = 1.5n + 13 \\ & \backslash] \end{aligned}$$

by distributing:

$$\begin{aligned} & \backslash[\\ & a_n = 1.5n - 1.5 + 14.5 = 1.5n + 13 \\ & \backslash] \end{aligned}$$

This simplified form makes calculations even more straightforward and clearly shows the linear relationship between (n) and (a_n) .

2. Sequence Behavior:

- Growth Rate: The sequence increases linearly by 1.5 each step.
- Limit: As $(n \rightarrow \infty)$, $(a_n \rightarrow \infty)$.
- Predictability: Any term can be calculated quickly with the explicit formula.

3. Sequence Visualization:

Plotting (a_n) vs. (n) yields a straight line with slope 1.5 and intercept 13, confirming the arithmetic progression nature.

Broader Context: Applications and Variations

The simplicity of the sequence's structure makes it a useful example in teaching concepts such as:

- Arithmetic sequences and series
- Linear functions and their properties
- Mathematical modeling of uniform growth

In applied fields, such sequences can model situations like:

- Uniform rate of increase in savings or investments
- Consistent growth in population models
- Scheduling tasks with fixed incremental steps

Extending the Sequence: Negative and Non-Integer Differences

While our sequence has a positive, non-integer difference, the same derivation applies if the sequence had:

- Negative difference (decreasing sequence)
- Different constant difference (e.g., 2, -1.5)
- Non-integer initial term

The key is identifying the common difference and initial term and applying the general arithmetic sequence formula:

$$\begin{aligned} & \backslash[\\ & a_n = a_1 + (n - 1)d \\ & \backslash] \end{aligned}$$

Concluding Remarks

The sequence 14.5, 16, 17.5, 19, 20.5 exemplifies a classic arithmetic progression. The process of deriving its n-th term formula underscores essential mathematical skills: recognizing pattern structures, verifying with initial data, and expressing the sequence explicitly.

The explicit formula:

$$\begin{aligned} & \backslash[\\ & a_n = 1.5n + 13 \\ & \backslash] \end{aligned}$$

not only simplifies calculations but also provides deep insight into the sequence's behavior. This approach can be extended to analyze more complex sequences, including geometric progressions or non-linear patterns, fostering a systematic mindset in mathematical problem solving.

Understanding such sequences enhances our ability to model real-world phenomena with predictable, incremental change—an invaluable skill across scientific, engineering, and economic disciplines.

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About the Author

[Your Name] is a mathematics educator and researcher specializing in sequence and series analysis, mathematical modeling, and educational methods for STEM fields. With a passion for making complex concepts accessible, [Your Name] develops resources and articles to foster deep understanding and appreciation of mathematics.

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