

Classify The Sequence As Arithmetic Or Geometric; Then Write A Rule For The Nth Term. 900,450,225,

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Introduction

Sequences are fundamental concepts in mathematics, representing ordered lists of numbers generated by specific rules. Recognizing whether a sequence is arithmetic or geometric is crucial for understanding its behavior and for deriving formulas to find any term within the sequence. In this article, we will analyze the sequence 900, 450, 225, and determine whether it is arithmetic or geometric. Subsequently, we will develop a general rule, known as the explicit formula, for finding the n th term of the sequence.

Understanding Sequences: Arithmetic and Geometric

What Is an Arithmetic Sequence?

- An arithmetic sequence is a sequence of numbers where the difference between consecutive terms is constant.
- This constant difference is called the common difference, denoted by d .
- The general form of an arithmetic sequence is:

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

where:

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

What Is a Geometric Sequence?

- A geometric sequence is a sequence where each term is obtained by multiplying the previous term by a fixed number called the common ratio, denoted by (r) .
- The general form of a geometric sequence is:

$$(a_n = a_1 \times r^{n-1})$$

where:

- (a_n) is the n th term
- (a_1) is the first term
- (r) is the common ratio

Analyzing the Given Sequence: 900, 450, 225

Step 1: Check for Arithmetic Pattern

To determine if the sequence is arithmetic, we examine the differences between consecutive terms:

1. $450 - 900 = -450$
2. $225 - 450 = -225$

Since the differences are not constant (-450 and -225), the sequence is not arithmetic.

Step 2: Check for Geometric Pattern

To verify if the sequence is geometric, we calculate the ratio of successive terms:

1. $450 \div 900 = 0.5$
2. $225 \div 450 = 0.5$

Both ratios are equal to 0.5, indicating a consistent ratio. Therefore, the sequence is geometric with a common ratio $(r = 0.5)$.

Classifying the Sequence

Based on the analysis, the sequence 900, 450, 225 is a geometric sequence because the ratio between successive terms is constant at 0.5. It is not an arithmetic sequence because the differences between terms are not constant.

Writing the Nth Term Rule

Step 1: Identify the First Term and Common Ratio

- First term, $(a_1 = 900)$
- Common ratio, $(r = 0.5)$

Step 2: Use the Geometric Sequence Formula

The general formula for the n th term of a geometric sequence is:

$$(a_n = a_1 \times r^{n-1})$$

Substituting the known values:

$$(a_n = 900 \times (0.5)^{n-1})$$

Explicit Formula for the Sequence

The explicit rule for the n th term of the sequence 900, 450, 225, ... is:

$$(a_n = 900 \times (0.5)^{n-1})$$

Verifying the Formula

Calculate the first few terms:

- When $(n=1)$:

$$\backslash (a_1 = 900 \times (0.5)^{\{0\}} = 900 \times 1 = 900 \backslash) \checkmark$$

- When $\backslash (n=2 \backslash)$:

$$\backslash (a_2 = 900 \times (0.5)^{\{1\}} = 900 \times 0.5 = 450 \backslash) \checkmark$$

- When $\backslash (n=3 \backslash)$:

$$\backslash (a_3 = 900 \times (0.5)^{\{2\}} = 900 \times 0.25 = 225 \backslash) \checkmark$$

The formula accurately generates the sequence's terms, confirming its correctness.

Additional Insights and Applications

Graphing the Sequence

Plotting the sequence's terms against their positions (n-values) would show a decreasing exponential curve approaching zero, characteristic of a geometric sequence with a ratio less than 1.

Real-World Applications

- Radioactive decay, where substances decrease exponentially over time.
- Financial calculations involving depreciation or compound interest with decreasing balances.
- Population models where resources or populations decrease by a consistent ratio.

Summary

In conclusion, the sequence 900, 450, 225 is a geometric sequence with a common ratio of 0.5. Its nth term can be expressed explicitly by the formula:

$$\backslash (a_n = 900 \times (0.5)^{\{n-1\}} \backslash) .$$

This formula allows us to determine any term in the sequence efficiently, aiding in analysis and application across various fields.

Final Remarks

Recognizing whether a sequence is arithmetic or geometric is a foundational skill in mathematics. It involves examining the differences and ratios of successive terms. Once identified, formulating an explicit rule for the n th term becomes straightforward, enabling deeper understanding and practical computations involving the sequence.

Frequently Asked Questions

Is the sequence 900, 450, 225 an arithmetic or geometric sequence?

It is a geometric sequence because each term is multiplied by a common ratio, specifically multiplied by 0.5.

What is the common ratio of the sequence 900, 450, 225?

The common ratio is 0.5, since $450 \div 900 = 0.5$ and $225 \div 450 = 0.5$.

Write the explicit formula for the n th term of the sequence 900, 450, 225.

The n th term is $a_n = 900 \times (0.5)^{n-1}$.

What is the pattern followed in the sequence 900, 450, 225?

Each term is obtained by multiplying the previous term by 0.5, indicating a geometric sequence with a common ratio of 0.5.

Can the sequence 900, 450, 225 be classified as an arithmetic sequence?

No, because the differences between terms are not constant; it is a geometric sequence.

What is the 5th term in the sequence 900, 450, 225?

Using the formula $a_n = 900 \times (0.5)^{n-1}$, the 5th term is $900 \times (0.5)^4 = 900 \times 0.0625 = 56.25$.

How do you determine whether a sequence is arithmetic or geometric?

By checking if the difference between consecutive terms is constant (arithmetic) or if the ratio of consecutive terms is constant (geometric).

Write a recursive rule for the sequence 900, 450, 225.

The recursive rule is $a_1 = 900$, and for $n > 1$, $a_n = a_{n-1} \times 0.5$.

Additional Resources

Sequence Classification and Nth Term Rule: An In-Depth Analysis of 900, 450, 225, ...

Understanding sequences is fundamental to grasping advanced mathematical concepts, especially in algebra and calculus. Whether in academic pursuits or practical problem-solving, correctly identifying the nature of a sequence—whether it's arithmetic, geometric, or another form—is crucial. Today, we analyze the sequence: 900, 450, 225, We will determine its classification and derive a general formula for its Nth term, providing a comprehensive, expert-level exploration.

Decoding the Sequence: An Initial Overview

At first glance, the sequence presents three initial terms:

- Term 1: 900
- Term 2: 450
- Term 3: 225

Our goal is to analyze the pattern these terms follow, identify whether the sequence is arithmetic or geometric, and then formulate a rule for its Nth term.

Understanding the Fundamentals: Arithmetic vs. Geometric Sequences

Before delving into the specific sequence, let's revisit what distinguishes these two common types of sequences.

Arithmetic Sequences

An arithmetic sequence is characterized by a constant difference between consecutive terms. This difference is known as the common difference (denoted as d).

General form:

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

where:

- a_1 is the first term,
- d is the common difference,
- n is the position of the term in the sequence.

Example:

Sequence: 2, 5, 8, 11, ...

- Common difference ($d = 3$)
- Nth term: ($a_n = 2 + (n-1) \times 3$)

Geometric Sequences

A geometric sequence features a constant ratio between consecutive terms, called the common ratio (denoted as r).

General form:

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

Example:

Sequence: 3, 6, 12, 24, ...

- Common ratio ($r = 2$)
- Nth term: ($a_n = 3 \times 2^{n-1}$)

Applying the Concepts to the Given Sequence

Let's analyze the sequence: 900, 450, 225,

Step 1: Check for Arithmetic Pattern

Calculate the differences between successive terms:

- $(450 - 900 = -450)$
- $(225 - 450 = -225)$

Since the differences are not constant (-450 and -225), the sequence is not arithmetic.

Step 2: Check for Geometric Pattern

Calculate the ratios of successive terms:

- $(\frac{450}{900} = 0.5)$
- $(\frac{225}{450} = 0.5)$

The ratios are constant at 0.5 , indicating the sequence is geometric.

Classifying the Sequence

Based on the calculations, the sequence:

$900, 450, 225, \dots$

is a geometric sequence with:

- First term $(a_1 = 900)$
- Common ratio $(r = 0.5)$

Deriving the Nth Term Formula

Having established the sequence as geometric, we can now derive the general Nth term formula.

Standard Geometric Formula

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

Plugging in the known values:

$$a_n = 900 \times (0.5)^{n-1}$$

This formula allows us to compute any term in the sequence directly, without listing all previous terms.

Verifying the Formula

Let's verify the formula by calculating the third term:

$$a_3 = 900 \times (0.5)^{3-1} = 900 \times (0.5)^2 = 900 \times 0.25 = 225$$

Which matches the third term as given, confirming the correctness of our formula.

Exploring the Sequence's Behavior and Applications

Understanding the nature of this sequence opens doors to various applications in real-world scenarios such as:

- Decay processes: Radioactive decay, where quantities halve over fixed periods.
- Financial calculations: Depreciation or reduction in value over time.
- Signal attenuation: In physics, where signals weaken exponentially.

The geometric pattern reflects multiplicative processes, making this sequence a prime example of exponential change.

Additional Features and Variations

While the original sequence is straightforward, variations can be considered:

- Changing the first term: For instance, starting at 600 with ratio 0.5.
- Different ratios: Using ratios like 2 or 3 to model growth sequences.
- Alternating sequences: Combining arithmetic and geometric patterns for more complex sequences.

Summary and Key Takeaways

- Sequence Type: The sequence 900, 450, 225, ... is geometric.
- Common Ratio: $(r = 0.5)$
- First Term: $(a_1 = 900)$
- Nth Term Formula:

$$\begin{aligned} &[\\ a_n &= 900 \times (0.5)^{n-1} \\ &] \end{aligned}$$

This formula provides a powerful tool for predicting future terms, analyzing the pattern, and understanding the underlying process governing the sequence's behavior.

Final Thoughts: The Importance of Sequence Classification

Accurately classifying sequences is not merely an academic exercise but a vital skill in fields like engineering, finance, physics, and computer science. Recognizing whether a sequence is arithmetic or geometric simplifies calculations and enhances understanding of the process it models.

In this case, identifying the geometric nature of the sequence allows for quick computations and insights into exponential decay phenomena, illustrating the elegance and utility of mathematical reasoning.

In essence, the sequence 900, 450, 225, ... exemplifies the beauty of geometric progressions, and mastering its classification and formulation equips you with a fundamental tool for tackling a broad array of scientific

and mathematical challenges.

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