Find The 60th Term Of The Arithmetic Sequence -10, 8, 26,

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Understanding how to find specific terms in an arithmetic sequence is a fundamental skill in mathematics, especially in algebra and number theory. In this article, we will carefully analyze the sequence given: -10, 8, 26, and explore how to determine its 60th term. This process involves identifying the common difference, understanding the general formula for the nth term, and applying it meticulously to find the desired term. Whether you're a student preparing for exams or someone interested in sequence patterns, this comprehensive guide will help clarify the steps involved.

Understanding Arithmetic Sequences

What Is an Arithmetic Sequence?

An arithmetic sequence is a sequence of numbers where the difference between any two successive terms is constant. This difference is called the common difference, often denoted by d. The general form of an arithmetic sequence can be written as:

$$a, a + d, a + 2d, a + 3d, \ldots$$

where:

- a is the first term,
- d is the common difference,
- The nth term is given by a specific formula.

Significance of Recognizing an Arithmetic Sequence

Recognizing that a sequence is arithmetic allows us to:

- Calculate any term directly without listing all previous terms,
- Find the sum of a specified number of terms,
- Analyze patterns and solve real-world problems involving uniform changes.

Identifying the First Term and Common

Difference in the Sequence

Given Sequence: -10, 8, 26, ...

The sequence provided is:

- First term (a_1) = -10
- Second term (a_2) = 8
- Third term (a_3) = 26

To confirm that this is an arithmetic sequence, we need to check if the difference between successive terms is constant.

Calculating the Common Difference d

Let's compute the differences:

1. $a_2 - a_1 = 8 - (-10) = 8 + 10 = 18$
2. $a_3 - a_2 = 26 - 8 = 18$

Since both differences are equal to 18, the common difference d is:

$$d = 18$$

This confirms that the sequence is arithmetic with:

- First term: $a_1 = -10$
- Common difference: $d = 18$

Formulating the General Term of the Sequence

The Formula for the nth Term

The general term a_n of an arithmetic sequence is given by:

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

Where:

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

Applying the Formula to Our Sequence

Plugging in the known values:

$$ a_n = -10 + (n - 1) \times 18 $$

This simplifies to:

$$ a_n = -10 + 18(n - 1) $$

Or, equivalently:

$$ a_n = -10 + 18n - 18 $$

$$ a_n = 18n - 28 $$

Therefore, the explicit formula for the nth term of the sequence is:

$$ \boxed{a_n = 18n - 28} $$

Calculating the 60th Term

Substituting $n = 60$ into the Formula

To find the 60th term:

$$ a_{60} = 18 \times 60 - 28 $$

Calculating:

$$ 18 \times 60 = 1080 $$

So,

$$ a_{60} = 1080 - 28 = 1052 $$

Final Answer

The 60th term of the sequence is:

$$ \boxed{1052} $$

Additional Insights and Related Concepts

Sum of the First 60 Terms

If you're interested in the sum of the first 60 terms, you can use the formula:

$$ S_n = \frac{n}{2} \times (a_1 + a_n) $$

For $n = 60$:

$$ S_{60} = \frac{60}{2} \times (-10 + 1052) = 30 \times 1042 = 31,260 $$

Therefore, the sum of the first 60 terms is 31,260.

Understanding the Pattern

The sequence progresses as:

- Term 1: -10
- Term 2: 8
- Term 3: 26
- Term 4: 44
- Term 5: 62
- ...
- Term 60: 1052

Notice the pattern of adding 18 each time, resulting in a steady increase.

Summary of Key Points

- The sequence -10, 8, 26, ... is arithmetic with a common difference of 18.
- The explicit formula for the nth term is $a_n = 18n - 28$.
- The 60th term is $a_{60} = 1052$.
- The sum of the first 60 terms is 31,260.

Conclusion

Finding specific terms in an arithmetic sequence requires identifying the first term and the common difference, then applying the general formula. In this case, recognizing the pattern allowed us to derive the explicit formula $a_n = 18n - 28$, making it straightforward to compute the 60th term. Mastery of these methods enables efficient problem-solving in algebra, mathematics competitions, and real-world scenarios involving uniform changes. Remember, the key steps involve understanding the sequence's pattern, formulating the general term, and applying the formula precisely.

Frequently Asked Questions

What is the common difference in the arithmetic sequence -10, 8, 26?

The common difference is 18 because 8 - (-10) = 18 and 26 - 8 = 18.

How do you find the 60th term of the arithmetic sequence -10, 8, 26?

Use the formula for the nth term: $a_n = a_1 + (n - 1)d$. Here, $a_1 = -10$, $d = 18$, so $a_{60} = -10 + (60 - 1) \times 18$.

What is the value of the 60th term in this sequence?

The 60th term is $-10 + 59 \times 18 = -10 + 1062 = 1052$.

What formula is used to find the nth term in an arithmetic sequence?

The formula is $a_n = a_1 + (n - 1)d$, where a_1 is the first term, d is the common difference, and n is the term number.

Is the sequence -10, 8, 26 increasing or decreasing?

The sequence is increasing because the common difference is positive (18).

What is the first term of the sequence?

The first term, a_1, is -10.

How many terms are between the first term and the

60th term?

There are 59 terms between the first and the 60th term.

Can the 60th term be negative in this sequence?

No, since the sequence is increasing and starting at -10, the 60th term is positive (1052).

If you wanted to find the 100th term, how would you do it?

Apply the same formula: $a_{100} = a_1 + (100 - 1) \times d = -10 + 99 \times 18 = -10 + 1782 = 1772$.

What is the significance of the common difference in an arithmetic sequence?

The common difference determines the rate at which the sequence increases or decreases, defining the pattern of the sequence.

Additional Resources

Find The 60th Term Of The Arithmetic Sequence -10, 8, 26, ...

Introduction to Arithmetic Sequences

An arithmetic sequence (also known as an arithmetic progression) is a sequence of numbers in which the difference between any two consecutive terms is constant. This constant is called the common difference (denoted as d).

Understanding the properties of arithmetic sequences is fundamental in various fields, including mathematics, engineering, computer science, and finance. They serve as foundational building blocks for more complex sequences and series.

In this detailed exploration, we will examine how to determine the 60th term of the specific arithmetic sequence:

-10, 8, 26, ...

Understanding the Given Sequence

Before delving into calculations, it's crucial to analyze the sequence:

- Term 1: -10
- Term 2: 8
- Term 3: 26

Observing these terms, we can identify the common difference:

d = Term 2 - Term 1 = 8 - (-10) = 8 + 10 = 18

Check the difference between the second and third terms:

d = 26 - 8 = 18

This confirms that the sequence is arithmetic with a common difference of 18.

Mathematical Representation of the Sequence

An arithmetic sequence can be expressed in a general form:

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

Where:

- a_n is the nth term of the sequence
- a_1 is the first term
- d is the common difference
- n is the position of the term in the sequence

For our sequence:

- $a_1 = -10$
- d = 18

Thus, the explicit formula for the nth term becomes:

$a_n = -10 + (n - 1) 18$

Calculating the 60th Term

To find a_{60}, substitute n = 60 into the formula:

a_{60} = -10 + (60 - 1) 18

Breaking down the calculation:

1. Compute 60 - 1:

59

2. Multiply 59 by 18:

59 18

3. Add -10 to the product:

a_{60} = -10 + (59 18)

Let's perform these calculations step-by-step:

Step 1: Multiply 59 by 18:

- 18 50 = 900
- 18 9 = 162
- Sum: 900 + 162 = 1062

Step 2: Add -10:

a_{60} = -10 + 1062 = 1052

Therefore, the 60th term of the sequence is 1052.

Alternative Methods and Verifications

While the direct formula approach is straightforward, it’s beneficial to understand alternative ways to verify the answer.

Method 1: Using Recursive Definition

- The sequence starts at a_1 = -10
- Each subsequent term adds d = 18

Calculate:

- $a_2 = a_1 + d = -10 + 18 = 8$
- $a_3 = a_2 + 18 = 8 + 18 = 26$
- Continuing this process up to a_{60}

This process, although tedious for large n, confirms the sequence's behavior. Given the pattern, the 60th term is obtained by adding (n - 1) d to the first term, matching the formula method.

Method 2: Graphical Interpretation

Plotting the sequence on a graph with term number n on the x-axis and value a_n on the y-axis yields a straight line with slope d = 18. The point at n=60 would be:

- x-coordinate: 60
- y-coordinate: as calculated, 1052

This visual approach emphasizes the linear nature of the sequence.

Understanding the Significance of the 60th Term

Knowing the 60th term provides insight into the growth of the sequence over a large number of terms.

- Magnitude: The 60th term is 1052, indicating significant growth due to the positive common difference.
- Applications: Such calculations are relevant in contexts like:

- Predicting long-term trends in finance (e.g., savings after multiple periods)
- Analyzing sequences in computer algorithms
- Modeling physical phenomena with linear progression

Additional Concepts Related to Arithmetic Sequences

Sum of the First n Terms

Often, problems involve summing multiple terms of an arithmetic sequence. The formula for the sum of the first n terms (S_n) is:

$S_n = (n/2) (a_1 + a_n)$

Applying this to find the sum of the first 60 terms:

$S_{60} = (60/2) (a_1 + a_{60}) = 30 (-10 + 1052) = 30 1042 = 31,260$

This sum reflects the total accumulated value over 60 terms.

Common Difference and Its Impact

The value of d influences the sequence significantly:

- Positive d: sequence increases over time
- Negative d: sequence decreases
- d = 0: sequence remains constant

In our sequence, d = 18 results in exponential growth, which can be advantageous or detrimental depending on context.

Real-World Examples of Arithmetic Sequences

Understanding how to find specific terms like the 60th is applicable in:

- Financial Planning: Calculating future savings or investments with fixed periodic contributions
- Population Modeling: Estimating population after a certain number of generations
- Manufacturing: Predicting production output over time with consistent increases
- Scheduling: Planning tasks that happen at regular intervals

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Summary and Final Remarks

To recap:

- The sequence provided is arithmetic with a first term of -10 and a common difference of 18.
- The explicit formula for the nth term is:

$a_n = -10 + (n - 1) 18$

- To find the 60th term:

$a_{60} = -10 + (60 - 1) 18 = -10 + 59 18 = -10 + 1062 = 1052$

- The 60th term is 1052, showcasing the linear growth of the sequence.

- Additional calculations, such as the sum of the first 60 terms, are straightforward once the sequence's properties are understood.

Understanding the principles behind the arithmetic sequence not only helps solve this specific problem but also equips you with tools to analyze and interpret linear progressions across various disciplines.

Conclusion

Mastering the process of finding specific terms in an arithmetic sequence is a fundamental skill in mathematics. It involves recognizing the sequence’s pattern, applying the explicit formula correctly, and verifying calculations. The problem of determining the 60th term of -10, 8, 26, ... exemplifies these concepts, reinforcing the importance of sequence analysis in both academic and practical contexts.

By comprehensively understanding the sequence's structure, calculation methods, and applications, you develop a robust foundation for tackling more complex mathematical sequences and series.

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