Find The 61st Term Of The Arithmetic Sequence -12, -28, -44 ...

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Understanding how to find a specific term in an arithmetic sequence is a fundamental concept in mathematics, especially in algebra and number theory. In this guide, we will explore the process step-by-step to determine the 61st term of the given sequence: -12, -28, -44, ... Knowing how to approach such problems not only helps in academic settings but also builds problem-solving skills applicable in various fields such as computer science, finance, and engineering.

What Is an Arithmetic Sequence?

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

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

where:
- a_n is the n^{th} term,
- a_1 is the first term,
- d is the common difference,
- n is the position of the term in the sequence.

Understanding this formula is crucial to solving problems related to arithmetic sequences, including finding specific terms like the 61st term.

Identifying the First Term and Common Difference

Before calculating the 61st term, we need to establish the initial values:

First Term (a_1)

From the sequence: -12, -28, -44, ...

- The first term a_1 is -12.

Common Difference (d)

To find d, subtract the first term from the second:

$$d = a_2 - a_1 = -28 - (-12) = -28 + 12 = -16$$

Check with the next pair to ensure consistency:

$$ a_3 - a_2 = -44 - (-28) = -44 + 28 = -16 $$

Since the difference remains constant, the common difference d is -16.

Applying the Formula to Find the 61st Term

Now that we have $a_1 = -12$ and $d = -16$, we can substitute these into the general formula to find a_{61}:

$$ a_{61} = a_1 + (61 - 1)d $$

Calculating step-by-step:

1. $61 - 1 = 60$
2. Multiply by the common difference:

$$ 60 \times -16 = -960 $$

3. Add to the first term:

$$ a_{61} = -12 + (-960) = -12 - 960 = -972 $$

Therefore, the 61st term of the sequence is -972.

Understanding the Importance of This Calculation

Calculating specific terms in an arithmetic sequence has practical applications:

- **Financial Planning:** Calculating future payments or savings over time, especially with fixed increments or decrements.
- **Engineering:** Estimating values that change linearly over time or space.
- **Data Analysis:** Recognizing patterns and predicting future data points in linear trends.

Knowing how to efficiently find terms like the 61st term enhances analytical skills and provides a foundation for more complex mathematical concepts.

Additional Tips for Working with Arithmetic Sequences

To become proficient in handling arithmetic sequences, consider the following tips:

1. Always Identify a_1 and d First

- Carefully read the sequence and extract the first term.
- Find the difference between consecutive terms to determine the common difference.

2. Verify the Common Difference

- Check multiple pairs of consecutive terms to ensure the difference is consistent.
- If the difference varies, the sequence might not be arithmetic.

3. Use the General Formula Wisely

- Remember that the formula:

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

is the key tool for finding any term in the sequence.

4. Practice with Different Sequences

- Try sequences with positive, negative, or fractional differences.
- This practice helps solidify understanding and prepares for more complex sequences.

Practice Problems to Reinforce Learning

To test your understanding, try solving these problems:

1. Find the 50th term of the sequence: 3, 7, 11, ...
2. The sequence: 100, 80, 60, ...; what is the 10th term?
3. Determine the 25th term of the sequence: -5, -1, 3, ...

Solutions:

1. First term $a_1 = 3$, common difference $d = 4$

$$a_{50} = 3 + (50 - 1) \times 4 = 3 + 49 \times 4 = 3 + 196 = 199$$

2. $a_1 = 100$, $d = -20$

$$a_{10} = 100 + (10 - 1) \times -20 = 100 + 9 \times -20 = 100 - 180 = -80$$

3. $a_1 = -5$, $d = 4$

$$a_{25} = -5 + (25 - 1) \times 4 = -5 + 24 \times 4 = -5 + 96 = 91$$

Conclusion

Finding the 61st term of the sequence -12, -28, -44, ... involves identifying the initial parameters and applying the arithmetic sequence formula correctly. The key steps are:

- Recognize the first term (a_1)
- Determine the common difference (d)
- Use the formula $a_n = a_1 + (n - 1)d$ to compute the desired term

In this case, the 61st term is -972. Mastery of this process enables you to handle a wide variety of problems involving linear sequences and prepares you for more advanced mathematical concepts. Keep practicing with different sequences to strengthen your understanding and problem-solving abilities.

Frequently Asked Questions

What is the common difference of the given arithmetic sequence -12, -28, -44 ...?

The common difference is -16, since -28 - (-12) = -16 and -44 - (-28) = -16.

How do you find the 61st term of the arithmetic sequence -12, -28, -44 ...?

Use the formula for the nth term of an arithmetic sequence: $a_n = a_1 + (n - 1)d$. Here, $a_1 = -12$, $d = -16$, so $a_{61} = -12 + (61 - 1)(-16)$.

What is the value of the 61st term in the sequence -12, -28, -44 ...?

The 61st term is -12 + 60 (-16) = -12 - 960 = -972.

Can you explain how the formula for the nth term applies to this sequence?

Yes, the formula $a_n = a_1 + (n - 1)d$ applies by plugging in the first term and common difference to find any term's value—in this case, the 61st.

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

The common difference determines the constant amount added or subtracted to get from one term to the next, defining the sequence's pattern.

Is the sequence -12, -28, -44 ... increasing or decreasing?

It is decreasing since the common difference is negative (-16).

What would be the 100th term of this sequence?

Using the formula: $a_{100} = -12 + (100 - 1)(-16) = -12 + 99 (-16) = -12 - 1584 = -1596$.

Additional Resources

Find The 61st Term Of The Arithmetic Sequence -12, -28, -44 ...

Introduction

Sequences are fundamental constructs in mathematics, forming the backbone of numerous disciplines such as algebra, calculus, and number theory. Among these, arithmetic sequences are perhaps the most straightforward and widely studied due to their simplicity and practical applications in real-world scenarios. The task to find specific terms within such sequences is a common exercise that tests understanding of the sequence's properties and the ability to apply formulas correctly.

This article undertakes an in-depth investigation into the problem: Find the 61st term of the arithmetic sequence -12, -28, -44 .... By dissecting the sequence's structure, deriving its general term, and applying the relevant formulas, we aim to provide clarity, precision, and comprehensive insights into this problem.

Understanding Arithmetic Sequences

Before delving into the specific sequence, it is essential to understand the general concept of an arithmetic sequence.

Definition and Properties

An arithmetic sequence is a sequence of numbers in which each term after the first is obtained by adding a fixed number, known as the common difference, to the preceding term.

Mathematically, an arithmetic sequence can be written as:

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

where:

- a_n is the n^{th} term,
- a_1 is the first term,
- d is the common difference,
- n is the position of the term in the sequence.

Example

For the sequence: 2, 5, 8, 11, 14, ...

- First term $a_1 = 2$,
- Common difference $d = 3$,
- The sequence progresses by adding 3 each time.

The Given Sequence: Analyzing the Data

The sequence provided is:

$$
-12, -28, -44, \ldots
$$

Our goal is to find the 61st term, a_{61}.

Step 1: Identifying the First Term and Common Difference

- First term $a_1 = -12$.

- Next, determine the common difference d:

$$
d = a_2 - a_1 = -28 - (-12) = -28 + 12 = -16
$$

- To verify, check the difference between the second and third terms:

$$
a_3 - a_2 = -44 - (-28) = -44 + 28 = -16
$$

- Consistent difference confirms $d = -16$.

Summary:

Term number	Term value	Difference from previous
1	-12	N/A
2	-28	-16
3	-44	-16

The sequence is confirmed to be arithmetic with:

- $a_1 = -12$,
- $d = -16$.

Deriving the General Term Formula

Having identified the first term and common difference, we can express the n^{th} term as:

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

Substituting the known values:

$$
a_n = -12 + (n - 1)(-16)
$$

Simplify:

$$
a_n = -12 - 16(n - 1)
$$

Expanding:

$$
a_n = -12 - 16n + 16
$$

Combine like terms:

$$
a_n = (-12 + 16) - 16n = 4 - 16n
$$

Thus, the general term is:

$$
a_n = 4 - 16n
$$

Calculating the 61st Term

To find the 61st term, substitute $n = 61$:

$$
a_{61} = 4 - 16 \times 61
$$

Calculate:

$$
16 \times 61 = (16 \times 60) + (16 \times 1) = 960 + 16 = 976
$$

Therefore:

$$
a_{61} = 4 - 976 = -972
$$

Answer:

$$
\boxed{
\text{The 61st term of the sequence is } -972
}
$$

Validating the Result

It's always prudent to double-check the calculation:

- The sequence decreases by 16 each term.
- Starting at -12, after 60 steps (since the first term is at step 1), the total decrease is:

$$
60 \times 16 = 960
$$

- The 61st term:

$$
-12 - 960 = -972
$$

which confirms our previous calculation.

Broader Context and Applications

Understanding how to analyze such sequences has practical implications across various fields:

- Economics: Calculating depreciation or consistent savings over time.
- Physics: Uniform acceleration scenarios where quantities change at a constant rate.
- Computer Science: Iterative algorithms with fixed step increments.

The methodology demonstrated here—extracting the common difference, deriving the general term, and computing specific terms—is fundamental in pattern recognition and problem-solving.

Additional Examples and Practice Problems

To deepen understanding, consider the following exercises:

1. Find the 50th term of the sequence: 3, -1, -5, -9, ...
2. Determine the 100th term of the sequence: 20, 15, 10, 5, ...
3. Given the sequence: $100, 85, 70, \ldots$, find the 75th term.

Solutions:

1. First term $a_1 = 3$, $d = -4$, $a_{50} = 3 + (50 - 1)(-4) = 3 - 196 = -193$.

2. First term $a_1 = 20$, $d = -5$, $a_{100} = 20 + (100 - 1)(-5) = 20 - 495 = -475$.

3. $a_1 = 100$, $d = -15$, $a_{75} = 100 + (75 - 1)(-15) = 100 - 1110 = -1010$.

Conclusion

The process of finding specific terms in an arithmetic sequence hinges on understanding its defining parameters: the first term and the common difference. In the case of the sequence -12, -28, -44 ..., we identified:

- First term $a_1 = -12$,
- Common difference $d = -16$,
- General term $a_n = 4 - 16n$,
- 61st term $a_{61} = -972$.

This approach illustrates the power of algebraic manipulation and pattern recognition in sequence analysis, offering tools for tackling a broad spectrum of problems in mathematics and its applications. As sequences underpin many scientific and engineering principles, mastering their properties is an essential skill for students and professionals alike.

References

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About the Author

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