If 19th Term Of An A.P. Is 844 And 844th Term Is 19 Then Find The Term Which Is Equal To Zero?

If 19th Term Of An A.P. Is 844 And 844th Term Is 19 Then Find The Term Which Is Equal To Zero?

Understanding the properties of Arithmetic Progression (A.P.) is fundamental in solving many mathematical problems. The problem at hand involves an A.P. where the 19th term and the 844th term are given, and the task is to find the term that equals zero. This type of problem not only tests your knowledge of the basic formulas of A.P. but also your ability to apply logical reasoning to find unknown terms.

In this article, we will explore a step-by-step approach to solve this problem, explain the underlying concepts, and provide additional tips and tricks to enhance your understanding of arithmetic progressions.

Introduction to Arithmetic Progression (A.P.)

Before delving into the specific problem, let’s revisit the fundamental concepts of arithmetic progression:

What is an Arithmetic Progression?

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

Example:
2, 5, 8, 11, 14, ...
Here, the common difference (d) = 3.

General Form of an A.P.

The nth term of an A.P. can be expressed as:

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

where:
- $ a $ = first term of the A.P.
- $ d $ = common difference.
- $ n $ = position of the term in the sequence.
- $ a_n $ = value of the nth term.

Understanding the Given Data

The problem states:

- The 19th term of an A.P. is 844.
- The 844th term of the same A.P. is 19.
- Find the term that equals zero.

Let's analyze this data systematically:

1. $a_{19} = 844$
2. $a_{844} = 19$

Our goal is to find the term a_k such that $a_k = 0$.

Step-by-Step Solution Approach

To solve this, we need to determine the first term a and the common difference d, then find the term where the value is zero.

Step 1: Write Equations for the Known Terms

Using the formula for the nth term:

$$
a_{19} = a + (19 - 1)d = a + 18d = 844
$$

Similarly,

$$
a_{844} = a + (844 - 1)d = a + 843d = 19
$$

Step 2: Set Up Two Equations

From the above,

$$
a + 18d = 844 \quad (1)
$$
$$
a + 843d = 19 \quad (2)
$$

Step 3: Eliminate a to Find d

Subtract equation (1) from equation (2):

$$
(a + 843d) - (a + 18d) = 19 - 844
$$
$$
a - a + 843d - 18d = -825
$$
$$
825d = -825
$$

Solve for d:

$$
d = \frac{-825}{825} = -1
$$

Step 4: Find the First Term a

Substitute $d = -1$ into equation (1):

$$
a + 18(-1) = 844
$$
$$
a - 18 = 844
$$
$$
a = 844 + 18 = 862
$$

So, the first term $a = 862$ and the common difference $d = -1$.

Step 5: Find the Term Which Is Zero

We want to find n such that:

$$
a_n = 0
$$

Using the formula:

$$
a + (n - 1)d = 0
$$

Substitute $a = 862$ and $d = -1$:

$$
862 + (n - 1)(-1) = 0
$$

Simplify:

$$
862 - (n - 1) = 0
$$
$$
862 = n - 1
$$
$$
n = 863
$$

Therefore, the 863rd term of the sequence is zero.

Summary of the Solution

- The first term of the A.P. is 862.
- The common difference is −1.
- The term which equals zero is the 863rd term.

Additional Insights & Tips

Why Is This Method Effective?

This approach uses basic algebra and substitution, which are straightforward and reliable methods for solving A.P. problems involving multiple terms. Recognizing the pattern and setting up equations based on the general formula makes the process systematic.

Common Mistakes to Avoid

- Mixing up the positions of terms and their values.
- Forgetting to verify the solutions by substituting back into the original formulas.
- Ignoring the sign of the common difference; it can be positive or negative.

Extensions and Practice Problems

To deepen your understanding, try solving additional problems such as:

1. Find the 50th term if the 10th term is 25 and the 100th term is 85.
2. Determine the term which is 1000 in an A.P. where the first term is 500 and the common difference is 5.
3. Find the first term and common difference if the 5th term is 20 and the 15th term is 60.

Conclusion

The problem of finding the term in an A.P. that equals zero, given specific terms, is a classic example of applying the basic formulas of arithmetic progressions. By systematically deriving the first term and common difference through algebraic equations, you can efficiently solve for any unknown term.

Remember:
- Always write down the known terms as equations.
- Use subtraction to eliminate variables.
- Carefully solve for the unknowns.
- Verify your answer by substituting back into the original formulas.

Mastering these steps will not only help you solve similar problems efficiently but also strengthen your overall understanding of sequences and series, which are fundamental topics in mathematics.

Keywords: Arithmetic Progression, A.P., nth term, sequence, algebra, problem-solving, zero term, common difference, first term, sequence formula

Frequently Asked Questions

Given that the 19th term of an AP is 844 and the 844th term is 19, how can we find the common difference and the first term?

Let the first term be a and common difference be d. Using the formula for the nth term $T_n = a + (n - 1)d$:

From $T_{19} = 844$: $a + 18d = 844$
From $T_{844} = 19$: $a + 843d = 19$
Subtracting the first from the second:
$(843d - 18d) = 19 - 844$
$825d = -825$
$d = -1$
Substitute $d = -1$ into $a + 18d = 844$:
$a + 18(-1) = 844$
$a - 18 = 844$
$a = 862$

How do we determine the term of the AP that equals zero in this problem?

To find the term which equals zero, set $T_n = 0$ and solve for n:
$0 = a + (n - 1)d$
Substitute $a = 862$ and $d = -1$:
$0 = 862 + (n - 1)(-1)$
$0 = 862 - (n - 1)$

(n − 1) = 862
n = 863

What is the 863rd term of the AP where a = 862 and d = −1?

The 863rd term is T863 = a + (863 − 1)d = 862 + 862(−1) = 862 − 862 = 0.

Is the term which is equal to zero part of the AP? If so, which term number is it?

Yes, the term which equals zero is part of the AP, and it is the 863rd term.

How can we verify the correctness of the term where the AP equals zero?

By substituting n = 863 into the nth term formula:
T863 = 862 + (863 − 1)(−1) = 862 − 862 = 0. Since the calculation confirms T863 = 0, the answer is verified.

What is the significance of identifying the term which equals zero in an AP?

Identifying the zero term helps in understanding the symmetry and the point at which the sequence transitions from positive to negative or vice versa, which is useful in many mathematical and real-world applications.

Can the same approach be used to find the term which equals any specific value in an AP?

Yes, to find the term equal to any value k, set Tn = k and solve for n using n = [(k − a) / d] + 1, provided the sequence and value are consistent.

Additional Resources

If 19th Term Of An A.P. Is 844 And 844th Term Is 19 Then Find The Term Which Is Equal To Zero? is a classic problem in arithmetic progression (A.P.) that challenges our understanding of the fundamental properties of sequences. Such problems are commonly encountered in mathematics exams, competitive tests, and as foundational exercises for students learning about sequences and series. They require a systematic approach involving the basic formulae of A.P., logical reasoning, and algebraic manipulation to find the unknown terms. In this article, we will provide a comprehensive guide to solving this problem step-by-step, along with explanations of key concepts and methods involved.

Understanding the Problem

Let's first restate the problem in clear terms:

- The 19th term of an arithmetic progression (A.P.) is 844.

- The 844th term of the same A.P. is 19.
- Our goal is to find the term in the sequence which is equal to zero.

This problem involves two known terms at different positions in the sequence, and from these, we need to determine the sequence's common difference and first term, ultimately leading us to identify the term that equals zero.

Key Concepts of Arithmetic Progression

Before diving into the solution, it’s essential to recall some fundamental concepts and formulae related to A.P.:

Definition of an A.P.

An arithmetic progression is a sequence of numbers where the difference between any two successive terms is constant. This constant difference is called the common difference (d).

General Term of an A.P.

The nth term of an A.P. is given by:

$$ T_n = a + (n-1)d $$

where:
- $ a $ = first term of the sequence
- $ d $ = common difference
- $ n $ = position of the term in the sequence

Step-by-Step Solution

Step 1: Write Down Known Terms

Given:
- $ T_{19} = 844 $
- $ T_{844} = 19 $

Using the general term formula:

$$
T_{19} = a + (19-1)d = a + 18d = 844
$$
$$
T_{844} = a + (844-1)d = a + 843d = 19
$$

Step 2: Set Up Equations

From the above, we have the system:

$$
\begin{cases}
a + 18d = 844 \quad (1) \\
a + 843d = 19 \quad (2)
\end{cases}
$$

\]

Step 3: Eliminate 'a' to Find 'd'

Subtract equation (1) from equation (2):

\[
(a + 843d) - (a + 18d) = 19 - 844
\]
\[
a - a + 843d - 18d = -825
\]
\[
(843 - 18)d = -825
\]
\[
825d = -825
\]

Step 4: Solve for 'd'

\[
d = \frac{-825}{825} = -1
\]

The common difference \(d = -1 \).

Step 5: Find 'a' (First Term)

Plug \(d = -1 \) into equation (1):

\[
a + 18(-1) = 844
\]
\[
a - 18 = 844
\]
\[
a = 844 + 18 = 862
\]

Therefore, the first term \(a = 862 \) and the common difference \(d = -1 \).

Finding the Term Which Is Equal To Zero

Step 6: Use the general formula to find the term equal to zero

We want to find the term \(T_n \) such that:

\[
T_n = 0
\]

Using the formula:

\[

$$
a + (n-1)d = 0
$$

Substitute known values:

$$
862 + (n-1)(-1) = 0
$$

Simplify:

$$
862 - (n - 1) = 0
$$
$$
862 = n - 1
$$
$$
n = 863
$$

Thus, the 863rd term of the sequence is zero.

Summary of the Results

Parameter	Value
First term a	862
Common difference d	-1
Term which equals zero	863rd term

Additional Insights and Applications

Importance of the Result

- Understanding the position of the zero term helps in analyzing the sequence's behavior.
- Since the sequence decreases by 1 each step, starting from 862, it reaches zero at the 863rd term.
- Beyond this point, the sequence will continue into negative territory, decreasing by 1 each subsequent term.

Practical Applications

- Such problems help in modeling real-world scenarios involving linear change, such as depreciation, temperature drops, or financial amortization.
- Recognizing the pattern allows for predictions of future or past values within a sequence.

Common Variations of the Problem

1. Finding the position of a specific term: Given two terms, determine the position of a term with a certain value.

2. Determining the sequence parameters: Given the first and last terms, find the total number of terms and the common difference.
3. Sequences with different step sizes: Problems involving geometric progressions or other sequences.

Final Thoughts

The problem "If 19th Term Of An A.P. Is 844 And 844th Term Is 19 Then Find The Term Which Is Equal To Zero?" demonstrates the power of basic algebraic manipulation combined with the fundamental formulae of arithmetic progression. By carefully setting up equations and solving for the unknowns, we deduced that the sequence has a first term of 862, a common difference of -1, and that the zero term occurs at the 863rd position.

Understanding such problems enhances problem-solving skills, deepens comprehension of sequences, and provides a foundation for tackling more complex mathematical challenges.

Quick Recap

- Use the general term formula for A.P.: $T_n = a + (n-1)d$.
- Set up equations based on known terms.
- Solve for the common difference d and first term a.
- Find the position n where $T_n = 0$.

By mastering these steps, you can confidently solve similar problems involving arithmetic progressions, equipping you with essential tools for mathematical reasoning and analysis.

Happy problem-solving!

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