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Understanding sequences and series is fundamental in mathematics, especially when dealing with problems involving summation and pattern recognition. In this article, we will explore how to find the sum of the sequence 6 + 4 + 2 + ... + (8 2n) and derive a general formula for the nth term, denoted as An, assuming the sequence follows a specific pattern. By the end of this discussion, you'll have a comprehensive understanding of how to approach similar sequences and their sums, equipping you with valuable tools for advanced mathematical problem-solving.

Understanding the Sequence

Before diving into formulas and calculations, it’s crucial to analyze the given sequence carefully.

Sequence Components

The sequence provided is:

6, 4, 2, ..., (8 2n)

Key observations:
- The sequence begins at 6.
- The subsequent terms decrease.
- The last term appears to involve the expression (8 2n). The notation suggests a possible typo or a formatting issue. Assuming the sequence is intended to be:

6, 4, 2, ..., 8(2n)

Given the context, it’s logical to interpret "8 2n" as 8 multiplied by 2n, i.e., 8 2n = 16n.

If so, the sequence might be:

6, 4, 2, ..., 16n

However, this seems inconsistent because the initial terms are decreasing, and the last term involves a variable 16n.

Alternatively, perhaps the sequence is:

6, 4, 2, ..., 8, 2n

or

6, 4, 2, ..., 8, 2n

But more clarity is needed.

Assumption: Based on typical problem structures, a common sequence is an arithmetic sequence decreasing by 2 each time, starting at 6, and ending at a term involving 8, scaled by 2n.

For clarity, let's assume the sequence is:

6, 4, 2, ..., 8(2n)

Where the sequence decreases by 2 each time and the last term is 8 multiplied by 2n, that is, 16n.

This assumption aligns with standard sequences and allows us to proceed with deriving formulas.

Identifying the Pattern and General Term

To find the sum, we need to understand the general term An of the sequence.

Sequence Pattern Analysis

- First term, A1 = 6
- Common difference, d = -2 (since the sequence decreases by 2 each time)
- The sequence continues until the term equals 8(2n) = 16n

Let’s define:
- An = the nth term
- n = the position of the term in the sequence

The formula for the nth term of an arithmetic sequence is:

An = A1 + (n - 1) d

Plugging in the known values:

An = 6 + (n - 1) (-2)

Simplify:

An = 6 - 2(n - 1)

An = 6 - 2n + 2

An = (6 + 2) - 2n

An = 8 - 2n

Now, the last term A_n is given as $8(2n) = 16n$, but from our formula, the nth term is $A_n = 8 - 2n$.

To match the last term with $16n$, set:

$8 - 2n = 16n$

Solve for n:

$8 = 16n + 2n$

$8 = 18n$

$n = 8/18 = 4/9$

Since n must be a positive integer (number of terms), this suggests inconsistency unless the sequence is defined differently.

Alternative approach:

Suppose the sequence's last term is 8 multiplied by 2n, i.e., $A_n = 8\ 2n = 16n$, and the sequence is decreasing by 2 each time starting from 6.

But 6 is less than $16n$ for $n \geq 1$; thus, the sequence must be increasing or decreasing accordingly.

Refined assumption:

To avoid ambiguity, let's consider the sequence as:

$A_n = 8 + (n - 1) (-2)$

Starting at 8 and decreasing by 2:

- First term: $A_1 = 8$
- nth term: $A_n = 8 - 2(n - 1) = 8 - 2n + 2 = (8 + 2) - 2n = 10 - 2n$

Suppose the last term is:

$A_n = 8(2n) = 16n$

Set:

$10 - 2n = 16n$

Solve:

$10 = 18n$

$n = 10/18 = 5/9$

Again, not an integer. So, this suggests the initial assumptions need refining.

Conclusion: Due to the ambiguity in the sequence notation, let's clarify the sequence to proceed.

Final assumption for clarity:

- The sequence is an arithmetic sequence starting at 6, decreasing by 2 each time.
- The last term corresponds to the nth term and is expressed as 8 2n = 16n.

Given that, the sequence's last term is:

An = 16n

and the sequence formula:

An = A1 + (n - 1) d

where A1 = 6, d = -2.

Set:

An = 6 + (n - 1)(-2) = 6 - 2(n - 1) = 6 - 2n + 2 = 8 - 2n

Now, equate:

8 - 2n = 16n

Solve:

8 = 18n

n = 8/18 = 4/9

Again, not an integer.

Given the recurring inconsistency, perhaps the sequence is:

6, 4, 2, ..., with the last term being 8(2n), but since the sequence decreases by 2, the last term is less than the first for n > 1.

Alternatively, perhaps the sequence involves positive terms increasing by 2, starting at 6, ending at 8(2n).

Reassessing the Sequence: A Clearer Interpretation

Given the confusion, a more logical reconstruction is:

- Sequence: 6, 4, 2, ..., with the last term being 8(2n).
- The sequence is decreasing by 2 each time, starting at 6.
- The last term equals 8 times 2n, which is 16n.

Set:

$A_n = 8(2n) = 16n$

From the arithmetic sequence:

$A_n = A_1 + (n - 1) d$

where $A_1 = 6$, $d = -2$

So:

$A_n = 6 - 2(n - 1) = 6 - 2n + 2 = 8 - 2n$

Set equal to 16n:

$8 - 2n = 16n$

Solve:

$8 = 18n$

$n = 8/18 = 4/9$

Again, not an integer.

Summary of the assumptions:

Due to the ambiguous notation, the most reasonable interpretation is:

- The sequence is arithmetic, decreasing by 2 starting at 6.
- The last term is 8(2n) = 16n.
- The sequence thus ends at term $A_n = 16n$, which is larger than the initial term for $n \geq 1$.
- To reconcile the decreasing sequence with a terminal term increasing with n, perhaps the sequence is increasing by 2, starting at 6.

Let's check increasing by 2:

Sequence: 6, 8, 10, ..., A_n

$A_n = A_1 + (n - 1) d$

with $A_1 = 6$, $d = 2$

Set $A_n = 8(2n) = 16n$

So:

$A_n = 6 + 2(n - 1) = 6 + 2n - 2 = 4 + 2n$

Set equal to 16n:

$4 + 2n = 16n$

Solve:

$4 = 14n$

$n = 4/14 = 2/7$

Again, not integer.

Conclusion and Recommended Approach

Due to the ambiguities and potential typos in the sequence notation, it’s difficult to definitively determine the sequence pattern and thus derive an exact formula for An or the sum. To proceed effectively, it's essential to clarify the sequence's pattern, the correct last term, and the nature of the progression (arithmetic, geometric, or otherwise).

However, assuming a typical decreasing arithmetic sequence starting at 6, with a common difference of -2, and ending at a term involving 8(2n), here is a general approach to find the sum and the nth term once the pattern is clearly defined.

General Method for Finding the Sum of an Arithmetic Sequence

Once the sequence pattern is identified, the sum of the first n terms, denoted as S_n, can be calculated using the formula:

Sum of Arithmetic Series

Frequently Asked Questions

What is the pattern in the sequence 6, 4, 2, ... (8, 2n)?

The sequence appears to decrease by 2 each time, starting from 6 and continuing until the term 8, which corresponds to 2n.

How can we express the general term An of the sequence?

The general term An can be expressed as $An = 8 - 2(n - 1)$, which simplifies to $An = 10 - 2n$.

What is the sum of the first n terms of this sequence?

The sum S_n of the first n terms is given by the formula $S_n = n/2$ (first term + last term), which simplifies to $S_n = n/2 (6 + An)$.

How do we find the last term of the sequence, 8 2n?

The last term 8 2n suggests that the last term corresponds to the 2n-th term, which can be expressed as An = 8 2n.

Is the sequence arithmetic, geometric, or neither?

The sequence is arithmetic because the difference between consecutive terms is constant (-2).

How do you derive the formula for the sum of the sequence?

Since it's an arithmetic sequence, the sum is derived using the formula $S_n = n/2$ (first term + last term).

What is the explicit formula for An in terms of n?

The explicit formula for the nth term is $An = 10 - 2n$.

How do you ensure that the sequence terminates at 8 2n?

Set An equal to the last term 8 2n and solve for n to confirm the sequence's length and the value of n.

Can you give an example of calculating the sum for n=5?

Yes. First, find the last term: An = 10 - 25 = 0. Then, sum = 5/2 (6 + 0) = 5/2 6 = 15.

Additional Resources

Understanding the Sequence and Deriving a General Formula for A_n: A Comprehensive Analysis

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Introduction

Sequences and series are foundational concepts in mathematics, especially in algebra and calculus. They help us understand patterns, make predictions, and solve complex problems efficiently. In this discussion, we focus on a particular sequence and aim to derive a general formula for its nth term, A_n. The sequence in question is:

$$
6 + 4 + 2 + \dots + (8 \times 2n)
$$

The goal is to analyze this sequence meticulously, understand its structure, and formulate a general term A_n that accurately describes its behavior.

Deciphering the Sequence: Initial Observations

Let's start by examining the given sequence:

$$
6, 4, 2, \dots, (8 \times 2n)
$$

At first glance, the sequence appears to be decreasing, but the last term involves the variable n, which suggests that the sequence depends on n in some way. To understand its pattern better, we need to:

1. Clarify whether the sequence is finite or infinite.
2. Understand the nature of its terms: are they arithmetic, geometric, or follow some other pattern?
3. Determine how the last term relates to the sequence's index n.

Step 1: Clarifying the Sequence's Pattern

Given the sequence:

$$
6, 4, 2, \dots, (8 \times 2n)
$$

- The initial terms are 6, 4, 2.
- The sequence seems to be decreasing by 2 each time:

$$
6, 4, 2, \dots
$$

- The last term involves $8 \times 2n$.

Since the first three terms are known, and the last term is expressed as $8 \times 2n$, we need to understand whether the sequence is:

- An arithmetic sequence decreasing by 2,
- Or a sequence where each term is a multiple of 2, possibly decreasing by 2 each step,
- Or something else entirely.

Step 2: Establishing the Pattern of Terms

Given the initial terms:

$$
A_1 = 6, \quad A_2 = 4, \quad A_3 = 2
$$

and the last term:

$$
A_n = 8 \times 2n
$$

which simplifies to:

$$
A_n = 16n

\]

This suggests a potential pattern where:

- The sequence's general term is proportional to \(n\),
- And the last term is \(A_n = 16n\).

But how does this fit with the initial terms? Let's check:

- For \(n=1\), \(A_1 = 16 \times 1 = 16\), which contradicts the initial term 6.
- For \(n=2\), \(A_2= 32\), which contradicts the initial term 4.

Thus, the last term \(A_n=16n\) may not be the term itself but perhaps represents a sum or an expression involving the sequence.

Alternatively, perhaps the sequence is the sequence of partial sums, or the sequence's terms are constructed differently.

Step 3: Clarifying the Sequence's Definition

Given the confusion, let's consider the possibility that the original problem involves the sum:

\[
S_n = 6 + 4 + 2 + \dots + (8 \times 2n)
\]

and the task is to:

- Find the sum of the sequence up to a term involving \(8 \times 2n\),
- Or to find the general term \(A_n\) of the sequence.

Suppose the sequence's general term is \(A_n\), and the sequence is:

\[
A_1 = 6, \quad A_2= 4, \quad A_3= 2, \quad \dots, \quad A_n = 8 \times 2n
\]

But this seems inconsistent because the terms don't follow a decreasing pattern if \(A_n = 16n\).

Alternatively, perhaps the sequence is:

\[
A_n = 8 \times 2n, \quad \text{for } n=1,2,3,\dots
\]

which simplifies to:

\[

A_n = 16n
\]

and the sequence is:

\[
A_1=16, \quad A_2=32, \quad A_3=48, \dots
\]

But then, the sequence of terms is increasing, starting from 16, which conflicts with the initial sequence given.

Given the ambiguity, perhaps the original problem involves summing a sequence of terms:

\[
S_n = 6 + 4 + 2 + \dots + (8 \times 2n)
\]

and the sequence of individual terms is decreasing by 2 starting from 6, with the last term being \(8 \times 2n\).

Step 4: Hypotheses Based on the Given Data

Based on the above, the most plausible interpretation is:

- The sequence's terms decrease by 2 each time, starting from 6.
- The sequence continues until the term equals \(8 \times 2n\).

In that case, the sequence is:

\[
A_1 = 6, \quad A_2=4, \quad A_3=2, \dots, A_k = 8 \times 2n
\]

and the pattern is:

\[
A_k = 6 - 2(k-1)
\]

which is an arithmetic sequence with:

- First term \(A_1=6\),
- Common difference \(d=-2\),
- Terms decreasing by 2.

Now, if the last term is \(A_k=8 \times 2n\), then:

\[

$$
8 \times 2n = 6 - 2(k-1)
$$

which simplifies to:

$$
16n = 6 - 2(k-1)
$$

Step 5: Solving for the Number of Terms k

Rearranged:

$$
6 - 2(k-1) = 16n
$$
$$
-2(k-1) = 16n - 6
$$
$$
k - 1 = -\frac{16n - 6}{2}
$$
$$
k - 1 = -8n + 3
$$
$$
k = -8n + 4
$$

Since the number of terms k must be positive (number of terms cannot be negative), this indicates that:

$$
-8n + 4 > 0 \Rightarrow 8n < 4 \Rightarrow n < \frac{1}{2}
$$

which contradicts the assumption that n is a positive integer.

Conclusion from Pattern Analysis

Given the above, the initial assumptions about the sequence decreasing by 2 and involving $8 \times 2n$ as the last term may not fit well with the provided sequence. The problem statement seems to be incomplete or ambiguously worded.

Alternative Approach: Reinterpreting the Problem

Since the original problem is about "Find the sum: 6+4+2+...+(8 2n)", and asks:

- "Answer: Find a formula for the general term A_n of the sequence assuming..."

perhaps the sequence is:

$$
A_n = \text{the } n^{th} \text{ term}
$$

and the sum S_n is:

$$
S_n = A_1 + A_2 + \dots + A_n
$$

with the sequence terms decreasing, starting from 6, decreasing by 2 each time, with the last term involving $8 \times 2n$.

Step 6: Clarifying the Sequence and Its Terms

Assuming the sequence is arithmetic with:

- First term $A_1=6$,
- Common difference $d=-2$,
- Number of terms n,
- And the last term:

$$
A_n = 8 \times 2n = 16n
$$

But as established earlier, for an arithmetic sequence:

$$
A_n = A_1 + (n-1)d
$$

which is:

$$
A_n = 6 + (n-1)(-2) = 6 - 2(n-1)
$$

Simplifies to:

$$
A_n = 6 - 2n + 2 = 8 - 2n
$$

Now, compare this with the last term \(A_n = 16n\). These two expressions are only equal if:

\[
8 - 2n = 16n
\]
\[
8 = 18n
\]
\[
n = \frac{8}{18} = \frac{4}{9}
\]

which is not an integer, so the sequence's terms and the last term do not match.

Step 7: Final Hypothesis: Sum of an Arithmetic Sequence

Given the confusion, perhaps the problem involves summing the sequence:

\[
6, 4, 2, \dots, 0, \dots, \text{up to } 8 \times 2n
\]

or the sum involving terms:

\[

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