

Precalculus Honors

Arithmetic Sequences and Partial Sums



The Sum of the First n Terms of an Arithmetic Sequence

When a_1 is the first term, a_n is the n th term, and n is the number of terms.

Formula:	
When the first and last terms are known:	$S_n = \frac{n}{2}(a_1 + a_n)$
When a_n is not known:	$S_n = \frac{n}{2}[2a_1 + (n - 1)d]$

This is commonly known as the n th partial sum.

EX #3: Find the sum of the first 100 natural numbers: 1, 2, 3, 4, 5, ...

Completely Editable

9.2

9.2 Arithmetic Sequences and Series

Arithmetic Sequences

Sequence – an ordered set of numbers. The dots (ellipsis) mean there are more numbers.
A sequence that does not end is called **infinite**.
EX. 3, 5, 7, 9, ...
Some sequences have a rule to describe the n^{th} term. The rule for the sequence above is
 $a_n = 2n + 1$.

Nth term of an Arithmetic Sequence

In an arithmetic sequence with first term a_1 and common difference d , the n th term a_n is given by the following
$$a_n = a_1 + (n - 1)d$$

EX #1: Find the ninth term of the arithmetic sequence whose first term is 8 and has a common difference of -5 .

Finding General Terms

EX #2: The numbers in the sequences below follow a general rule?
A. 1, 1.25, 1.5, 1.75, ...
B. $-1, -\frac{1}{2}, -\frac{1}{3}, -\frac{1}{4}, \dots$

The Sum of the First n Terms of an Arithmetic Sequence

When a_1 is the first term, a_n is the n th term, and n is the number of terms.

Formula:	
When the first and last terms are known:	$S_n = \frac{n}{2} (a_1 + a_n)$
When a_n is not known:	$S_n = \frac{n}{2} [2a_1 + (n - 1)d]$

This is commonly known as the n th partial sum.

EX #3: Find the sum of the first 100 natural numbers: 1, 2, 3, 4, 5, ...

EX #4: The sum of the first 18 terms of an arithmetic sequence is 1404. If $a_{18} = 124$, find the first term.

Finding the Sum of a Series

EX #6: Find the sum of the finite arithmetic series $4 + 9 + 14 + 19 + 24 + \dots + 99$

EX #7: Find the sum of the series:

$$\sum_{k=1}^{13} (4k + 5)$$

EX #8: Use a calculator to find the sum of the series

$$\sum_{k=1}^{12} (6k - 3)$$

EX #9: Find the missing numbers in the sequence

A. ..., 132, , 98, ...

Sum of a Finite Sequence

Find the sum of the finite arithmetic series $2 + 5 + 8 + 11 + 14 + 17 + \dots$

Determining Convergence

In Unit 1 we discussed the end behavior of functions. The end behavior of sequences.

Limit of a Sequence

Let $\{a_n\}$ be a sequence of real numbers. Consider a real number L , the sequence **converges** and $\lim_{n \rightarrow \infty} a_n = L$ if the limit is finite or nonexistent.

EX #10: Determine whether the sequences converge or diverge.
A. $\frac{1}{1}, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \frac{1}{n}, \dots$
B. $\frac{1}{1}, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \frac{1}{n}, \dots$

C. 2, 4, 6, 8, 10, ...
D. $1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \frac{1}{n}, \dots$

EX #11: Determine whether the sequences converge or diverge. If it converges, give the limit.

A. $(\frac{3n}{n^2})$

C. $\frac{n^2 + 2}{n^2 + n}$

Using Explicit Formulas

EX #12: Find the 46th term of the sequence 2, 5, 8, 11, 14, ...

EX #13: The number of seats in the first 16 rows of an arena form an arithmetic sequence. If there are 20 seats in Row 1, 23 seats in Row 2, how many seats are in Row 16?

EX #14: How many logs will be in a pile of timbered trees if there are 30 logs in the bottom layer, 29 in the second, and so on until there is one in the top layer?

NOTES

9.2

Arithmetic Sequences & Partial Sums Homework

Name _____

Date _____ Period _____

Problems 1–4, find the n th term of the arithmetic sequence $\{a_n\}$ whose initial term a_1 and common difference d are given. What is the fifty-first term?

1. $a_1 = -7$; $d = 4$

2. $a_1 = -2\pi$; $d = \frac{\pi}{2}$

3. $a_1 = 1$; $d = -\frac{1}{3}$

4. $a_1 = \sqrt{2}$; $d = \sqrt{2}$

Problems 5–8, find the indicated term in each arithmetic sequence.

5. 100th term of 1, 3, 5, ...

6. 60th term of $-2, 0, 2, \dots$

7. 80th term of 1, $-2, -5, \dots$

8. 60th term or $\frac{3}{2}, 2, \frac{5}{2}, 3, \dots$

Problems 9–12, find the first term and the common difference of the arithmetic sequence described. Give a recursive formula for the sequence. Find a formula for the n th term.

9. 8th term is 5; 20th term is 41

10. 5th term is -15 ; 21st term is -47

11. 4th term is -17 ; 20th term is 63

12. 5th term is 8; 13th term is -72

Problems 13–18, find each sum.

13. $2 + 4 + 6 + \dots + 58$

14. $5 + 9 + 13 + \dots + 53$

15. $-1 + 3 + 7 + \dots + (4n - 5)$

16. $1 + 3 + 5 + \dots + (2n - 1)$

17. $\sum_{n=1}^{50} (2n - 5)$

18. $\sum_{k=1}^{80} \left(8 - \frac{1}{2}n\right)$

Problems 19–24, determine whether the sequence converges or diverges. If it converges, give the limit.

19. $\frac{1}{1}, \frac{1}{4}, \frac{1}{9}, \frac{1}{16}, \dots$

20. 1, 4, 9, 16, ...

21. $\left\{\frac{2n-2}{n+1}\right\}$

22. $a_n = \left(\frac{3}{2}\right)^n$

23. $a_1 = 2$; $a_{n+1} = a_n + 3$ for $n \geq 1$

24. $\left\{\frac{2n-2}{1-4n}\right\}$

Problems 25–29, solve.



25. The first row of seats in Section G of a baseball stadium has 5 seats. There are a total of 20 rows of seats in the section. If each row contains two more seats than the row preceding it, how many

26. The fifth and ninth terms of an arithmetic sequence are -9 and -25 , respectively. Find the first term and a recursive rule for the n th term.

27. A new piece of equipment costs \$15,000. Your accountant says the equipment can be depreciated each year by 8% for tax purposes. What value will the company show on the tax return after 5 years?

28. Prescott Publishing pays \$34,000 yearly with raises of \$1800 per year. Lexington Publishing House pays \$38,000 yearly with raises of \$1200 per year. Which company will pay more in the 10th year? How much more?

Practice Sets

Lesson Warm-Ups

3. Find the sum of the series: $\sum_{k=1}^{12} (3k + 2)$	4. Determine whether the sequence converges or diverges. Give the limit if it converges. $\left\{ \begin{matrix} 5n - 2 \\ 6 - 7n \end{matrix} \right\}$
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Name _____ Date _____ Period _____	
Lesson 9.2: Arithmetic Sequences and Partial Sums Warm-Up # 2	
1. Find the n th term of the arithmetic sequence a_n whose initial term $a_1 = 4$ and the common difference is $d = -3$.	2. Write the general rule for the sequence: $-6, -4, -2, 0, \dots$
3. Find the sum of the series: $\sum_{k=1}^{12} (5k - 2)$	4. Determine whether the sequence converges or diverges. Give the limit if it converges. $\left\{ \begin{matrix} 4n^2 + 2 \\ 1 - 2n \end{matrix} \right\}$

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Form A

Period _____

arithmetic
sequence $a_1 = 4$
and $d = -3$

9.2 Arithmetic Sequences & Partial Sums	Form B
Name _____	
Date _____ Period _____	
1. Find the n th term of the arithmetic sequence a_n whose initial term $a_1 = -5$ and the common difference is $d = 2$	
2. Find the 51 st term of the arithmetic sequence. $6, 4, 2, 0, -2, \dots$	
3. Find the sum. $3 + 1 - 1 - 3 - \dots - (5 - 2n)$	
4. Find the sum	

2. Find the 51st term of the arithmetic sequence.
 $-2, 3, 8, 13, \dots$

3. Find the sum.
 $-1 + 1 + 3 + 5 + \dots + (2n - 3)$

4. Find the sum

Daily Lesson Quiz

Grade: _____

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Grade: _____