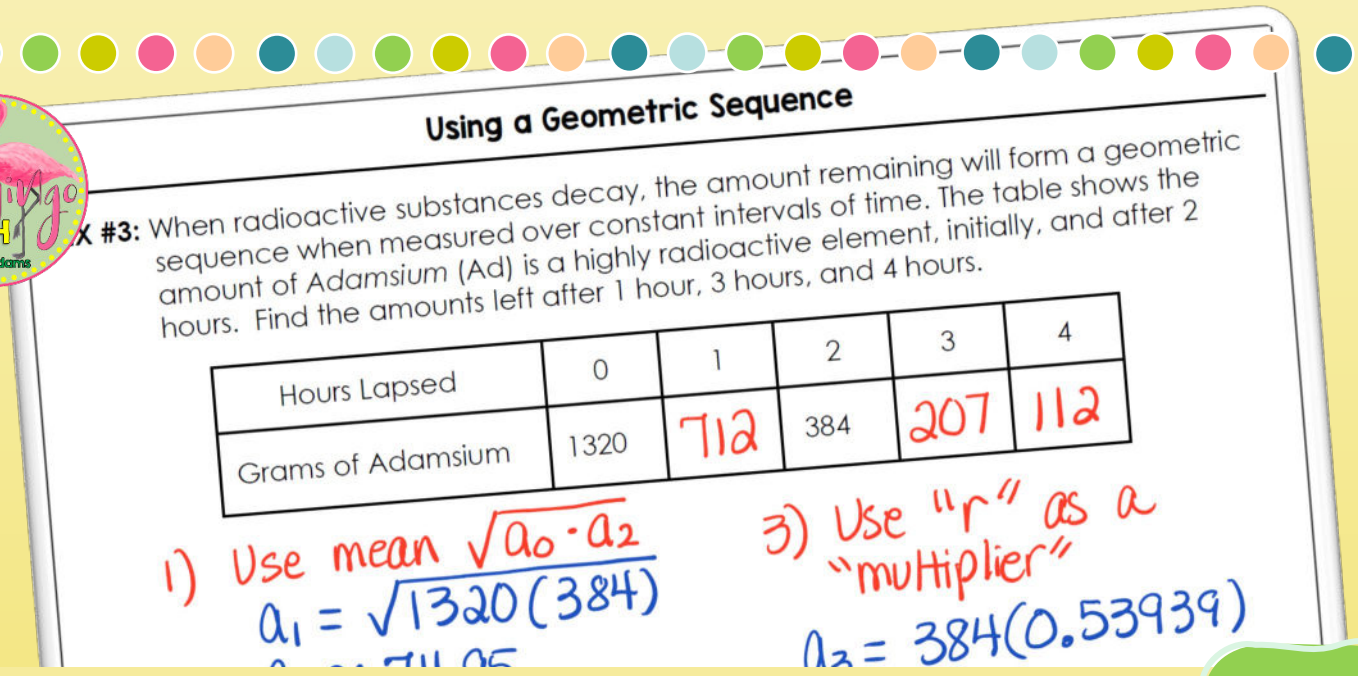
Algebra 2 Honors

Sequences and Series



Guided Notes

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ALGEBRA 2 CURRICULUM

Scope and Sequence

Unit 9: Sequences & Series

Lesson	Skills & Learning Objectives
[9.1] Arithmetic Sequences	❑ Describe and analyze mathematical patterns ❑ Represent real-world situations with sequences ❑ Define, identify, and apply arithmetic sequences ❑ Apply a formula for finding the nth term of a sequence
[9.2] Geometric Sequences	❑ Describe and analyze geometric sequences ❑ Define, identify, and apply geometric sequences ❑ Apply a formula for finding the nth term of a sequence
[9.3] Arithmetic Series	❑ Write, analyze and evaluate arithmetic series ❑ Represent situations using summation notation
[9.4] Geometric Series	❑ Write, analyze and evaluate a finite geometric series ❑ Write analyze and evaluate real-world situations with series

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Arithmetic Sequences

Arithmetic sequences have the same differences between terms (add):

$d = a_2 - a_1, a_3 - a_2, \ldots$

d = common difference between consecutive terms

Each term in an arithmetic sequence can be obtained recursively from its previous term by adding d:

EXPLICIT or GENERAL FORM:	$a_n = a_1 + (n-1)d$ for $n \geq 1$
	$a_n = dn + c$, $C = a_1 - d$
RECURSION FORMULAS:	$a_1 = k$, $a_{n+1} = a_n + d$ (for all $n \geq 1$)
	$a_1 = k$, $a_n = a_{n-1} + d$ (for all $n > 1$)

Analyzing Arithmetic Sequences

EX#5: Is the sequence an arithmetic sequence? 1, 5, 9, 13, 17, . . .

EX #6: Find the 46th term of the sequence 2, 5, 8, 11, 14, . . .

Lesson 9.2: Geometric Sequences

A sequence with a constant ratio between consecutive terms is known as a _____ sequence.

A geometric sequence with a starting value a and a common ratio r is a sequence of the form $a, ar, ar^2, ar^3, \ldots$

EX. 4, 8,16, 32, 64, . . .

The ratio of consecutive terms of a geometric sequence is called a _____ ratio.

EX. 4, 8,16, 32, 64, . . . has a common ratio of _____.

Given two positive numbers, the positive square root of the product of the two numbers is the _____

EX. The geometric mean of 3 and 48 is _____.

Geometric Sequence Formulas	
EXPLICIT DEFINITION:	$a_n = a_1 \bullet r^{n-1}$, *for* $n \geq 1$
RECURSIVE DEFINITION:	$a_1 = a$ $a_n = a_{n-1} \bullet r$, *for* $n > 1$

How to find the ratios between consecutive terms?

EX. 2, 4, 8, 16, . . .

Using a Geometric Sequence

EX #3: When radioactive substances decay, the amount remaining will form a geometric sequence when measured over constant intervals of time. The table shows the amount of *Adamsium* (Ad) is a highly radioactive element, initially, and after 2 hours. Find the amounts left after 1 hour, 3 hours, and 4 hours.

Hours Lapsed	0	1	2	3	4
Grams of Adamsium	1320		384		

Using the Geometric Mean

The geometric mean of two positive numbers x and y is _____ .

In a sequence the formula is:

In a geometric sequence, the square of the middle term of any three consecutive terms is equal to the product of the other two terms. For example, 4, −8, 16, −32, . . .

Lesson 9.3: Arithmetic Series

Vocabulary	Example:
The sum of the terms of a sequence is called a _____.	The series 3 + 6 + 9 + 12 + 15 corresponds to the sequence 3, 6, 9, 12, 15. The sum of the series is _____.
An _____ series has infinitely many terms.	
Any series whose terms form an arithmetic sequence is known as an _____.	1 + 5 + 9 + 13 + 17 + 21 is an arithmetic series with _____ terms.
_____ Is the sum of the terms of the sequence denoted as $\sum_{k=1}^{n}(a_k)$, where _____ is the summation of notation	$\sum_{n=1}^{5}(3n-2)$
In summation notation, the least and greatest integer values of the index n are called _____.	$\sum_{n=1}^{5}(3n-2)$ In this example, the limits are _____ and _____ .

Sum of an Arithmetic Sequence Formula

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

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

Series and Summation

EX#6: If an arithmetic series has $a_1 = 2$, $d = 5$, and $n = 20$,

A. Write the summation notation for the series.

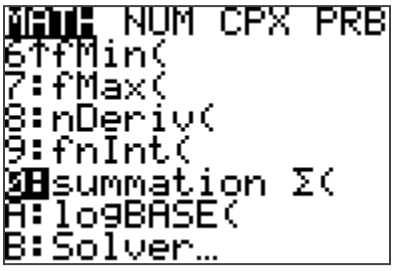
B. Find S_n of the series.

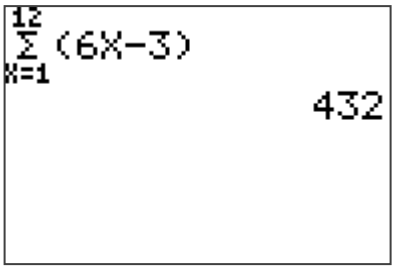
Using the Sum of a Finite Series

EX #7: 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?

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

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





Lesson 9.4: Geometric Series

Vocabulary	Example:
The sum of the terms in a geometric sequence is known as a _____.	The series 2.5 + 5 + 10 + 20 + 40 corresponds to the sequence 2.5, 5, 10, 20, 40. The sum of the series is 77.5.
An infinite series $a_1 + a_2 + \ldots + a_n + \ldots$ is said to _____ if the sum $a_1 + a_2 + \ldots + a_n$ gets closer and closer to a real number as *n* increases.	
An infinite series will _____ if it does not converge.	

Sums of Geometric Series Formula

When a_1 is the first term, r is the common ratio, $r \neq 1$, and n is the number of terms.

Sum of a Finite Geometric Sequence with ratio $r \neq 1$	$S_n = a_1\left(\frac{1-r^n}{1-r}\right)$
Alternate Form of the Finite Formula	$S_n = \frac{a_1 - a_1 \cdot r^n}{1-r}$
Sum of an Infinite Geometric Series if $\lvert r \rvert < 1$	$S = \frac{a_1}{1-r}$

NOTE: An infinite geometric series with $\lvert r \rvert \geq 1$ does not have a finite sum. The series is said to **diverge.**

EX #1: What do you need to find the sum of the first 8 terms in the series
3 + 6 + 12 + 24 + . . . ?