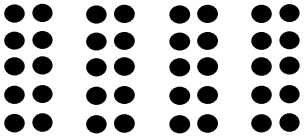
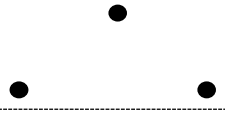
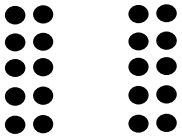
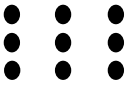
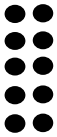
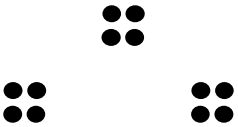
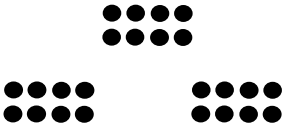
Introduction to Geometric Sequences

Scaffolded Notes

Name _____ Date_____ Period ___ Teacher _____

What are sequences?

At the beginning… 	At the beginning… 	At the beginning… 
After 1 minute… 	After 1 minute… 	After 1 minute… 
After 2 minutes… 	After 2 minutes… 	After 2 minutes… 
After 3 minutes… 		After 3 minutes… 
Write the terms in the sequence. _____ , _____ , _____, _____ How would you find the next term?	Write the terms in the sequence. _____ , _____ , _____ How would you find the next term?	Write the terms in the sequence. _____ , _____ , _____, _____ How would you find the next term?

Geometric Sequences

What is a geometric sequence?	What is a common ratio?

Swing Problem

Samantha's dad gives her a push on the swing. At her highest point, she is 5ft off of the ground. If he does not give her another push, each progressive swing will be 85% of the height of the previous swing. How would you find the height of the next three swings? Use this information to write a formula for the 10th swing.

Finding the Height of Each Swing	
# of Swings	Height of Swing
1	$a_1 = 5$
2	$a_2 =$
3	$a_3 =$
4	$a_4 =$
10	$a_{10} =$

Name _____KEY_____ Date_____ Period ___ Teacher _____

What are sequences?

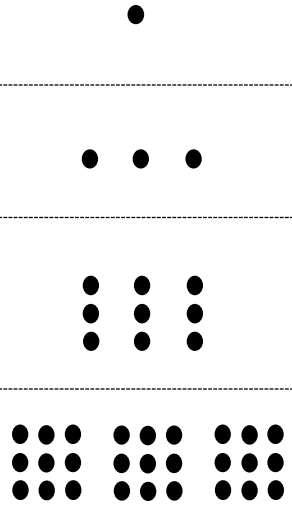
They are a string of objects that follow a particular pattern.

At the beginning…

After 1 minute…

After 2 minutes…

After 3 minutes…

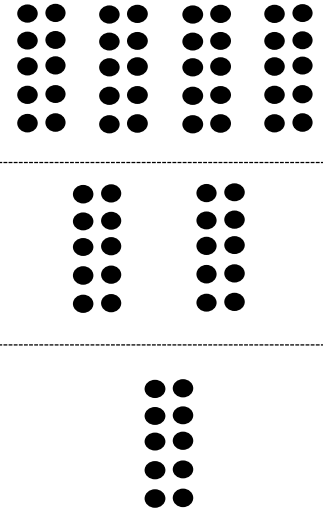


Write the terms in the sequence.
$1, 3, 9, 27$
How would you find the next term?
Multiply the last term by 3

At the beginning…

After 1 minute…

After 2 minutes…



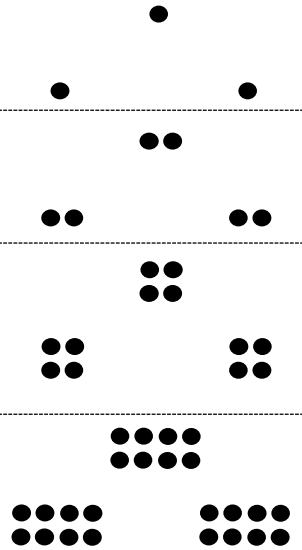
Write the terms in the sequence.
$40, 20, 10$
How would you find the next term?
Multiply the last term by $\frac{1}{2}$

At the beginning…

After 1 minute…

After 2 minutes…

After 3 minutes…



Write the terms in the sequence.
$3, 6, 12, 24$
How would you find the next term?
Multiply the last term by 2

Geometric Sequences

What is a geometric sequence?

A sequence in which each term after the first is found by multiplying the previous term by a constant called the common ratio.

What is a common ratio?

The constant that is multiplied by each term in a geometric sequence in order to find the next term.

Swing Problem

Samantha's dad gives her a push on the swing. At her highest point, she is 5ft off of the ground. If he does not give her another push, each progressive swing will be 85% of the height of the previous swing. How would you find the height of the next three swings? Use this information to write a formula for the 10th swing.

Finding the Height of Each Swing	
# of Swings	Height of Swing
1	$a_1 = 5$
2	$a_2 = 5(0.85)$
3	$a_3 = 5(0.85)(0.85)$
4	$a_4 = 5(0.85)(0.85)\ (0.85)$
10	$a_{10} = 5(0.85)^{10-1}$

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Revisiting Our Geometric Sequences

Determine the common ratio for each sequence. Then, find the next term.

$1, 3, 9, 27, \ldots$	common ratio (r) = _____ next term = _____
$40, 20, 10, \ldots$	common ratio (r) = _____ next term = _____
$3, 6, 12, 24, \ldots$	common ratio (r) = _____ next term = _____

Geometric Sequences: Finding the Next Terms

Step 1: Find the common ratio (r) by dividing a term in the geometric sequence by its preceding term.

Step 2: Multiply the common ratio (r) by the term at the end of the sequence. Continue until you have the desired amount of terms.

Find the next 2 terms in the sequence.

$324 \quad 108 \quad 36$

What is the common ratio (r)?

The next 2 numbers in the sequence are…

_____ and _____

Find the next 3 terms in the sequence.

$-3 \quad -15 \quad -75$

What is the common ratio (r)?

The next 3 numbers in the sequence are…

_____ , _____ , and _____

Geometric Sequences: Finding the nth Term

The formula for finding the nth term in a geometric sequence is

$$a_n = a_1 \cdot r^{n-1}$$

Step 1: Find the common ratio (r) by dividing a term in the geometric sequence by its preceding term.

Step 2: Substitute your given values and the common ratio into the equation.

Assuming that the geometric sequence continues, what is the height of a bouncing ball on the 9th bounce?

# of Bounces	1	2	3
Height	3	1.8	1.08

Find the values for each variable in the formula.

$a_1 =$
$n =$
$r =$

Use the formula for finding the nth term in a geometric sequence to find a_9.

Assuming that the geometric sequence continues, how many bacteria will be in the culture at the end of 7 hours?

Hour(s)	1	2	3
Bacteria	250	500	1000

Find the values for each variable in the formula.

$a_1 =$
$n =$
$r =$

Use the formula for finding the nth term in an geometric sequence to find a_7.

Name _____KEY_____ Date_____ Period ___ Teacher _____

Revisiting Our Geometric Sequences

Determine the common ratio for each sequence. Then, find the next term.

$1, 3, 9, 27, \ldots$	common ratio (r) = 3 next term = 81
$40, 20, 10, \ldots$	common ratio (r) = $\frac{1}{2}$ next term = 5
$3, 6, 12, 24, \ldots$	common ratio (r) = 2 next term = 48

Geometric Sequences: Finding the Next Terms

Step 1: Find the common ratio (r) by dividing a term in the geometric sequence by its preceding term.

Step 2: Multiply the common ratio (r) by the term at the end of the sequence. Continue until you have the desired amount of terms.

Find the next 2 terms in the sequence.

$324 \quad 108 \quad 36$

What is the common ratio (r)?

$r = \frac{108}{324} = \frac{1}{3}$

The next 2 numbers in the sequence are…

12 and 4

Find the next 3 terms in the sequence.

$-3 \quad -15 \quad -75$

What is the common ratio (r)?

$r = \frac{(-15)}{(-3)} = 5$

The next 3 numbers in the sequence are…

-375, $-1{,}875$, and $-9{,}375$

Geometric Sequences: Finding the nth Term

The formula for finding the nth term in a geometric sequence is

$a_n = a_1 \cdot r^{n-1}$

- a_n: the nth term in the sequence
- a_1: the first number in the sequence
- r: the common ratio
- n: the position in the sequence that you are looking for

Step 1: Find the common ratio (r) by dividing a term in the geometric sequence by its preceding term.

Step 2: Substitute your given values and the common ratio into the equation.

Assuming that the geometric sequence continues, what is the height of a bouncing ball on the 9th bounce?

# of Bounces	1	2	3
Height	3	1.8	1.08

Find the values for each variable in the formula.

$a_1 = 3$
$n = 9$
$r = \frac{1.8}{3} = 0.6$

Use the formula for finding the nth term in a geometric sequence to find a_9.

$a_9 = 3 \cdot (0.6)^{9-1}$
$a_9 \approx 0.0504$

Assuming that the geometric sequence continues, how many bacteria will be in the culture at the end of 7 hours?

Hour(s)	1	2	3
Bacteria	250	500	1000

Find the values for each variable in the formula.

$a_1 = 250$
$n = 7$
$r = \frac{500}{250} = 2$

Use the formula for finding the nth term in an geometric sequence to find a_7.

$a_7 = 250 \cdot (2)^{7-1}$
$a_7 \approx 16{,}000$

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Geometric Sequences: Write an Equation for the nth Term		
Step 1: Write the formula for the nth term.	Write an equation for the nth term in the geometric sequence $21, -63, 189, \ldots$	Write an equation for the nth term in the geometric sequence $162, 108, 72, \ldots$
Step 2: Use the given sequence to determine a_1 and r. Substitute your values into the formula.		

Find a Term in the Sequence Given a Term in the Sequence and the Common Ratio		
Step 1: Write the formula for the nth term.	Find the 12th term of a geometric sequence for which $a_5 = 17$ and $r = -0.4$.	Find the 5th term of a geometric sequence for which $a_7 = -113$ and $r = 6$.
Step 2: Determine which terms you are given in the sequence and use that information to substitute the values for a_n, and r into your formula.		
Step 3: Solve for a_1.		
Step 4: Write the formula for the nth term again.		
Step 5: Substitute the values for a_1, r, and n.		
Step 6: Simplify.		

Write it Out:
What do you know about geometric sequences? You can use diagrams, examples, and words to show what you know.

Name _____KEY_____ Date_____ Period ___ Teacher _____

Geometric Sequences: Write an Equation for the nth Term

	Write an equation for the nth term in the geometric sequence $21, -63, 189, \ldots$	Write an equation for the nth term in the geometric sequence $162, 108, 72, \ldots$
Step 1: Write the formula for the nth term.	$a_1 = 21$ and $r = \frac{(-63)}{21} = -3$	$a_1 = 162$ and $r = \frac{108}{162} = \frac{2}{3}$
Step 2: Use the given sequence to determine a_1 and r. Substitute your values into the formula.	$a_n = a_1 \cdot r^{n-1}$ $a_n = 21 \cdot (-3)^{n-1}$	$a_n = a_1 \cdot r^{n-1}$ $a_n = 162 \cdot (\frac{2}{3})^{n-1}$

Find a Term in the Sequence Given a Term in the Sequence and the Common Ratio

	Find the 12th term of a geometric sequence for which $a_5 = 17$ and $r = -0.4$.	Find the 5th term of a geometric sequence for which $a_7 = -113$ and $r = 6$.
Step 1: Write the formula for the nth term.	$a_n = a_1 \cdot r^{n-1}$	$a_n = a_1 \cdot r^{n-1}$
Step 2: Determine which terms you are given in the sequence and use that information to substitute the values for a_n, and r into your formula.	$17 = a_1 \cdot (-0.4)^{5-1}$	$-113 = a_1 \cdot (6)^{7-1}$
Step 3: Solve for a_1.	$17 = a_1 \cdot 0.0256$ $664.0625 = a_1$	$-113 = a_1 \cdot 46656$ $-0.0024 \approx a_1$
Step 4: Write the formula for the nth term again.	$a_n = a_1 \cdot r^{n-1}$	$a_n = a_1 \cdot r^{n-1}$
Step 5: Substitute the values for a_1, r, and n.	$a_{12} = 664.0625 \cdot (-0.4)^{12-1}$	$a_5 \approx -0.0024 \cdot (6)^{5-1}$
Step 6: Simplify.	$a_{12} \approx -0.0278$	$a_5 \approx -3.1104$

Write it Out:
What do you know about geometric sequences? You can use diagrams, examples, and words to show what you know.

Geometric Sequences

a_n	$=$	a_1	r^{n-1}

Glue the definitions under the flaps.

the nth term in the sequence	equals	the first term in the sequence	the common ratio taken to the power of one less than the term you want to find

1. Cut along the solid lines of the matchbook foldable.
2. Cut along the solid lines of glue in definitions.
3. Glue the definitions on the bottom side of each matchbook flap.
4. Use the blank space inside of your matchbook to write examples of the formula for finding a term in a geometric sequence.

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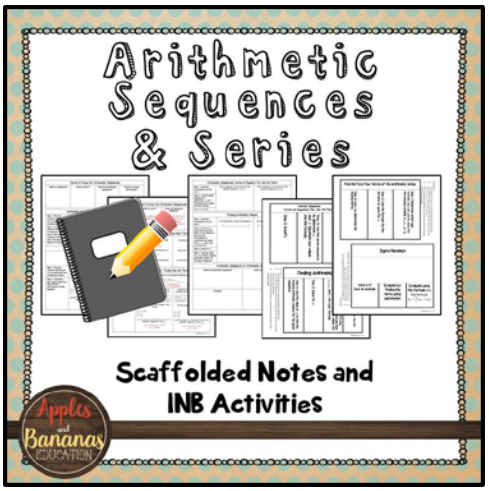

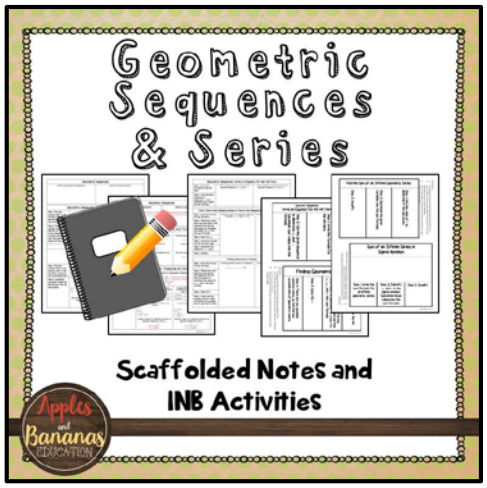

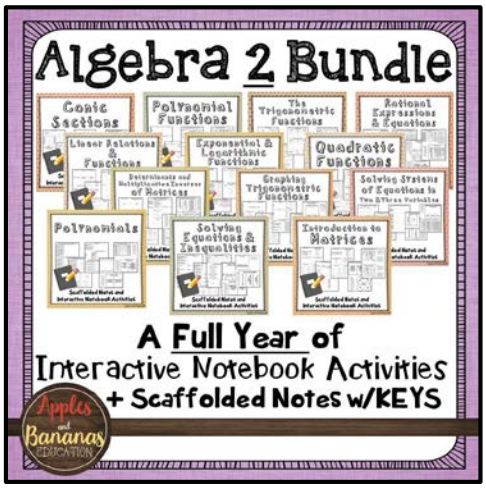

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