AGS 2 Notes
Geometric Sequence Review

Name: Key
Date: 09/08/17 Period: _____

Multiplying & Dividing Patterns

For each pattern below, identify how the terms change from one to the next.

1, 2, 4, 8, 16, ... ·2 ·2 ·2 ·2 $\frac{8}{4} = ·2$	1, 3, 9, 27, 81, ... ·3
1, 10, 100, 1000, 10000, ... ·10	3, 6, 12, 24, 48, ... ·2
80, 40, 20, 10, 5, 2.5 1.25, ... ÷2 $\cdot\frac{1}{2}$ ·0.5	4, 2, 1, ½, ¼, ... ÷2 $\cdot\frac{1}{2}$ ·0.5

Geometric Sequence

Since a number is multiplied or divided to get the next number in the sequence in each pattern above, they are called Geometric Sequences. · or ÷

Common Ratio

The number that is multiplied (the reciprocal number divided) is called the "common ratio" as it can be found by dividing a term by the previous term (the one right before it). $\frac{f(n)}{f(n-1)}$

Example

A scientist is studying bacteria that doubles in number every day. If he starts with 50 cells of bacteria, how many cells will there be after one day? Two days? Three, four, five days? Fill in the table to help you. ×2

Day	0	1	2	3	4	5
Cells	50	100	200	400	800	1600
		×2	×2	×2	×2	×2

What is the initial value?

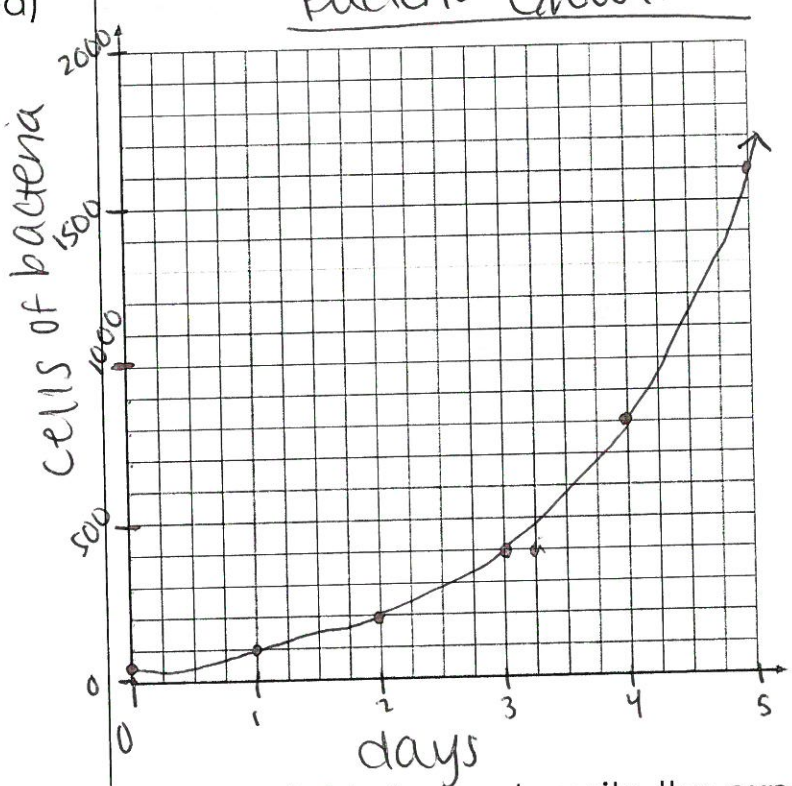
50 cells of bacteria

What is the common ratio?

·2

Example (continued)

Graph the bacteria's growth over the five days.



Fill in the table below to write the explicit rule for this pattern:

Day	Calculation	Cells
0	$50 \cdot 2^0 = 50 \cdot 1 = 50$	50
1	$50 \cdot 2^1 = 50 \cdot 2 = 100$	100
2	$50 \cdot 2^2 = 50 \cdot 4 = 200$	200
3	$50 \cdot 2^3 = 50 \cdot 8 = 400$	400
4	$50 \cdot 2^4 = 50 \cdot 16 = 800$	800
5	$50 \cdot 2^5 = 50 \cdot 32 = 1600$	1600
n	$50 \cdot 2^n =$	$50 \cdot 2^n$

Explicit Formula

$$f(n) = f(0) \cdot r^n$$

$f(n)$ = output (y-value)

r = common ratio

n = term #

$f(0)$ = initial value (starting value)

Exponents	Since the ratio is repeatedly multiplied, we use exponents to write the explicit rule. The ratio is multiplied n times because that is the term number. For example, in the problem above, if we wanted the number of bacteria on the 20th day, you would multiply 50 by 2 twenty times, or: $50 \cdot 2^{20}$
Using the Common Ratio	When we filled in the table for the bacteria, we were using the Recursive Rule again. However, since we multiply to get the next term, the recursive rule changes slightly:
Recursive Formula	$f(n) = f(n-1) \cdot r \; ; f(0) = a$ $f(n) =$ current term's value $f(n-1) =$ previous term's value $r =$ common ratio $f(0) = a$ initial value
Example	For the bacteria's growth, the recursive formula would be: $f(n) = f(n-1) \cdot 2 \; ; \; f(0) = 50$
Example	Oxygen-14 is a radioactive isotope with a half-life of about 1 minute (every minute, half of it disappears). You have 10 pounds of Oxygen-14 to start with. a. What is the initial weight of the Oxygen-14? What is the common ratio? initial weight $f(0) = 10$ lbs Oxygen-14 common ratio $r = \div 2 \cdot 0.5 \cdot \frac{1}{2}$

Example (continued)

b. How much Oxygen-14 is left after 1 minute? 2, 3, 4, 5 minutes? Fill in the table.

Minutes	0	1	2	3	4	5
Pounds of Oxygen-14	10	5	2.5	1.25	0.625	0.3125
		$\div 2$	$\div 2$	$\div 2$	$\div 2$	$\div 2$

c. What is the explicit formula for the sequence?

$f(n) = f(0) \cdot r^n$

$f(n) = 10(0.5)^n$ or $f(n) = 10\left(\frac{1}{2}\right)^n$

d. What is the recursive formula for the sequence?

$f(n) = f(n-1) \cdot r$; $f(0) = a$

$f(n) = f(n-1) \cdot \frac{1}{2}$; $f(0) = 10$

$f(n) = f(n-1) \cdot 0.5$; $f(0) = 10$

$f(n) = \frac{f(n-1)}{2}$; $f(0) = 10$