

Math 1

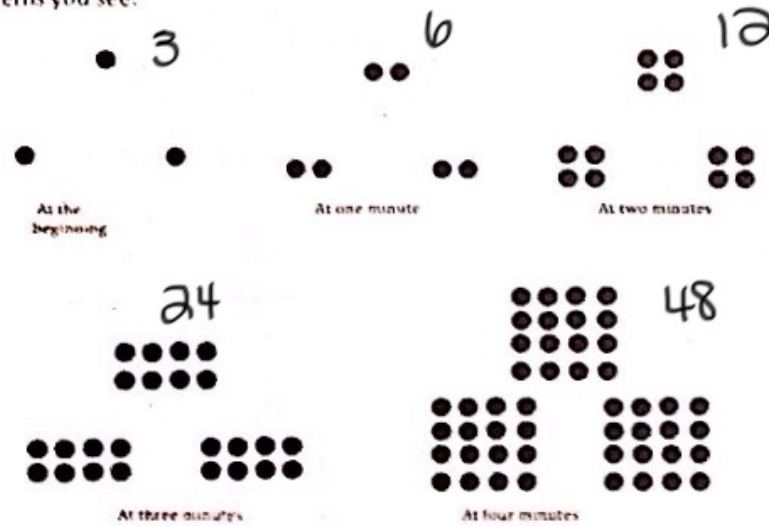
Math 2
Study!

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Investigation 2: Geometric Sequences

Below, you are given a sequence of dots. What do you notice? Answer the questions that follow about the sequence of dots and the patterns you see.



- Describe and label the pattern of change you see in the above sequences of figures.
- Assuming the sequence continues in the same way, how many dots are there at 5 minutes?
- Write a recursive function rule, in subset notation, to describe how many dots there will be after t minutes.
- Write an explicit function rule to describe how many dots there will be after t minutes.

Doubling or $\times 2$

$48 \times 2 = 96$

$$a_n = 2(a_{n-1}), a_1 = 1$$

$$y = 3(2^x)$$

Start $x=0$ ↑ multiplier

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The pattern you studied in the situation above represents a **geometric sequence**. A geometric sequence can be identified by the **constant ratio** between consecutive terms. As you continue, we will focus more specifically on

What type of function does a geometric function represent?
How do we write recursive rules for geometric sequences using subset notation?

- 5 Find the next 3 terms in each geometric sequence. Identify the constant ratio. Write a recursive function rule, in subset notation and an explicit function rule for each sequence. Circle where you see the common ratio in each function (Remember, the first number of the sequence is the 1st term, not the 0th term)

a. $1, 2, 4, 8, 16, \underline{32}, \underline{64}, \underline{128}$

$\overset{0 \ 1 \ 2 \ 3 \ 4}{\curvearrowright}$
 $\div 2 \times 2$

Recursive function: $a_n = 2(a_{n-1}), a_1 = 1$

Common ratio: $\times 2$

Explicit function: $y = 1(2^x)$

b. $\frac{1}{8}, \frac{1}{2}, 2, 8, 32, 128, \underline{512}, \underline{2048}, \underline{8192}$

$\overset{0 \ 1}{\curvearrowright}$
 $\div 4 \times 4$

Recursive function: $a_n = 4(a_{n-1}), a_1 = \frac{1}{8}$

Common ratio: $\times 4$

Explicit function: $y = \frac{1}{8}(4^x)$

c. $10, 5, 2.5, 1.25, \underline{.625}, \underline{.3125}, \underline{.15625}$

$\overset{0 \ 1}{\curvearrowright}$
 $\times 2 \div 2 \times \frac{1}{2}$

Recursive function: $a_n = \frac{1}{2}(a_{n-1}), a_1 = 10$

Common ratio: $\times \frac{1}{2}$

Explicit function: $y = 10(\frac{1}{2}^x)$

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6. What type of function do geometric sequences represent?

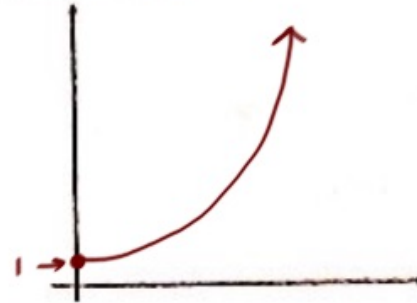
Exponential

7. Below you are given various types of information. Write the recursive and explicit functions for each geometric sequence. Finally, graph each sequence, making sure you clearly label your axes.

a) $1, 2, 4, 8, 16, \dots$
 $0 \quad 1 \quad 2 \quad 3 \quad 4$

Recursive: $a_n = 2(a_{n-1}), a_1 = 2$

Explicit: $y = 1(2^x)$

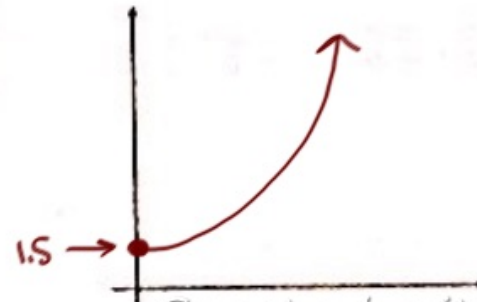


b)

Time (Days)	0	1	2	3	4
Number of Cells	3	6	12	24	

Recursive: $a_n = 2(a_{n-1}), a_1 = 3$

Explicit: $y = 1.5(2^x)$



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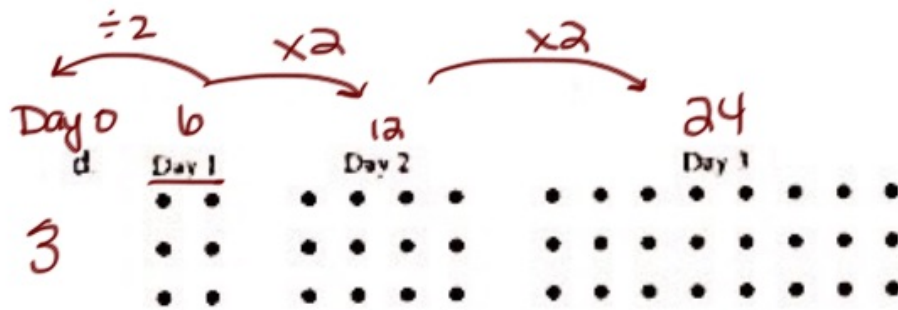
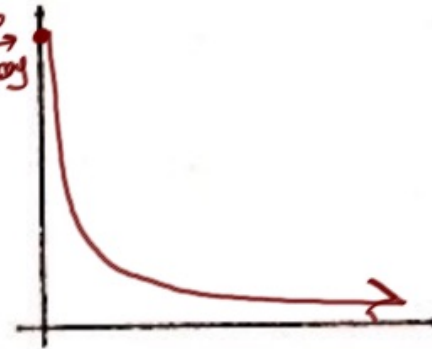


c. Claire has \$300 in an account. She decides to take out half of what's left at the end of each month $\rightarrow x=0$ mult = $\frac{1}{2}$ $\frac{300}{150}$

Recursive: $a_n = \frac{1}{2}(a_{n-1}), a_1 = 150$

0	1	2
300	150	75

Explicit: $y = 300(\frac{1}{2})^x$



Recursive: $a_n = 2(a_{n-1}), a_1 = 6$

Explicit: $y = 3(2^x)$



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Check Your Understanding

a. Complete the table below.

n	1	2	3	4	5	6
$f(n)$	27	9	3			

- b. What is the common ratio?
- c. Write a recursive function.
- d. Write an explicit function.

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x	y
0	$\frac{4}{3}$
1	4
2	12
3	36

Annotations: $\div 3$ (from 4 to $\frac{4}{3}$), $\times 3$ (from $\frac{4}{3}$ to 4)

$$y = \frac{4}{3}(3^x)$$

$$y = 1.\bar{3}(3^x)$$

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