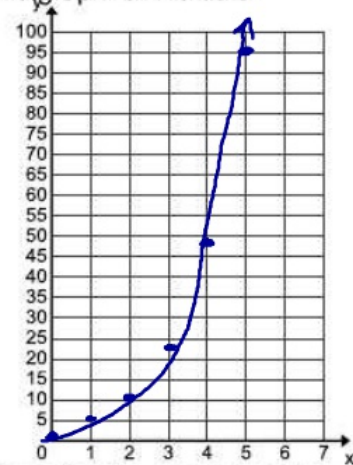


- Describe the pattern of change you see in the above sequence of figures.  
*Double number of dots.*
- Assuming the sequence continues in the same way, how many dots are there at 5 minutes? At 6 minutes? At 7 minutes? Make a table and graph for the data.

Time	Pattern	# of Dots
0	3	3
1	$(3 \cdot 2)$	6
2	$(3 \cdot 2) \cdot 2$	12
3	$(3 \cdot 2 \cdot 2) \cdot 2$	24
4	$(3 \cdot 2 \cdot 2 \cdot 2) \cdot 2$	48
5	$3 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$	96
6		
7		



The pattern of dots can be written as a geometric sequence.

$$a_0, a_1, a_2, a_3, a_4, \dots$$

Geometric Sequence: A number sequence formed by multiplying a term in a sequence by a fixed number to find the next term.

Common Ratio (r): The fixed number that is multiplied to each term of a geometric sequence.

Geometric Sequence Formulas:

Recursive:  $f(0) = \underline{\quad}$ ,  $f(x+1) = f(x) \cdot r$

Explicit:  $f(x) = a_0 \cdot r^n$

$f(0) = 3, f(x+1) \cdot 2$   
 $f(x) = 3 \cdot 2^x$

### Number Patterns

Given the first four numbers in each geometric sequence write a recursive and explicit formula:

1.  $\frac{12}{2} = 6$   $\frac{72}{12} = 6$   $\frac{432}{72} = 6$   
 $a_0$   $a_1$   $a_2$   $a_3$   $a_4$   
 2, 12, 72, 432, ...  $r=6$

2.  $\frac{40}{80} = \frac{1}{2}$   $\frac{20}{40} = \frac{1}{2}$   $\frac{10}{20} = \frac{1}{2}$   
 80, 40, 20, 10 ...  $r = \frac{1}{2}$

Recursive:  $f(x) = 2$   
 $f(x+1) = f(x) \cdot 6$

Recursive:  $f(x) = 80$ ;  $f(x+1) = f(x) \cdot \frac{1}{2}$

Explicit:  $f(x) = 2 \cdot 6^x$


Explicit:  $f(x) = 80 \left(\frac{1}{2}\right)^x$

### Picture Patterns

Count the small triangles.

Stage 0

  $\frac{4}{1} = 4$

  $\frac{16}{4} = 4$

  $r=4$

$a_0$   
1

$a_1$   
4

$a_2$   
16

1. Write a recursive formula and an explicit formula for the number of small triangles in each stage.

Recursive:  $f(x) = 1$   
 $f(x+1) = f(x) \cdot 4$

Explicit:  $f(x) = 1 \cdot 4^x$

2. How many triangles will there be in the 8<sup>th</sup> stage? 15<sup>th</sup> stage?

$f(8) = 1 \cdot 4^8$   
 $= 65536$

$f(15) = 1 \cdot 4^{15}$   
 $= 1,073,741,824$

3. If there are 1024 triangles, what stage is represented?

$f(?) = 1024$

Find the next two numbers in the sequence. Then complete the table.

Pattern	Common Difference or Common Ratio	Recursive Formula	Explicit Formula
81, 27, 9, <u>3</u> , $\frac{1}{3}$ $\frac{27}{81} = \frac{1}{3}$ $\frac{9}{27} = \frac{1}{3}$	Geometric $r = \frac{1}{3}$	$f(x) = 81$ $f(x+1) = f(x) \cdot \frac{1}{3}$	$f(x) = 81 \cdot \left(\frac{1}{3}\right)^x$
-1-4=-5 -6-1=-5 4, -1, -6, -11, -16 $\frac{-1}{4} = \frac{-4}{-1} = \frac{-6}{-11} = \frac{-6}{-16}$	Arithmetic $d = -5$	$f(x) = 4$ $f(x+1) = f(x) + -5$	$f(x) = 4 + x(-5)$
-4, -8, -16, -32, -64 $\frac{-8}{-4} = 2$ $\frac{-16}{-8} = 2$	Geometric $r = 2$	$f(x) = -4$ $f(x+1) = f(x) \cdot 2$	$f(x) = -4 \cdot 2^x$

**Assignment: T4-63 Geometric Sequences**

Ben Cooper was born in 1900. By 1930 he had 3 sons, all with the Cooper last name. By 1960 each of Bob's 3 boys had exactly 3 sons of their own. By the end of each 30 year time period, the pattern of each Cooper boy having exactly 3 sons of their own continued.

1. Create a representation that would show this pattern.
  
2. Predict how many Cooper sons were born in the 30 year period of 1960 and 1990, if the pattern continues.
  
3. Predict how many Cooper sons were born in the 30 year period of 1990 and 2020, if the pattern continues.
  
4. Write the recursive and explicit rule for the number of Cooper sons born in a 30 year period.

Recursive:

Explicit:

Given the first four numbers in each geometric sequence write a recursive and explicit formula:

5. 64, 16, 4, 1, ...

Recursive

Explicit

6. -3,-9, -27, -81 ...

Recursive

Explicit

7. 1, 6, 36, 216, ...

Recursive

Explicit

8. -8,-4, -2, -1 ...

Recursive

Explicit

Given the picture patterns write a recursive and explicit formula:

9.

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++  
++

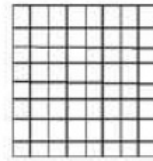
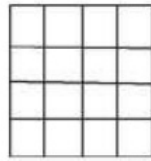
++++  
++++  
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++++++  
++++++  
++++++

Recursive

Explicit

10.



Recursive

Explicit

11. Find the next two numbers in the sequence. Then complete the table.

Pattern	Common Difference or Common Ratio	Recursive Formula	Explicit Formula
6, 12, 24, ____, ____			
14, 11, 8, ____, ____			
2, -2, -6, ____, ____			
-6, 18, -54, ____, ____			
72, 36, 18, ____, ____			
-9, -13, -17, ____, ____			

Review.

12. The Weekes use the Movies-R-Us movie plan to rent movies. They pay a monthly fee of \$10 and then \$1.50 per movie that they have delivered to their home. If their bill last month was \$28.00, how many movies did they rent?
13. Weston ran the same number of miles on Tuesday and Thursday and on Saturday he ran 3 times as many miles as Tuesday. If he ran a total of 7.5 miles last week, how many miles did he run on Tuesday?
14. Two angles are consecutive, interior angles. One of the angles is 30 more than twice the other angle. Find the measure of each angle.
15. In a quadrilateral, the second angle is 40 more than the first angle, the third angle is twice the first, and the fourth angle is 4 times the first angle. Find the measure of each angle.