

## Arithmetic Sequences

**Task Name:** Growing Dots

**Task Description:** In this task, students will describe a growing pattern with tables, graphs, and equations.

**Grade Level:** 9

**Standards Addressed:** HSF-BF.A.1 , HSF-BF.A.1.a , HSF-BF.A.2 , HSF-IF.A.2 , HSF-IF.A.3 , HSF-LE.A.2

**Content Focus:** Using a mathematical representation to represent patterns.

**Prior Knowledge:** Students should have prior knowledge using variables to describe a changing quantity.

**Before the Launch:**

Divide each board into four parts and ask students to write each task in one of them.

**Launch:**

**Teacher:** A student has a friend in another country whom she texts using words because he can't receive images. She wants to describe every pattern in just two sentences. Would you like us to help with her texts?

**Students :** yes!

**Teacher:** So for each pattern use the previous one and generate a new step then write your two sentences.

**Type 1.**

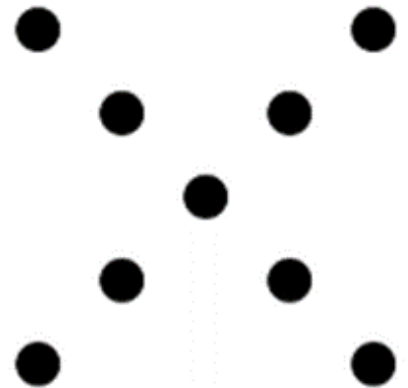
1.



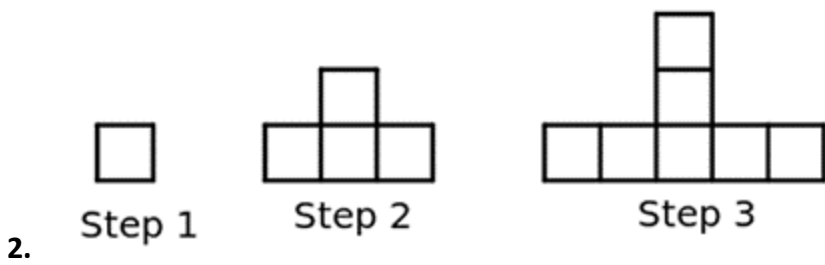
At the  
beginning



At one minute



At two minutes



3. Sarah, a friend of hers, started to help. She counted the number of tiles at each step and made a table.

step number	2	3	4	5	6
number of tiles	7	10	13	16	19

4. Dan, another of her friends, explained that the middle tower is always the same number as the step number. He also pointed out that the two arms on each side of the tower contain one less block than the step number.

Type 2.

(When most groups are almost done, extend the activity with this.)

Teacher: Her friends text back, "Can you tell me the number in step 20 for each of them?"

Type 3.

(When most groups are almost done, extend the activity with this.)

Teacher: "Oh, he sent back three math formulas that he believes are related to those four patterns, but he lost the order and needs help to sort them! He also wants another formula!"

Teacher: "Oh, someone tell that boy to do his homework by himself! 😊" but we believe in collaboration! Yes!!!

So :

a)  $y = 3x - 1$

b)  $y = 3(x - 1) + 1$

c)  $y = 3x + 1$

### **Consolidation Tasks:**

Teacher: "You have 3 minutes to be ready to present your work. Your group needs to share which pattern was harder and how you detailed it!"

**Definitions:**

**Arithmetic sequence**

a sequence of numbers with a common .....between outputs.

Recursive thinking: relates one output to the next output.

**Recursive equation**

Next = Previous + (Common ..... )

Explicit equation

The diagram shows the equation  $f(t) = 4t + 1$ . The term  $f(t)$  is enclosed in a green circle, and a blue arrow points from below to it. The term  $4t$  is also enclosed in a green circle, and a blue arrow points from below to it. This illustrates the relationship between the function notation and the variable  $t$  in the recursive equation.

.....  
notice: you can use the words more than one time!  
( input , output, difference, ratio )

**Example of an arithmetic sequence:**

**Example of describing a visual pattern using an Arithmetic Sequence**

**Table:**

**Recursive equation**

**Explicit equation**

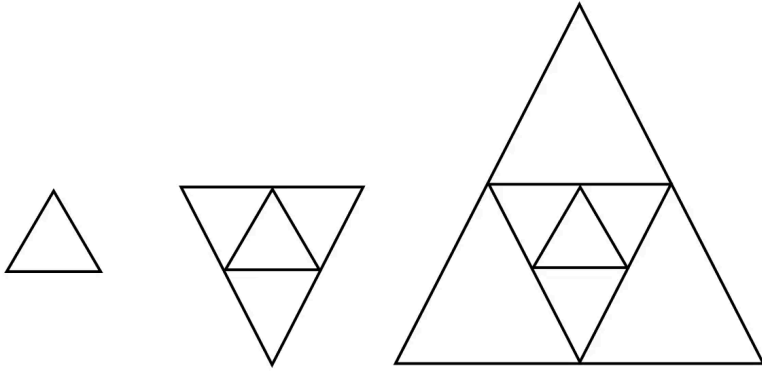
**Advice to my future self:**

CYU- Today:

Mild:

1. For each pattern make the table and Table, Recursive equation, and Explicit equation:

a)

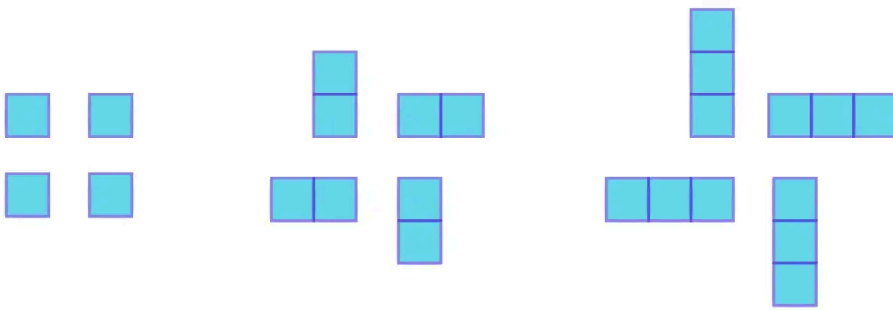


x	y

Recursive equation:

Explicit equation:

b)



x	y

Recursive equation:

Explicit equation:

2. Use the given values in the table to determine a pattern and complete the tables. Write a brief explanation of the pattern you used to finish the table. Try to write it as a mathematical expression if possible using explicit and recursive notation. Does the table represent an arithmetic sequence? If so, how do you know?

A.

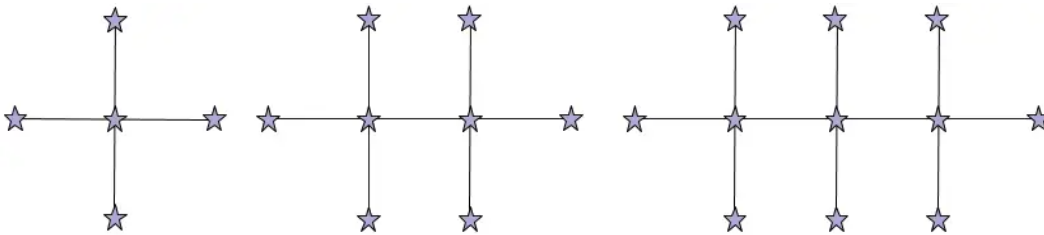
Term	1	2	3	4	5	6	7	8
Value	3	6	12	24				

B.

Term	1	2	3	4	5	6	7	8
Value	76	60	44	28				

2. For each pattern make the table and Table, Recursive equation, and Explicit equation:

a)



x	y

Recursive equation:

Explicit equation:

b)

Nancy focused on the number of blocks in the base compared to the number of blocks above the base. She said the number of base blocks were the odd numbers starting at 1. She also noticed the number of tiles above the base followed the pattern 0, 1, 2, 3, 4. She organized her work in the table.

Step number	# in base + # on top
1	1 + 0
2	3 + 1
3	5 + 2
4	7 + 3
5	9 + 4

x	y

Recursive equation:

Explicit equation:

2. Use the given values in the table to determine a pattern and complete the tables. Write a brief explanation of the pattern you used to finish the table. Try to write it as a mathematical expression if possible using explicit and recursive notation. Does the table represent an arithmetic sequence? If so, how do you know?

A)

Term	1st	2nd	3rd	4th	5th	6th	7th	8th
Value	- 15	- 8	- 1	6				

B)

Term	1st	2nd	3rd	4th	5th	6th	7th	8th
Value	320	160	80	40				

### CYU-Past

*Mild:*

#### Recal:

Some equations have two variables. You may recall seeing an equation written in slope-intercept form:  $y = 5x + 2$ . When given an  $x$ -value, the equation can be used to determine the associated  $y$ -value. A solution to an equation is the value that makes the equation a true statement. Therefore, a solution to an equation with two variables must include both the  $x$ -value and the  $y$ -value. Often the answer is written as an ordered pair. **The  $x$ -value is always first.** Example:  $(x, y)$ .

Determine the  $y$ -value of each ordered pair based on the given  $x$ -value.

3.  $y = 7x - 13$

$(6, \_)$ ,  $(-3, \_)$ ,  $(1, \_)$

4.  $y = -x + 8$

$(-8, \_)$ ,  $(5, \_)$ ,  $(0, \_)$

#### Recal:

Based on the function notation provided, evaluate the function to determine the output.

Example:

Instead of using  $x$  and  $y$  in an equation, like  $y = 5x + 1$ , mathematicians often write  $f(n) = 5n + 1$  because it can give more information. With this notation, the direction to find  $f(2)$  means to replace the value of  $n$  with 2 and perform the operations to find  $f(n)$ . The point  $(n, f(n))$  is in the same location on the graph as  $(x, y)$ , where  $n$  describes the location along the  $x$ -axis, and  $f(n)$  is the height of the graph.

Given that  $f(n) = 8n - 3$  and  $g(n) = 3n - 10$ , evaluate the following functions with the indicated values.



13.  $f(1) =$

14.  $g(0) =$

Write each expression using an exponent.

17.  $7 \times 7 \times 7 \times 7$

18.  $3 \times 3 \times 3 \times 3 \times 3 \times 3$

19.  $\frac{1}{5} \times \frac{1}{5}$

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*Spicy:*

**Recal:**

**The  $x$ -value is always first.** Example:  $(x, y)$ .

Determine the  $y$ -value of each ordered pair based on the given  $x$ -value.

3.  $y = 5x - 2$

$(0, \_)$ ,  $(3, \_)$ ,  $(-9, \_)$

4.  $y = -3x + 8$

$(-4, \_)$ ,  $(1, \_)$ ,  $(7, \_)$

**Recal:**

Based on the function notation provided, evaluate the function to determine the output. The point  $(n, f(n))$  is in the same location on the graph as  $(x, y)$ , where  $n$  describes the location along the  $x$ -axis, and  $f(n)$  is the height of the graph.

Given that  $f(n) = 8n - 3$  and  $g(n) = 3n - 10$ , evaluate the following functions with the indicated values.

15.  $f(5) =$

16.  $g(-4) =$

For problems 20–22: Write each expression in expanded form (a). Then calculate the value of the expression (b).

20.  $7^1$

a. expanded form:

b. value of the expression:

21.  $5^4$

a. expanded form:

b. value of the expression:

22.  $7(2)^3$

a. expanded form:

b. value of the expression: