

PIAF – Pedagogical Scenario

(PIAF = Développement de la pensée informatique et algorithmique dans l'enseignement fondamental – Development of computational and algorithmic thinking in basic education)

Title

Make it draw!

Practical Information

(Ideal) Number of students: 16

Age of the students: 9 – 12 years

Duration of the scenario: 3 sessions of 45 minutes each

Main discipline of the Scenario

C 1.3 Identify the input parameters of an action sequence

C 2.6 Break down objectives into simpler sub-objectives

C 4.1 Compare two objects according to a given criterion

Description

Learners learn about patterns and how to identify elements of patterns of figures composed of geometrical shapes as well as numerical patterns.

PIAF-specific competencies/goals

Specific PIAF Competencies:	
C1	Competency 1: Abstracting away / generalizing > 1.3- Identify the input parameters of an action sequence > Identify the types and amounts of shapes in a pattern > Given a pattern and a sequence of actions, students identify the information needed from the pattern to be used as inputs to execute the sequence of actions
C2	Competency 2: Compose/decompose a sequence of actions > 2.6- Break down objectives into simpler sub-objectives > Separate and order the steps required to identify a pattern > Students identify and follow the steps and sub-steps needed for determining the type and frequency of elements that compose a figure, the calculation of the algorithm for the pattern, and the creation of growing figures based on the pattern
C3	Competency 4: Evaluate objects or sequences of actions > 4.1- Compare two objects according to a given criterion > Compare two figures

	based on their composing elements > The students are given tasks on which they need to compare the composing elements of related figures or sets of numbers
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Pre-requisite for the activities

Read and follow basic instructions

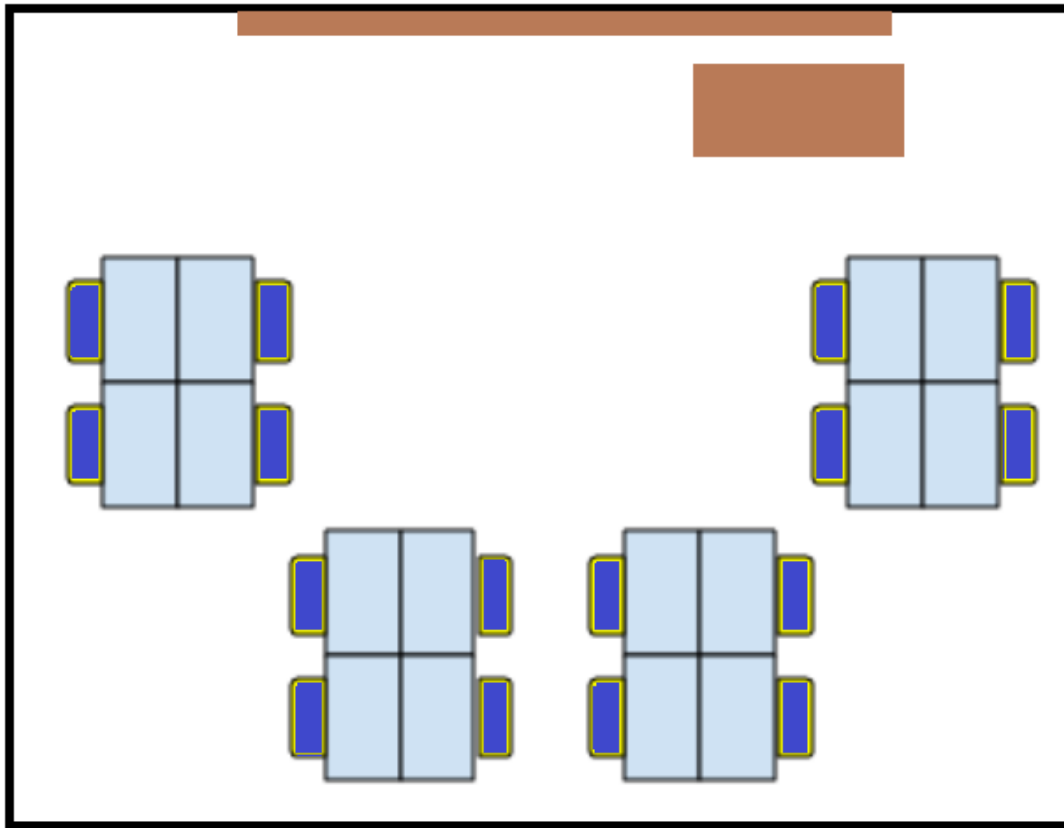
Counting and basic arithmetic calculations (sum and subtraction) of integers

Recognize basic geometric shapes, colors, and numbers

Digital Resources

Technical	Didactic
Not applicable	Course notes and attachments

Organization of the classroom



Scenario (Sequence of the activities)

Activity 1 What are patterns?		
1. Introduction – topic presentation (10')	<p><u>Group Format:</u> whole class</p> <p><u>Document:</u> Teacher's attachment A</p> <p><u>Instruction:</u> "A pattern is a repeated sequence of shapes, numbers or words. Patterns indicate an order and can allow us to create figures or many other things"</p> <p><u>Students task:</u> interact by responding to questions</p> <p><u>Instructors role:</u> After presenting the topic, the instructor elaborates on the examples given.</p> <p><u>Expected response:</u> students will learn to recognize patterns of words, numbers and shapes by answering a set of questions in a specific sequence</p>	
2. Introductory activity (15')	<p><u>Group Format:</u> dyads</p> <p><u>Document:</u> Teacher's attachment A, Student's attachment 1</p> <p><u>Instruction:</u> "Now that you have an idea of what patterns are, I will give you a sheet with tables to fill. You need to find out the next element of the pattern, and for that you need to first identify its elements and and sequence."</p> <p><u>Students task:</u> Work in dyads filling out the worksheet.</p> <p><u>Instructors role:</u> Go with each dyad and clarify the task when needed.</p> <p><u>Expected response:</u> Students are able to identify the necessary information from the patterns to be able to fill the tables and predict the next element of each pattern</p> <p><u>Anticipation of difficulties:</u> If students don't notice any patterns, provide examples such as: on which days they come to school, ask to say the months of the year and ask on which month their birthday is</p>	1.3, 2.6
3. Comparing figures 1 (5')	<p><u>Group Format:</u> whole class</p> <p><u>Document:</u> Teacher's attachment B</p> <p><u>Instruction:</u> "To further learn how to identify elements, I will present some figures out of shapes. I need your help to find the figures which have the same type and number of elements. Let us look at an example"</p> <p><u>Students task:</u> Interact with the instructor</p>	

	<p><u>Instructors role:</u> Show the students examples of figures with the same number of elements.</p> <p><u>Expected response:</u> Recognize how the figures have the same elements</p>	
4. Comparing figures 2 (10')	<p><u>Group Format:</u> in pairs</p> <p><u>Document:</u> Teacher's attachment B, Student's attachment 2</p> <p><u>Instruction:</u> <i>"Pair up and solve this instruction sheet."</i></p> <p><u>Students task:</u> Work on the instruction sheet with their partner.</p> <p><u>Instructors role:</u> Pass by each pair and check the difficulties students are facing.</p> <p><u>Expected response:</u> correct matching of the figures and complete table</p>	1.3, 4.1
5. End of session finalize activity and summarize (5')	<p><u>Group Format:</u> whole class</p> <p><u>Instruction:</u> <i>"What did we learn today?"</i></p> <p><u>Students task:</u> Verbal description of what has been learned during this session</p> <p><u>Instructors role:</u> Guide the students with questions for obtaining the expected answers</p> <p><u>Covered topics:</u></p> <ul style="list-style-type: none"> -What is a pattern -Learned about elements a pattern -How to predict the sequence of a pattern -Identify similar figures based on the same amount of shapes they have 	
Activity 2 Growing patterns 1		
1. Reminder (5')	<p><u>Group Format:</u> whole class</p> <p><u>Instruction:</u> <i>"Can someone remind me of what we did last time?"</i></p> <p><u>Students task:</u> Verbal description of the activities done in the previous session</p> <p><u>Instructors role:</u> Guide the students with questions for obtaining the expected answers</p> <p><u>Covered topics:</u></p> <ul style="list-style-type: none"> -Learned about elements a pattern -Identify similar figures based on the same amount of shapes they have 	

<p>2. Arithmetic pattern explained (10')</p>	<p><u>Group Format:</u> whole class <u>Document:</u> Teacher's attachment C <u>Instruction:</u> "Now that you are experts on the simple patterns, let us look at some more complex patterns. We have two different sets of colored squares and we need to find the relation <u>between</u> them." <u>Students task:</u> Interact and find solutions with the instructor <u>Instructors role:</u> The instructor draws the tables on the board and guides students to find the solution. <u>Expected response:</u> Students find the relation between elements (colors/shape)</p>	
<p>3. Arithmetic patterns application 1 (10')</p>	<p><u>Group Format:</u> pairs <u>Document:</u> Teacher's attachment D, Student's attachment 3 <u>Instruction:</u> "Time for you to apply what we just learned. Try to solve with your partner the following exercises and we will check your work together." <u>Students task:</u> Solve the sheet <u>Instructors role:</u> The instructor draws the grids on the board and fills it out with the students when they are done <u>Expected response:</u> Students fill the sheet and find the relation between elements (colors/shapes)</p>	<p>1.3, 4.1</p>
<p>4. Arithmetic patterns application 2 (10')</p>	<p><u>Group Format:</u> whole <u>Document:</u> Teacher's attachment E <u>Instruction:</u> "Another form of patterns can be shown in table format. Look at set A and B in this table. Can you find the relation between A and B? <u>Students task:</u> Interact and find solutions with the instructor <u>Instructors role:</u> The instructor draws the tables on the board and guides students to find the algorithm.. <u>Expected response:</u> Students find the relation between the sets</p>	
<p>5. Arithmetic patterns application 3 (5')</p>	<p><u>Group Format:</u> Pairs <u>Document:</u> Teacher's attachment F, Student's attachment 4 <u>Instruction:</u> "Here are some more examples. In the coming 5 minutes, try to come up with the relation of the elements given." <u>Students task:</u> Fill out the table in the sheet <u>Instructors role:</u> Assist the students that need more help to complete the table.</p>	<p>1.3, 2.6, 4.1</p>

6. End of session (5')	<p><u>Group Format:</u> Whole class</p> <p><u>Instruction:</u> <i>"What did we learn today?"</i></p> <p><u>Students task:</u> Verbal description of what has been learned during this session</p> <p><u>Instructors role:</u> Guide the students with questions for obtaining the expected answers</p> <p><u>Covered topics:</u></p> <ul style="list-style-type: none"> - Found the relation between two patterns - Wrote an equation relating colors/shapes 	
Activity 3 Growing patterns 2		
1. Reminder (5')	<p><u>Group Format:</u> whole class</p> <p><u>Instruction:</u> <i>"Can someone remind me of what we did last time?"</i></p> <p><u>Students task:</u> Verbal description of the activities done in the previous session</p> <p><u>Instructors role:</u> Guide the students with questions for obtaining the expected answers</p> <p><u>Covered topics:</u></p> <ul style="list-style-type: none"> - Learned about patterns - Learned identify patterns between sets of numbers - Growing patterns in figures 	
2. A new challenge (10')	<p><u>Group Format:</u> whole class</p> <p><u>Document:</u> Teacher's attachment G</p> <p><u>Instruction:</u> <i>"I can imagine a long snake of shapes. It is made up of pentagons and circles. The shapes increase every day. Help me count the number of pentagons and circles every time this snake grows! "</i></p> <p><u>Students task:</u> Interact and find solution with the instructor</p> <p><u>Instructors role:</u> Create the snake by sticking its parts on the board. Guide the students with questions for obtaining the expected answers. Add parts till you reach snake number 2. Fill out the table with the student's answers.</p> <p><u>Expected response:</u> Students understand the relation between the number of days and number of parts of the snake (pentagons, circles, and pentagons-circles).</p>	
3. Finding the relation (10')	<p><u>Group Format:</u> in pairs</p> <p><u>Document:</u> Teacher's attachment H, Student's attachment 5</p>	1.3, 2.6,

	<p><u>Instruction:</u> <i>"Fill out the following instruction sheet. With your partner try to find the numerical patterns that predict how the snake grows each day. Then, use the pattern to find the number of pentagons and circles our snake will have on the 20th day."</i></p> <p><u>Students task:</u> Work on the instruction sheet with their partner.</p> <p><u>Instructors role:</u> Pass by each pair and check the difficulties students are facing.</p> <p><u>Expected response:</u> finding the number of parts for the snake on the 20th day</p>	4.1
4. Discussion (5')	<p><u>Group Format:</u> whole class</p> <p><u>Instruction:</u> <i>"You all did a great job! Let us sum up the solution together."</i></p> <p><u>Students task:</u> Interact with the instructor</p> <p><u>Instructors role:</u> Explain the strategy used to find the number of parts. Ensure the points of difficulties that were identified during pair work are addressed</p> <p><u>Expected response:</u> finding the relation between number of parts of the snake as days increase</p>	1.3, 4.1
5. Cage Challenge (10')	<p><u>Group Format:</u> in pairs</p> <p><u>Document:</u> Teacher's attachment I, Student's attachment 6</p> <p><u>Instruction:</u> <i>"We must cage this snake. It is growing fast, and we need to adjust the cage to a bigger size! Let us look at the instruction sheet and find the number of bars we need, pair up with your classmate and try to solve. I will pass by in turn and work with you"</i></p> <p><u>Students task:</u> Work on the instruction sheet with their partner.</p> <p><u>Instructors role:</u> Pass by each pair and check the difficulties students are facing.</p> <p><u>Expected response:</u> finding the correct relation between the length of the snake and cage needed.</p>	1.3, 2.6, 4.1
6. End of session (5')	<p><u>Group Format:</u> whole class</p> <p><u>Instruction:</u> <i>"What did we learn today?"</i></p> <p><u>Students task:</u> Verbal description of what has been learned during this session</p> <p><u>Instructors role:</u> Guide the students with questions for obtaining the expected answers</p>	

	<p><u>Covered topics:</u></p> <ul style="list-style-type: none">-what is the numerical pattern of expandable shapes- what is the numerical relation between the elements-algorithms for predicting patterns	
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Assessment

Identifying the shape components of each fractal. Analyzing the relation between the subcomponents.

Competencies/ PIAF-Goals	Activities for the assessment	Assessment criteria
1.3. Identify the input parameters of an action sequence	Recognition of elements in a pattern	Completing the tables
2.6. Break down objectives into simpler sub-objectives	Finding elements in Fractal Arts	Reproducing the original fractal art
4.1. Evaluate objects or sequences of actions	Comparing figures based on the shape pattern	Matching the correct figures

Received Feedback on the created Scenario

If you have had the opportunity to experiment with the scenario presented here, suggest some feedback on it: what worked well, the obstacles encountered, the learner's feedback, your feelings, possible ways to improve it.

Bibliography

Mathwire. (2010). Patterns & Algebra. <http://mathwire.com/archives/algebra.html>

Attachments

Attachments Overview

Activity	Teacher Attachment	Student Attachment
1.1	A	
1.2	A	1
1.3	B	
1.4	B	2
2.2	C	
2.3	D	3
2.4	E	
2.5	F	4
3.2	G	
3.3	H	5
3.5	I	6

Teacher's Attachments

Teacher's Attachment: A

Used in activity:	1.1: Introduction – topic presentation 1.2: Introductory activity
Along with Student's Attachment(s):	1

1.1: Introduction - Topic presentation

Pattern: sequence of shapes, numbers or any other element that has a consistent and predictable order.

The first activities will cover patterns with shapes and figures, then patterns with figures made of basic shapes, and lastly sequences of number patterns.

For the introduction of the topic, discuss the definition of what a pattern is and then ask if anyone can provide an example. Below are some simple pattern examples that can be quickly drawn in the whiteboard:

Example 1:



Example 2:

Eat Run Sleep Eat Run Sleep

Example 3:

5, 7, 10, 5, 7, 10, 5




For each example, ask the following questions in the following sequence. Only after covering the 5 questions of one example, move on with the next example. Cover as many examples as possible. The next activity will use the same questions:

Questions	Example 1	Example 2	Example 3
1. In total, how many individual elements do you see in the example?	7	6	7
2. Which unique elements do you see in the example?	Two: "triangle" and "circle"	Three: "eat", "run", and "sleep"	Three: 5, 7, and 10

3. How many of each of the unique elements can you count in the example?	Triangle: 5 Circle: 2	Eat: 2 Run: 2 Sleep: 2	5: 3 7: 2 10: 2
4. What is sequence between the unique elements?	After 2 triangles there's 1 circle after	"Eat" is always followed by "Run", and "Run" is always followed by "Sleep". "Sleep" always precedes "Eat"	5 is always followed by 7, and 7 is always followed by 10. 10 always precedes 5
5. Based on the previous answers, what would be the next element of the pattern?	Triangle	Eat	7

1.2: Introductory activity

From each of the following patterns, identify the necessary information to complete the table below

Pattern 1	
Pattern 2	
Pattern 3	

Questions	Pattern 1	Pattern 2	Pattern 3
1. In total, how many individual elements do you see in the pattern?	12	8	13
2. Which unique elements do you see in the pattern?	3: butterfly, beetle, bee	5: chef, sailor, astronaut, painter, musician	3: apple, pineapple, banana

		(orchestra director)	
3. How many of each of the unique elements can you count in the pattern?	Butterfly: 6 Beetle: 2 Bee: 4	Chef: 2 Sailor: 2 Astronaut: 2 Painter: 1 Musician: 1	Apple: 4 Pineapple: 6 Banana: 3
4. What is sequence between the unique elements?	Butterflies (3) → Beetle (1) → Bees (2)	Chef (1) → Sailor (1) → Astronaut (1) → painter(1) → musician (1)	Apple (2) → Pineapple (3) → Banana (2)
5. Based on the previous answers, what would be the next element of the pattern?	Butterfly	Painter	Banana

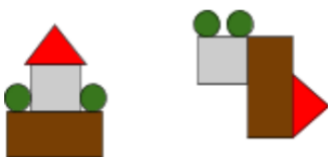
Teacher's Attachment: B

Used in activity:	1.3: Comparing figures 1 1.4: Comparing figures 2
Along with Student's Attachment(s):	2

The following instruction sheet has some guidelines to help you structure your activity. This will help students recognize the elements and compare the figures.

1.3: Comparing figures 1

Start by using a simple example with colors for students to recognize the elements:



For the images above, ask the following questions:

1. Are those images the same? No
2. Are the images similar in some way? Yes, they have the same amount and color of shapes.
3. Which elements can we find in each? Let us compare and check if the pattern is the same although the figures are different.

Continue by using another example for students to compare:

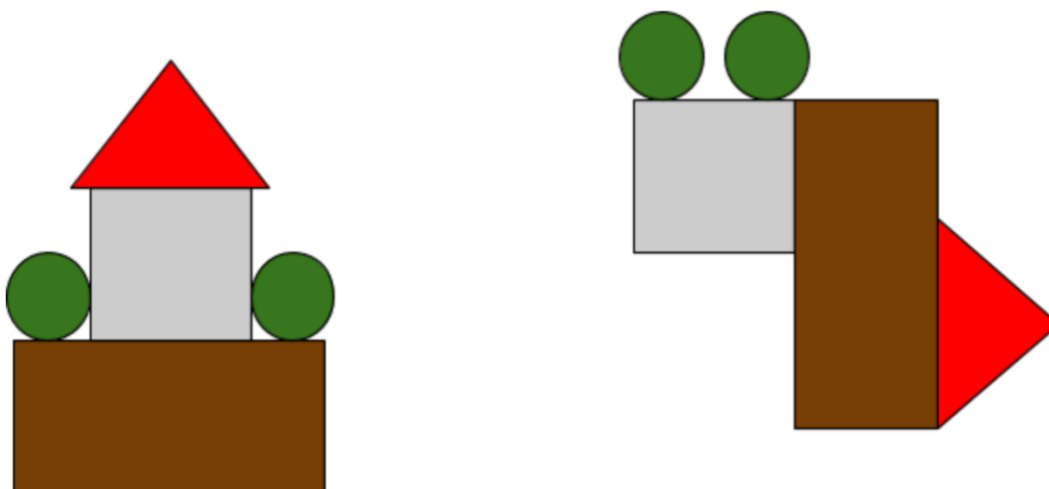
Start with the same 3 questions from above and after that, direct the students to look for similar elements and count the number of elements (shapes) in this example:



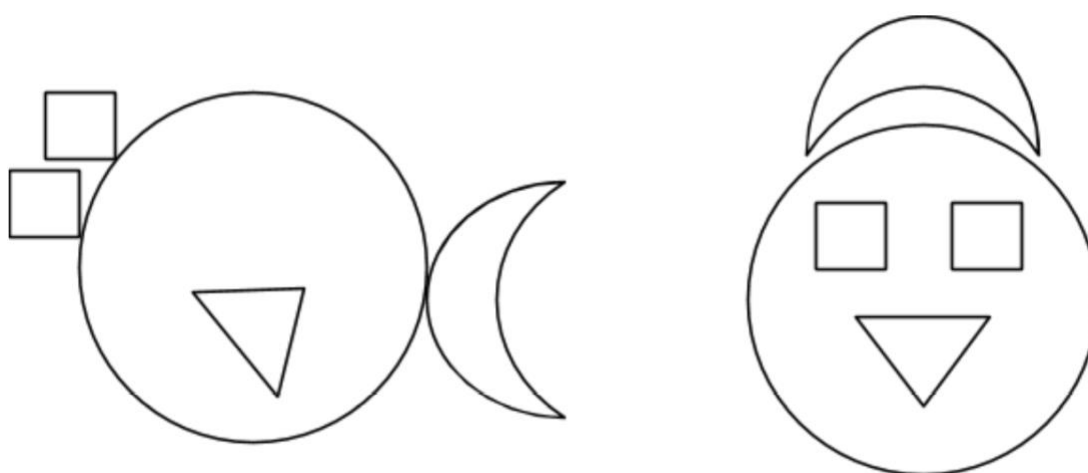
Elements that both figures have:

1 circle 2 squares 1 triangle 1 crescent shape

Pattern ready to be printed. Recommended print size: A3 page. Adjust print size based on classroom size



Pattern ready to be printed. Recommended print size: A3 page. Adjust print size based on classroom size



1.4: Comparing figures 2



Figure 1

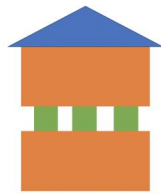


Figure 3



Figure 5

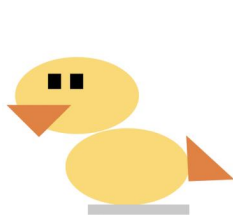


Figure 2



Figure 4



Figure 6

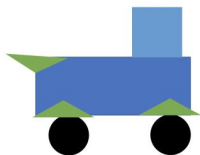


Figure 7



Figure 8

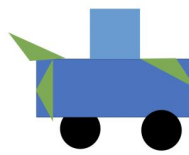


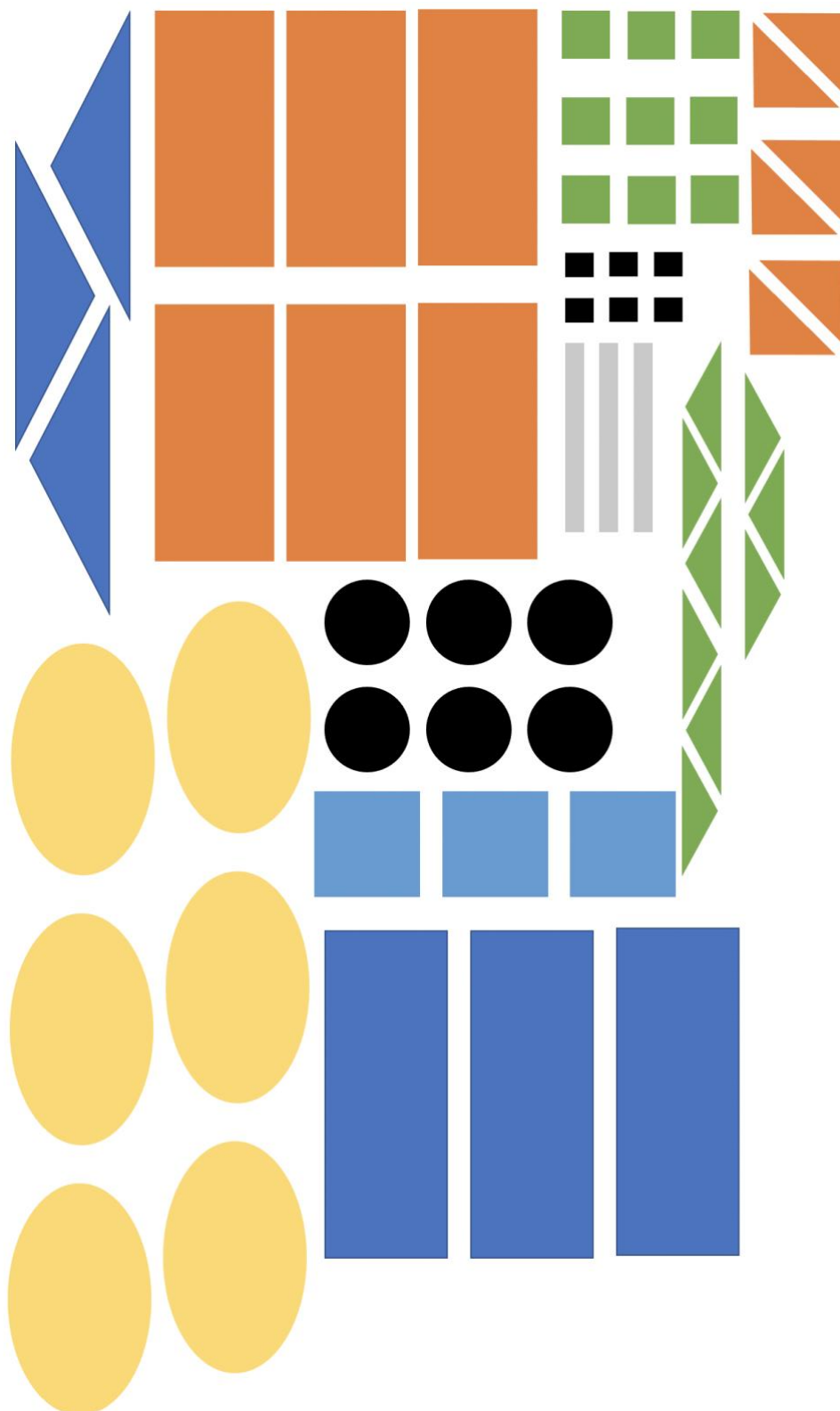
Figure 9

Figures 1 , 3 and 5 are similar. Each figure has 1 triangle(s), 3 square(s), 2 rectangle(s), and 0 circle(s)

Figures 2 , 4 and 6 are similar. Each figure has 2 triangle(s), 2 square(s), 1 rectangle(s), and 2 circle(s)

Figures 7 , 8 and 9 are similar. Each figure has 3 triangle(s), 1 square(s), 1 rectangle(s), and 2 circle(s)

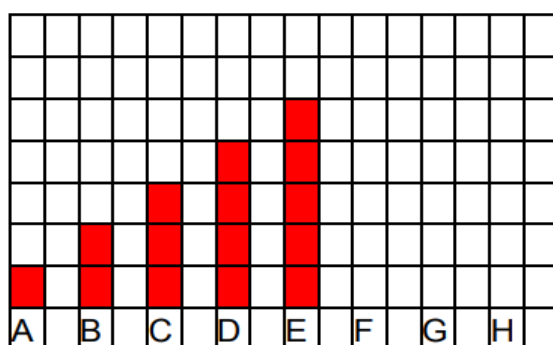
Shapes for activity 1.4. Recommended print size: A3 page.



Teacher's Attachment: C

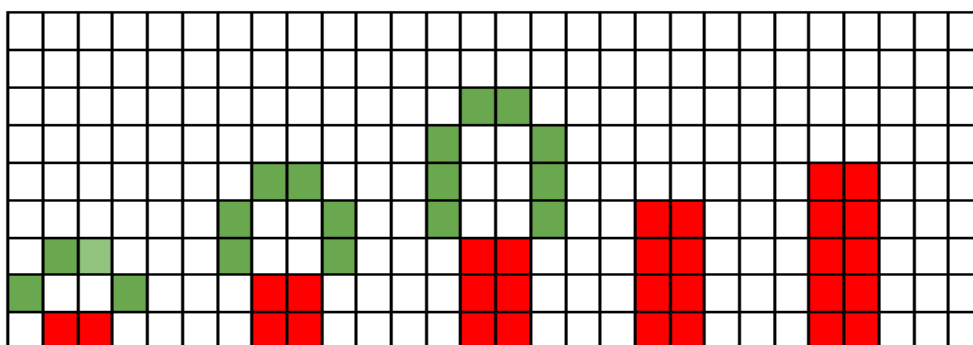
Used in activity:	2.2 Arithmetic pattern explained
Along with Student's Attachment(s):	none

Remind the students of repeated patterns by showing them an example. Recreate the grid below on the whiteboard and start by adding each pattern sequence element (i.e. A, B, C...) at a time. Ask the students to determine what is the change between each pattern sequence element (i.e. add 1 square at the top), and based on that predict the sequence of the pattern on F, G, and H.



Second example. Guide the students to recognize the algorithm being used for completing the red and green patterns. Red squares: increments of 2. Green squares: the amount of red squares plus 2. New green squares are always added on the sides, 1 square per side.

Note: ensure to have a big enough grid so all squares can be included.

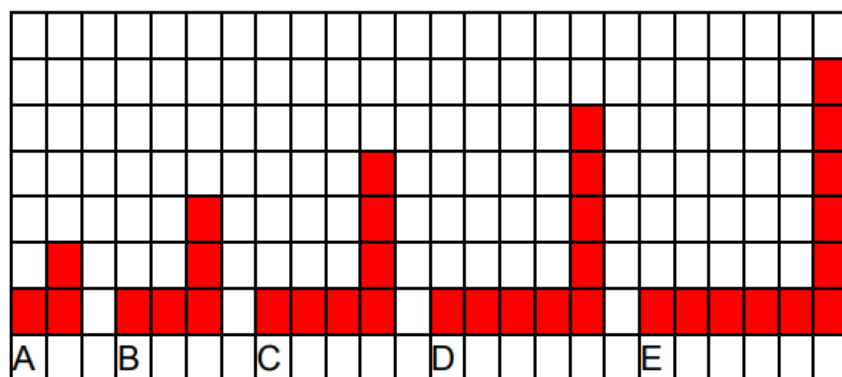


Teacher's Attachment: D

Used in activity:	2.3 Arithmetic patterns application 1
Along with Student's Attachment(s):	3

Exercise 1

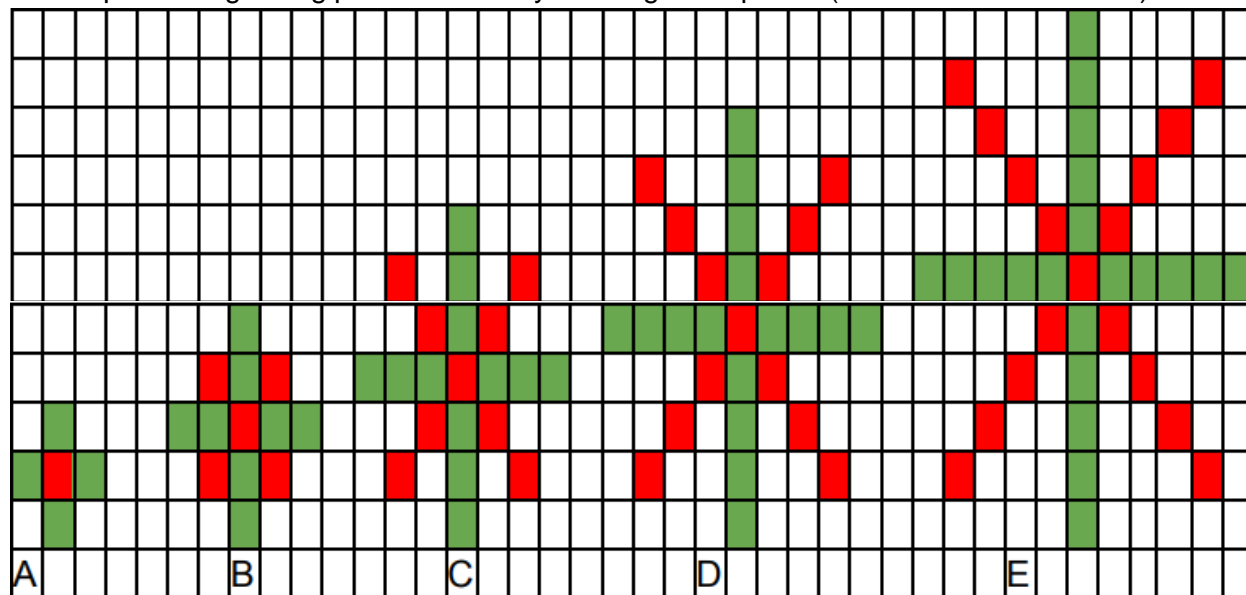
a. Complete the growing patterns D&E by coloring the squares



b. What is the pattern followed? Suggested answer: One red square is added at each end of the bended line.

Exercise 2

a. Complete the growing patterns D&E by coloring the squares (use two different colors)



- b. What is the pattern followed for the green color? Each following figure has **4 more green squares**. The new green squares are added 1 on each of the 4 green lines (i.e. top, bottom, left, and right)
- c. What is the pattern followed for the red color? Each following pattern has 4 more red squared. The red squares are added at the ends of each of the 2 red lines (i.e. from top left to bottom right and from top right to bottom left)
- d. Is there a relation between the amount of Green and Red squares? Yes, on each figure there is always 3 more green squares than green ones or $(\text{Red} + 3 = \text{Green})$
- .

Teacher's Attachment: E

Used in activity:	2.4 Arithmetic patterns application 2
Along with Student's Attachment(s):	none

From previous exercises students were able to identify patterns by counting the squares. Now they should be able to calculate and recognize numerical patterns between different sets of numbers.

Start by a simple example:

Set A start at 40 and subtract 5:	40	35	30	...	...	...	...	...	...
Set B start at 75 and subtract 5:	75	70	65	...	...	...	...	...	...

Algorithm: How are A and B related?

A and B are related by 35. To avoid talking about negative numbers, the instructions always require identifying the biggest number of a column first and then performing a subtraction with the second number. It's also important to note that this relationship is constant, therefore you can first explain this using the values from A and B from the first column with numbers, which are 40 and 75:

"To determine how A and B are related, **first** we take the biggest number in a column, in this case we will be looking at the first column with numbers and identify that B, with a value of 75, has the biggest number of that column. **Then** we subtract A, which is the smaller number and is 40. The result of this subtraction is 35, therefore we can conclude that A and B are related by 35."

We can summarize the first step with the following formula:

$$B - A = 35$$

We can summarize our finding with any of these two formulas:

$$B - 35 = A \text{ or } A = B - 35$$

A and B are related by 35

To ensure this is clear to the students, ask them to repeat the 2 steps with any of the other numbers of the same column (i.e. 35 and 70 or 30 and 65)

Teacher's Attachment: F

Used in activity:	2.5 Arithmetic pattern application 3
Along with Student's Attachment(s):	4

Exercise 1: For each table, **first** fill the missing numbers of each row by following the instruction in the first column. **Then**, explain how X and Y are related on each table.

Table A

X starts at 0 and add 3	0	3	6	9	12	15	18	21	24	27
Y start at 2 and add 3	2	5	8	11	14	17	20	23	26	29

How are X and Y related? By 2. $X = Y - 2$

Table B

X starts at 4 and add 3	4	7	10	13	16	19	22	25	28	31
Y start at 3 and add 3	3	6	9	12	15	18	21	24	27	30

How are X and Y related? By 1. $Y = X - 1$

Table C

X starts at 6 and add 5	6	11	16	21	26	31	36	41	46	51
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Y start at 1 and add 5	1	6	11	16	21	26	31	36	41	46
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How are X and Y related? By 5. $Y = X - 5$

Teacher's Attachment: G

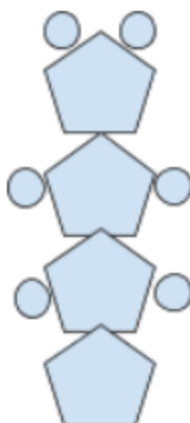
Used in activity:	3.2 A new challenge
Along with Student's Attachment(s):	none

Parts of snake to print and attach on the board. Table to fill out



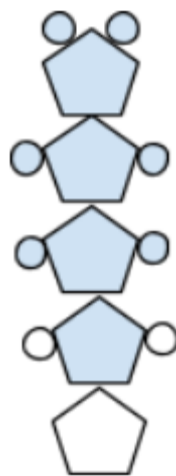
Amount of pentagons and circles needed. The next page contains all the shapes ready for printing.

"I have pentagons and circles. I will build a snake. Let us see how many of each element I will use."



Number of Day	Number of Pentagons	Number of Circles
Day 1	4	6

On day 2, the snake will grow. It will have more of each element.



Number of Day	Number of Pentagons	Number of Circles
Day 1	4	6
Day 2	5	8

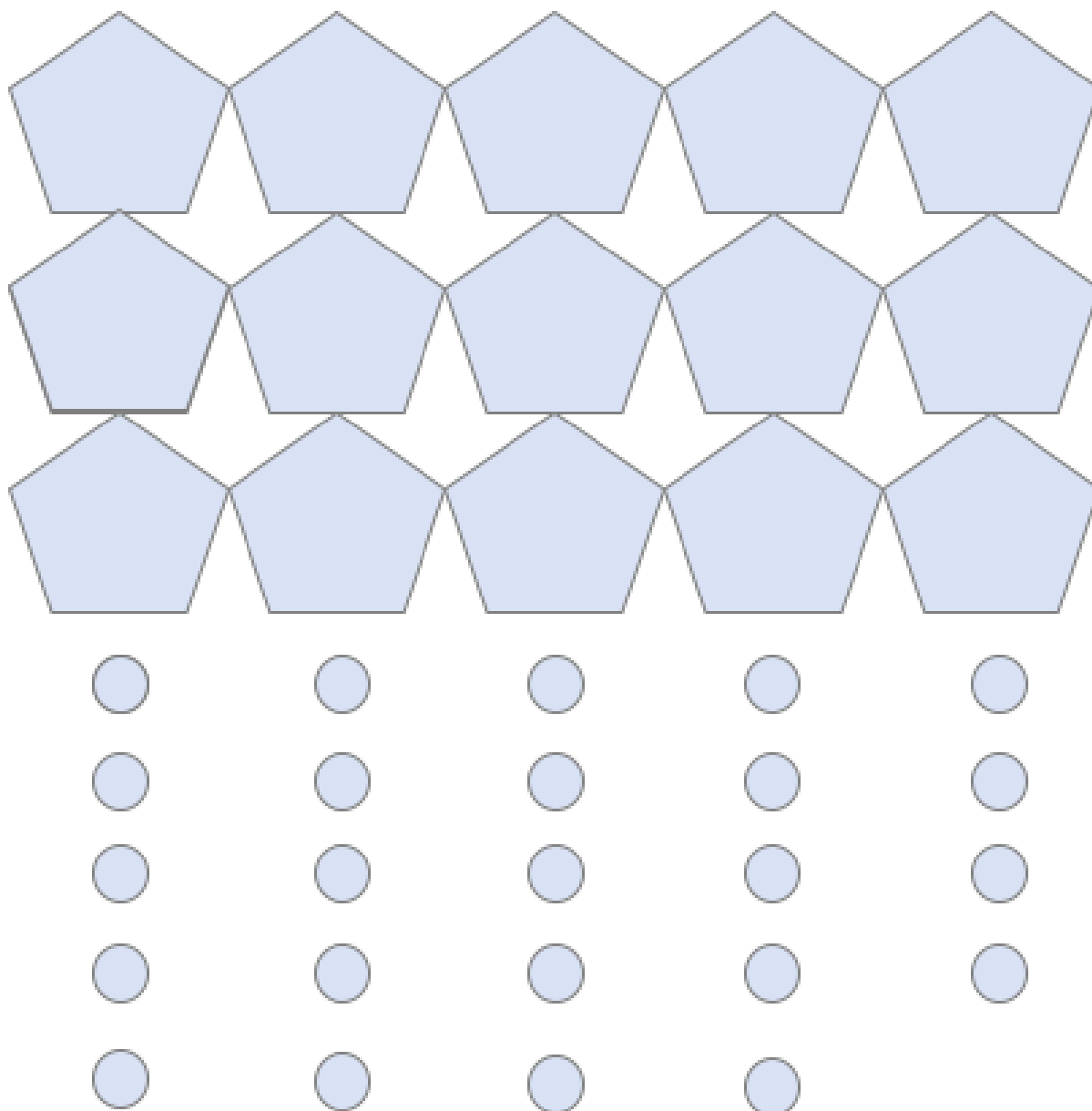
Based on what we now know about how much the snake grew from day 1 to day 2, how do you think it will grow on day 3?

Number of Day	Number of Pentagons	Number of Circles
Day 1	4	6
Day 2	5	8
Day 3	6	10

What is the numeric pattern for the pentagons, the circles, and the relationship between pentagons and circles?

1. Pentagons: 1 more per day
2. Circles: 2 more per day
3. Pentagons and circles: Two. For each pentagon there are two circles

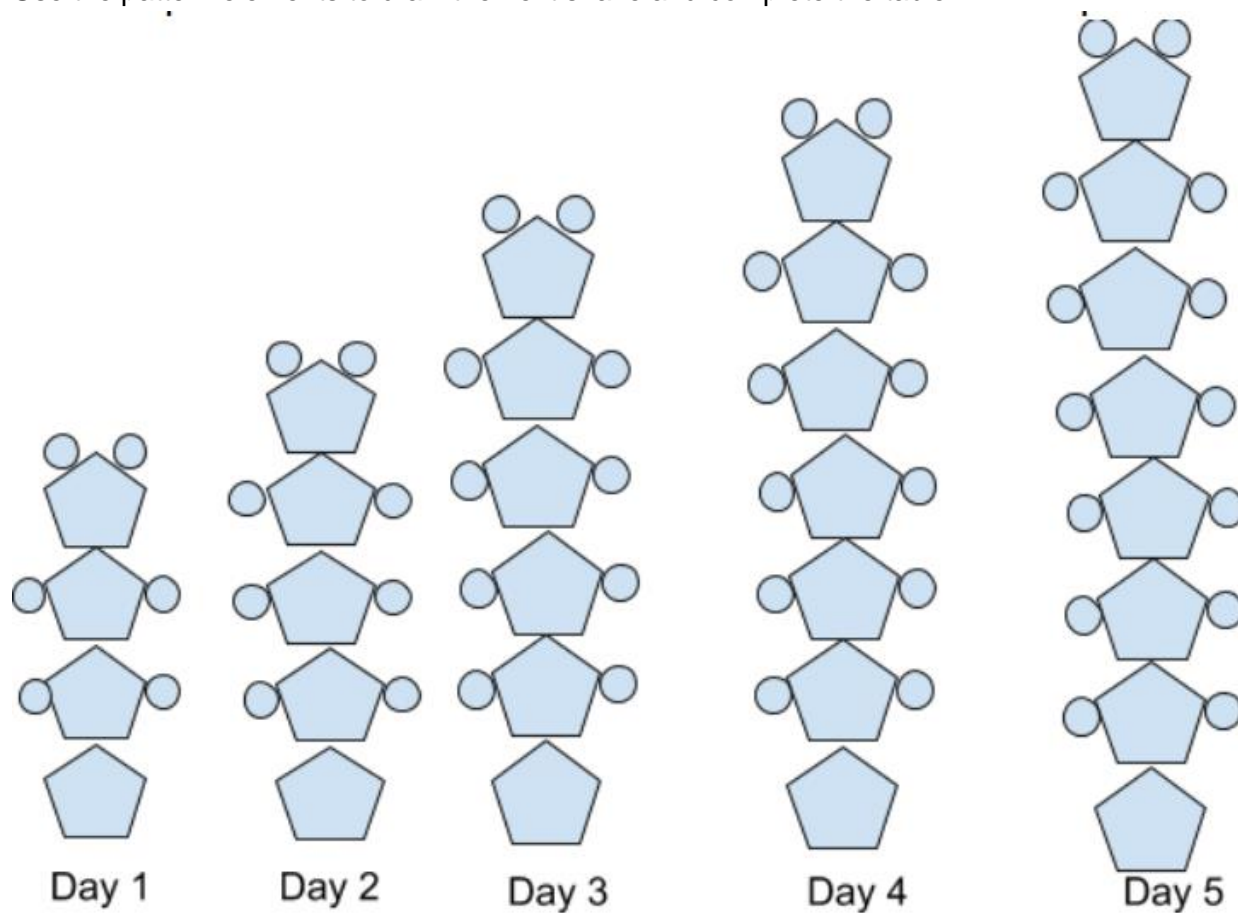
Pattern ready to be printed. Recommended print size: A3 page. Adjust print size based on classroom size



Teacher's Attachment: H

Used in activity:	3.3 Finding the relation
Along with Student's Attachment(s):	5

Use the pattern elements to draw the next snake and complete the table



To find the pattern of 12th and 20th day, think about the relation of elements to the number of days from the days 1 to 5.

Day	Pentagons	Circles	Total shapes
1	4	6	10
2	5	8	13
3	6	10	16
5	8	14	22
12	15	28	43
20	23	44	67
	Pentagon = Day + 3	Circle = (Pentagon – 1) * 2	

Teacher's Attachment: I

Used in activity:	3.5 Cage Challenge
Along with Student's Attachment(s):	6

Day	Pentagons	Circles	Total shapes	Cage Bars
1	4	6	10	4
2	5	8	13	7
3	6	10	16	10
5	8	14	22	16
12	15	28	43	37
20	23	44	67	61
	Day+3	Pentagon-1 then doubled		

Pattern algorithm of pentagons and circles:

day + 3 = pentagons;




(pentagons – 1) * 2 = circles

Pattern algorithm of bars: grows of 3 bars every day

Student's Attachments

Attachment 1: Patterns, elements and number of sets

From each of the following patterns, identify the necessary information to complete the table below

Pattern 1	
Pattern 2	
Pattern 3	

Questions	Pattern 1	Pattern 2	Pattern 3
1. In total, how many individual elements do you see in the pattern?			
2. Which unique elements do you see in the pattern?			

3. How many of each of the unique elements can you count in the pattern?			
4. What is sequence between the unique elements?			
5. Based on the previous answers, what would be the next element of the pattern?			

Attachment 2: Activity sheet. Compare and match the figures

Instructions: From the nine figures below, identify the ones that have the same amount of shapes and fill out the table



Figure 1

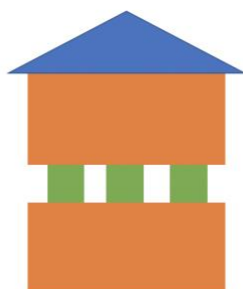


Figure 3



Figure 5

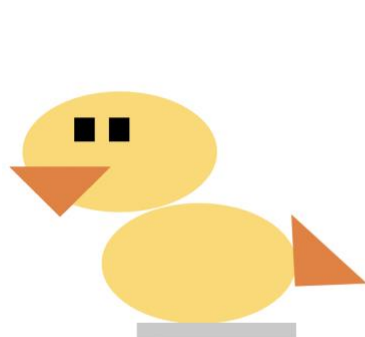


Figure 2



Figure 4

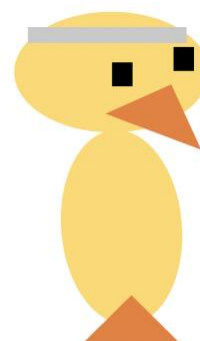


Figure 6

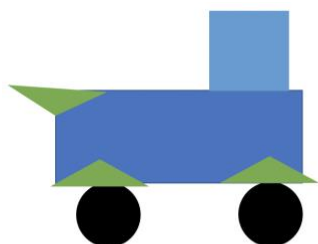


Figure 7



Figure 8

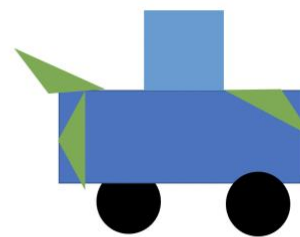


Figure 9

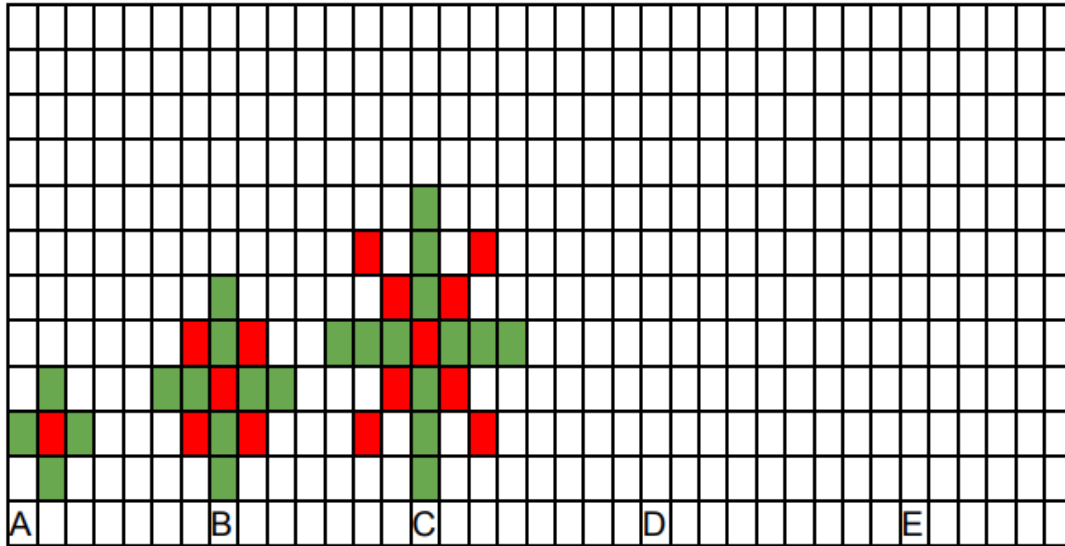
Figures __ , __ and __ are similar. Each figure has __ triangle(s), __square(s), __ rectangle(s), and __ circle(s)

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__square(s), __ rectangle(s), and __ circle(s)

Exercise 2

- a. Complete the growing patterns D&E by coloring the squares (use two different colors).



- b. What is the pattern followed for the green color?

- c. What is the pattern followed for the red color?

- d. Is there a relation between the amount of Green Red squares?

Attachment 4: Tables and algorithm

Exercise 1: For each table, **first** fill the missing numbers of each row by following the instruction in the first column. **Then**, explain how X and Y are related on each table.

Table A

X starts at 0 and add 3	0									
Y start at 2 and add 3	2									

How are X and Y related? By ____ . $X = __ - __$

Table B

X starts at 4 and add 3	4									
Y start at 3 and add 3	3									

How are X and Y related? By ____ . $Y = __ - __$

Table C

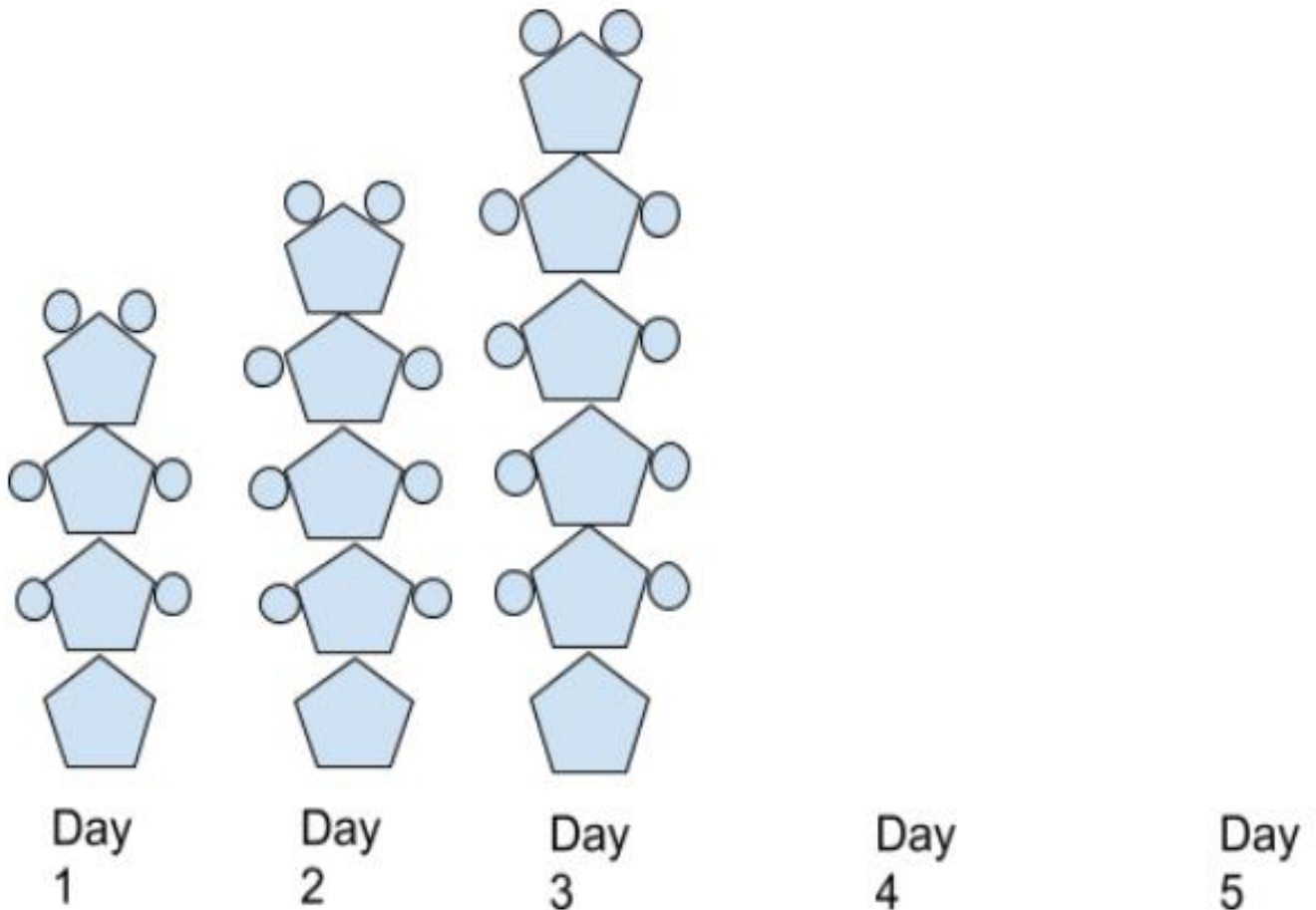
X starts at 6 and add 5	6									
----------------------------	---	--	--	--	--	--	--	--	--	--

Y start at 1 and add 5	1									
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How are X and Y related? By $__\cdot__ = __ - __$

Attachment 5: Glowing Snake Pattern

Use the pattern elements to draw the next snake and complete the table.



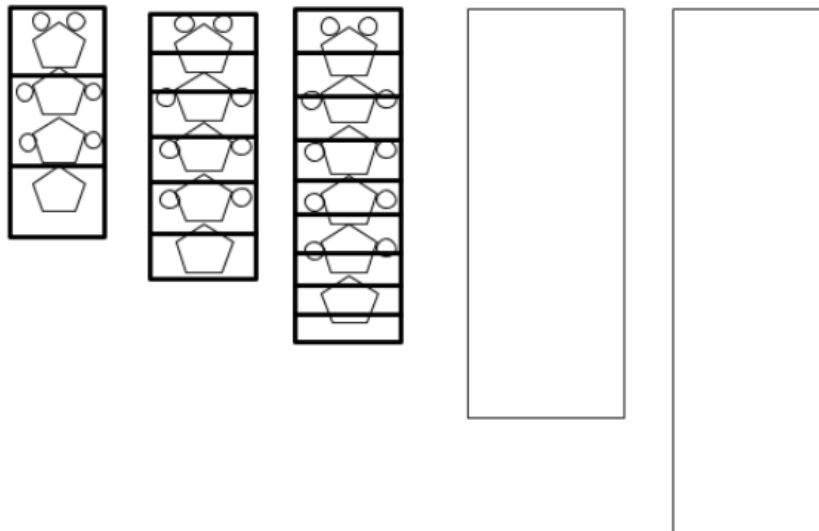
To find the pattern of 12th and 20th day, think about the relation of elements to the number of days from the days 1 to 5.

On the last row, complete the formula for calculating the amount of pentagons and circles.

Day	Pentagons	Circles	Total shapes
1			
2			
3			
5			
12			
20			
	Pentagon = __ + __	Circle = (__ - __) * __	

Attachment 6: Growing Cage pattern.

1. Fill the table with the number of pentagons, circles, and cage bars from the first 3 snakes
2. Find the relation between the number of day and the cage bars from the first 3 snakes
3. Fill the number of elements (pentagons, circles, cage bars) for the fourth snake
4. Draw the fourth snake with its cage bars
5. Fill the amount of elements (pentagons, circles, cage bars) for the fifth snake
6. Draw the fifth snake with its cage bars
7. Find the pattern algorithm for the snake elements and cage bars



Day	Pentagons	Circles	Total shapes	Cage Bars
1	4	6	10	4
2				
3				
5				
12				
20				

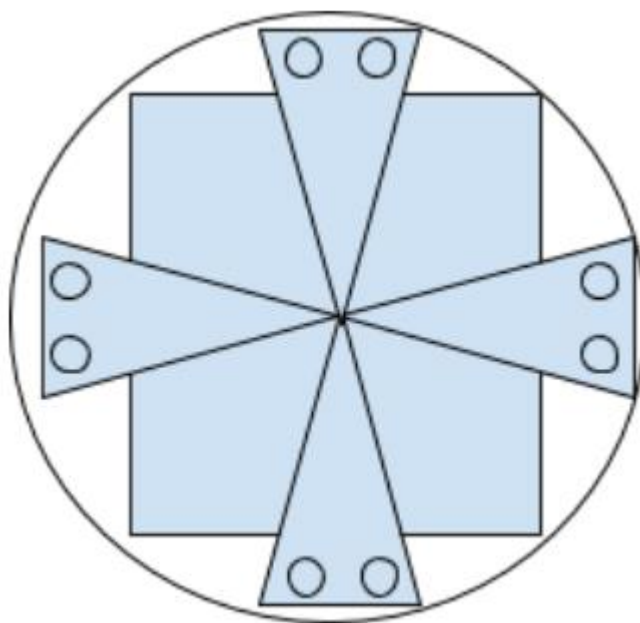
Pattern algorithm of pentagons and circles:

Pattern algorithm of bars

Evaluation

1. Fill the gaps by identifying the shape components of each figure.

Notice the relation between the amount of polygon sides and the amount of triangles and circles. Then, complete the table.



<p>The first layer is a white big circle. The second layer is a polygon shape of _____ sides. Therefore, it is a _____. Each side of the square has a _____. The total number of triangles is _____. Each triangle has _____ small circles. The total number of circles is _____.</p>	Figure 1	
	Shape	Total number

2. As one of the shapes has changed, the number of sides increased. Complete the below table to find the new number elements in the figure.

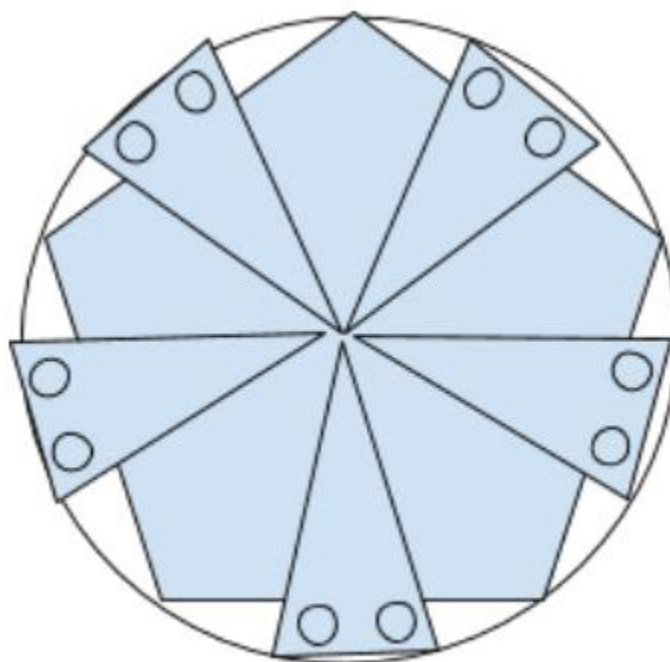



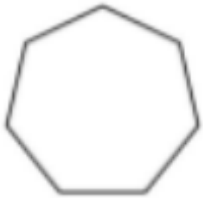


Figure 2

Shape	Total number

3. Copy your above answers in the corresponding first two rows of the table below. Then, use that information to find the pattern between polygon sides, triangles, and circles to complete the table.

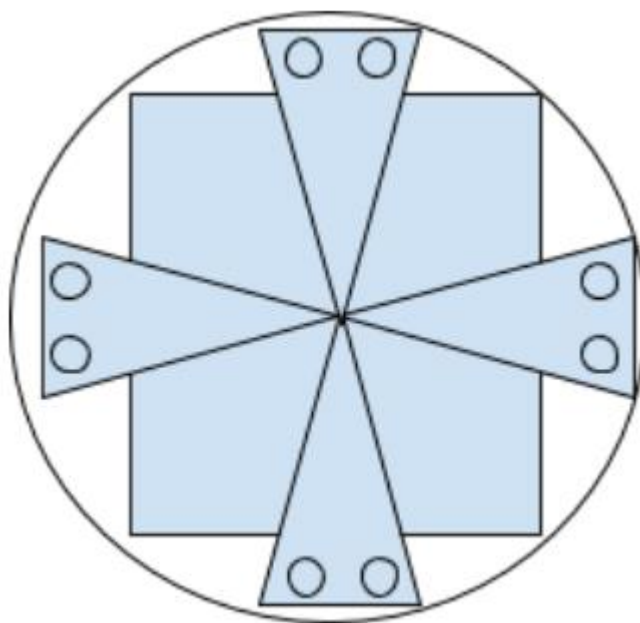
Figure	Polygon	Polygon sides	Number of triangles	Number of small circles
1				
2				
3				
4				

4. Demonstrate the 4th figure in a drawing below. The figure should look like the one from the previous exercise:

Evaluation answer sheet

1. Fill the gaps by identifying the shape components of each figure.

Notice the relation between the amount of polygon sides and the amount of triangles and circles. Then, complete the table.



<p>The first layer is a white big circle. The second layer is a polygon shape of ____4____ sides. Therefore, it is a ____square____. Each side of the square has a ____triangle____. The total number of triangles is ____4____. Each triangle has ____2____ small circles. The total number of circles is ____8____.</p>	Figure 1	
	Shape	Total number
	Big Circle	1
	Square	1
	Triangle	4
	Small Circle	8

2. As one of the shapes has changed, the number of sides increased. Complete the below table to find the new number elements in the figure.

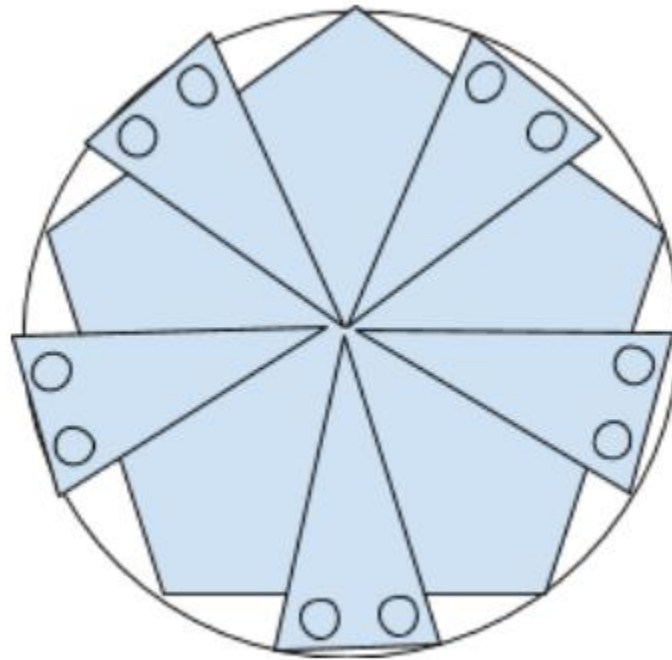



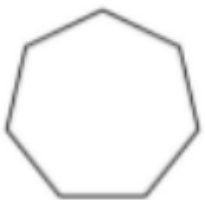


Figure 2	
Shape	Total number
Big Circle	1
Pentagon	1
Triangle	5
Circle	10

3. Copy your above answers in the corresponding first two rows of the table below. Then, use that information to find the pattern between polygon sides, triangles, and circles to complete the table.

Figure	Polygon	Polygon sides	Number of triangles	Number of small circles
1		4	4	8
2		5	5	10
3		6	6	12
4		7	7	14

4. Demonstrate the 4th figure in a drawing below. The figure should look like the one from the previous exercise:

