



**THIRD SPACE
LEARNING**

Math Intervention Pack

Geometric patterns

Grade 4

How to use the resources

1. Title Slide

Use this slide to activate prior knowledge needed for lesson. Students should be encouraged to initially attempt the question presented independently.

2. Let's Learn

Use this slide to introduce the concept. Tutors should work with the student to explore the concept together, usually using diagrams to support understanding.

3. Follow Me + Your Turn

The tutor should work through the follow me slide, modeling the process and explaining their thinking out loud.

Students should use the your turn slide as an opportunity to work through a question similar to the follow me questions. They should apply the method modeled by the tutor in the follow me slide. Students should be encouraged to explain their thinking out loud.

4. You Do

Students should work through a range of questions that build in complexity.

Tutors can offer support but students should initially be encouraged to attempt these questions independently.

5. Go Further

Use this slide to allow students to apply their understanding to a more challenging question in an unfamiliar context.

6. Support for Slides

The support slide is used to support students during the lesson. In the tutor notes, there will be guidance as to when to use the support slide.

7. Check Your Understanding

Tutors should use this slide to assess the student's knowledge and whether or not they have mastered the concept within the lesson.

Standard

4.OA.5: Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself.

Key Mathematical Ideas

1. Determine the pattern in a sequence of shapes.
2. Continue a given shape pattern by drawing subsequent figures in the sequence.
3. Create an equation that can be used to find the number of objects in future figures in the pattern.

Overview

Terminology

- **Pattern:** Set of numbers or objects that can be described by a specific rule
- **Rule:** A set of guidelines for a series of numbers or figures that tells how to get from one term in the series to the next
- **Term:** Each number or figure in a pattern is called a term

Sentence Stems

- The will have (number) of (objects).
- The number of (objects) changes by each term.
- We can find the (number) term by

Overview

Common Misconceptions

Common Misconceptions	Tutoring Strategies	Checks for Understanding
Students may confuse the term number with the number representing the figures (number of squares, matchsticks, etc.)	Have students list out the number of objects - if they continue to confuse this, they can make a table with the term number and number of objects under it.	How many (objects) are in term #....?

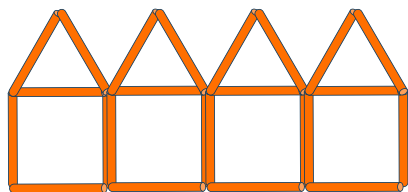
Title Slide

If stuck

- Ask students how the shapes change each time. They should easily be able to tell that one “house” is added. They can also say one square + one triangle is added each time.

Answers

- One square and one triangle (stacked) are added each time.



Let's Learn

If stuck

- Ask students to count the blocks in each shape.
- Ask students to look at/list the sequence of numbers.
- If needed, help students make a list of numbers to get to the 10th term.

Questions

- How does the shape change each time?
- How many blocks are in term three?
- How are the numbers changing?
- How many blocks are added each time? Where?
- How can we determine what the 10th term will look like?

Watch out for

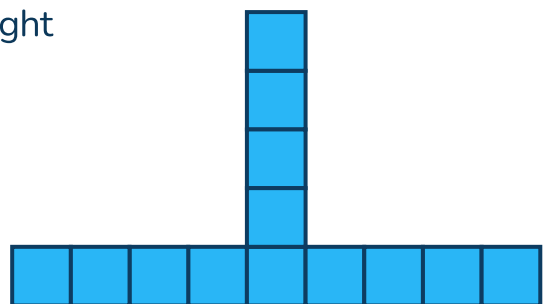
- Students not realizing that a block is added to the top, left, and right.
- Students counting the middle square twice. (counting the row and counting the column)

Answers

a. Term 3 is 10, term 4 is 13

b. 3 blocks are added each time: 1 top, 1 left, 1 right

c. 31



Follow Me

Modeling prompts

- Let's look at how each figure is changing - I see that each figure has one blue dot, but the red dots increase by two (one in the row and one in the column) each time.
- We can also look at the number sequence that describes the number of counters in each figure - starting at 3, the counters increase by 2 with each term.
- To determine the number of counters in the 6th figure, we can just count by 2 - 3, 5, 7, 9, 11, 13. The 6th number is 13, so there will be 13 counters in the 6th term.
- We can also use the numbers to help us determine future terms. How does the number of counters change each term? (add 2)
- We can create a formula using this information - notice that the term number + the next counting number = the number of counters in the term. So for term 6: $6 + 7 = 13$ counters; term 20: $20 + 21 = 41$ counters)

Answers

- a. One red dot is added to the left of the row and one is also added to the top of the column. (Two counters are added each time)
- b. 13
- c. 41

Your Turn

If stuck

- Walk students through each term, discussing the number of matchsticks and point out how each time it is a square and the matchsticks on each side increase.
- Ask them leading questions to help them determine how the pattern is increasing.

Question a

- What is changing each time? Is something being added or taken away?
- How many matchsticks are added each time? How do you know?
- How is the number sequence that describes the pattern changing each time? What would be the rule?

Question b

- How many matchsticks will be in the 6th term?
- What will the 6th term look like?
- What is the easiest way to determine how many matchsticks will be in the 6th term

Question c

- Look at the term number and the number of matchsticks in each term? What is the connection between each pair of numbers? (Answer: Term number multiplied by 4 = the number of matchsticks)
- How can we use this information to determine how many matchsticks will be in the 20th term?

Watch out for

- Students misinterpreting the pattern or students using the term number as the pattern.

Answers

a. Each side of the shape gets bigger by 1 matchstick each time. The number of matchsticks on each side = the term number. Multiply the term number by 4 to get the total number of matchsticks.

b. 24

c. 80

You Do

If stuck

- Help students see that the number of blocks is increasing each time - the big space in the middle of each rod is just the term number made of the smaller blocks.

Question 1

- How do you know how many blocks are in each rod? How do the first and second rods help you determine how many rods are in the others?
- How many blocks are in the middle section of term 6? How do you know?
- How does the term number help you determine how many blocks are in each rod?
- How many blocks are added each time?
- How could we create an equation to help us determine the number of blocks in any future term numbers? (Answer: Term number + 2 = the number of blocks in the rod)

Question 2

- How is the pattern of matchsticks increasing?
- How can we use the numbers to help us determine the number of matchsticks in future term numbers?

Watch out for

- Be sure that students understand the middle part of the rods in problem 1 each represent a group of blocks - they do not count as just 1 block

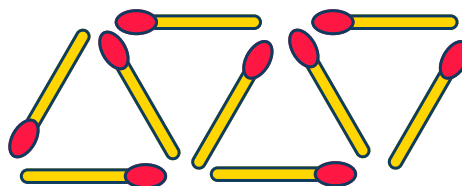
Answers

1. The middle part represents 6 blocks



1a. 12

2. 2 match sticks are added



2a. 21

Go Further

If stuck

- If students are struggling to find two ways to describe the pattern, give them one example and ask them to find a similar pattern.
- Students may need additional help understanding part b as it involves some higher level thinking.

Questions

- How did you think of two different ways to describe this pattern? Can you think of any other ways? (Add a column on the left each time - each with one more block than the previous column)
- Why do you think Julia used this way of thinking? Do you think it is easier or more difficult than the two ways you listed above?
- How could we create a “formula” for determining future term numbers using Julia’s method?
- (Read example answer on the slide and discuss this “formula” with students)

Watch out for

- Students misinterpreting the patterns or not being able to “see” the pattern in different ways
- Students not being able to understand the way of thinking shown in part b

Answers

a. Add one row to the bottom each time (the row will be 1 block greater than the previous row). OR Add one block to the top of each column, including the end of the new column.

b. Julia creates a rectangle (which doubles the term each time - the column represents the term number. The row is 1 more than term number). Next term (4) would be a 4 x 5 rectangle (= 20) ten divided in half (= 10). 100th term would be 100 x 101 rectangles (= 10,100) divided in half = 5,050

Support for Slide(s)

This slide supports the Let's Learn slide.

If stuck

- This slide will help students understand how to create a “formula” or equation to determine the amount of objects for any term number.

Questions

- How can we use the equation to find the number of blocks in any term number?

Answers

- Term 4 is 13
- 301
- odd

Check Your Understanding

Correct answers

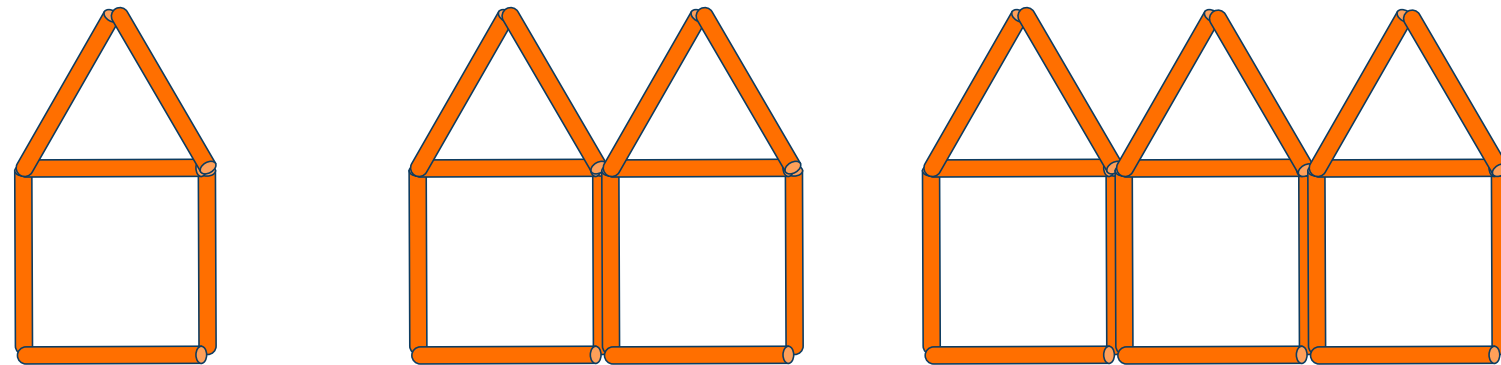
- c (8 tiles in the top row, 6 tiles in the bottom row)
- a. Students may pick this answer choice if they choose the next figure in the pattern instead of the sixth.
- b. Students may pick this answer if they miscount and choose the 7th figure instead of the 6th.
- c. This is the correct answer. Students should be able to determine that: each row in the figure increases by one tile each time, the bottom row has the same number of tiles as the term number, the top row has two more tiles than the bottom row. Therefore, the 6th figure will have 8 tiles in its top row and 6 tiles in its bottom row.
- d. Students may pick this answer if they miscount and choose the 5th figure instead of the 6th.

Today you will learn about

Geometric patterns

Warm-up question

Can you describe how this **pattern** is growing?

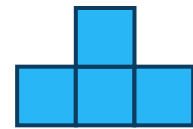


What would the next figure in the sequence look like?

Let's learn

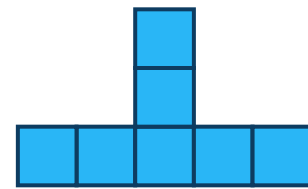
We can find a general rule to describe **sequences** and use this to find the next shape in the sequence.

Tina has created a growing sequence using blocks.



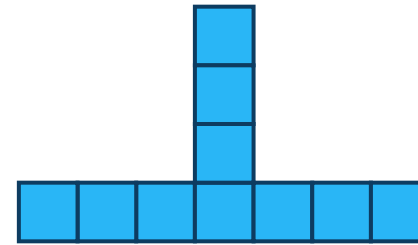
Term 1

4



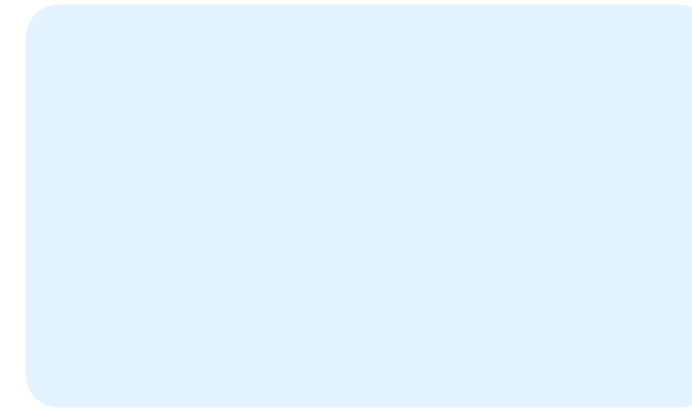
Term 2

7



Term 3

.....



Term 4

.....

Number of blocks:

a Draw the next term in the sequence and complete the two missing numbers.

b Can you describe how the sequence is growing each time?

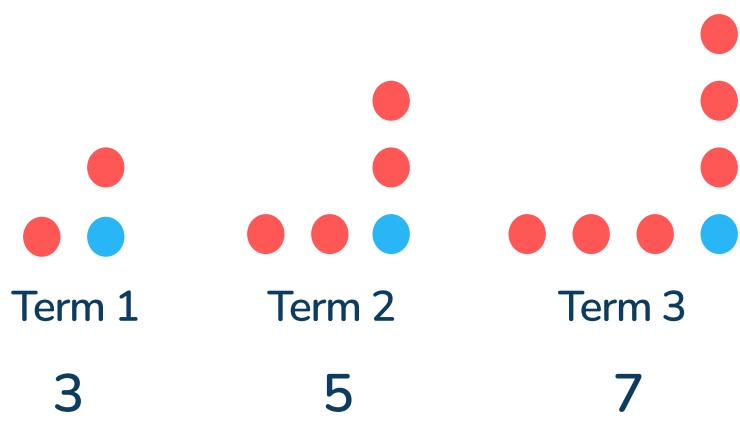
c What would the value of the 10th term be in the sequence?

.....

Follow me



Here is a shape pattern made from counters.

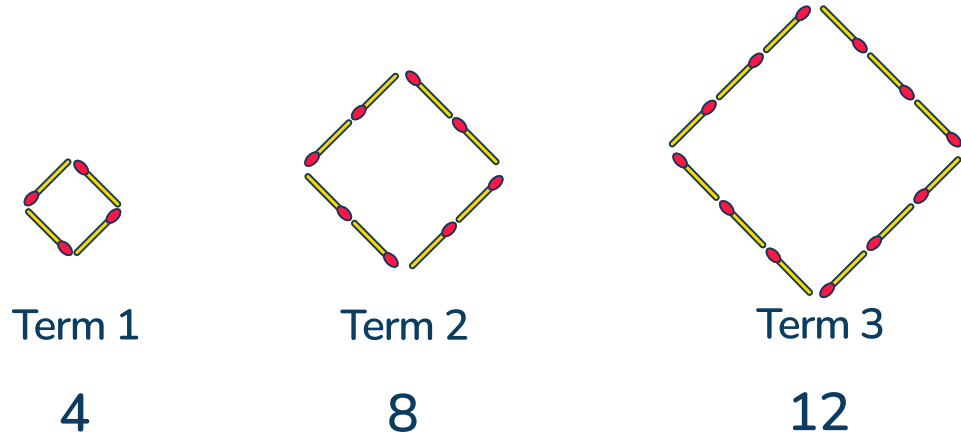


- a Look at what is staying the same each time and what is changing. Describe the pattern.
- b How many counters will there be in the 6th term?
- c What would the 20th term in the sequence be?

Your turn



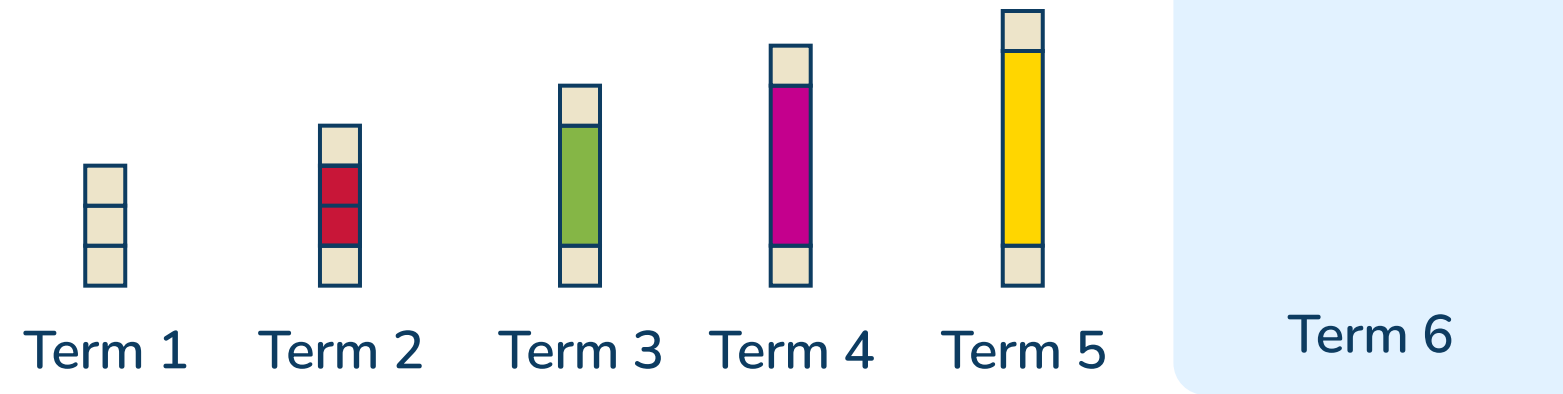
Here is a shape pattern made from matchsticks.



- a Look at what is staying the same each time and what is changing. Describe the pattern.
- b How many matchsticks will there be in the 6th term?
- c What would the 20th term in the sequence be?

You do

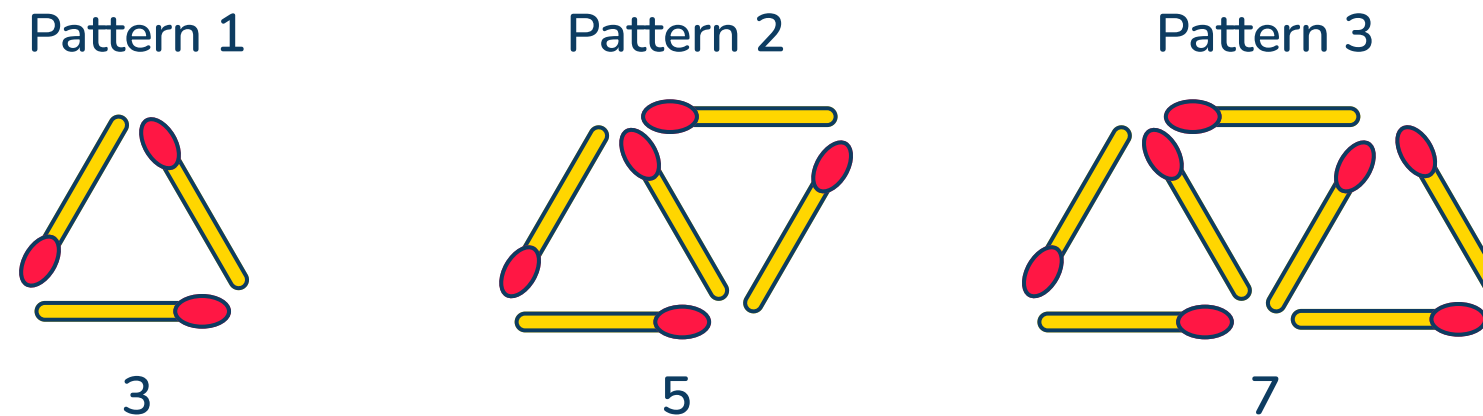
- 1 Look at the pattern of rods made of blocks.
Draw the next rod in the pattern.



- a What would the total length of the rods of Term 10 be?

.....

- 2 Look at the pattern of matchsticks.
Draw the next pattern.



- a How many matchsticks would be needed for the 10th term in the sequence?

.....

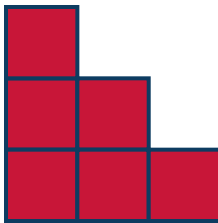
Look at the growing pattern of blocks.



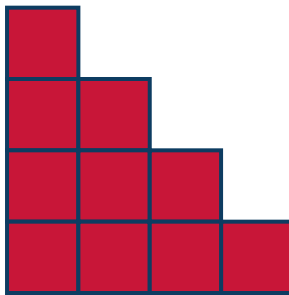
Term 1



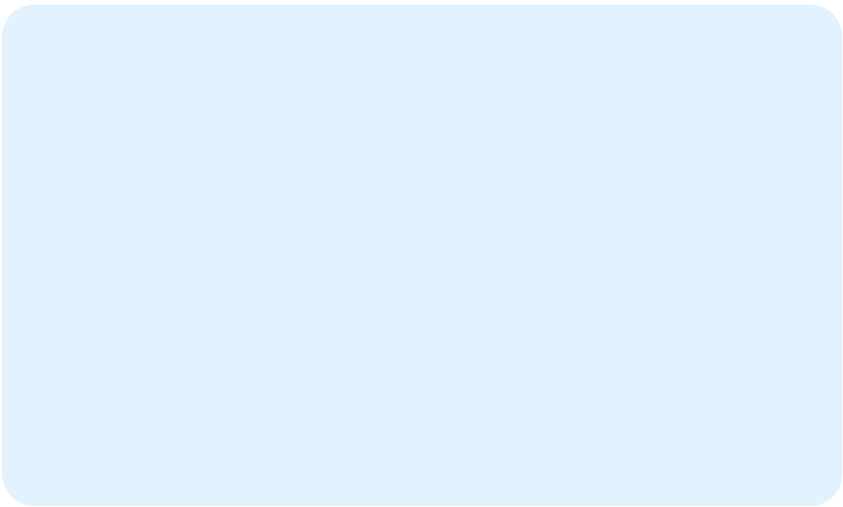
Term 2



Term 3



Term 4



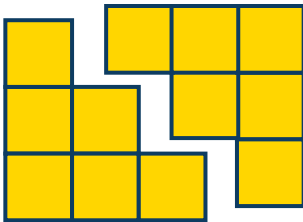
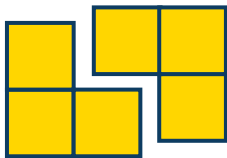
Term 5

a Describe the pattern in two different ways. Then, draw the next term.

.....

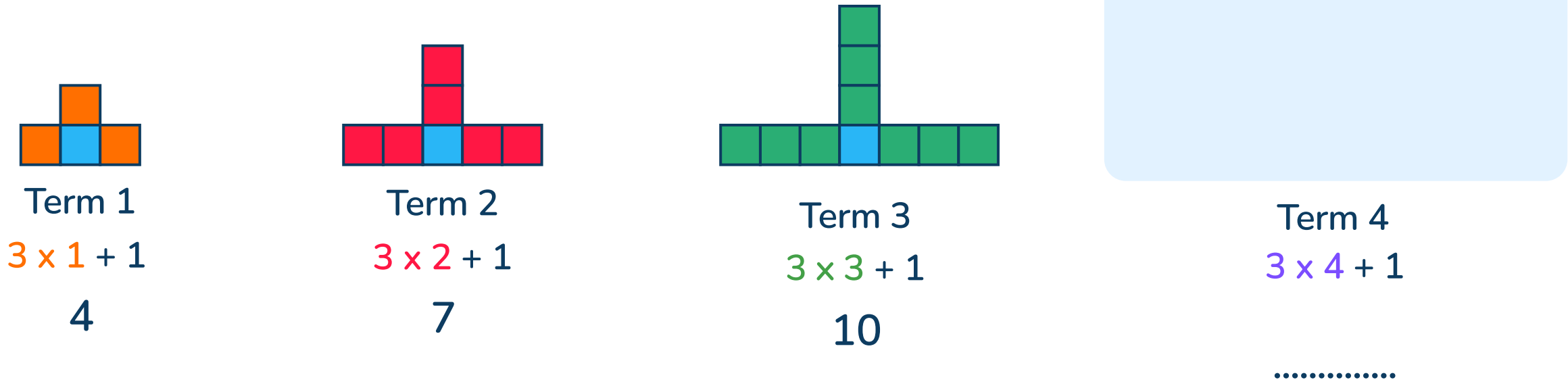
.....

b Julia saw the pattern in a different way. She drew the following figures to demonstrate her thinking.



Describe how Julia saw the pattern growing. How would Julia calculate the number of blocks in the next term? What about the 100th term?

Let's look at what is happening in this sequence in more detail.



Number of blocks:

We can replace the term number with a letter.

$3 \times n + 1$ $3 \times n + 1$ $3 \times n + 1$ $3 \times n + 1$

b

What would the 100th term be?
.....

Will the 100th term be odd or even?

Check your understanding

Look at the pattern made out of square tiles.
What would be the 6th figure in the pattern?

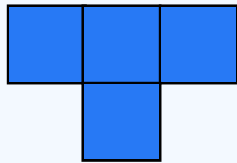


Figure 1

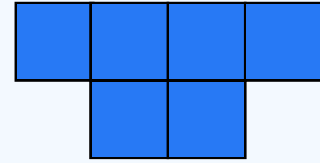


Figure 2

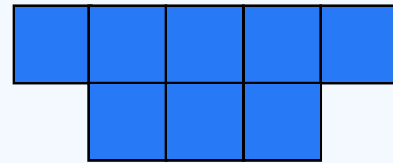
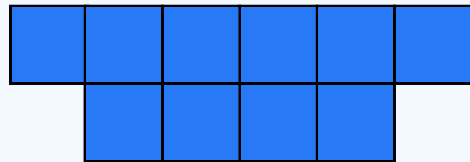
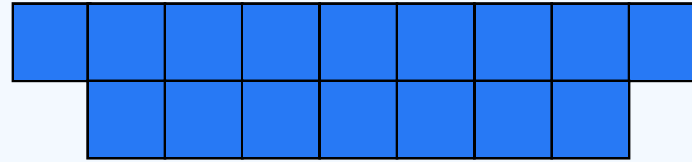


Figure 3

a



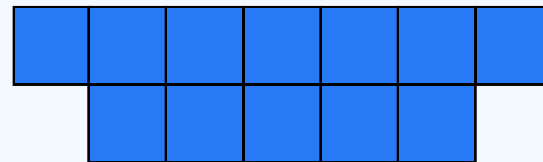
b



c



d



Why do I need to try this question
on my own first?

- To show your tutor what you understand
- To give you more practice
- To show your teacher how you are doing



Do you have a group of students who need a boost in math?

Each student could receive personalized lessons every week from our specialist one-on-one math tutors.




- ✓ Differentiated instruction for each student
- ✓ Aligned to your state's standards
- ✓ Scaffolded learning to close gaps

“We just had our first session and it went great! The kids really liked it and felt like they were learning! One even said he finally felt like math was making sense.”



Michelle Craig, Instructional Coach,
Sherwood Forest Elementary, Washington

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