4.CA.9 Describe the relationship between two terms and use it to find a second number when a first number is given. Generate a number pattern that follows a given rule.	
Reporting Category: Computation and Algebraic Thinking	**Subdomain**: Solving Problems
4.CA.9 Instructional Framework	
Assessed On: ☐ Checkpoint 1 ☐ Checkpoint 2 ☐ Checkpoint 3 ☑ Summative	
Content Limits: ● Whole numbers up to 1,000 ● Operations in patterns include addition, subtraction, multiplication, and division. ● Division should not include remainders. ● Items should use an open box or blank, not variables, to represent an unknown number.	
Clarifications: ● Number patterns may be represented by shapes.	
Calculator Availability: Not Allowed	
Expected Academic Vocabulary: rule, term, number pattern, input/output table,	
Examples of Context and Varying Difficulty Levels+	
Context: Easy	Limit to addition and subtraction operations; use smaller initial terms (less than 50); use smaller rates of change.
Context: Medium	Use all operations, use intermediate initial terms (between 50 and 100); use intermediate rates of change (ex. Between 10 and 20 for addition/subtraction; between 5 and 10 for multiplication and division)
Context: Difficult	Use only multiplication and division with larger initial terms (greater than 100); use larger rates of change; rules may use two operations.
Proficiency Level Descriptors and Example Items	
Looking Back: 3.CA.8 ILEARN Item Specification	**Looking Ahead**: 5.CA.4 ILEARN Item Specification
Below Proficiency: Identify a number pattern that follows a given rule, OR determine the number that completes a pattern when given a rule.	
The first number in a pattern is 5. The pattern follows the rule “Add 3”.	This is a DOK 1 item because students must identify the number that

Choose the second number in the pattern. a. 3 b. 5 c. 7 **d. 8**	completes the pattern when given the rule. This is an easy item because it uses addition with a small initial term and a small rate of change.
Sarah created a number pattern using the rule “Subtract 15”. Which number pattern did Sarah create? a. 31, 46, 61, 76 b. 15, 14, 13, 12 **c. 76, 61, 46, 31** d. 15, 16, 17, 18	This is a DOK 2 item because students must identify the number pattern that follows the given rule. This is a medium difficulty problem because it uses an immediate term and an immediate rate of change.
Approaching Proficiency: Complete a number pattern using a given rule.	
The first number in a pattern is 44. The pattern follows the rule, “Divide by 2, then add 6”. What are the next three numbers in the pattern? 44, ⬜, ⬜, ⬜ **Answer: 28, 20, 16**	This is a DOK 2 item because students must use a given rule to calculate the remaining terms in a number pattern. This is a medium difficulty item because it begins with a smaller initial term, includes smaller rates of change, but requires two operations within the rule.
Use the rule “Multiply by 8” to complete the input/output table.	This is a DOK 2 item because students must use a given rule to calculate the terms in the output column of the table. This is a medium

Input	Output
4	
8	
16	
20	

.

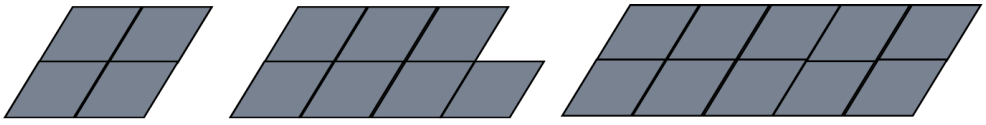
Answer:

Input	Output
4	32
8	64
16	128
20	160

difficulty item because it uses an intermediate rate of change.

At Proficiency: Analyze a number pattern to determine the rule and use it to generate a subsequent number, OR generate a number pattern that follows a given rule.

The first three terms of a pattern are shown.



Term 1 **Term 2** **Term 3**

How many parallelograms will there be in Term 6?

Answer: 19 (add 3)

This is a DOK 2 item because the students must analyze the given pattern, identify the rule, then determine a subsequent number within the pattern.

This is an easy item because it uses addition with a small initial term and a small rate of change.

Sarah used a rule to create an input/output table.

Identify the rule and use it to complete the table.

This is a DOK 2 item because students must analyze the numbers given in the table to identify the rule and

Input	Output
48	8
36	6
24	
12	

Answer: Rule is divide by 6.

Input	Output
48	8
36	6
24	4
12	2

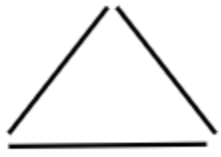
use it to determine subsequent numbers within the pattern.

This is a medium difficulty item because it uses division and an intermediate rate of change.

Above Proficiency: Identify the rule for and extend complex number patterns. Describe the relationship between the terms to justify the validity of the rule.

Calvin used triangles made of sticks to represent a number pattern.

He used 3 sticks to make the first triangle.



He continued to add rows of triangles to make the next two figures.

This is a DOK 3 item because students must gather and analyze the data in the table to identify the number pattern and extend the pattern. The students must also explain the pattern and the relationship between the data to justify the explanation.

This is a medium difficulty item because it uses multiplication.

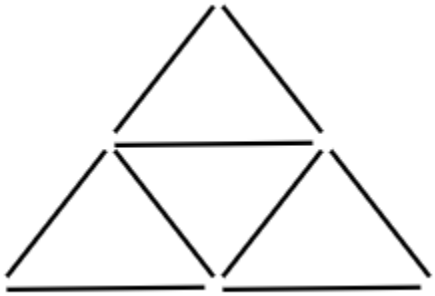


Figure 2

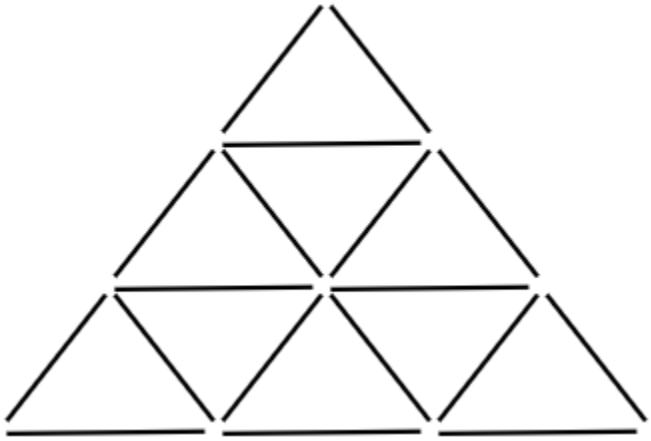


Figure 3

Part A: Complete the table and include the number of triangles and sticks Calvin will use if he adds a fourth row.

Number of Rows	Number of Triangles	Total Number of Sticks
1		
2		
3		
4		

Part B: Identify and explain the rule for finding the total number of sticks.

Answer:
Part A:

Number of Rows	Number of Triangles	Total Number of Sticks
1	1	3
2	4	9
3	9	18
4	16	30

Part B:
Students see a relationship between the number of rows and total number of sticks. Students should identify the rule as multiplying the row number by 3 and adding the sum to the total number of sticks in the previous row.