MA.4.AR.3.2

Overarching Standard: ***MA.4.AR.3*** Recognize numerical patterns, including patterns that follow a given rule.

Benchmark of Focus

MA.4.AR.3.2: Generate, describe and extend a numerical pattern that follows a given rule.

Examples: Generate a pattern of four numbers that follows the rule of adding 14 starting at 5.

Benchmark Clarifications

Clarification 1: Instruction includes patterns within a mathematical or real-world context.

Related Benchmark/Horizontal Alignment

- MA.4.NSO.2.2
- MA.4.FR.2.2
- MA.4.M.2.2

Vertical Alignment

Previous Benchmarks	Next Benchmarks
MA.3.AR.3.3	MA.5.AR.3.1 MA.5.AR.3.2

Terms from the K-12 Glossary

- Expression

Purpose and Instructional Strategies

The purpose of this benchmark is to build understanding of numerical patterns. Students should generate numerical patterns that follow a given rule with one step. This concept builds on identifying, creating and extending numerical patterns (MA.3.AR.3.3).

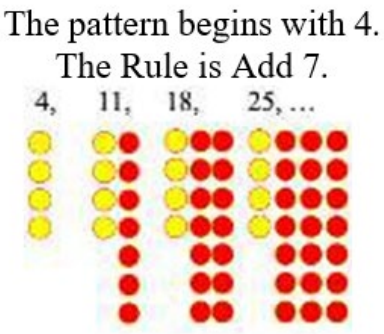
- As students use numerical patterns, they will reinforce facts and develop fluency with operations (MTR.5.1).
- A pattern is a sequence that repeats the same rule over and over. Patterns and rules are related. A rule dictates what that pattern will look like.
- Students need multiple opportunities creating and extending number patterns.
- Students investigate different patterns to find rules, identify features in the patterns and justify the reason for those features.
- Students should look for relationships in the patterns they create and be able to describe and generalize.

Common Misconceptions or Errors

- Students often make mistakes due to lack of fluency with the four operations which hinders them from being able to extend the pattern according to the rule.

Strategies to Support Tiered Instruction

- Instruction includes students drawing quick pictures of the numbers represented or using two-color counters or square tiles to model their patterns to aid students in seeing how the rule affects the terms and to make accurate calculations.
    - Example:



Questions to ask students:

- **Ask the student to identify the next 3 numbers in a pattern when starting with 3 and following rule "add 5"**
- Sample answer that indicates understanding: The next three numbers in the pattern are 8, 13, 18

- **How could you describe the pattern? What do you notice?**
- Sample answer that indicates understanding: Students could identify the alternating odd and even repetition, growing sequence, or alternating of the digits 8 and 3 in the ones place value.

- **Ask the student to identify the next 4 numbers in a pattern when starting with 50 and following the rule "subtract 9". How could describe the pattern?**
- Sample answer that indicates understanding: The next four numbers in the pattern are 41, 32, 23, 14. The tens place is decreasing and the ones place is increasing.

- **Describe the strategy used to determine the pattern above.**
- Sample answer that indicates understanding: Student could describe how they used subtracting 10 and adding 1 to the number rather than counting back by ones.

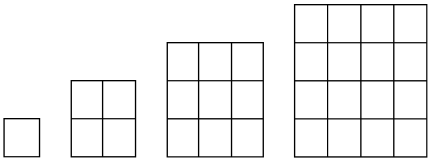
Instructional Tasks

Instructional Task 1

The first term of a pattern is an odd number. The rule is add 13. Will the 4^{th} term be odd or even? Based on the pattern described, will the 4^{th} term always be odd or even? Explain your reasoning.

Instructional Task 2

Part A. Find the areas of the squares shown in which the side lengths start at 1 and increase by 1 each time: (1x1) (2x2) (3x3) (4x4), etc.
Extend the pattern up to 10 terms.



Part B. Find the perimeters of the squares shown in which the side lengths start at 1 and increase by 1 each time: (1x1) (2x2) (3x3) (4x4), etc.
Extend the pattern up to 10 terms.

Instructional Items

Instructional Item 1

The first term in a pattern is 6. The pattern follows the rule "add 4." Which of the numbers below is a term in the pattern?

A. 1
B. 8
C. 14
D. 16

Achievement Level Descriptors

Benchmark	Context	Assessment Limits
MA.4.AR.3.2 Generate, describe, and extend a numerical pattern that follows a given rule. Example: Generate a pattern of four numbers that follows the rule of adding 14 starting at 5. Clarification 1: Instruction includes patterns within a mathematical or real-world context.	Both	Items must provide the rule. Rules are limited to one procedural step that includes any of the four mathematical operations. Items are limited to whole numbers.

ALD 2	ALD 3	ALD 4	ALD 5
extends a numerical pattern from a given rule.	describes and extends numerical patterns that follow a given rule.	generates, describes, and extends a numerical pattern that follows a given rule.	identifies an error and generates, explains, and extends numerical patterns that follow a given rule.

Additional Resources:

CPALMS Resources

Khan Academy: Math Patterns with Tables

Resources/Tasks to Support Your Child at Home:

- Khan Academy: Math Patterns with Toothpicks
- IXL: Identify number patterns