

UNIT PLANNING TOOL

Planning Focus: Algebra: Generate and Analyze Patterns

Module(s)/Unit(s) Envision 4th Grade Topic 14

CCSSM: OA.C.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. *For example, given the rule "Add 3" and the starting number 1, generate terms in the resulting sequence and observe that the terms appear to alternate between odd and even numbers. Explain informally why the numbers will continue to alternate in this way.*

Supported standards:

OA.C.3 Solve multi-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quality.

OA.C.4 Gain familiarity with factors and multiples

NBT.C.4 Fluently add and subtract multi-digit whole numbers using the standard algorithm.

NBT.C.5 Multiply a whole number of up to four digits by a one-digit whole number...

NBT.C.6 Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors...

Mathematical Practices being emphasized:

SMP 1: Make sense of problems and persevere in solving them.

SMP 8: Look for and express regularity in repeated reasoning.

Essential Questions

How can you use a rule to continue a pattern?

How can you use a table to extend a pattern?

How can you use a repeating pattern to predict a shape?

Key Concepts

- Find a pattern for a given rule.
- Use a table to extend a pattern (rule).
- Use addition, subtraction, multiplication, and division to find basic patterns.
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Compendium

(planned on a separate piece of paper)

Pre and Post Assessments

Preassessment – *See attached.*

(Preassessment based on concepts that will help the teachers know students' current understanding of shapes.)

- Review what you know page 518
- Completing a table
- What do they notice about the numbers in a pattern? (increasing, decreasing, even/odd, end in 0...)

Post Assessment

- Topic 14 assessments and/or performance tasks

Other formative assessment opportunities:

- Inquiry Chart
- Work on unit lessons
- Guided math groups
- Exit slips

Connections (Real World Applications)

Recognizing patterns and rules helps us make predictions about our world. Patterns make life feel less chaotic. Mathematicians often describe math as the science of pattern and order.

Patterns are all around us: the timing for streetlights, number of petals on a flower, hours you sleep each night, music, dance, seashells, waves, the number of lunches served at a school each day, computer programming, video games

Language Functions/Structures

The rule is ____.
 That pattern is _____. One of the features of the pattern is _____.
 The labels for the columns/rows would be _____ and _____.
 The next number is _____ because _____.

Vocabulary

Rule, pattern, table, number line, sequence, relationship
 Analyze, extend
 Column, row, feature (of the pattern)
 Repeating pattern, growing pattern, shrinking pattern

Focus and Motivation**Visual Thinking Strategy**

Put a collection of pictures on a Google or PPT slide that show different patterns. Have students share what they observe about the pictures. Then have them share predictions about what we they will be studying

Pattern Challenges – “What’s my rule?” or “What’s next in the pattern?”***Square Sequences*** – Enrichment 14-2

Project one sequence at a time. Have students work with partners to identify the next numbers in the sequence. Or show them the “answers” and have them find the rule.

Line Patterns – Enrichment 14-3

Project each pattern to the front of the class. Have students work with a partner or use a white board to identify the next part of the pattern. Compare answers and have students explain why they think that is the next pattern. Keep the tone challenging and fun to keep it part of Focus and Motivation.

Pattern Blocks – Have students build a pattern. Example – My rule is triangle, rhombus, square. What will the 25th shape be? Have students come up with a pattern themselves.

YouCubed: Growing Shapes 3-4 <https://www.youcubed.org/resource/classic-wim-week-1-grades-3-4/>

How do you see the groups growing?

Rule tells how numbers

or shapes in a pattern are related.

Type of pattern

shrinking pattern ↓

increasing

Rule: subtract 5

40, 35, 30, 25, 20

Rule: add 4

← 16 20 24 28 →

+4 +4 +4

growing pattern ↑

decreasing

Rule: O O Δ X

O O Δ X O O Δ X O O Δ X

repeating pattern

Patterns and Rules

Using tables

How many legs do spiders have? 5

Rule: multiply 8

| | | | | | |
|---------|---|----|----|----|----|
| spiders | 1 | 2 | 3 | 4 | 5 |
| legs | 8 | 16 | 24 | 32 | 40 |

table or chart

Features of pattern: legs all even. Multiples of 4, 8.

In every video game, score is 7 points greater than

Rule: add 7

| | | | | | |
|-------|-----|-----|-----|-----|-----|
| score | 14 | 21 | 28 | 35 | 42 |
| ↑ | +7 | +7 | +7 | +7 | +7 |
| score | 110 | 117 | 124 | 131 | 138 |

Features of pattern:
• Scores can be even or odd
• ?

Repeating Patterns

Rule: Δ O □

What will the 25th shape be?

Δ O □ Δ O □ Δ O □ Δ O □ Δ O □

↑ 25th shape

$25 \div 3$ shapes = 6 R 1

The pattern repeats 6 times plus one more.

We will persevere when analyzing patterns and identifying rules.

Mathematical Standards and Practices

Patterns and rules

Inquiry Chart

What we know about _____ ?

What we want to learn about _____ ?

Rule → tells how #'s or shapes in a pattern are related

Rule -5

40, 35, 30, 25, 20
Shrinking pattern
decreasing

Rule $+4$

growing pattern
increasing

Rule $OO\Delta X$

$OO\Delta XOO\Delta XOO\Delta X$

repeating pattern

Rule $1, 3, 5, 7$

$1, 3, 5, 7, 1, 3, 5, 7$

what?

Mathematical Standards and Practices

We will persevere when analyzing patterns and identifying rules.

Patterns and rules

Using tables

How many legs do 5 spiders have?
Rule: multiply 8

| | | | | | |
|---------|---|----|----|----|----|
| spiders | 1 | 2 | 3 | 4 | 5 |
| legs | 8 | 16 | 24 | 32 | 40 |

Features of pattern:
legs all even • multiples of 2, 4, 8

In every video game, _____ score is 7 points greater than _____

Rule: add 7

| | | | | | |
|-------|-----|-----|-----|-----|-----|
| Score | 14 | 21 | 28 | 35 | 42 |
| Score | 30 | 37 | 44 | 51 | 58 |
| Score | 110 | 117 | 124 | 131 | 138 |

Features of pattern
scores can be even or odd

what we know

- The pattern can go big to smaller and smaller to big.
- Patterns can have shapes, colors, and sizes.
- A rule can have x and y.
- Every pattern follows a rule.
- Some patterns go from small to big. Any of the operations can be used in patterns.
- Patterns can go with numbers.

Repeating Patterns

Rule: $\Delta O O \square$

What will the 25th shape be?



$25 \div 3 \text{ shapes} = 6 R 1$
The pattern repeats 6 times plus one more

Patterns and rules Inquiry Chart

?? what we want to know

what we want to know about patterns, like their colors, their sizes, their shapes their rules.

what kinds of rules does a pattern have?
The rules can make it decrease, increase or repeat. The rule determines the pattern.

- How do I draw patterns correctly?
- Analyze the pattern carefully.
 - Draw the pattern.
 - Check our work.