

## 5.OA.B: OPERATIONS & ALGEBRAIC THINKING

**Cluster Statement:** Analyze patterns and relationships.

**Additional Cluster** (Students should spend the large majority of their time (65-85%) on the major work of the grade/course. Supporting work and, where appropriate, additional work should be connected to and engage students in the major work of the grade.)

<p><b>Standard Text</b></p> <p><b>5.OA.B.3</b> Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. <i>For example, given the rule "Add 3" and the starting number 0, and given the rule "Add 6" and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.</i></p>	<p><b>Standards of Mathematical Practice</b></p> <p>SMP3: Students can construct viable arguments and critique the reasoning of other by comparing descriptions and looking for counterexamples, ordered pairs that do not fit the rule</p> <p>SMP 7: Students can look for and make use of structure when finding patterns, students are developing a deeper understanding of all 4 operations and beginning to make generalizations by constructing rules for their patterns.</p>	<p><b>Students who Demonstrate Understanding Can:</b></p> <ul style="list-style-type: none"> <li>Identify the relationship between two patterns.</li> <li>Given a starting point, apply two math rules to that number.</li> <li>Graph data on a coordinate plane (positive numbers only).</li> </ul>
		<p><b>Depth of Knowledge:</b> 1</p>
		<p><b>Bloom's Taxonomy:</b> Analyze, Understand</p>
<p><b>Previous Learning Connections</b></p> <ul style="list-style-type: none"> <li>Connect to following one rule and then determined what happened in that pattern. (4.OA.5)</li> </ul>	<p><b>Current Learning Connections</b></p> <ul style="list-style-type: none"> <li>Connect to graphing points on a coordinate plane. (5.G.1, 5.G.2)</li> </ul>	<p><b>Future Learning Connections</b></p> <ul style="list-style-type: none"> <li>Connect to applying the use of variables to represent two quantities in real world problems. Students will write equations to represent the dependent and independent variables. (6.EE.9)</li> <li>Connect to describing the relationship in ratio rates to solve real world problems. (6.RP.2, 6.RP.3)</li> </ul>

**Clarification Statement:**

This standard is closely related to graphing points in the first quadrant of a coordinate plane (5.G.1-2) This standard extends the work from Fourth Grade, where students generate numerical patterns when they are given one rule.

In Fifth Grade, students are given two rules and generate two numerical patterns. The graphs that are created should be line graphs to represent the pattern. This is a linear function which is why we get the straight lines.

**Common Misconceptions**

- Students may reverse the points when plotting them on a coordinate plane. They count up first on the y-axis and then count over on the x-axis. The location of every point in the plane has a specific place. Have students plot points where the numbers are reversed such as (4, 5) and (5, 4). Begin with students providing

a verbal description of how to plot each point. Then, have them follow the verbal description and plot each point.

**Multi-Layered System of Supports (MLSS)/Suggested Instructional Strategies**

**Pre-Teaching**

Pre-teach (Targeted): *What pre-teaching will prepare students to productively struggle with the mathematics for this cluster within your HQIM?*

- For example, some learners may benefit from targeted pre-teaching that rehearses prior learning when studying analyzing patterns and relationships because students will generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns and graph the ordered pairs on a coordinate plane.

Pre-teach (Intensive): *What critical understandings will prepare students to access the mathematics for this cluster?*

- 4.OA.C.5: This standard provides a foundation for work with analyzing patterns and relationships because the students will be able to 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. If students have unfinished learning within this standard, based on assessment data, consider ways to provide intensive pre-teaching support prior to the start of the unit to ensure students are ready to access grade level instruction and assignments.

**Core Instruction**

*Access*

Interest: *How will the learning for students provide multiple options for recruiting student interest?*

- For example, learners engaging with analyzing patterns and relationships benefit when learning experiences include ways to recruit interest such as providing novel and relevant problems to make sense of complex ideas in creative ways because students who are allowed to express their creativity when solving and analyzing patterns and relationships will become more engaged in their learning. Allowing students to be creative will help the students become interested in topics that they once felt were boring.

*Build*

Effort and Persistence: *How will the learning for students provide options for sustaining effort and persistence?*

- For example, learners engaging with analyzing patterns and relationships benefit when learning experiences attend to students attention and affect to support sustained effort and concentration such as providing feedback that emphasizes effort, improvement, and achieving a standard rather than on relative performance because students who are provided feedback on their effort or areas of improvement will become more engaged in their learning. When they are given tips and ideas on how to improve their work, they will persevere to become more successful.

Language and Symbols: *How will the learning for students provide alternative representations to ensure accessibility, clarity and comprehensibility for all learners? (e.g., a graph illustrating the relationship between two variables may be informative to one learner and inaccessible or puzzling to another; picture or image may carry very different meanings for learners from differing cultural or familial backgrounds).*

- For example, learners engaging with analyzing patterns and relationships benefit when learning experiences attend to the linguistic and nonlinguistic representations of mathematics to ensure clarity can comprehensibility for all learners such as making explicit links between information provided in texts and any accompanying representation of that information in illustrations, equations, charts, or diagrams because students learn by being led by example. Students learn by different means. Some need to see examples that tie into what they are learning. If they can visually see what the problem is asking them to solve for, then they will understand how to access the problems to come to a solution.

Expression and Communication: *How will the learning provide multiple modalities for students to easily express knowledge, ideas, and concepts in the learning environment?*

- For example, learners engaging with *analyzing* patterns and relationships benefit when learning experiences attend to the multiple ways students can express knowledge, ideas, and concepts such as providing differentiated feedback (e.g., feedback that is accessible because it can be customized to individual learners) because students need feedback to help them understand the skills or concepts. Students make their own mistakes and need to learn from those mistakes, so providing feedback that is good for one student may not be good for another. Make the feedback meaningful to each individual student to help them be more successful.

*Internalize*

Executive Functions: *How will the learning for students support the development of executive functions to allow them to take advantage of their environment?*

- For example, learners engaging with *analyzing* patterns and relationships benefit when learning experiences provide opportunities for students to set goals; formulate plans; use tool and processes to support organization and memory; and analyze their growth in learning and how to build from it such as providing guides and checklists for scaffolding goal-setting because students are eager learners. If you provide them with guidance on how to set goals, they will eventually learn to do so on their own. If the students are provided with guides and checklists, the students will learn what is vital and important for setting their goals for success.

**Re-Teaching**

Re-teach (Targeted): *What formative assessment data (e.g., tasks, exit tickets, observations) will help identify content needing to be revisiting during a unit?*

- For example, students may benefit from re-engaging with content during a unit on *analyzing* patterns and relationships by clarifying mathematical ideas and/or concepts through a short mini-lesson because the students will be able to create, analyze and solve patterns and practice “PEMDAS” in order for them to create their pattern while getting the correct response. This enables the students to practice order of operations.

Re-teach (Intensive): *What assessment data will help identify content needing to be revisited for intensive interventions?*

- For example, some students may benefit from intensive extra time during and after a unit *analyzing* patterns and relationships by confronting student misconceptions because students will need to be able to walk through the PEMDAS process. The students will need to understand the process of multiplication and division and addition and subtraction do not necessarily need to be performed in that order. Students need to remember that the order goes from the operation on the left to the right. These misconceptions will give the students incorrect answers for their problems.

**Extension**

*What type of extension will offer additional challenges to ‘broaden’ your student’s knowledge of the mathematics developed within your HQIM?*

- For example, some learners may benefit from an extension such as the opportunity to understand concepts more quickly and explore them in greater depth than other students when studying *analyzing* patterns and relationships because students will be able to explore generating patterns and creating graphs and charts to exhibit their responses to the problems. It would also allow students to explore different topics and develop their own specifications for solving problems.

**Culturally and Linguistically Responsive Instruction:**

**Validate/Affirm:** How can you design your mathematics classroom to intentionally and purposefully legitimize the home culture and languages of students and reverse the negative stereotypes regarding the mathematical abilities of students of marginalized cultures and languages?

**Build/Bridge:** How can you create connections between the cultural and linguistic behaviors of your students’ home culture and language the culture and language of school mathematics to support students in creating mathematical identities as capable mathematicians that can use mathematics within school and society?

Supporting Productive Struggle in Learning Mathematics: The standard for mathematical practice, makes sense of mathematics and persevere in solving them is the foundation for supporting productive struggle in the mathematics classroom. “Too frequently, historically marginalized students are overrepresented in classes that focus on memorizing and practicing procedures and rarely provide opportunities for students to think and figure things out for themselves. When students in these classes struggle, the teacher often tells them what to do without building their capacity for persistence.” Teachers need to provide tasks that challenge students and maintain that challenge while encouraging them to persist. This encouragement or “warm-demander” requires a strong relationship with students and an understanding of the culture of the students. For example, when studying analyzing patterns and relationships supporting productive struggle is critical because the process develops a sense of perseverance and creative problem solving. When students face problems they don't immediately know how to solve, we don't want them to give up because we want them to continue to work towards a possible solution that helps them understand the problem on their own way of thinking.

**Standards Aligned Instructionally Embedded Formative Assessment Resources:**

Source: PARCC Released Item 2019

Two Patterns are shown.

Pattern A	2	4	6	8	10
Pattern B	12	24	36	48	60

Which Statement about the corresponding terms in Pattern A and Pattern B is always true?

- A. The terms in Pattern B are 6 times the corresponding terms in Pattern A.
- B. The terms in Pattern B are 10 times the corresponding terms in Pattern A.
- C. The terms in Pattern B are 10 more than the corresponding terms in Pattern A.
- D. The terms in Pattern B are 20 more than the corresponding terms in Pattern A.

**Answer Key A**

**Relevance to families and communities:**

During a unit focused on analyzing patterns and relationships, consider options for learning from your families and communities the cultural and linguistic ways this mathematics exists outside of school to create stronger home to school connections for students, for example, during community events, students and families can create charts and graphs that will show price/cost analysis when selling products during these events. Families could develop a sense of determining which type of snack or drink would sell more at different prices in order to determine how much to charge for their products.

**Cross-Curricular Connections:**

Science: Give students data represented in a table. Have students discuss the relationship between the numbers in the table.