Rich Mathematical Task – Grade *2 – How Many Tables?*

Task Overview/Description/Purpose:
• The purpose of this task is for students to analyze and extend a growing pattern and deepen their understanding of how a growing pattern stays the same and how it changes. • In this task, students will analyze, describe, and extend a pattern to begin making generalizations about them.

Standards Alignment: Strand - *Computation and Estimation*	
Primary SOL: 2.16 The student will identify, describe, create, extend, and transfer patterns found in objects, pictures, and numbers. **Related SOL:** 1.14, 3.16	
Learning Intentions: • **Content –** I am learning to describe how a growing pattern is changing and extend a growing pattern to solve a problem. • **Language –** I am learning to use math vocabulary to describe how a pattern is changing as it grows. • **Social –** I am learning to communicate my thinking, listen to the math ideas of others, and share feedback.	
Success Criteria (Evidence of Student Learning): • I can describe how a growing pattern changes and extend a growing pattern. • I can represent patterns using manipulatives, pictures, and/or numbers. • I can communicate my thinking clearly to my classmates and describe my math ideas. • I can listen as my classmates share their math ideas.	
Mathematics Process Goals	
Mathematical Understanding	• Students will demonstrate an understanding of growing patterns and how they grow.
Problem Solving	• Students will apply their understanding of patterns to find solutions to the task.
Communication and Reasoning	• Students will use math vocabulary to describe and extend the pattern. • Students will justify their mathematical decisions through their representations.
Connections and Representations	• Students will represent their thinking using manipulatives and/or a drawing. • Students will make connections between their representations.

Task Pre-Planning
Approximate Length/Time Frame*:* 60 minutes
Grouping of Students: Begin with a whole class launch of the task. After introducing the task, students begin the task independently. As the task progresses, students will share ideas with a shoulder partner. Students will communicate thinking, by sharing representations during a whole group reflection. This task can be given at any time during your pattern unit to see how students are progressing with the concept of growing patterns. If you choose to give it before starting the unit, you can see what knowledge the students already have growing patterns. If you give the task during your unit, you can see how students are progressing with growing

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Task Pre-Planning

patterns and what additional supports they may need. If given at the end of the unit, the task can be a good assessment of the student's knowledge of growing patterns and how they grow.

Materials and Technology:
- color tiles, squares
- pencil
- crayons
- colored pencils
- student task
- Virtual Implementation Google Slides

Vocabulary:
- pattern
- growing, changing
- extend, continue
- describe, predict
- model, representation
- relationships

Anticipate Responses: See the Planning for Mathematical Discourse Chart (columns 1-3).

Task Implementation (Before)

Task Launch:
- In a whole group setting, engage students in a "Finish the Pattern" activity. Show students a pattern, such as, 2, 4, __, __, __ or 3, 6, __, __, __. Ask students to complete the pattern in a way that makes sense to them. There are multiple ways to finish the pattern. Some students may extend it as a repeating pattern, while others create a growing pattern. The teacher should validate all answers equally, as the purpose of this activity is to have students communicate their math thinking and justify their reasoning. This launch activity provides the teacher insight into how students are thinking about patterns.
- Share the learning intentions and success criteria with the students. Clarify any vocabulary you think may be difficult for your students.
- Invite students to connect with the context and activate prior knowledge by asking, "Have you ever been to a restaurant for a party or with a large group? How did the restaurant provide seating for everyone?"
- Explain that today's problem is about a girl named Lulu that wants to have a birthday dinner for her mom at a restaurant. She is trying to figure out how many tables will be needed to seat the people that are coming. Sometimes in restaurants, tables have to be pushed together to seat a larger group of people. Your task is to listen to the clues in the story to figure out what is happening in the problem and help Lulu determine how many tables will be needed for the birthday dinner.
- Introduce the task by reading the problem aloud to students. Ask a few students to restate the task in their own words to promote understanding and provide an opportunity to clarify any questions.
- Explain that students will begin working individually on the task and later will work collaboratively with a partner to discuss the task and possible solutions and ways to represent their solutions.
- Redirect them to the language and social learning intentions for this task. After discussing with their partner, they need to be prepared to share their thinking with the class.
- Review the rubric with students. Let them know you are looking for their:
    - Mathematical Understanding
    - Problem Solving
    - Communication and Reasoning
    - Representations and Connections

  You may choose to just focus on just one or two of the process goals. Make your selected focus goals clear to students before they begin working on the task.
- Pass out the task to each student to think about and solve individually.
- After students have had some time to think and work on the problem, they can discuss with a partner sharing how they solved the problem and the reasonableness of their solution.

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Task Implementation (Before)
● Implement suggestions for additional student support below as needed.

Task Implementation (During)

Directions for Supporting Implementation of the Task

- Monitor – Teacher will listen and observe students as they work on the task and ask assessing or advancing questions (see potential ideas on the Planning for Mathematical Discourse Chart).
- Select – Teacher will decide which strategies or thinking that will be highlighted (after student task implementation) in order to advance mathematical ideas and support student learning.
- Sequence – Teacher will decide the order in which student ideas will be highlighted (following the student task implementation). The teacher should sequence from the least sophisticated strategy to the most sophisticated strategy. For instance, start with a student who just added four people to every table that is added, to students who extend the pattern but do not seat people at the end of the table. Then conclude with students who extend the pattern and are able to describe the relationship between the number of tables and the number of people seated.
- Connect – Teacher will consider ways to facilitate connections between different student responses.
  - As the teacher is monitoring individual students and partner pairs, s/he will look for strategies that are being used and record on a Planning Chart.
  - The teacher should use questions to assess or advance student thinking.
  - Students should be encouraged to explore different strategies for solving, ask their partner questions about their work, and evaluate the reasonableness of their solutions.

Suggestions For Additional Student Support

May include, among others:

- Encourage the use of manipulatives or student drawings.
- Pair vocabulary with visuals.
- Co-create an anchor chart with students and reference the visual as needed to reinforce new vocabulary words.
- Prepare student work space with materials required for the task.
- Sentence frames can be used to support student thinking:
  - The strategy I used to solve is _____.
  - First I am going to _____. Next, I will _____. I will know I have solved the problem because _____.
  - I noticed _____, so I _____.
  - With one table, _____ people can be seated. With two tables, _____ people can be seated. This pattern will continue _____.
- To extend the task, add parameters such as: *If the tables were triangular, how would this change how many people could be seated? What patterns do you notice?*
- To extend the task, add parameters such as: *If the tables were trapezoids, how would this change how many people could be seated? What patterns do you notice?*
- To extend the task, add parameters such as: *If the tables were hexagons, how would this change how many people could be seated? What patterns do you notice?*
- To extend the task, add parameters such as: *If 20 people come to her mom's birthday dinner, how many tables will Lulu need the restaurant to push together in a row, so they have enough seats for everyone?*

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Task Implementation (After)

Connecting Student Responses (From Anticipating Student Response Chart) and Closure of the Task:

- Based on the actual student responses, sequence and select particular students to present their mathematical work during class discussion. Consider sharing one strategy that shows a common misconception, and two other strategies that can connect to each other. Facilitate a discussion about similarities and difference between the strategies. For example, begin with students who just added four people to every table that is added to the row, to students who extend the pattern but do not seat people at the end of the table. Then end with students who extend the pattern and are able to describe the relationship between the number of tables and the number of people seated.
- Reflect on student solution strategies during a whole group discussion. Use this time to make connections between different student responses and connect the responses to the key mathematical ideas for growing patterns. Possible questions and sentence frames to connect student strategies:
    - How are these strategies alike? How are they different?
    - __________'s strategy is similar to ________'s strategy because __________.
    - How do these connect to our Learning Intentions?
    - Why is this important?
- Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion (opportunity for gallery walk or think/pair/share with a partner or small group).
- As students share their work, ask questions like:
    - How did you think about the problem?
    - How can you prove (convince us) that your solution makes sense?
    - Do you agree or disagree? Why?
    - Did anyone think about it in a different way?
    - What patterns are you noticing?
    - That was a big math idea, who can restate it?
    - Who can add onto this idea?
- Close the lesson by returning to the success criteria. Have students reflect on their progress toward meeting the success criteria.

Teacher Reflection About Student Learning:

- As you reflect, think about whether the learning intentions and success criteria were met. Why or why not?
- Use the rich mathematical task rubric to evaluate students' progress toward the process goals.
- How will the evidence provided through student work inform further instruction? Analyze student work to determine who was unable to demonstrate proficiency with the following mathematical ideas.
    - Who had difficulty getting started with the task?
    - Who inaccurately added four each time a table was added to seat more people?
    - Who had difficulty describing how to extend the pattern?
    - Who inaccurately did not seat people at the end of the table?
    - Who was unable to complete the task, even when additional support was provided?
    - Who was able to accurately extend the pattern and describe how it was growing?
    - Who did not have to build/draw the pattern to figure out a solution?
    - Who was able to identify the relationship between the number of tables and the number of people that could be seated as the tables were pushed together?

Planning for Mathematical Discourse

Mathematical Task: How Many Tables? Content Standard(s): SOL 2.16

Teacher Completes Prior to Task Implementation			**Teacher Completes During Task Implementation**	
Anticipated Student Response/Strategy *Provide examples of possible correct student responses along with examples of student errors/misconceptions*	**Assessing Questions – Teacher Stays to Hear Response** *Teacher questioning that allows student to explain and clarify thinking*	**Advancing Questions – Teacher Poses Question and Walks Away** *Teacher questioning that moves thinking forward*	**List of Students Providing Response** *Who? Which students used this strategy?*	**Discussion Order - sequencing student responses** ● *Based on the actual student responses, sequence and select particular students to present their mathematical work during class discussion* ● *Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion*
Anticipated Student Response A: Student has difficulty getting started.	● Can you retell the problem to me? ● What is the problem asking you to do? ● Describe what you notice in step 1. How many people are able to sit there? ● Describe what you notice in step 2. How many people are able to sit there? ● What do you think will happen next? ● What could you do to get started?	● Would drawing a picture help you to solve this task? ● Would using manipulatives help you to solve this task? ● How can you show what will come next?		
Anticipated Student Response B: Student adds four people that are seated each time a table is added.	● Tell me about your work. ● How many people can sit around one table? ● What happens when two tables are pushed together? ● How many people will fit around? ● What are you noticing?	● What do you notice about where people can sit when the tables are pushed together? ● What will happen if you push another table together with the other ones?		

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Teacher Completes Prior to Task Implementation			**Teacher Completes During Task Implementation**	
Anticipated Student Response/Strategy *Provide examples of possible correct student responses along with examples of student errors/misconceptions*	**Assessing Questions – Teacher Stays to Hear Response** *Teacher questioning that allows student to explain and clarify thinking*	**Advancing Questions – Teacher Poses Question and Walks Away** *Teacher questioning that moves thinking forward*	**List of Students Providing Response** *Who? Which students used this strategy?*	**Discussion Order - sequencing student responses** ● *Based on the actual student responses, sequence and select particular students to present their mathematical work during class discussion* ● *Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion*
Anticipated Student Response C: Student extends the pattern as tables are pushed together but does not seat people at the end of the table.	● Tell me about your thinking. ● What changes as the tables are pushed together? ● Did you use a drawing/manipulative to help you? ● Where can people be seated in your representation? ● Does your representation match what is happening in the problem? How do you know? ● How are the first two steps of the task represented in your drawing/model?	● What do you notice about where people can sit when the tables are pushed together? ● How could manipulatives or a drawing help you solve this task?		
Anticipated Student Response D: Student accurately extends the pattern but has difficulty describing how it grows as additional tables are pushed together.	● Tell me about your thinking. ● Did you use a drawing/manipulative to help you? ● How do you know that your representation matches the problem? ● What did you notice as tables were pushed together? ● Did you notice any patterns?	● Is there a relationship between the steps? ● Did you use a rule to help you figure out your solution? ● Can you solve this task without building each step? ● How would you explain your work to a classmate?		

Teacher Completes Prior to Task Implementation			**Teacher Completes During Task Implementation**	
Anticipated Student Response/Strategy *Provide examples of possible correct student responses along with examples of student errors/misconceptions*	**Assessing Questions – Teacher Stays to Hear Response** *Teacher questioning that allows student to explain and clarify thinking*	**Advancing Questions – Teacher Poses Question and Walks Away** *Teacher questioning that moves thinking forward*	**List of Students Providing Response** *Who? Which students used this strategy?*	**Discussion Order - sequencing student responses** ● *Based on the actual student responses, sequence and select particular students to present their mathematical work during class discussion* ● *Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion*
	● What stays the same? What changes? ● By how much is the number of people that can be seated changing as the number of tables increases?			
Anticipated Student Response E: Student accurately extends the pattern and is able to describe the relationship between the number of tables and the number of people that can be seated.	● What did you notice? ● What strategy did you use to figure out how the pattern was growing each time? ● How did you determine the rule for telling the number of tables and the number of people that could be seated? ● What is the relationship between the number of tables and number of people that can be seated? How do you know? ● How can patterns be used to make predictions about what comes next?	● How could you figure out the pattern without building it? ● Can you describe how many tables would be needed to seat 20 people? How do you know? ● Can you solve this task without building each step? ● How did you determine the rule for telling the number of tables and number of people that can be seated? ● What would happen if you change the shape of the tables? (See extensions under suggestions for additional student support.) ● How does your understanding of patterns help you determine the		

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Teacher Completes Prior to Task Implementation			**Teacher Completes During Task Implementation**	
Anticipated Student Response/Strategy *Provide examples of possible correct student responses along with examples of student errors/misconceptions*	**Assessing Questions – Teacher Stays to Hear Response** *Teacher questioning that allows student to explain and clarify thinking*	**Advancing Questions – Teacher Poses Question and Walks Away** *Teacher questioning that moves thinking forward*	**List of Students Providing Response** *Who? Which students used this strategy?*	**Discussion Order - sequencing student responses** • *Based on the actual student responses, sequence and select particular students to present their mathematical work during class discussion* • *Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion*
		relationship between the number of tables and the number of people that can be seated in this task?		

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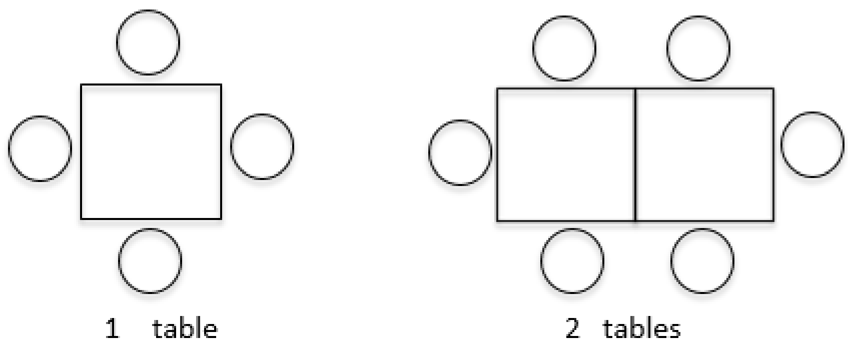
Name________________________________ Date________________________

How Many Tables?

Lulu is planning a birthday dinner for her mom at a restaurant. The restaurant uses square tables to seat customers. Four people fit around one square table, one on each side. For larger groups, the restaurant pushes same-sized tables together. Two tables pushed together will seat 6 people. In the picture, each square represents a table and each person is represented by a circle.



If 12 people come to her mom's birthday dinner, how many tables will Lulu need the restaurant to push together in a row, so they have enough seats for everyone? What patterns do you notice each time the restaurant adds another table? Show your work and explain your thinking.

Rich Mathematical Task Rubric

	Advanced	Proficient	Developing	Emerging
Mathematical Understanding	Proficient Plus: ● Uses relationships among mathematical concepts	● Demonstrates an understanding of concepts and skills associated with task ● Applies mathematical concepts and skills which lead to a valid and correct solution	● Demonstrates a partial understanding of concepts and skills associated with task ● Applies mathematical concepts and skills which lead to an incomplete or incorrect solution	● Demonstrates little or no understanding of concepts and skills associated with task ● Applies limited mathematical concepts and skills in an attempt to find a solution or provides no solution
Problem Solving	Proficient Plus: ● Problem solving strategy is efficient	● Problem solving strategy displays an understanding of the underlying mathematical concept ● Produces a solution relevant to the problem and confirms the reasonableness of the solution	● Chooses a problem solving strategy that does not display an understanding of the underlying mathematical concept ● Produces a solution relevant to the problem but does not confirm the reasonableness of the solution	● A problem solving strategy is not evident or is not complete ● Does not produce a solution that is relevant to the problem
Communication and Reasoning	Proficient Plus: ● Reasoning is organized and coherent ● Consistent use of precise mathematical language and accurate use of symbolic notation	● Communicates thinking process ● Demonstrates reasoning and/or justifies solution steps ● Supports arguments and claims with evidence ● Uses mathematical language to express ideas with precision	● Reasoning or justification of solution steps is limited or contains misconceptions ● Provides limited or inconsistent evidence to support arguments and claims ● Uses limited mathematical language to partially communicate thinking with some imprecision	● Provides little to no correct reasoning or justification ● Does not provide evidence to support arguments and claims ● Uses little or no mathematical language to communicate thinking
Representations and Connections	Proficient Plus: ● Uses representations to analyze relationships and extend thinking ● Uses mathematical connections to extend the solution to other mathematics or to deepen understanding	● Uses a representation or multiple representations, with accurate labels, to explore and model the problem ● Makes a mathematical connection that is relevant to the context of the problem	● Uses an incomplete or limited representation to model the problem ● Makes a partial mathematical connection or the connection is not relevant to the context of the problem	● Uses no representation or uses a representation that does not model the problem ● Makes no mathematical connections

Task Supporting Documents

Possible Sentence Frames for Supporting Learners

The strategy I used to solve is _____.

First I am going to _____. Next, I will _____. I will know I have solved the problem because _____.

I noticed _____, so I _____.

With one table, _____ people can be seated.
With two tables, _____ people can be seated.
This pattern continues ______.