Rich Mathematical Task – Grade 2 – *Brownie Pans*

Task Overview/Description/Purpose:

- In this task, students will represent fractional parts of a whole using models (brownie pans) and will compare the amounts of brownies eaten by each of three people.
- The purpose of this task is to explore what happens to the size of each piece when the whole is cut into more pieces. Students will notice relationships between the number in the denominator and the size of each fractional piece.

Standards Alignment: Strand – *Number and Number Sense*

Primary SOL: 2.4 The student will

a) name and write fractions represented by a set, region, or length model for halves, fourths, eighths, thirds, and sixths;
b) represent fractional parts with models and with symbols; and
c) compare the unit fractions for halves, fourths, eighths, thirds, and sixths, with models.

Related SOLs: 1.4ab; 3.2abc

Learning Intention(s):

- **Content** - I am learning how to divide a whole into equal parts. I am learning how to compare the size of different fraction pieces.
- **Language** - I am learning how to name fraction representations, orally and written**.**
- **Social** - I am learning to explain my thinking as it relates to dividing wholes into equal parts. I am learning to listen to and explain my peers' strategies, and connect them to my own strategy.

Success Criteria (Evidence of Student Learning):

- I can divide a whole into equal parts and name the resulting fraction.
- I can name two fractions and compare them to determine which one is smaller/larger.
- I can show my math thinking about fractions through pictures, numbers, and words.

Mathematics Process Goals

Problem Solving	• Students will engage in problem solving as they explore the size of fraction pieces with different denominators.
Communication and Reasoning	• Students will communicate their thinking process for representing Juan, Shantel, and Dave's brownie pans using words, pictures, and numbers (fractions). • Students will use appropriate and accurate written and/or oral mathematical language to express ideas about fractions in the brownie pans. • Students will demonstrate sound reasoning and justify their solutions through the use of words, pictures, or numbers (fractions).
Connections and Representations	• Students will make connections between the number in the denominator and the size of each fractional piece (i.e. as the denominator becomes larger, each piece becomes smaller). • Students will create representations to demonstrate relationships between the brownie pans.

Task Pre-Planning

Approximate Length/Time Frame: 45 minutes

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Task Pre-Planning

Grouping of Students: Students should begin the task independently. After actively monitoring student strategies and responses, the teacher should purposefully pair students together to share ideas. Following partner work, the teacher will purposefully choose 3-4 students to share their work with the class in a whole group setting.

Materials and Technology:

- student task template
- graphic organizer (optional)
- pencils
- fraction manipulatives (circles, squares, towers, etc.)
- chart paper/markers (optional)

Vocabulary:

- fraction
- equal parts
- whole
- numerator, denominator
- less than/greater than/equal to
- smaller/larger

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

Task Implementation (Before) 10 minutes

Task Launch:

- **Anticipate prior knowledge:** The teacher will help students access their prior knowledge about fractions and equal parts by asking the following questions and allowing students time to share with a partner:
    - Have you ever shared something with a friend, brother, or sister?
    - Was it fair? How did you know?
    - How did you share it?
    - How did you know how much each person received?
- The teacher should actively listen to student discussions and choose 3-4 students to share their anecdote with the class during a whole group discussion. The teacher may consider scribing some of the students' answers on a board or chart paper and creating a visual representation of how the child shared the object(s).
- The teacher should tell students, "Today we are going to solve a problem where three people each have a pan of brownies. They are going to divide their pans of brownies into equal parts and then eat some of the parts."
- **Ensure understanding of task:** The teacher will read the task aloud to all students. Discuss what information you know from the task.
- Next, the teacher will review relevant vocabulary before students begin the task. Use the vocabulary listed above in addition to any words or phrases that may be generated by students. Consider posting the vocabulary where all students can see and access it (anchor chart, math notebooks, board).
- **Establish clear expectations:** Review rubric with students as a tool for monitoring their proficiency. Review classroom expectations for working independently, working with a partner, and engaging in a whole group discussion. Review expectations for using any classroom materials and/or manipulatives.

Task Implementation (During) 20 minutes

Directions for Supporting Implementation of the Task

- **Monitor** – The teacher will observe students as they work independently on the task. The teacher will engage with students by asking assessing or advancing questions as necessary (see attached *Question Matrix).*
- **Select** – The teacher will select students to partner up based on the strategies used. The teacher may decide to pair students who used similar strategies or students who used different strategies. Allow students time to work together in pairs on the task. The teacher will engage with pairs by asking assessing or advancing questions as necessary (see page 4*)*.
- **Sequence** – The teacher will select 3-4 student strategies to share with the whole group. One suggestion is to look for one common misconception and two correct responses to share.
- **Connect** – The teacher will consider ways to facilitate connections between different student representations.

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Task Implementation (During) 20 minutes

Suggestions For Additional Student Support

- Sentences frames:
  - The strategy I will use to solve the problem is _____.
  - Because Juan ate ½ of his brownie pan and Shantel ate less, I knew that _____.
  - I know my solution is correct because _____.
  - I know that _(fraction)_ is more/less than _(fraction)_ because _____.
- Vocabulary development:
  - Use Frayer models to deepen understanding of vocabulary terms.
  - Pair vocabulary with visuals.
  - Keep vocabulary on an anchor chart or word wall and reference the visual as needed to reinforce verbal, written, and graphic representations of new vocabulary words.
- Organization:
  - Use of graphic organizer, graph paper or lined paper
  - Prepare student work space with materials required for task.
  - Allow students to use rulers to make straight lines in the brownie pans.
- Extension:
  - What if Juan ate 1/3 of his brownie pan? How would that change your solution?
  - What if Shantel ate more than Juan, and Dave ate more than Shantel? How would that change your solution?

Task Implementation (After) *15 minutes*

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

- 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).
- Based on the actual student responses, select and sequence specific students to present their mathematical work during class discussion. Consider sharing one strategy that shows a common misconception, and two other accurate strategies that can connect to each other. Facilitate a discussion about similarities and differences between the strategies.
- Connect different students' responses and connect the responses to the key mathematical ideas (i.e. the idea that as the denominator becomes larger, each fraction piece in the whole becomes smaller) to bring closure to the task.

Teacher Reflection About Student Learning:

- Use the rich mathematical task rubric to evaluate students' progress toward the goals of the lesson.
- Consider how the evidence provided through student work can be used to inform further instruction. Some suggestions are to:
  - create small groups to address misconceptions or provide extensions
  - implement this rich mathematical task again using slightly different parameters (i.e. Shantel ate more than Juan and Dave ate more than Shantel)

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Planning for Mathematical Discourse

Mathematical Task: ____Brownie Pans___ Content Standard(s): ____SOL 2.4____

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 questioning that allows student to explain and clarify thinking*	**Advancing Questions** *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* • *Connect different students' responses and connect the responses to the key mathematical ideas* • *Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion*
Anticipated Student Response: "I don't know how to do this."	• Focus on the part we know about Juan: What does ½ look like? How could you represent that?	• If Shantel ate less, what could Shantel's pan look like? • How could manipulatives or a picture help you?		
Anticipated Student Response: The student makes each brownie pan a different size (i.e. the wholes are not equivalent).	• What do you know about the size of each person's brownie pan?	• How can this information help you as you represent their brownie pans?		
Anticipated Student Response: The student's solution does not follow the parameters (i.e. they try to put Juan, Shantel, and Dave's pieces all in one whole).	• What does the problem say? (Each person has their own pan.) • Does your picture match what the problem says?	• How could you show that they each have their own brownie pan?		

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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 questioning that allows student to explain and clarify thinking*	**Advancing Questions** • *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* • *Connect different students' responses and connect the responses to the key mathematical ideas* *Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion*
Anticipated Student Response: Student's representation is correct, but student has difficulty naming the fraction.	• What can you tell me about your representation? • In order to name the fraction, we need to have equal parts. Does your representation show equal parts in the brownie pan?	• How can you use equal parts to help you name the fraction?		
Anticipated Student Response: Student can draw an accurate model and correctly name the fraction (uses unit fractions).	• Tell me about your strategy. • How do you know your solution is correct?	• Could you find another solution to the problem? • What if Shantel or Dave ate more than one piece?		
Anticipated Student Response: Student can draw an accurate model and correctly name the fractions (at least one fraction is not a unit fraction).	• Tell me about your strategy. • How did you know your solution was correct?	• Can you find another solution to the problem? • Did you notice any patterns that helped you solve the problem? • Teacher may refer to extension activities on page 3.		

Name_____ Date_____

Brownie Pans

Juan, Shantel, and Dave each had a pan of brownies. The pans were the same size.

- Juan ate half of his pan of brownies.
- Shantel ate a smaller amount of her pan of brownies than Juan.
- Dave ate a smaller amount of his pan of brownies than Shantel.

What fractions could describe the amount of each pan of brownies that Juan, Shantel, and Dave ate? Show your work and explain your thinking.

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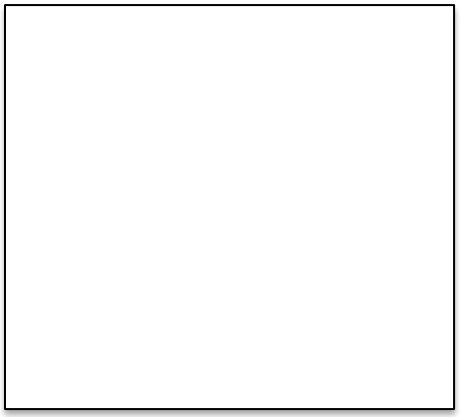
Rich Mathematical Task Rubric

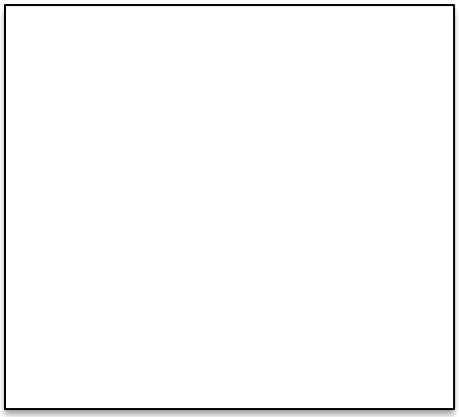
	Advanced	Proficient	Developing	Emerging
Mathematical Understanding	Proficient Plus: • Uses relationships among mathematical concepts or makes mathematical generalizations	• Demonstrates an understanding of concepts and skills associated with task • Applies mathematical concepts and skills which lead 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 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 well developed or 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	• Problem solving strategy displays a limited 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 • Does not produce a solution that is relevant to the problem
Communication and Reasoning	Proficient Plus: • Reasoning or justification is comprehensive • Consistently uses precise mathematical language to communicate thinking	• Demonstrates reasoning and/or justifies solution steps • Supports arguments and claims with evidence • Uses mathematical language to communicate thinking	• 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	• Provides no correct reasoning or justification • Does not provide evidence to support arguments and claims • Uses 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

Brownie Pan Graphic Organizers

Juan's brownie pan



Shantel's brownie pan



Dave's brownie pan