

Rich Mathematical Task – Grade 6 – *Cookie Toppings*

Task Overview/Description/Purpose:	
<ul style="list-style-type: none"> In this task, students will determine how many batches of cookies can be made with a given amount of toppings. This task is designed to develop an understanding of operations with fractions as it relates to real-life application, with a particular focus on modeling and application of fraction division. 	
Standards Alignment: Strand – Computation and Estimation	
<p>Primary SOL: : 6.5 The student will</p> <ul style="list-style-type: none"> a) multiply and divide fractions and mixed numbers; and b) solve single-step and multistep practical problems involving addition, subtraction, multiplication, and division of fractions and mixed numbers. <p>Related SOL (within or across grade levels/courses): 3.5, 4.5 abc, 4.6 ab, 5.4, 5.5 ab, 5.6 ab</p>	
Learning Intentions:	
<ul style="list-style-type: none"> Content (based on Essential Knowledge and Skills) - I am learning about operations and modeling with fractions and how they can be used to solve real-life problems. Language- I am learning how to communicate various problem-solving and modeling strategies with fraction operations. Social- I am learning how to describe my models and problem solving to others in order to refine my thinking. 	
Success Criteria (Evidence of Student Learning):	
<ul style="list-style-type: none"> I can use operations with fractions to solve a practical problem. I can model fraction operations to help me with me conceptual understanding. I can justify my computational process and problem-solving strategy used in solving real-life problems. I can make suggestions and listen to feedback from my peers to make revisions to my work and thinking. 	
Mathematics Process Goals	
Problem Solving	<ul style="list-style-type: none"> Students will apply the concept of operations with fractions to model a practical situation.
Communication and Reasoning	<ul style="list-style-type: none"> Students will justify the number of batches of cookies baked based on their problem solving strategy and/or modeling.
Connections and Representations	<ul style="list-style-type: none"> Students will use pictures, bar models, or algorithms to model the real-life problem. The task builds upon prior knowledge of solving multistep practical problems and conceptual understanding of fractions.
Task Pre-Planning	
Approximate Length/Time Frame: 60 minutes	
<p>Grouping of Students: The teacher will launch the task with the whole class allowing students to read the task and ask clarifying questions before any mathematics work is started. The task will be distributed for students to work on individually for 20 minutes. Students should prepare a strategy to share (or multiple strategies to share) with the whole class. The teacher should alert individual students whose work she/he plans to share so that they will be prepared. In order to reflect and move forward, the teachers should sequence the strategies the students used in order to make a connection between the strategy and the mathematics standard.</p>	

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Task Pre-Planning	
When to give the task: The task should be given before the start of instruction focusing on mathematical operations with fractions (particularly division). This task will provide the teacher with formative data as to which students have had exposure to problem solving with fractions, as well as students' conceptual understanding.	
Materials and Technology: <ul style="list-style-type: none">• blank paper• colored pencils or highlighters• handout with blank bar models (possible scaffold)• manipulatives such as linking cubes, pattern blocks, fraction bars	Vocabulary: <ul style="list-style-type: none">• fraction• batch
Anticipate Responses: See Planning for Mathematical Discourse Chart (Columns 1-3)	
Task Implementation (Before)	
Task Launch: <ul style="list-style-type: none">• As a whole class, the teacher should employ a reading strategy (3-Reads Protocol is explained below) to ensure all students understand what the problem is asking and the vocabulary that is used in the task.<ul style="list-style-type: none">○ First read: Students focus on what the situation is about. Teacher debrief providing clarity to the problem and addressing vocabulary questions.○ Second read: Students identify what the quantities are in the situation. Teacher debrief.○ Third read: Students identify the mathematical question being asked of this situation. Teacher debrief. There should not be any discussion of strategy during this point.	
Task Implementation (During)	
Directions for Supporting Implementation of the Task <ul style="list-style-type: none">• Monitor – Teacher will listen and observe students as they work on task and ask assessing or advancing questions (see chart on next page)• Select – Teacher will decide which strategies or thinking that will be highlighted (after student task implementation) that will advance mathematical ideas and support student learning• Sequence – Teacher will decide the order in which student ideas will be highlighted (after student task implementation)• Connect – Teacher will consider ways to facilitate connections between different student responses	
Suggestions For Additional Student Support <ul style="list-style-type: none">• Have manipulatives and paper with pre-made bar models printed at the front of the room for students to use as needed.• Some students get stuck at one way of thinking and using one method. Asking questions like “How confident are you?” and “What would convince someone?” will help students get past this point.• For students with attention challenges ask student to restate the problem or important information.• For students who need more support in justifying their thinking, you may choose to provide them with the sentence frames below.<ul style="list-style-type: none">○ What I know about the problem is...○ My method for solving the problem was...○ I know that _____ batches of cookies are made because ...• For ELs with first language literacy, try to provide prompt, or parts of prompt, in their home language.	

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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. Some possible big mathematical ideas to highlight could include:
 - Common misconceptions
 - Concrete to representational to abstract
 - Using models (such as linking cubes) and pictures to clarify that leftover butterscotch morsels makes $\frac{1}{3}$ batch, which is $\frac{1}{4}$ cup of morsels ($\frac{1}{3}$ of $\frac{3}{4}$).
- Connect different students' responses and connect the responses to the key mathematical ideas to bring closure to the task. Possible questions and sentence frames to connect student strategies:
 - How are these models alike? How are they different?
 - Where do you see _____'s strategy in _____'s strategy?
 - Why is this important?
- Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion. For instance, provide the students whose work was not selected as part of the sequence of student work that will be shown the opportunity to validate and/or question what they see.

Teacher Reflection About Student Learning:

- Student understanding of the content through the use of the process goals will be assessed with the Rich Mathematical Task Rubric.
- When this task is used to introduce the 6.5 a,b content, students cannot be expected to perform at a proficient or advanced level in all four sections of the rubric.
- The results of this task will help the teacher assess background knowledge and give the students an opportunity to apply this knowledge to a new situation.
- Teachers may choose to revisit this same task at a later date in order to document student growth.
- NOTE: After the task was piloted in a classroom and anchor papers were scored by a team of teachers, the wording in question #2 was modified. The modified wording assists in clarifying that students understand the difference between a fraction of a batch and a fraction of a cup. Both the original and modified versions of the task are included in this template.

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Mathematical Task: Cookie Toppings

Content Standard(s): 6.5ab

Anticipated Student Response/Strategy <i>Provide examples of possible correct student responses along with examples of student errors/misconceptions</i>	Assessing Questions – Teacher Stays to Hear Response <i>Teacher questioning that allows student to explain and clarify thinking</i>	Advancing Questions – Teacher Poses Question and Walks Away <i>Teacher questioning that moves thinking forward</i>	List of Students Providing Response <i>Who? Which students used this strategy?</i>	Discussion Order - sequencing student responses <ul style="list-style-type: none"> ● <i>Based on the actual student responses, sequence and select particular students to present their mathematical work during class discussion</i> ● <i>Connect different students' responses and connect the responses to the key mathematical ideas.</i> ● <i>Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion</i>
Anticipated Student Response: Non - starter	<ul style="list-style-type: none"> ● What do you notice? ● What do you wonder? ● What do you predict the answer might look like? ● What information do you know? 	<ul style="list-style-type: none"> ● What problem solving strategy have you used before? ● How can you organize the information given? ● Can you make a prediction of what the solution might be? 		
Anticipated Student Response: Student draws a picture representing the portion (amount) per batch.	<ul style="list-style-type: none"> ● What does your picture represent? ● How many pictures do you have to draw to represent the problem? 	<ul style="list-style-type: none"> ● How have you used the strategy of drawing a picture before? ● How does your picture represent leftover toppings? What does the fraction represent? 	STUDENT D	
Anticipated Student Response:	<ul style="list-style-type: none"> ● What does the bar model represent? 	<ul style="list-style-type: none"> ● How can you use your knowledge of fractions and whole units to help 	STUDENT A STUDENT C STUDENT F	

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Student uses a bar model to represent one whole cup of toppings. The student divides the bar model to the correct fractional portion for each batch.	<ul style="list-style-type: none"> ● How are you going to use the bar to represent the amount needed per batch? 	you determine the number of batches? <ul style="list-style-type: none"> ● Does your answer make sense? 		
Anticipated Student Response: Students use mathematical sentences to create a representation of the division required for each topping.	<ul style="list-style-type: none"> ● What mathematical operation are you using when determining the number of batches from the total amount? ● Why did you decide to use this operation? 	<ul style="list-style-type: none"> ● How can you check your mathematical work? ● What does the $\frac{1}{3}$ represent on your quotient of $7\frac{1}{3}$ for butterscotch morsels? 	STUDENT B	
Anticipated Student Response: Students use a table to organize their information for number of toppings and number of batches.	<ul style="list-style-type: none"> ● What does each column in your table represent? ● How will you use this to find the number of batches? ● Do you have column titles? 	<ul style="list-style-type: none"> ● How can you use your table to calculate the total number of batches created? ● Did the answer you came up with match what you expected? 		

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Anticipated Student Response: Students use repeated addition to find number of batches.	<ul style="list-style-type: none"> • Explain your work to me. What does each addend represent? • How does your work show you the number of batches? 	<ul style="list-style-type: none"> • What happens if your sum doesn't equal the amount of toppings you started with? • Is the $\frac{1}{4}$ you have left over a fraction of a batch or a fraction of a cup? 	STUDENT E	

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Name _____ Date _____

Cookie Toppings

Hector and Emilio love volunteering at the local bakery. They especially love that the baker allows them to eat the leftover cookie toppings that don't make a full batch of cookies. Chocolate chips, butterscotch morsels, and sprinkles are the featured toppings of the day. The chart below shows the total amount of each topping and the amount needed for one batch of cookies.



Topping	Total Amount	Amount per Batch
Chocolate Chips	$5\frac{1}{2}$ cups	$\frac{1}{2}$ cup
Butterscotch Morsels	$5\frac{1}{2}$ cups	$\frac{3}{4}$ cup
Sprinkles	$3\frac{1}{2}$ cups	$\frac{1}{4}$ cup

- 1) Based on this information, how many batches of cookies can they make with each topping? Show your strategy using pictures, words, and symbols.

Number of Batches		
Chocolate Chips	Butterscotch Morsels	Sprinkles

- 2) Which topping will Hector and Emilio be allowed to eat? What fraction of a cup of that topping will be left over? Provide evidence to support your reasoning.

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NOTE: After the task was piloted in a classroom and anchor papers were scored by a team of teachers, the wording in question #2 was modified as shown on next page. The modified wording assists in clarifying that students understand the difference between a fraction of a batch and a fraction of a cup.

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Rich Mathematical Task Rubric

	Advanced	Proficient	Developing	Emerging
Mathematical Understanding	<p>Proficient Plus:</p> <ul style="list-style-type: none"> • Uses relationships among mathematical concepts 	<ul style="list-style-type: none"> • Demonstrates an understanding of concepts and skills associated with task • Applies mathematical concepts and skills which lead to a valid and correct solution 	<ul style="list-style-type: none"> • Demonstrates a partial understanding of concepts and skills associated with task • Applies mathematical concepts and skills which lead to an incomplete or incorrect solution 	<ul style="list-style-type: none"> • 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	<p>Proficient Plus:</p> <ul style="list-style-type: none"> • Problem solving strategy is efficient 	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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	<p>Proficient Plus:</p> <ul style="list-style-type: none"> • Reasoning is organized and coherent • Consistent use of precise mathematical language and accurate use of symbolic notation 	<ul style="list-style-type: none"> • Communicates thinking process • Demonstrates reasoning and/or justifies solution steps • Supports arguments and claims with evidence • Uses mathematical language to express ideas with precision 	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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	<p>Proficient Plus:</p> <ul style="list-style-type: none"> • Uses representations to analyze relationships and extend thinking • Uses mathematical connections to extend the solution to other mathematics or to deepen understanding 	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Uses no representation or uses a representation that does not model the problem • Makes no mathematical connections