Rich Mathematical Task – Grade *4* – *Camping Combinations*

Task Overview/Description/Purpose:

- In this task, students will identify equivalent measures of liquid volume units to determine possible combinations for packing drinking water.
- The purpose of this task is for students to apply the given equivalent measure of one unit of liquid volume to determine at least two different combinations of containers totaling three gallons.

Standards Alignment: Strand – *Number and Number Sense*

Primary SOL: 4.8d The student will solve practical problems that involve length, weight/mass, and liquid volume in U.S. Customary units.

Related SOL: 3.7b, 4.8c, 5.9b

Learning Intention(s):

- **Content** - I am learning to apply relationships of equivalent measures of liquid volume.
- **Language** - I am learning to use language that describes different combinations of liquid volume equivalent to three gallons.
- **Social** - I am learning to listen and respond to my peers' explanations in ways that move us all forward as math learners.

Success Criteria (Evidence of Student Learning):

- I can identify equivalent measures of liquid volume, given the equivalent measure of one unit.
- I can explain the relationship of equivalent measures of liquid volume to reason about different drinking water combinations.
- I can communicate my combinations for solving using liquid volume language: equivalent, cups, pints, quarts, gallons.
- I can determine at least two different combinations of drinking water and justify my reasoning to my peers.
- I can give specific feedback and use suggestions to clarify thinking.

Mathematics Process Goals

Problem Solving	• Students will determine equivalent measures of liquid volume to create at least two different combinations of packing drinking water. • Students will accurately apply the relationship of one unit of equivalent measure to obtain at least two valid combinations.
Communication and Reasoning	• Students will communicate their thinking process for determining two different combinations of packing drinking water to their learning community. • Students will justify solution process in an organized and coherent matter. • Students will use appropriate mathematical language, including equivalent to, cup, pint, quart, and gallon to express ideas with accuracy and precision.
Connections and Representations	• Students will use an appropriate representation to explore the problem and justify their solution. • Students will describe connections between their representations and the representations of their peers. • Students will connect and/or extend thinking to other mathematical ideas such as equivalent measures of length and weight/mass.

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Task Pre-Planning

Approximate Length/Time Frame: 60 minutes

Grouping of Students: Groups can consist of 2 to 4 students. Teacher should look for opportunities for students to be math leaders and choose student groups that encourage collaboration and perseverance.

Materials and Technology:

- Virtual Implementation Google Slides
- liquid volume measuring tools for 1 cup, 1 pint, 1 quart, 1 gallon
- water
- copy of task
- pencil

Vocabulary:

- liquid volume
- equivalent
- cup
- pint
- quart
- gallon

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

Task Implementation (Before) 10 – 15 minutes

Task Launch:

- The teacher will display the liquid volume measuring tools of 1 cup, 1 pint, 1 quart and 1 gallon and ask students what they already know about these tools. The teacher will record information shared by students on chart paper (or in virtual presentation) and display during task.
- Some important ideas to listen for to support context of problem are:
  - Recognizing units that are less than or greater than another unit
  - Identifying equivalent measures of liquid volume
- Next, students will engage in a Would You Rather routine. To stimulate reasoning, the teacher will ask students to make a choice between two different scenarios and justify their thinking. The teacher will ask, "Would you rather":
  - Have 2 cups or 2 pints of chocolate milk?
  - Have 1 gallon or 4 quarts of lemonade?
  - Have 6 pints or 10 cups of soda?
- The teacher will have a few students share their choice for each and justify their reasoning.
- The teacher will read the task aloud to students alongside the Learning Intentions and Success Criteria. Be sure to review expectations for collaborative work before dismissing into groups. Support materials and manipulatives should be accessible for student use.
- The teacher will ask questions to make sure the task is understood: "What are we trying to figure out?" "What do you already know that can help you get started?" Allow students to turn and talk.

Task Implementation (During) 20 – 30 minutes

Directions for Supporting Implementation of the Task

- Monitor – The teacher will observe students as they work on task and ask assessing or advancing questions as necessary (see *Planning for Mathematical Discourse Chart*).
- Select – Teacher will decide which strategies will be highlighted (after student task implementation) that will advance mathematical ideas and support student learning.
- Sequence – The teacher decide the order in which student ideas will be highlighted (after student task implementation). One suggestion is to look for one common misconception and two correct responses using different strategies to share.
- Connect – The teacher will consider ways to facilitate connections between different student representations.

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Task Implementation (During) 20 – 30 minutes

- As teacher is monitoring, teacher will look strategies that are being used and record on *Planning for Mathematical Discourse Chart*.
- Teacher should use questions to assess or advance student thinking.
- Students should be encouraged to explore different strategies for solving and evaluate effectiveness.

Suggestions for Additional Student Support

May include, among others:

- Sentence frames for supporting student-to-student discourse:
  - I agree/disagree with _____'s strategy because _____.
  - I know that ____ cups/pints/quarts is equal to 1 gallon. Therefore, I know that _____ cups/pints/quarts is equal to 3 gallons.
  - First I am going to _____. Next I will _____. I will know I have solved the problem because _____.
- One equivalent unit of measure for liquid volume
- Liquid volume measuring tools and water to act out problem

Task Implementation (After) *20 minutes*

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:
  - a common misconception;
  - trajectory of sophistication in student ideas (i.e. concrete to abstract)
  - different solutions with reasoning
  - different representation of same solution
- Connect student responses and connect the responses to the key mathematical ideas to bring closure to the task. Possible questions to connect student strategies:
  - How are these strategies alike? How are they different?
  - 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, such as a gallery walk to allow feedback on all strategies.
- Close the lesson by returning to success criteria. Have students reflect on their progress related to the criteria.

Teacher Reflection About Student Learning:

- Teacher will use the *Planning for Mathematical Discourse Chart* (anticipated student solutions) to monitor which students are using specific strategies. This will include: possible misconceptions, learning trajectories and sophistication of student ideas, and multiple solution pathways. Next steps based on this information could include:
  - Informing sequence of tasks. What will come next in instruction to further student thinking in determining equivalent measures of liquid volume?
  - Informing small groups based on misconceptions that are not addressed in sharing.
- After task implementation, the teacher will use the Rich Mathematical Task Rubric criteria to assess where students are in their mathematical understanding and use of the process goals. This could be a focus on one category. Next steps, based on this information, could include informing small groups based on where students are in engagement in the process goal(s).

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Planning for Mathematical Discourse

Mathematical Task: Camping Combinations Content Standard(s): SOL 4.8d

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: **Common misconception* Student determines how many of 1 unit of measure are in 3 gallons instead of using provided numbers of containers.	• I see that you have determined that 48 cups is equivalent to 3 gallons. • How many 1 cup containers does the problem say you can use?	• How can you use your equivalent measure to help you adjust your thinking?		
Anticipated Student Response: Student is unable to start the problem.	• Tell me what you are thinking. • Look at the chart that we made before we started the task. • Share supporting document with 1 equivalent measure • How can this information help you?	• How can you use what you know about 1 gallon to help you figure out a combination for 3 gallons?		
Anticipated Student Response: Student draws "big g" or "gallon man" correctly but is unable to determine equivalent measures.	• Tell me about your representation. • Let's start with 1 gallon. Can you tell me how many cups equal 1 gallon? Pints? Quarts?	• How can you use what you know about 1 gallon to help you figure out a combination for 3 gallons?		

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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 is able to find only 1 combination for packing drinking water.	• Tell me about your representation. • I see you used (quarts and pints) to create this combination. • How many quarts do you have left to use now? Pints? Cups? • Let's record the new amounts of each unit that you have left to use.	• Can you use the same strategy to determine another combination with these containers?		

Name_____ Date_____

Camping Combinations

The Jones family is going camping. They need to bring 3 gallons of drinking water and have the following water containers:

- (6) one quart containers
- (20) one pint containers
- (40) one cup containers

Show at least two different combinations for packing 3 gallons of water.

Choose which combination is best for packing drinking water.

Explain your thinking using pictures, numbers and words.

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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

NAME _____ DATE _____

Equivalent Measures of Liquid Volume

	Cups	Pints	Quarts	Gallons
Cups	- - - - - - - - - - - - - - - - -	1 Pint = __ Cups	1 Quart = __ Cups	1 Gallon = __ Cups
Pints	__ Cups = 1 Pint	- - - - - - - - - - - - - - - - -	1 Quart = __ Pints	1 Gallon = 8 Pints
Quarts	__ Cups = 1 Quart	__ Pints = 1 Quart	- - - - - - - - - - - - - - - - -	1 Gallon = __ Quarts
Gallons	__ Cups = 1 Gallon	8 Pints = 1 Gallon	__ Quarts = 1 Gallon	- - - - - - - - - - - - - - - - -