Rich Mathematical Task – Grade *4* – *Trip Transportation*

Task Overview/Description/Purpose:

- In this task, students will determine number of vans, SUVs, and/or economy cars that will be needed to account for the number of students, teachers, and chaperones.
- The purpose of this task is for students to solve problems involving addition, subtraction, multiplication, and division.
- Students will need to understand how to interpret the remainder in division situations.

Standards Alignment: Strand – *Number and Number Sense*

Primary SOL: 4.4cd The student will

c) estimate and determine quotients of whole numbers, with and without remainders; and

d) create and solve single-step and multistep practical problems involving addition, subtraction, and multiplication, and single-step practical problems involving division with whole numbers.

Related SOLs (within or across grade levels/courses): 3.3, 3.4, 5.4

Learning Intention(s):

- **Content** - I am learning to divide and interpret remainders.
- **Language** - I am learning to use language that describes the remainder in a division situation.
- **Social** - I am learning to listen and respond to my peers' mathematical thinking.

Success Criteria (Evidence of Student Learning):

- I can identify the number of vans, SUVs, and cars needed given constraints of passenger information, chaperone limitations, and allowing for remainders.
- I can explain what a remainder means in the task and can account for it in my solution.
- I can represent the number of vans, SUVs, and cars needed and can justify my reasoning to my peers.
- I can give and accept specific feedback to move my thinking forward.

Mathematics Process Goals

Problem Solving	• Students will determine the number of vans, SUVs, and economy cars needed using addition, subtraction, multiplication, and division. • Students will use the remainder to adjust the solution.
Communication and Reasoning	• Students will communicate their thinking process for determining transportation needed to peers. • Students will justify their solution process in an organized and coherent matter. • Students will use appropriate mathematical language, including sums, difference, products, quotients, and remainder.
Connections and Representations	• Students will use an appropriate representation for division and will justify their choice. • Students will describe connections between their representations and the representations of their peers. • Students will connect and/or extend their thinking to other mathematical ideas such as relating whole numbers to decimals.

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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
- online calculator (optional)
- handheld calculator (optional)
- Base Ten Blocks virtual manipulative (optional)
- Interactive number line (optional)
- copy of task
- blank and/or grid paper
- pencil

Vocabulary:

- sum
- difference
- product
- quotient
- remainder
- estimate

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

Task Implementation (Before) 10 – 15 minutes

Task Launch:

- The teacher will display one of Steve Wyborney's Subitizing Images to get students using some of the language of the task (sums, products) The teacher will give students one minute to observe the quick image and share how they subitized it.
- 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.
- Post Word Wall cards and anchor charts related computation. This may assist students with vocabulary used in written and oral communication.
- Some important ideas to listen for to support the context of problem are:
    - Use mathematical language (sums, difference, product, quotient, remainder)
    - Constraints of the problem (students, teachers, and chaperones; passenger limits)

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 will 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.
    - As teacher is monitoring, teacher will look strategies that are being used and record on *Planning for Mathematical Discourse Chart*.
    - The teacher should use questions to assess or advance student thinking.

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Task Implementation (During) 20 – 30 minutes

- 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:
  - My strategy was similar to _____'s strategy because _____.
  - I know that ____ vans, _____SUVs, _____economy cars are needed because _____.
  - I know that the remainder of ____ will require another _____because_____.
  - First I am going to _____. Next I will _____. I will know I have represented the total number of passengers because _____.
- Calculators, base ten blocks, and interactive number lines can be used to represent the total number of passengers (students, teachers, chaperones).

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 representations of the 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 the transportation needed? What does the remainder mean in the task?
  - 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: Trip Transportation Content Standard(s): SOL4.4cd

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*</br>Student ignores remainder or thinks of it as a decimal.	• I see that you have determined that 12 vans are needed. • Did you have a remainder? What does the .1 mean?	• What does the 109 mean in your problem? • What does the 9 mean in your problem? • How many passengers would 1 van allow for? 5 vans? 10 vans?		
Anticipated Student Response: Student is unable to start the problem.	• Tell me what you are thinking. • Can you restate the problem? What are you trying to figure out? • Can you make an estimate of vans? SUVs? Cars? What do you need more of? Less of?	• How can you use a number line to show the number of passengers in 1 van? 5 vans? 10 vans? • How can you use base ten blocks to show the number of passengers in 1 SUV? 10 SUVs? 20 SUVs? • How can you use a calculator to show the number of passengers in 1 economy car? 10 economy cars? 20 economy cars?		

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		Does this help you make a reasonable estimate?		
Anticipated Student Response: Student uses division to find one way using either all vans, all SUVs, or all economy cars.	• Tell me about your thinking.	• Is this the only combination that would work? What if you used SUVs or economy cars instead of vans? • What if you only had 10 vans available? What would you use instead?		
Anticipated Student Response: Student easily create two or more solutions.	• Tell me about your solutions.	• What combination would allow you the greatest number of chaperones? How do you know? Do you see a pattern?		

Name_____ Date_____

Trip Transportation

The fourth grade won a field trip paid for by a local car rental company. They may use any combination of vans, SUVs, and economy cars. Seating capacity is listed below.

- Drivers are included and not figured into the passenger information.
- There are 87 students and 7 teachers. They may invite up to 15 chaperones.

Vans	SUV (Sport Utility Vehicle)	Economy Cars
Seats 9 passengers	Seats 7 passengers	Seats 4 passengers

Which combination of vans, SUVs, and compact cars would you order? How many chaperones would be invited? Any empty seats?

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