Rich Mathematical Task – Grade 2 – *Mystery Number*

Task Overview/Description/Purpose:

- In this task, students will use place value clues to discover and build a three-digit mystery number.
- The purpose of this task is to deepen students' understanding of place and value of each digit in a three-digit number.

Standards Alignment: Strand – *Number and Number Sense*

Primary SOL: 2.1a) The student will read, write, and identify the place and value of each digit in a three-digit numeral, with and without models.

Related SOL (within or across grade levels/courses): 1.2a, 3.1a

Learning Intention(s):

- **Content** - I am learning how to identify the place and value of digits in three-digit numbers.
- **Language** - I am learning how to read and write three-digit numbers.
- **Social** - I am learning to explain my thinking as it relates to using clues to find a three-digit number. 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 create a three-digit number that meets all of the clues.
- I can identify the place and value of each digit in a three-digit number.
- I can represent the value of a three-digit number using pictures, numbers, and words.

Mathematics Process Goals

Problem Solving	• Students will engage in problem solving as they find a mystery number that satisfies the given clues.
Communication and Reasoning	• Students will communicate their thinking process for representing the value of their mystery number using words, pictures, and numbers. • Students will use appropriate and accurate written and/or oral mathematical language to express ideas about place value with three-digit numbers. • Students will demonstrate sound reasoning and justify their solutions using words, pictures, or numbers.
Connections and Representations	• Students will make connections between the given clues and the possible digits to satisfy each of the clues. • Students will create representations to demonstrate the value of the three-digit mystery number.

Task Pre-Planning

Approximate Length/Time Frame: 45 minutes

Grouping of Students: Students should begin the task independently. After actively monitoring student strategies and responses, the teacher should intentionally 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:	**Vocabulary:**

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Task Pre-Planning

- student task template
- Virtual Implementation Google Slides
- pencils, place value chart
- place value manipulatives (Base-10 blocks, place value discs, etc.)
- place
- value
- digit
- greater than
- less than

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 understand how to use clues to engage in deductive reasoning by showing the picture of a farm (see page 8) and giving students the following information:
  - I am thinking of a mystery object that is in this picture. I am going to give you two clues to help you figure out the mystery object.
  - The first clue is that the object is round. What could it be? What could it NOT be? (Students may say it could be the sun or the wheels on the tractor.)
  - The second clue is that the object is black and gray. What could it be? What could it NOT be? (It could be either the small or large tractor wheel.)

  Discuss how some objects do not fit any of the clues, some objects fit one of the clues, and some objects fit both of the clues. Inform students they will be doing something similar today as they use clues to find a mystery number that Anika created. (The farm picture is from https://cliparts.zone/farm-scene-cliparts.)
- **Ensure understanding of task:** The teacher will read the task aloud to all students. Discuss what information you know from the task. If necessary, provide students with a brief review of place value, including identification of the ones place, tens place, and hundreds place, and the difference between place and value. If students have difficulty getting started, model a similar type of problem using a two-digit number.
  - Say "I'm thinking of a two-digit number. Here are some clues."
  - Clue #1: The ones digit is an odd number.
  - Clue #2: The tens digit is three less than the ones digit.
  - Ask "What could my number be?"
  - Discuss how there could be multiple solutions that meet the criteria in the clues.
- **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).* If students need help to get started, suggest they use a "Guess and Check" strategy to guess a number, then check to see if the number meets the criteria for the mystery number.
- **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*)*.

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Task Implementation (During) 20 minutes

- **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, but different, responses to share.
- **Connect** – The teacher will consider ways to facilitate connections between different student solutions.

Suggestions For Additional Student Support

- Additional support for the task:
  - Have students write and model the numbers 49 and 94.
  - Ask students, "How are these numbers similar? How are they different?"
  - Discuss how the digits are the same, but the order of the digits matters. They are in different places and thus, have different values.
- Sentences frames:
  - The strategy I will use to solve the problem is _____.
  - I put a _____ in the ones place so then I knew that _____.
  - I know my solution works 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 a blank place value chart.
  - Prepare student work space with materials required for task.
- Extension:
  - Are there digits you can't use in the ones place? Tens place? Hundreds place?
  - How many possible solutions can you find that fit all three clues?
  - What if Anika's mystery number had a digit in the hundreds place that was less than the digit in the tens place? How would that change your solution?

Task Implementation (After) *15 minutes*

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

- There are 16 possible solutions to this task. The mystery number could be any of the following: 321, 421, 521, 621, 721, 821, 921, 542, 642, 742, 842, 942, 763, 863, 963, or 984.
- 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 of starting with the digit in the ones place and building the number from there) 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; or

Teacher Reflection About Student Learning:
○ implement this rich mathematical task again using slightly different parameters (i.e. the digit in the hundreds place is less than the digit in the tens place, or the digit in the ones place is double the digit in the tens place).

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Planning for Mathematical Discourse

Mathematical Task: ____Mystery Number_____ Content Standard(s): ____SOL 2.1a___

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."	• What do you know from the first clue? What do you know from the second clue? • How can that help you? • What do you know about place value? • Will you start with the digit for the ones place, tens place, or hundreds place? Why?	• Suggest a "guess and check" approach to find digits that meet the clues. • How could you represent the clues on paper?		
Anticipated Student Response: The student tries to start in the tens place or hundreds place first.	• How has this strategy worked for you? What challenges are you finding? • Think about what you've done so far. Does it satisfy the clues?	• Could you start with a different place?		
Anticipated Student Response: The student's solution does not follow the parameters (i.e. the tens digit is not double the ones	• Read each clue one at a time. Does your number fit each clue?	• How can you adjust your solution so that your mystery number fits each clue?		

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*
digit, or the hundreds digit is not greater than the tens digit).	• What does it mean if the tens digit is double the ones digit? • What does it mean if the hundreds digit is greater than the tens digit?			
Anticipated Student Response: Student creates a correct mystery number, but has difficulty creating an accurate representation of the value.	• What do you know about the relationship between place and value in a number? • What values do the Base 10 blocks represent? • What is the value of the flat? Rod? Unit?	• How could you use manipulative (Base-10 blocks, place value chart, place value discs, etc.) to help you represent the number?		
Anticipated Student Response: Student can find at least one correct mystery number, and is able to accurately represent the value of the mystery number.	• Tell me about your strategy. • How do you know your solution is correct?	• Open-ended: How many mystery numbers can you find and represent? Do you notice any patterns? • There are 16 possible mystery numbers that meet all of the clues. How many of them can you find and represent?		

Name: _____ Date: _____

Mystery Number

Anika wanted her friends to guess a mystery number she created. She gave them the following clues:

- The number has three digits.
- The digit in the tens place is double the digit in the ones place.
- The digit in the hundreds place is greater than the digit in the tens place.

What could be the mystery number Anika created? How could you represent the value of the mystery number using pictures, numbers, or words?

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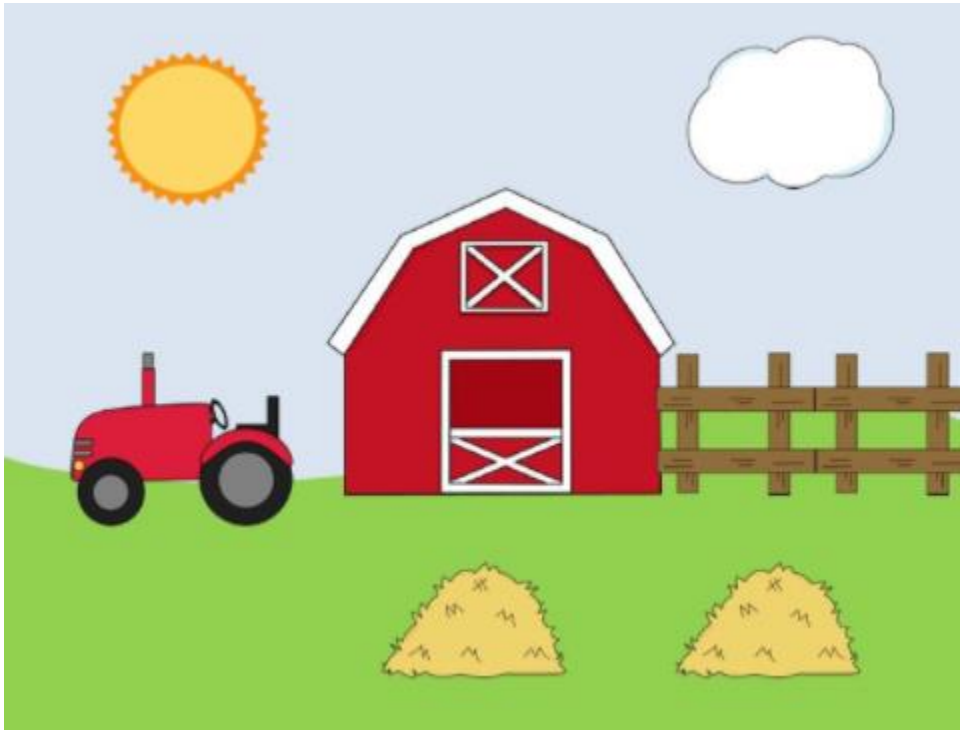
Rich Mathematical Task Rubric

	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

Task Launch: Farm Picture



Farm scene clipart from https://cliparts.zone/farm-scene-cliparts