Rich Mathematical Task – Grade *1 – How can they be equal?*

Task Overview/Description/Purpose:
The purpose of this task is for students to explore and deepen their understanding of the concept of equality. Students will investigate a contextual situation working with digits 1-9 to build an equation that represents the relationship of two expressions of equal value.

Standards Alignment: Strand – ***Patterns, Functions and Algebra***	
Primary SOL: 1.15 The student will demonstrate the understanding of equality through the use of the equal sign. **Related SOL (within or across grade levels/courses):** 1.7, 2.17, 3.17	
Learning Intentions: • **Content** - I am learning to understand the ways mathematical relationships can be expressed and defended. • **Language -** I am learning to understand and use the language and notation to describe equality. • **Social -** I am learning to understand that everyone contributes to our learning and to recognize connections among our reasoning.	
Evidence of Student Learning (based on Essential Knowledge and Skills): • I can describe equality. • I can identify equivalent values and represent equalities through the use of objects, numbers, words and the equal (=) symbol. • I can identify and describe expressions that are not equal (e.g. 2 + 3 is not equal to 3 + 4). • I can recognize that equations can be used to represent the relationship between two expressions of equal value (e.g. 5 + 2 = 3 + 4). • I can model an equation that represents the relationship of two expressions of equal value. • I can use problem-solving strategies.	
Mathematics Process Goals	
Problem Solving	• Students will use problem-solving strategies to explore mathematical expressions using single digits to determine which combinations will produce equal values.
Communication and Reasoning	• Students will orally explain and justify why created expressions are equivalent or equal.
Connections and Representations	• Students will make connections between the operations of addition and subtraction. Students will make connections between expressions and compare their values using concrete and/or symbolic representations.

Task Pre-Planning	
Approximate Length/Time Frame*:* 60 minutes	
Grouping of Students: Following the whole group launch, students will be partnered for this task. Partners work through possible answers, and then individually record their chosen solution.	
Materials and Technology: • counters or connecting cubes • digit cards • operation symbol cards	**Vocabulary:** • equal to • not equal to • has the same value as

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Task Pre-Planning

- balance equation work mat
- pan balance
- copy of task for each student
- greater than, less than
- equation

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

Task Implementation (Before)

Task Launch:

- Introduce task by discussing concept of equality using visual model of pan balance, colored cubes and the equal symbol. What does this symbol (=) mean? Elicit from students different ways we could place combinations of cubes to make the scale balance. How do you know when it's balanced? What does this mean? Record a few responses (e.g. 5 = 5, 4 + 2 is the same or has the same value as 3 + 3)
- Show unequal example; 4 (purple) cubes and 2 (orange cubes) is not equal to 9 (purple cubes). What could we do to make the scale balance? How could we change the group of 9 to make it equal to the group of 6? Model taking away an amount to create a subtraction expression.
- Read task aloud to students. Share with students materials they can choose to work with to help them solve the problem: balance work mat, counters, digit cards, symbols +, - and =).
- Distribute copies of task and have materials accessible for partners.

Task Implementation (During)

Directions for Supporting Implementation of the Task

- Monitor – Teacher will listen and observe students as they work on task and ask assessing or advancing questions (see chart on page 4)
- Select – Teacher will decide which strategies or thinking 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

- Provide sentence frames to support student thinking:
    - Emma's numbers could be _____ because_____.
    - Mike's numbers could be _____ because_____.
    - Emma and Mike's amounts are equal because_____.
- Provide sentence frames to support student justification:
    - _____ is not equal to _____. The answers are different. _______ is more/less than _____ and _____ have the same value as _____.
- Have students act out what they think Mike and Emma are working on. (One partner demonstrating Emma's thinking and the other partner Mike's.)
- If students have difficulty making equivalent expressions, try asking them to choose an equal value for both Mike and Emma. Then challenge students to find a way to create that sum or difference. How could Mike and Emma both get a result of 3?
- Remove constraint of subtraction expression; changing task to Mike and Emma both added the two numbers they selected.
- For students who may need additional examples to support the content of the operations, have a couple of modeled examples available.

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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. Typically start with strategies you think that all students can connect with and share the most complex last. ● As students share, a pan balance could be used to test out student solutions in order to connect symbolic representations with concrete model. When testing an equation that is not true, work with students to make changes so it becomes balanced (equal). How could we change Emma's numbers so she would have the same amount as Mike? ● As students share their work, record student equations that model equality. Discuss solutions and ask questions like: o How did you choose the numbers for this problem? o Did you choose small numbers or big numbers? Why? o Did you start with adding two numbers or subtracting? Why? o Did you find any patterns that helped you? Explain. o How can you convince us that Mike and Emma have equal amounts? o Do you agree or disagree? Why? o Did anyone think about it in a different way? o That was a big math idea, who can restate it? o Is there just one solution to this problem or more than one? How do you know? ● Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion.
Teacher Reflection About Student Learning:
● Use the rich mathematical task rubric to evaluate students' progress toward goals. ● Look at students' work. Did students meet criteria for success in "I can" statements? o Is there understanding of equal symbol or do so students view symbol, as here comes the answer? These students could benefit from work with pan balance and concrete items to demonstrate different ways to create equal amounts. o Did students create expressions that are not equivalent? Work with pan or number balance; share guess and check strategy to create expressions that are equal. o Did students demonstrate the relationship between expressions or create two separate equations resulting in same value? Work to transition into one equation of equality. Ask students to investigate how 4 + 4 = 8 and 9-1 = 8 could be recorded as one number sentence. Posing a series of true /false equations may help advance student understanding (e.g., 4 + 4 = 8, 9 -1 = 8, 4 + 4 = 9 -1, 4 +3 = 9-1). o Were students able to model an equation that represents the relationship of two expressions using addition? Or addition and subtraction? Have expression cards using both addition and subtraction that students could test for equal values (e.g., 7 -3, 3 +1, 8-5, 2 +1).

Rich Mathematical Task – Grade *1 – How Are They Equal?*

Planning for Mathematical Discourse

Mathematical Task: How can they be equal?

Content Standard(s): SOL 1.15

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 Stays to Hear Response** *Teacher questioning that allows student to explain and clarify thinking*	**Advancing Questions – Teacher Poses Question and Walks Away** *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 uses guess and check to test out expressions. Strategies range from randomly guessing numbers – to organized method such as solving one side of the equation then finding numbers that will work for the other side.	• How did you decide which numbers to try? • How did you find numbers that gave Emma and Mike an equal amount? • What did you learn from trying out different numbers?	• What numbers could you change to find another way to make equal amounts for Emma and Mike? • How many different ways do you think there may be to solve this problem?		
Anticipated Student Response Student has expressions that are unequal values (e.g. Emma chose 3 + 5 and Mike chose 5 -3).	• Can you tell me about the numbers you chose? • Can you show me what happened with Emma's numbers? (Mike's) • Does Mike have more than, less than or the same amount as Emma?	• If Mike and Emma have different amounts, what number could you change in order for them to have equal amounts?	Student D	

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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 Stays to Hear Response** *Teacher questioning that allows student to explain and clarify thinking*	**Advancing Questions – Teacher Poses Question and Walks Away** *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 uses operation of addition for both expressions (e.g. 2 + 4 = 5 + 1).	• Can you tell me about your work? • Can retell the problem to me? • What was different about how Mike and Emma choose to work with their numbers?	• What part of the equation shows Mike's subtracting the numbers he chose?		
Anticipated Student Response Student creates two separate expressions but doesn't demonstrate relationship with equal symbol (e.g. Emma chose 4 + 2 and Mike chose 9 -3).	• Can you tell me about your work? • How do you know that Mike and Emma ended with the same amount?	• Is there a way to show this with just one number sentence (equation)?	Student A	
Anticipated Student Response Student creates equation; 4 + 2 = 6 = 9 – 3 = 6	• Tell me about your number sentence? • How does your number sentence match what we see on the balance?	• How might you write this equation using two equal signs? Just one equal sign?	Student C	

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Anticipated Student Response: Student creates an addition and subtraction expression of equal value and models relationship with equal symbol.	• Can you tell me about your work? • How did you figure out that these numbers created equal amounts?	• What other numbers might Emma and Mike have chosen and still have equal amounts? • What's the largest (smallest) possible amount both Mike and Emma could have?	Student E Student B	
Anticipated Student Response: Student has method of organizing more than one solution (e.g. list, table).	• Can you explain how you organized your work? • How did you find more numbers that would work for Mike and Emma to have the equal amounts?	• Did you notice any patterns as you made your list of possible solutions?	Student C	

Name ____________________________ Date ___________________

How can they be equal?

First graders were working with the numbers 1 - 9.

- Emma chose two numbers and added them.
- Mike chose two numbers and subtracted them.
- They both ended with the same amount.

What numbers could Emma and Mike have used?

Show your thinking using pictures, numbers and/or words.

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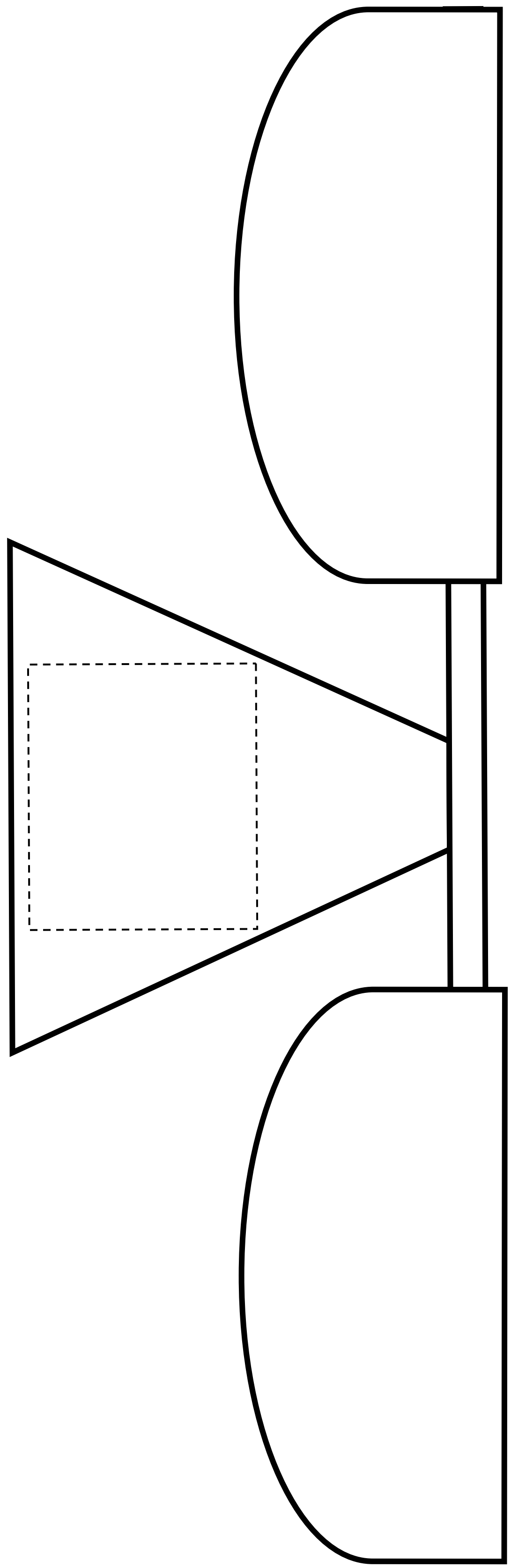
Rich Mathematical Task Rubric

	Advanced	Proficient	Developing	Emerging
Mathematical Understanding	Proficient Plus: • Uses relationships among mathematical concepts	• 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 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	Proficient Plus: • Problem solving strategy is 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	• 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	• 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	Proficient Plus: • Reasoning is organized and coherent • Consistent use of precise mathematical language and accurate use of symbolic notation	• Communicates thinking process • Demonstrates reasoning and/or justifies solution steps • Supports arguments and claims with evidence • Uses mathematical language to express ideas with precision	• 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	• 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	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



Digit Cards

1	1	2	2
3	3	4	4
5	<u>6</u>	7	8
<u>9</u>	=	+	-
+	-	=	5