Task: The Cube Trains Task — 1st Grade

Tom and Sam are making cube trains by connecting colored linking cubes. Tom uses 9 red cubes and 3 blue cubes to make his train. Sam uses some green cubes and 4 yellow cubes. The cube trains have the same number of cubes.

How many green cubes did Sam use in his cube train?

Make a model and write an equation to show the number of green cubes that Sam used in his train. Explain how you know that your answer is correct.

Teacher Notes:

This task asks students to determine the number of green cubes used in a cube train that consists of 12 cubes. This problem involves an “add to” situation with an unknown starting quantity. (See CCSS Glossary p. 88 – Table 1: Common addition and subtraction situations.) Students must determine the number of cubes in the cube train by finding the number of cubes in an equivalent train. Connecting cubes or other manipulatives should be available for students to model the problem; however, students may choose to model the problem with a drawing. Students may be able to determine the number of cubes with the model and may not choose to write an equation. Students should be guided to represent the situation with both a model and an equation and to connect the two representations with an explanation of how they know the answer is correct. Some students may benefit from modeling Sam’s train on a part-part-whole mat.

The solution paths presented in this task focus on equations that could be used to solve this problem. Students may choose many ways to solve the problem, such as: adding to, taking from, putting together, taking apart, comparing, or using a derived fact. Whole group instruction should focus on making sense of the problem, thinking strategies and equations. Whole group discussion can also highlight the meaning of the equal sign as a symbol to indicate equivalence and not a symbol to indicate “and the answer is”. The equation, $9 + 3 = \square + 4$, is presented as a possible solution path but might not be written by a first grade student. This equation could be presented by the teacher during whole group to allow students to explore/discuss.

Common Core State Standards for Mathematical Content	Common Core State Standards for Mathematical Practice
1.OA.A.1 Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem. 1.OA.B.3 Apply properties of operations as strategies to add and subtract.[2] *Examples: If 8 + 3 = 11 is known, then 3 + 8 = 11 is also known. (Commutative Property of Addition.) To add 2 + 6 + 4, the second two numbers can be added to make a ten, so 2 + 6 + 4 = 2 + 10 = 12. (Associative Property of Addition.)*	1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.

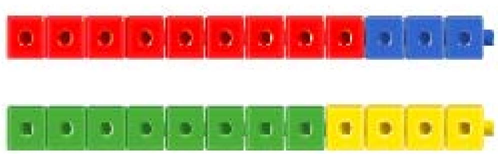
Essential Understandings

- Quantities can be combined, decomposed, and rearranged in any order, but the total number of objects remains the same. (Conservation of Number.)
- Two quantities can be combined in any order and the whole quantity will remain the same because no new items were added and no new items were taken away. (Commutative Property: 9 +3 = 3 + 9)
- Addition and subtraction are inverse operations because two or more quantities can come together and then the whole amount of objects can be taken apart, but the composition of the whole quantity remains the same. (Doing and Undoing, Inverse Operations; 9 + 3 = 12, 12 – 9 = 3)
- Decomposing and recomposing sets in systematic ways can help you solve problems quickly and notice relationships among quantities. (Fact strategies – Make Double, Make a Ten; 9 + 3 = 10 + 2)
- Problems can be solved by counting all, counting on from a quantity, counting on from the largest set, or using derived facts when solving for the whole amount or the missing part of the whole.
- Mapping devises and tools can help you gain a sense of the quantities involved, to notice increases and decreases, and consider the doing and undoing related to addition and subtraction.
- Analyzing a story problem prior to solving it to determine if the result should have more, less or be about the same amount may help you determine if your response is reasonable or if it makes sense.

Explore Phase

Possible Solution Paths

Student models the problem by drawing cubes or using manipulatives.



Student determines that 9 + 3 = 12 and understands that Tom and Sam are both using 12 cubes. Student models the problem with the following equation:

$\boxed{?} + 4 = 12$

Student may use a use a variety of strategies to find the missing addend in this equation. Examples may include: counting up from 4 to 12, subtracting 4 from 12, using a number line, using a part-part-whole mat, etc. Students may also reason that the number of

Assessing and Advancing Questions

Assessing Questions

- Which train represents Sam's train and how do you know?
- How many cubes are in each boy's train and how do you know?
- Describe how you found the solution to the equation.

Advancing Questions

- If the number of Sam's green cubes are the same as Tom's red cubes, how would that change the number of total cubes that Sam has?
- If Tom gives his blue cubes to Sam to add to his train. How many cubes will be in Sam's train now? What equation could you write to show this?

<table>
<tr>
<td>yellow cubes is one less than the number of blue cubes; therefore, the number of green cubes must be one less than the number of red cubes.</td>
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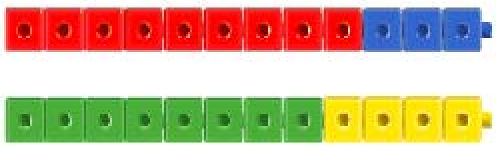
<td>Student models the problem by drawing cubes or using manipulatives.



Student determines that 9 + 3 = 12 and understands that Tom and Sam are both using 12 cubes. Student understands that 4 yellow cubes are used and the difference between 4 and 12 will determine the number of green cubes. Student models the problem with the following equation:

$12 - 4 = \boxed{?}$

Student may use a variety of strategies to determine the missing difference in the equation. Examples may include: counting up from 4 to 12, taking 4 from twelve, using a number line, using a part-part-whole map, etc. Students may also reason that the number of yellow cubes is one less than the number of blue cubes; therefore, the number of green cubes must be one less than the number of red cubes.</td>
<td>Assessing Questions
Which train represents Sam's train and how do you know?
How many cubes are in each boy's train and how do you know?
Why did you use a subtraction equation for this problem?
Describe how you found the solution to the equation.
Advancing Questions
If the number of Sam's green cubes are the same as Tom's red cubes, how would that change the number of total cubes that Sam has?
If Tom gives his blue cubes to Sam to add to his train. How many cubes will be in Sam's train now? What equation could you write to show this?</td>
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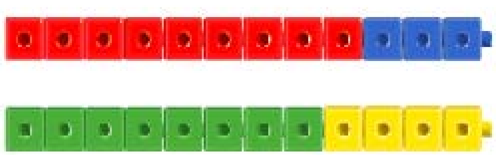</td>
<td>Assessing Questions
Describe why you wrote this equation.
What part of your equation represents Tom's cubes?
What part of your equation represents Sam's cubes?
Advancing Questions</td>
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Student models the problem with the following equation: $9 + 3 = \boxed{?} + 4$ Student determines that 8 green cubes are needed so that the number of green and yellow cubes is equal to the number of red and blue cubes. Students may also reason that the number of yellow cubes is one less than the number of blue cubes; therefore, the number of green cubes must be one less than the number of red cubes. This equation could also be modeled with a balance scale. The balance scale will allow students to see that the number of red and blue cubes is the same as the number of green and yellow cubes. This equation allows for the discussion of the meaning of the equal sign as a symbol to present equivalence and not a symbol to mean "and the answer is".	• If someone thought that the missing addend was 12, how could you show them that this could not be correct? • How would the equation change if Sam had 5 green cubes and some yellow cubes but his total number of cubes is still the same as Tom's?
Possible Student Misconceptions	
Student does not recognize that each child has 12 cubes and attempts to find the number of green cubes by adding 9 + 3 + 4.	Do you think it is possible for Sam to have more than 12 cubes? Why or why not?
Student finds the number of cubes in Sam's train to be 12 and misinterprets the total number of cubes in the train to be the number of green cubes.	How many cubes does Sam have altogether? How do you know?
Student models the story problem with the equation: $9 + 3 = \boxed{?} + 4$ Student has the misconception that the equal sign means "and the answer is" and incorrectly completes the equation to show that the 9 + 3 = 12 + 4.	What is 9 + 3? What is 12 + 4? Is it true that 9 + 3 = 12 + 4?
Entry/Extensions	**Assessing and Advancing Questions**
If students can't get started….	How many red cubes does Tom have? How many blue cubes does Tom have? How many total cubes does Tom have? How many cubes does Sam have altogether?

If students finish early….	Sam and Tom build a new cube train with pink and white cubes. The train has the same number of cubes as the other trains but has 3 less pink cubes than the number of green cubes in Sam's train. How many pink cubes and how many white cubes are in the new train? If Tom and Sam build a cube train that is twice as long as the red and blue train, how many cubes are in the new train?
Discuss/Analyze	
Whole Group Questions	

- How can I find the number of cubes in Tom's train?
- How can both an addition and a subtraction equation be used to find the number of green cubes that Sam has?
- Model the addition and subtraction equations on the number line. How are they alike and how are they different?