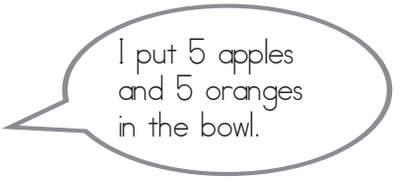
Apples and Oranges

Sasha is filling a bowl with apples and oranges.



Is there another way to fill this bowl with apples and oranges and have exactly 10 pieces of fruit in it?

YES NO

Explain your answer. Write number sentences to show your thinking.

Teacher Notes: Apples and Oranges

Questions to Consider About the Key Mathematical Concepts

Are students able to determine all of the ways in which two numbers can be combined by addition to give a sum of 10? To what extent do they

- apply understanding of quantity, part–whole relationship, and compensation?
- represent sums of ten by writing number sentences?

Common Core Connection (1.OA)

Grade: First

Domain: Operations and Algebraic Thinking (OA)

Clusters:

A. Represent and solve problems involving addition and subtraction.

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.

B. Understand and apply properties of operations and the relationship between addition and subtraction.

1. OA.B.3. Apply properties of operations as strategies to add and subtract. 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).

C. Add and subtract within 20.

1. OA.C.5. Relate counting to addition and subtraction (e.g., by counting on 2 to add 2).

Uncovering Student Understanding About the Key Concepts

Using the Apples and Oranges Probe can provide the following information about how students are thinking about combining numbers to make a sum of 10.

Do they

- use knowledge of addition fact families to find sums of ten?

OR

Do they

- think there is only one way to make a sum of 10?

Do they		*Do they*
• understand compensation—the idea that in order to maintain the quantity of a set, if I increase the quantity of one addend by one, I must decrease the quantity of the other by one?	OR	• increase one quantity without decreasing the other quantity?
• apply an understanding of the problem context—6 apples and 4 oranges is different from 4 apples and 6 oranges?	OR	• identify sums of numbers without consideration of the problem context?

*E*xploring Excerpts From Educational Resources and Related Research

Common areas of difficulty and development for students:

The big idea of hierarchical inclusion leads to two more big ideas: compensation and part/whole relationship. "Once children construct an understanding of hierarchical inclusion they can begin to consider compensation." (Fosnot & Dolk, 2001, p. 36)

"If 6 + 1 = 7 then necessarily 5 + 2 = 7 as well, because while one more has been removed from the six, it has been added to the one—compensation. . . . As this idea of compensation is extended to generate other ways to make 7, a deeper understanding of the relationship of parts to whole is constructed. If 5 + 2 = 7. Then 7 – 2 = 5." (Fosnot & Dolk, 2001, p. 36)

"Part-whole understanding of number provides a stronger conceptual base for addition and subtraction strategies. . . . Children in a kindergarten study transferred their part-whole knowledge to the solution of simple addition and subtraction word problems, with twice as many problems solved than by children taught to count by ones." (Jensen, 1993, p. 51)

"One of the most important reasoning strategies for basic facts is to make use of known facts to derive other basic facts. Other facts are often built on knowledge of the facts that sum to ten. Students who do not gain this skill are at a significant disadvantage when learning facts with the sums eleven through eighteen and when computing with greater numbers." (Dacey & Collins, 2010, p. A16)

*S*urveying the Prompts and Selected Responses in the Probe

This Probe consists of one yes/no prompt with a supporting explanation. The item is designed to elicit understandings and common difficulties as described below.

If a student chooses	*It is likely that the student*
No	• does not understand part–whole relationship or conservation. • does not understand the problem-solving situation given.
Yes (correct answer) A = apples R = oranges 10 A + 0 R = 10 0 A + 10 R = 10 9 A + 1 R = 10 1 A + 9 R = 10 8 A + 2 R = 10 2 A + 8 R = 10 7 A + 3 R = 10 3 A + 7 R = 10 6 A + 4 R = 10 4 A + 6 R = 10 5 A + 5 R = 10	• recognizes that there is more than one way to fill a bowl with apples and oranges to make a total of 10 items in the bowl. • *If the student's explanation includes all the possible number sentences, it is likely that the student* ○ understands conservation and addition fact families. ○ can systematically identify all of the pairs of numbers that add to 10. ○ recognizes that 10 apples and 0 oranges, and 0 apples and 10 oranges, are also possible combinations.

*T*eaching Implications and Considerations

Ideas for eliciting more information from students about their understanding and difficulties:

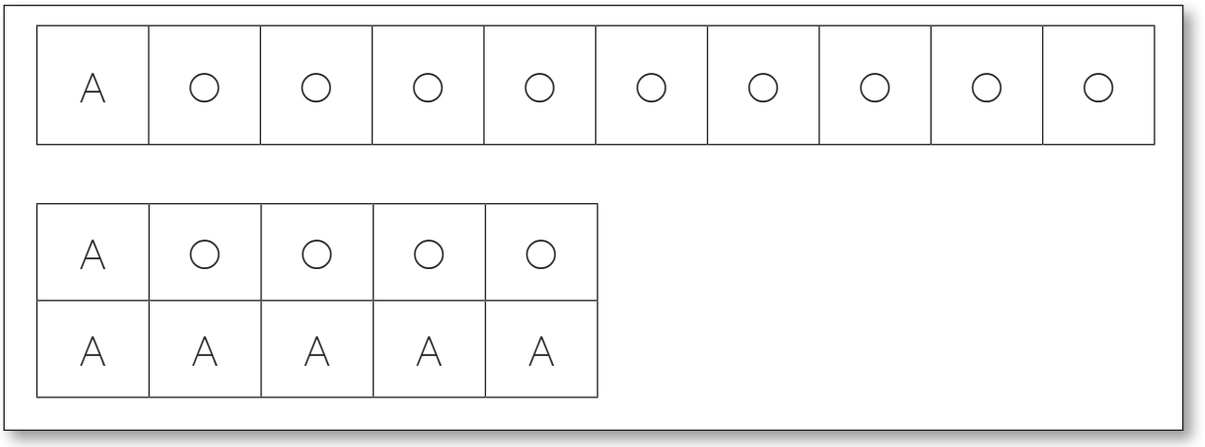
- For students who determined there is more than one way to fill the fruit bowl, ask,
  - How did you determine the ways that Sasha could fill the fruit bowl?
  - How do you know that you have found all of the ways that Sasha can fill the bowl?
- If the students struggled to find multiple combinations of apples and oranges, offer a simpler example to see if they approach the task any differently:
  - If Sasha wanted to put a total of only 5 pieces of fruit in the bowl, how many ways could she fill the bowl?

Ideas for planning instruction in response to what you learned from the results of administering the Probe:

- Provide concrete materials, such as a collection of orange counters, cubes, or tiles to represent oranges and a collection of red counters,

cubes, or tiles to represent apples. Ask students to build the different combinations of apples and oranges that Sasha could put in the bowl. Physically building may help students make sense of the context and identify the combinations they have missed.

- Provide a template with two rows of 5 blocks or one row of 10 (see example below) to help students organize and record information. These can help them to see patterns that they might use to determine if they have found all of the combinations.



Sample Student Responses to Apples and Oranges

Responses That Suggest Difficulty

Sample Student Response 1

Student circled no and wrote, "Sasha can fill the bowl with 5 apples and 5 oranges because 5 + 5 equals 10. Or else there will not be 10."

Sample Student Response 2

Student circled yes and wrote

5 + 5 = 10

6 + 4 = 10

3 + 7 = 10

8 + 2 = 10

1 + 9 = 10

Apples and Oranges Variation

4.1V

Sasha is filling a bowl with fruit.

She has some apples,

and she has some oranges.

Sasha wants to have exactly 10 pieces of fruit in the bowl.

Three students were working on this same problem.

Maddie

There are 5 ways that Sasha can have 10 pieces of fruit in the bowl.

Pat

There are 11 ways that Sasha can have 10 pieces of fruit in the bowl.

Chris

There is 1 way that Sasha can have 10 pieces of fruit in the bowl.

Who do you agree with?

☐ I agree with Pat

☐ I agree with Maddie

☐ I agree with Chris

☐ I don't agree with any of them

Now, write down all the number sentences that show why you agree.