

Candy Boxes

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To see a video clip of this lesson being implemented in a third grade classroom go to [The Candy Boxes Problem - Third Grade](#).

Summary	This class centers on the possible amounts of candies two children, John and Maria, have. They each have the same, unspecified number of candies inside their own candy box. John has, in addition, one extra candy and Maria has three extra candies. What are the possible total candies they might have?
Goals	Work with variables, function tables, and algebraic representations for variables.
Materials	Two Opaque Boxes that hold up to 100 candies (Plastic Card File Boxes also work) labeled with the names of their owners (John, Maria), Individually Wrapped Hard Candy (i.e.: Jolly Ranchers), Rubber Bands (to help keep the boxes closed), Handouts, Overheads
Keywords	Contextualized Situations Interpretation of Stories Full Class Discussion Function Representations Production of Algebraic Expressions Production of Tables Representing Variables Small Group Work
Foci	Variables and Function tables; Symbolic notation for variables as standing for the possible amount in a box and to represent John's and Maria's functions; The difference between two additive functions is constant: for any possible amount in the box, the difference between John's and Maria's amounts is always 2; Representing the situation in words, pictures, or symbols, from the point of view of John or Maria (Maria always has 2 more than John, John always has 2 less than Maria).

Introduction:

1. John's amount is a function of the number of candies in the box. If the amount in the box is n , his total is $n+1$. So $f(n)=n+1$ is the function. Another way to express this is through mapping notation: $n \rightarrow n+1$.

Maria's amount corresponds to the function $f(n)=n+3$.

n refers to the number of candies in a box, whatever that number is. Although n stands for any possible number, we cannot say that John has n candies because that will suggest that he has as a total only what is in the box.

Likewise, we cannot refer to Maria's candies as n (if we are already using the n to signify the number of candies in the box.) If n were used for all three of these purposes (candy in box, John's candy, Maria's candy) this would give the incorrect idea that each of the values were the same.

2. It is totally arbitrary which letter we use to represent the unknown amount in a box. But once that letter is assigned a meaning, we can't continue to use it arbitrarily.

3. Don't expect students to spontaneously produce the idea of using a letter to represent a variable. However, it may happen that one or two students will wish not to make a prediction, or to use a question mark or line segment to represent the amount in the box. These cases are opportunities for bridging to the convention of using a letter for a variable.

Activity Plan:

Comparing the Boxes

1. Comparing the Amounts [Whole Class]

Show two identical boxes of candies, said to be John's and Maria's. Put a single candy on top of John's and 3 extra candies on top of Maria's (possibly in ziplock bags or taped to the boxes to avoid dropping them repeatedly), and explain:

John and Maria each have a box of candies.

The two boxes have exactly the same number of candies in them.

John's box has one extra candy on top of it.

Maria's box has 3 extra candies on top of it.

What can we say about how many candies they have?

Talk about the problem with the class. What do they know about how many candies John and Maria each have? What can they say? What do they know for certain? What can they say about the *difference* between their amounts?

2. Representing the problem [Group Work]

Distribute the class handout (page 1) and ask the children to write and/or draw what they know about the boxes in their handouts.

Go around and observe varieties of answers in handouts. Jot down names of four or five children whose examples will later be discussed. Some possible representations include:

- Iconic instantiations (e.g., drawings of 6 candies for John, 8 candies for Maria).
- Numerical instantiations (e.g., John has 6, Maria has 8).
- Line segments representing diverse amounts.
- Symbolic (Question marks used for the amount in each box).

Put examples from children on board. Focus on:

- How children have represented differently the amounts for John and Maria.
- How the difference between John's amount and Maria's amount is represented.

Show two vertical line segments on the blackboard and ask which one might stand for John's amount, which for Maria's amount.

3. A Table of Possible Values [Whole Class]

Refer to students' suggested amounts for John and Maria not as predictions but as possible values. We want to downplay the notion that we're trying to guess the single correct value.

Present the table of possible values using the overhead on page 2 to the class. Explain that their job is to tell us how many candies they think could be in each box.

Write each student's name in the first column, on the respective row. That way, you can refer to the different row's as "Paul's prediction", "Susan's prediction" etc. As "predictions" are entered make sure to note whether some students think others' "predictions" are not sensible or possible and ask them to explain their disagreements.

For each prediction, ask the students to state how many candies, in total, John would have, and how many candies Maria would have. Write these amounts in the appropriate cells, sometimes as a total, sometimes as the guessed amount plus 1 for John and the amount plus 3 for Maria.

If there is an inconsistency in the number presumed to be in the box, allow a student to change the answer. Strike through the original number suggested (leaving it on the overhead) and place the new value next to it.

After the table has been tidied up, ask students to state whether they see any pattern. Carefully try to assess the pattern they are trying to articulate. Eventually, if not right away, some students will come up with the idea that Maria will always have 2 more than John, and John will always have 2 less than Maria. Refer to this as the difference in their amounts. But if the students use other expressions that are consistent with the mathematics, you can use those also.

Discuss what they see in the table. Ask them, "How could we make them have the same amount?"

Explain that since we don't know yet how many candies are in each box, we are going to say that there are n candies and ask:

What can we write about the total number of candies that Maria has? $[n+3]$

If n is the number of candies in a box, what can we write about the total number of candies that John has? $[n+1]$

Wait for answers, discuss them, and guide the children to propose and/or to adopt notation with a letter standing for the amount in a box.

4. Other contexts [Whole Class]

Ask the children:

*What if the table were about John's and Maria's **heights**?*

Can you think of other stories? [Possible contexts are money, ages, number of siblings (brothers and sisters), how many miles they live from the school, someone's marbles before and after playing, etc.]

5. Present homework for students [Whole Class]

Display the homework (Page 3), explain what it is about and what you expect the students to do.

Overhead and Handout: Representing John and Maria's Candies (Page 1)

Name: _____ Date: _____

John and Maria each have a box of candies.
John has a box of candies and one extra candy on top.
Maria has a box of candies and three extra candies on top of hers.
The two boxes have exactly the same number of candies in them.

Draw or write something below that compares how many candies John and Maria have.

Overhead and Homework

(Page 3)

Name: _____ Date: _____

Talita and Jose have the same birthday (July 15).
But Talita is exactly 5 years younger than Jose.

Complete the table for Talita's and Jose's ages

How old will Jose be when Talita is 7 years old?

Show here how old Talita will be when Jose is 7 years old.

Jose's age	Talita's age	The difference between their ages
7		
	7	
8		
	10	
10		
	15	

Extra credit:

Let's use the letter k to mean: Jose's age.

If Jose is k years old, how many years old will Talita be?
