

Two of Everything or The Magic Pot

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CONCEPTS: Algebra and Functions, Mathematical Reasoning

SKILLS: Thinking algebraically, identifying and describing patterns, determining function rules, presenting information in table form, translating from everyday language to mathematical notation, writing algebraic expressions

MATHEMATICS STANDARDS: Gr 2: AF 1.0, 1.2, 1.3, MR 1.0, 2.0, 2.1, 2.3, 3.0; Gr 3: AF 1.0, 1.1, 1.2, 2.0, MR 1.1, 2.3, 2.4; Gr 4: AF 1.0, 1.1, MR 1.1, 2.3, 2.4; Gr 5: AF 1.0, 1.2, MR 1.1, 2.3, 2.4

GRADES: 2–5

MATERIALS: *Two of Everything* by Lily Toy Hong; large bowl, pot, or paper bag; two identical bags of “gold” coins, two identical hairpins, two each of other items to put into the pot; construction paper, markers, blank copy paper, Student Activity Sheet (page 49)

INTRODUCTION

In Lily Toy Hong’s *Two of Everything* the main character, a poor farmer named Mr. Haktak, finds a pot buried in his garden. He takes it home to Mrs. Haktak to see if she might be able to find a use for it. While he struggles to carry the pot home, his coin purse containing his last five gold coins falls to the ground. He picks up the purse, drops it into the pot, and makes his way home. Once home, Mr. Haktak shows the pot to Mrs. Haktak. When she peers into the pot, her one and only hairpin falls in. When she reaches in to retrieve her hairpin, she finds two identical hairpins in the pot. She also pulls out two identical coin purses, each containing five gold coins!

As the story continues, the Haktaks discover that they have indeed found a magic pot—a pot that doubles whatever is put into it. This causes a bit of worry after Mrs. Haktak falls into the pot, but the clever Haktaks find a way to resolve this problem and eventually live happily ever after.

I have found the story of the Haktaks and their magic pot to be a nice twist on the typical function machine. It also gives meaning to

the commonly used Input/Output table since, in the story, one quantity goes in the pot and another quantity comes out.

PREPARATION

Before reading *Two of Everything*, prepare your own “magic pot” by placing one bag of gold coins, one hairpin, and one each of a few other items inside a large bowl, pot, or decorated paper bag. I use a large plastic Halloween cauldron for my magic pot. Trader Joe’s sells small purses filled with chocolate coins, and most drug stores sell inexpensive hair clips.

PROCEDURE

Reading the Story

Make sure the pot is handy while you read the story so you can demonstrate the first few items that the Haktaks put inside. When you get to the part of the story where Mr. Haktak throws his purse into the pot, put the second bag of gold coins into your pot. When you read that Mrs. Haktak’s hairpin falls in, drop the second hairpin into your pot.

As you read Mrs. Haktak’s exclamation, “Look! I’ve pulled out TWO hairpins exactly alike, and TWO purses, too!” reach into the pot and pull out the two hairpins, putting one in each hand to show the original and the exact duplicate, and then the two purses, again putting one in each hand.

As you continue with the story, discuss all of the items that the Haktaks (intentionally or not) put into the pot and how each time the original item or items come out, plus an exact copy.





The In/Out Table

Once you have finished the story, introduce students to the In/Out table by writing a T-table on the board and labeling the left column “What goes in the pot” and the right column “What comes out of the pot.”

Ask students what information they think will go in each column, stressing that the left column shows what goes into the pot (input)

and the right column shows what comes out of the pot (output). Ask students for examples from the story to fill in the chart. Once they have named all of the things from the story, ask for other ideas of what they could put into the pot and what would come out of the pot.

Mr. Haktak's Pot

What goes in the pot	What comes out of the pot
 1 hair clip	 2 hair clips
 5 coins	 10 coins

After you have discussed the items from the story, introduce students to a second chart that uses numbers. Ask for many examples of inputs and outputs to help students recognize the rule for Mr. Haktak's pot.

Mr. Haktak's Pot

In	Out
1	2
2	4
3	6
4	8
5	10
6	12

What's the Rule?

After the chart is filled in, have students talk among themselves and describe the "magic" of the pot. To help get them started, ask them questions such as, "What does this pot do?" "What is the rule for this magic pot?" and "How would you describe what is magical about the Haktak's pot?"

After the students have talked about the "magic" of the pot, ask volunteers to share ideas about what is shown on the In/Out chart. Students are likely to say things such as "It doubles it." "Whatever goes in gets multiplied by two." "You always get a match." and "If you put four in, you'll get eight out." Encourage students to describe the rule in as many different ways as they can and write the exact words the students use on the board.

Are All the Rules the Same?

After you have written down students' descriptions of the rule for Mr. Haktak's pot ask, "Are all these rules the same? If we put five coins in the pot, does it matter whose rule we use to find out how many coins will come out?"

Verify that all the rules are mathematically equivalent by using them to determine the output number. For example, if a student suggests doubling, ask "If we put five coins in the pot and then double them, how many coins will come out?" Follow this with another rule, such as multiplying by two, by asking, "If we put five coins in the pot and then multiply by two, how many coins will come out?" Students should see that no matter which version of the rule is used, the resulting output will be double the input.

The Rule as an Algebraic Expression

Once you have completed your discussion of the different rules, work with students to translate their verbal descriptions into expressions that use mathematical symbols. At this point you will want to introduce the idea of how to express the rule for *any number*. For example, using the rule "Whatever goes in gets multiplied by two," ask students how they could express each part of the description. "Whatever goes in" can be translated to *any number* or n , "gets multiplied" gets translated to \times , and "by two" becomes 2. The new, symbolic version of the rule is now $n \times 2$.

To further help students develop their understanding of mathematical notation, you may want to tell them that mathematicians would express this as $2n$, which is a shortcut way to write $n \times 2$. For the rule "You always get a match," the expression could be written as $n + n$, since you always have the original number that you put in the pot (the first n), and (+) an exact match (the second n).

Another Pot

Once students are comfortable using words and symbols to describe the rule for Mr. Haktak's pot, introduce them to Mr. Haktak's friend, Mr. Hong. Tell students that Mr. Hong also found a pot in his garden and hoped that it was magic like Mr. Haktak's pot. To find out if his pot was also magic, Mr. Hong put one

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coin in his pot and, when he checked, pulled out three coins.

Ask students to describe the rule for Mr. Hong's pot. Based on Mr. Haktak's pot, many students may suggest that Mr. Hong's pot multiplies whatever goes in by three. Ask students if there are any other possible rules for Mr. Hong's Pot. If no one suggests "adding 2," tell the students that Mr. Hong put his three coins back into the pot and this time took out five coins. (It is important for students to understand that it is not possible to determine the rule with certainty with only one input/output pair.)

Start a new T-table for Mr. Hong's pot and encourage students to use words to describe the rule, and then to translate the words into symbolic notation.

Mr. Hong's Pot

In	Out
1	3
3	5
5	7
7	9
9	11
11	13
n	$n + 2$

Students' Magic Pots

After students have discussed the rule for Mr. Hong's magic pot, pass out paper and have students create their own In/Out charts. Tell them to choose a rule and create a T-table, filling in at least six rows that show both the inputs and the outputs.

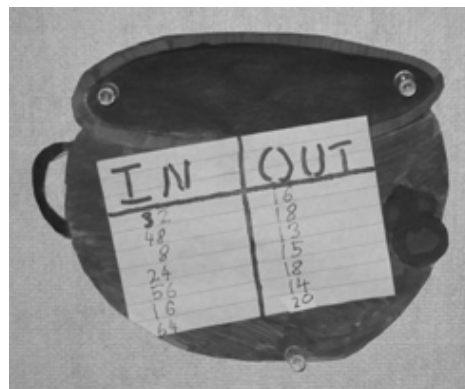
After students fill in six rows of their charts, have each student trade papers with another student and then try to figure out each other's rules. This is a perfect opportunity for students to provide their own level of differentiation. Some students will stick with a simple rule, such as $n + 5$ or $10n$, while others may choose to challenge themselves with a rule like n^3 or $7n - 1$.

Another way to increase the level of challenge is to ask students to create pots with a mixture of missing inputs and outputs. (Make sure these pots include at least two complete input/output pairs so the rule can be determined.)

In	Out
1	3
3	7
5	15
9	
11	23

Decorating a Magic Pot

Once students have completed their own In/Out charts, give them a "magic pot" to decorate.



Have them glue their chart on the pot and then put them up for display. Instead of putting the rules next to the matching pots, scatter them around so that others can try to match the rules with the pots.

Number the pots and provide students with the Student Activity Sheet (page 49) to use for recording which rule goes with which pot. Your students will enjoy challenging each other and having their work included as part of the mathematics curriculum.

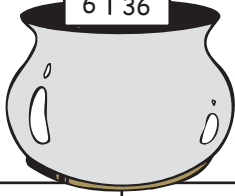


Reference

Hong, Lilly T. *Two of Everything: A Chinese Folktale*. Morton Grove, IL: Albert Whitman & Company, 1993.

Student Activity Sheet, page 49 . . .

In	Out
2	4
4	16
6	36



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In	Out
1	2
3	6
5	10



Pot Number	Rule
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	

Pot Number	Rule
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	