

Various Variables

Purpose

Students will use symbols to write any number and understand that an equation can be used to describe a rule for finding a second number when a first number is given.

Materials

For the teacher: medium-size cardboard box, construction paper, blank $3\frac{1}{2} \times 5$ " index cards, blank $8\frac{1}{2} \times 11$ " paper, tape

For each student: copy of Black Line Master (BLM) *Equation Rules*

Activity

A. Pre-Activity Preparation

- Create a "function machine" from a cardboard box.
 - Cut the back of the box open for ease of operation.
 - Cover the sides and front of the box with construction paper.
 - Cut slits in the left and right sides of the box. Make the slit large enough to slide the index cards through easily.
- Prepare the index cards with several "input" numbers on which to perform the functions as well as the numbers that will be "output" when the function is performed (e.g., if the function is "+ 4," you might input 2, 18, 35 and output 6, 22, and 39). Use four or five different functions that include a variety of arithmetic operations.
- Write the function in various forms (e.g., "+ 4," " $\square + 4$," " $y = x + 4$ ") on $8\frac{1}{2} \times 11$ " pieces of paper, which you will tape to the front of the "function machine."

B. Introduction

- Ask students to think of a number (not too large!). Tell them to double it and then add 10 to the result. Have them to halve that result and then subtract the number they first thought of.
- Ask several students to tell the class their answer. (All should say 5.) Ask for a show of hands to see who else obtained 5.
- Ask several students what number they started with. (These will vary.)
- Ask the class how all these different starting numbers could end up at the same result. (Answers may refer to doubling and then halving or to "subtract the number you first thought of.")

(continued)

MEETING INDIVIDUAL



NEEDS

For students having difficulty understanding the use of x and y , spend more time using boxes to represent variables.

INCORPORATING



TECHNOLOGY

Have students use a spreadsheet program to emulate a function box by creating input/output columns for several different functions.

Activity (continued)

5. Tell the class that you have thought of a number, but you won't tell them what it is. In fact, you are going to hide it in a box (\square). Then repeat the instructions in step 1 and write as you say each instruction: \square $\square \square$ $\square \square + 10$ $\square + 5$ 5
6. Show students how these symbols represent your instructions and that they make it clear why you always finish with the answer 5 for any number you hide in the box.

C. Group Activity

1. Divide students into groups of three or four.
2. Have students make up their own “think of a number” tricks and try them on their group. (These could include just changing 10 into another number or replacing addition by subtraction.)
3. Have students use boxes to explain how their tricks work.

D. Class Activity

1. Tell students that you are now going to use a different kind of box to look at rules for changing numbers.
2. Set up the “function machine” and put some numbers through it until students work out the rule.
3. Tape the rule in the form (e.g., “+ 4”) on the front of the box.
4. Tell students that this can be made clearer by including the input number in the rule. Tape the rule in the form (e.g., “ $\square + 4$ ”) on the front of the box. Explain that the box here means just what it did earlier: it stands for any number.
5. Explain that mathematicians use letters instead of boxes and also give a name to the output number. Tape the rule in the form (e.g., “ $y = x + 4$ ”) on the front of the box and show how input numbers x turn into output numbers y when you use this equation.


E. Individual Practice


Give students the BLM *Equation Rules*, explain what they are to do, and have them complete it.


Questions for Review

Basic Concepts and Processes

During the activity, discuss the following questions with students to gauge their understanding of the indicators:

 Tell me what your trick is.

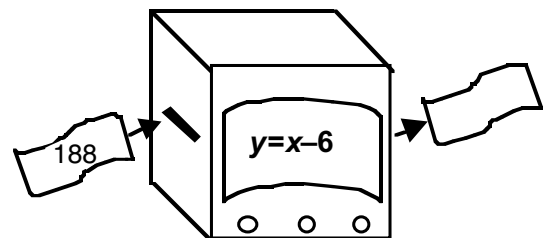
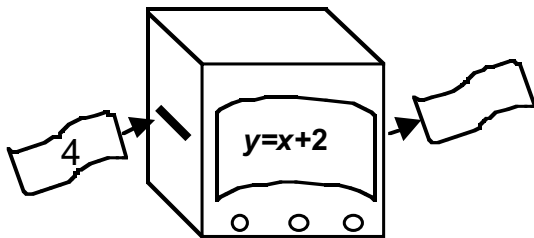
 Show me how it works.

 What does this equation tell you to do with the input number?

Name: _____

Equation Rules

What number would come out of the function machines below?
Write the answer on the paper leaving the machine.

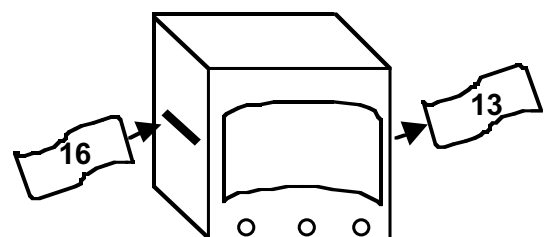
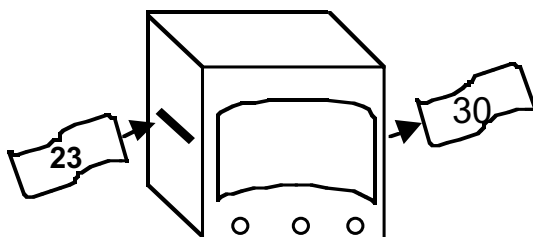


Using the function machines above, find the missing numbers and write them below:

Number going into machine	Number coming out of machine
8	
12	
	20

Number going into machine	Number coming out of machine
235	
50	
	158

Find the missing functions for the function machines below. Write the function on the front of the function machines, using an equation.



Number going into machine	Number coming out of machine
5	12
51	58
130	137

Number going into machine	Number coming out of machine
32	29
40	37
4	1

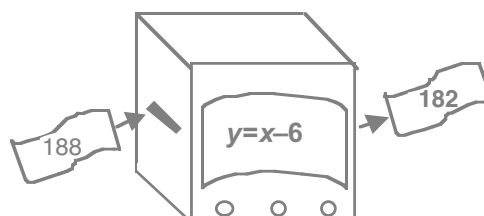
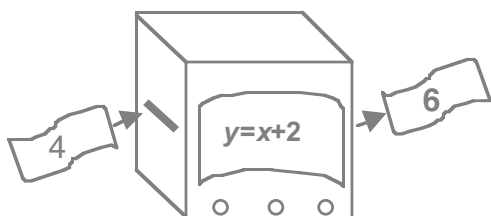
Equation Rules

Teacher Directions

Have the students find the missing numbers and functions from the function machines pictured. Instruct them to write the numbers on the function machine pictures or in the tables as instructed.

Answer Key

What number would come out of the function machines below?
Write the answer on the paper leaving the machine.

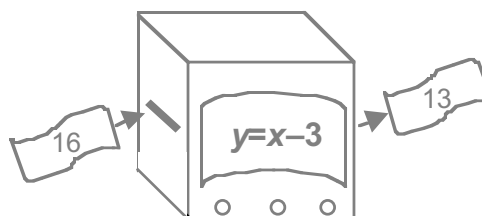
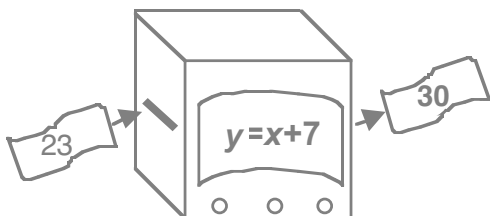


Using the function machines above, find the missing numbers and write them below:

Number going into machine	Number coming out of machine
8	10
12	14
18	20

Number going into machine	Number coming out of machine
235	229
50	44
164	158

Find the missing functions for the function machines below. Write the function on the front of the function machines, using an equation.



Number going into machine	Number coming out of machine
5	12
51	58
130	137

Number going into machine	Number coming out of machine
32	29
40	37
4	1