Name:_____ Date:_____ Period:_____

Function Box

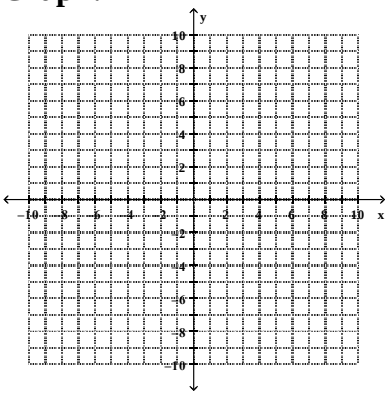
For each round of the function box, do the following:

a) Record the Input and Output values in the table.
b) Predict what the output will be after each input is shared.
c) Graph the data.
d) Determine if the machine is "working," and if possible, state the rule.

1. **Table:**

Input	Output

Graph:



Function and Rule:

Is the machine working? YES NO

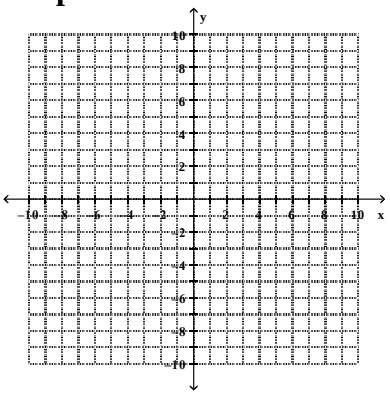
What is the rule?

_____

2. **Table:**

Input	Output

Graph:



Function and Rule:

Is the machine working? YES NO

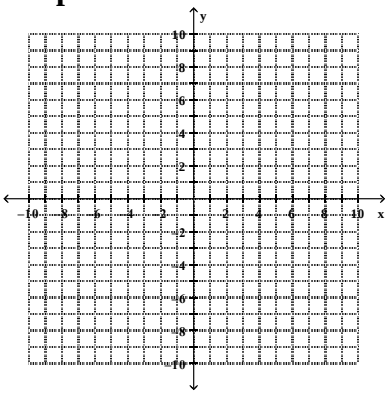
What is the rule?

_____

3. **Table:**

Input	Output

Graph:



Function and Rule:

Is the machine working? YES NO

What is the rule?

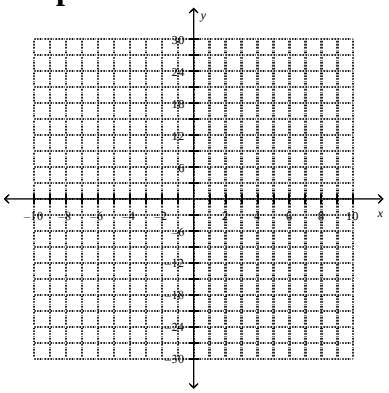
_____

Name:_____ Date:_____ Period:_____

4. **Table:**

Input	Output

Graph:



Function and Rule:

Is the machine working? YES NO

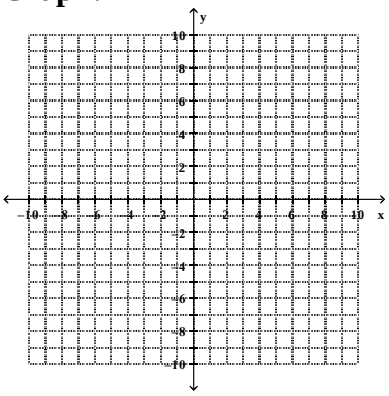
What is the rule?

_____

5. **Table:**

Input	Output

Graph:



Function and Rule:

Is the machine working? YES NO

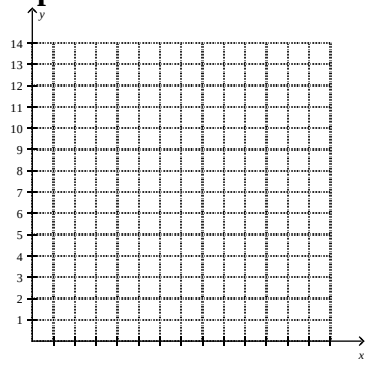
What is the rule?

_____

6. **Table:**

Input	Output

Graph:



Function and Rule:

Is the machine working? YES NO

What is the rule?

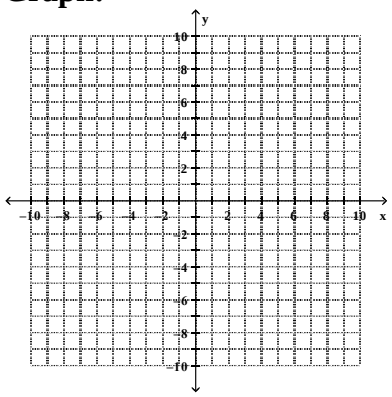
_____

Name:_____ Date:_____ Period:_____

7. **Table:**

Input	Output

Graph:



Function and Rule:

Is the machine working? YES NO

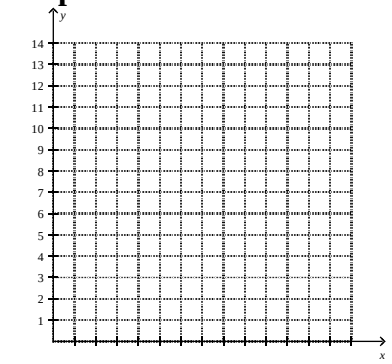
What is the rule?

_____

8. **Table:**

Input	Output

Graph:



Function and Rule:

Is the machine working? YES NO

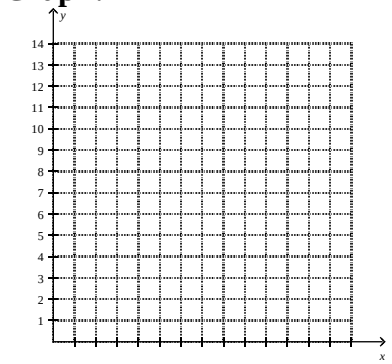
What is the rule?

_____

9. **Table:**

Input	Output

Graph:



Function and Rule:

Is the machine working? YES NO

What is the rule?

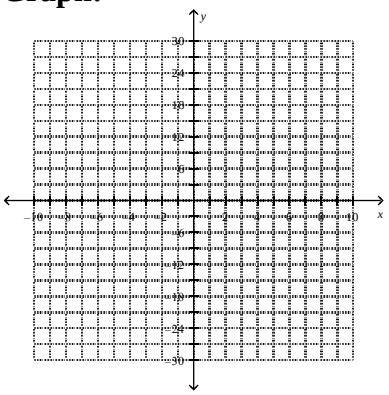
_____

Name:_____ Date:_____ Period:_____

10. **Table:**

Input	Output

Graph:



Function and Rule:

Is the machine working? YES NO

What is the rule?

_____

Analysis Question

1. Problems 1, 2, 4, 6, 7, 9 and 10 represented functions. Problems 3, 5 and 8 were not functions. What is a **function**? Use the words **input** and **output** in your definition.

_____

_____

_____.

2) How do you know if data represents a function?

_____

_____

_____.

Name:_____ Date:_____ Period:_____

Function or Non-Function

Look at each problem below. Using our definition of a function, decide if each item is a function or not; then circle your answer. Be prepared to explain your reasoning to the class.

Function: Each input has exactly one output.

1. Function Non-Function

Input	Output
1	0
2	2
3	0

2. Function Non-Function

Input	Output
2	14
4	10
6	6

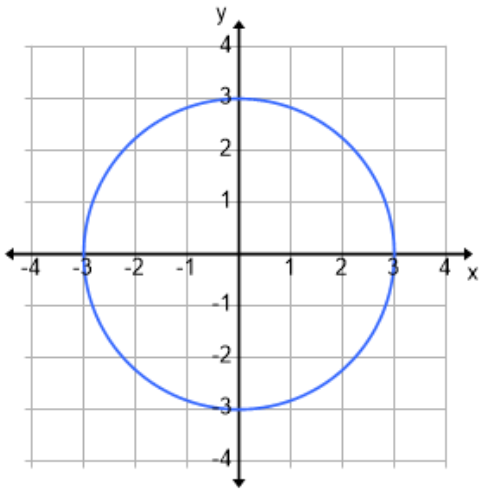
3. Function Non-Function

$y = 4c - 1$

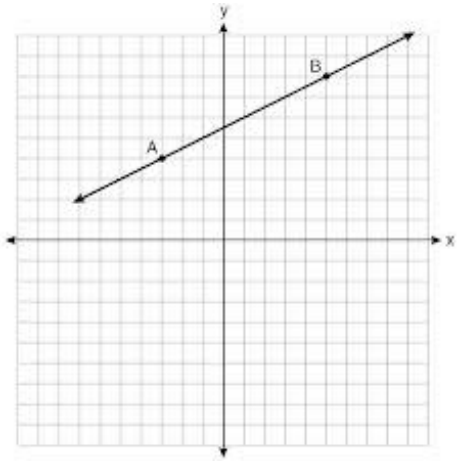
4. Function Non-Function

"Multiply the input by one less than the input"

5. Function Non-Function



6. Function Non-Function



7. Function Non-Function

Set of ordered pairs:
$(0, 0), (4, 16), (-2, 4), (4, 16)$

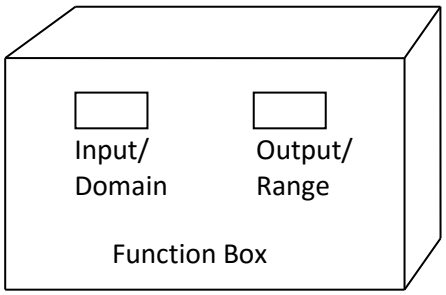
8. Function Non-Function

Set of ordered pairs:
$(0, 0), (4, 8), (-2, -4), (4, -8)$

Teacher Directions

Objective
Students will study patterns in tables and graphs of input/domain and output/range values in a function machine to understand the concept of a function.

Materials
- Index cards or small pieces of paper on which to write numbers
- Calculator (optional)
- Function Box or Tri-Fold Poster



Instruction to Build Function Box
Cut two slots into the side of the box. The slots have to be large enough to pass items back and forth. Label the slot on the left, "Input/Domain" and the slot on the right, "Output/Range." The functions or "rules" need to be written on the index cards ahead of the lesson (see end of lesson for rules).

Pre-lesson review of what it means for a vending-type machine to "work" (if needed)
The following class discussion will help students understand when the machine is "working" and when the machine is not following a "rule" that we can figure out. A picture of the vending machine is on the last page of the packet to offer students a visual representation. Display or draw at front of class.

The school has installed a new vending machine with snacks. The manufacturer has determined the following:
A = apple B = banana C = carrots D = granola bar E = hardboiled egg F = orange

Day 1 After Installation The first day the machine is installed, the following happens:
- Student One puts in $0.50, presses A and an apple comes out
- The next student puts in $0.50, presses C and carrots come out
- The next student puts in $0.50, presses E and a hardboiled egg comes out
- The next student puts in $0.50, presses F and an orange comes out
- Another student puts in $0.50, presses C and an apple comes out
- Another student puts in $0.50, presses F and an apple comes out

Use think-pair-share to ask students, "Is the machine working correctly?" Help students identify that if you press F and get an orange, the next time you press F, you should also get an orange. Once students understand what it means for a machine to "work," proceed on to the lesson.

Teacher Directions

Activity Notes

Begin the class by telling students that today, you will see who is good at predicting. Students will try to tell you what will come out of the function box for a given input. Choose a student to be inside the function box. Explain to this student that you will give them a rule. When given an input, they will apply the rule to the input and give back an output through the output/range slot. Give the student a pen, a calculator, and 20-30 slips of paper to write the output on. You will also need some slips of paper to give to volunteers as the input.

Function Box

Once ready, pass out the Function Box activity sheet to each student. Begin by giving the student in the box the first rule, add 3. Ask for volunteers, to come one at a time to write a number between 0 and 10 on a slip of paper and put into the input slot. Ask each volunteer to share the number they wrote. Record this on the table on the activity sheet under "input" and instruct the students to do the same. After the first number is put into the slot, ask the class to silently predict what will come out. Have the student in the box to get the output value and share it with the class; record this in the output column and instruct students to do the same. Repeat this process at least 4 more times, each time asking the class to predict the output value.

Once most students know the rule, have students share what they think the rule is with a partner. Call on students to share the rule and record this in the third column.

Note: It is **IMPERATIVE** to go back to the first number or any other input value to put in and try again to verify if the machine is working.
Be sure to do this for rules 3, 5, and 8.

Have the students graph the ordered pairs (input, output) and then have them circle their answer regarding the box's functioning. Call on a few students to share what they circled and why. Repeat the same process for the rest of the rules.

Note: For rule 6, draw the shape in the table and graph them in the same order on the x-axis.

Analysis Questions

After completing all rules, give students 5 minutes to answer the summary question on their own. Then allow them to share with a partner and have a few students share with the class. The goal is for students to define a function as every input has a unique output.

Function or Non-Function

For practice and formative assessment, have students now turn to the Function or Non-Function activity sheet. Have students refer to the definition of a function to determine which should be labeled as functions and which are non-functions. Give them about 5-10 minutes to complete this alone and then another 5-10 minutes to discuss with a partner. Afterwards, use thumbs-up or thumbs-down to have each student vote on each problem. Finally, select students at random to explain whether it is a function or a non-function and why.

Problems	1	2	3	4	5	6	7	8
Answers	Function	Function	Non-Fn	Function	Non-Fn	Function	Function	Non-Fn

Teacher Directions

Rules to use in Function Machine and Answers

Problem	Input Values and Materials	Write This on the Card	Possible Rules Students Will Share	Function or Non-Function
1	Any number (use cubes)	Add 3	Add 3 $x + 3$ add three to number	Function
2	Any number (use cubes)	Subtract 2	Take away 2 $x - 2$ 2 less than the number	Function
3	Any number (use cubes)	Add any # (0-10), but change what you add each time You may repeat.	No rule	Non-function
4	Any number	Multiply input by 3	3x 3 times x Multiply the number by 3	Function
5	Any number	Alternate picking odd # then even # no matter what the input You may repeat.	No rule	Non-function
6	Draw a 2-dimensional polygon	Count # of sides	Number of sides	Function
7	Any number	Double input and then add 5	2x+5 double input then add 5 5 more than twice the input	Function
8	Student name spelled out	Pick 0, 1 or 10 each time (not in a pattern)	No rule	Non-function
9	Student name spelled out	Count the number of letters in the name	Number of letters to spell the name	Function
10	Any number	Multiply the number by itself	Number squared Multiply number by itself x^2	Function

Brain Food

A = Apple

B = Banana

C = Carrots

D = Granola Bar

E = Hardboiled Egg

F = Orange