

**SUBJECT:** Mathematics

**GRADE LEVEL:** Eighth grade

**TITLE:** *The Function Machine*

**ALIGNMENTS:**

Eligible Content: M8.D.1.1.3

Key Words: function, rule of a function, input/output table, rule of linear functions, function table, linear function

**VOCABULARY**

- function: A relation in which every input value has a unique output value
- input: the number or value that is entered into the function, usually the  $x$
- output: the number or value that comes out of the process, usually the  $y$

**OBJECTIVES:**

- Students will determine the rule of the function given a table of value.
- Students will then match the rule to its graph.

**ESSENTIAL QUESTION:**

- How can an understanding of tables and relationships lead to an understanding of simple equations, and how can this table be generalized into an equation?

**DURATION:** 45-60 min

**MATERIALS:**

- Internet access
- Warm up graph paper
- Partner worksheet
- Exit ticket

**INSTRUCTIONAL PROCEDURES:**

**W:** Put problem on the board to access students' prior knowledge of plotting points on graph paper when given a table. Check warm up to make sure students plotted points correctly.

$x$	$y$
1	-7
2	-4
5	5
6	8

**“Good, today we are going to take our functions tables one step further. We are going to look at a function table and write the rule or equation to match the table. After we do a few guided examples, you will get with your partner and do 5 problems together. Then you will get on the Internet and use “The Function Machine” game to evaluate your own understanding.”**

**H:** “Here is a function table with the input labeled  $x$  and the output labeled  $y$ .

$x$	$y$
1	5
2	6
3	7
4	8

**Ask yourself, what can I do to 1 to get 5, to 2 to get 6, ....?”** Allow students time to work on the table then write students' responses on board. Student response should be add 4. **“Good, the rule is to add 4. If we add 4 to each  $x$  term, then we will get the  $y$  term.  $Y$  is what I am looking for so I am going to start with  $y =$  . Then I look at the rule which for this one is to add 4 to the  $x$ . So put it all together and you get  $y = x + 4$ . Check for understanding before moving on by asking if there are any questions.**

**“Okay lets take a look at this one:**

$x$	$y$
1	1
3	9
6	36
9	81

**Ask yourself, what can I do to 1 to get 1, to 3 to get 9, to 6 to get 36, ....?"** Allow students time to work on the table then write students' responses on board. Remind students that their rule has to work for each  $x/y$ , not just the first. Student response should be square the  $x$ . **"Good, the rule is to square the  $x$ . So let's write the equation  $y = \text{first}$ , then the rule is square  $x$ . How do I write square  $x$ ?"** Student response should be  $x$  squared or with an exponent of 2. **"Good job, let's write the equation  $y = x^2$ "**

**"Okay, lets take a look at another one.**

$x$	$y$
3	5
4	7
5	9
10	19

**Ask yourself, what can I do to 3 to get 5, to 4 to get 7, 5 to get 9, ...?"** Allow students time to figure out the rule. Watch carefully to see which students have developed mastery and those that are still struggling. You could also have them pair up with a partner to figure out the rule. Write down all students' responses. Student responses should be multiply by 2 then subtract 1.

**"Good, the rule is to multiply by 2 then subtract 1. Now what would be the equation to go with this rule?"** Give students time to think about the equation. Call on students and write their responses on board. If you get different responses, work through each equation until you get the right answer. **"The equation is  $y = 2x - 1$ ?"** Make sure to stop here and ask if there are any questions. If you use the "thumbs up, thumbs down" method, you could check for understanding that way.

**E: "Okay, now we are going to do 5 problems with your partner. Now make sure that you both have input in writing the rule and equation. When you are done, let me check them and then you can get on the computer and play the "The Function Machine" game."** Hand out Partner worksheet. Answers:

1.  $y = 2x + 5$    2.  $y = x^2 - 1$    3.  $y = 7x$    4.  $y = 6x + 4$    5.  $y = 3x - 0.5$

**R:** As students are working in partners, monitor student performance. Visit each group and have students explain their thinking and clarify any misunderstandings.

Once they have show partner mastery, have students get on the Internet for activity below.

For those students who are showing strong proficiency of the concepts, you can have one of the partners write a function table and the other student will have to write the equation.

**E:** For individual practice, have students go to <http://wpsu.org/games/FindRule.swf> on the Internet and complete The Function Machine activity by themselves. Tell them that there is an additional step to the function machine and that they will also have to graph their  $x/y$  table. Have students write their work and “thinking” process and their  $x/y$  table down on a piece of paper. As students are working on this activity, you can move around the room and look at the top of their screen to see how many tables (equations) they have gotten right and how many graphs they have gotten right, helping those who need it.

If further assessment is needed, have students complete the Exit Ticket. Answer:  
 $y = 3x + 1$

**SUGGESTED INSTRUCTIONAL STRATEGIES:**

**T:** For those students who are showing strong proficiency of the concepts, you can have one of the partners write a function table and the other student will have to write the equation during the partner worksheet.

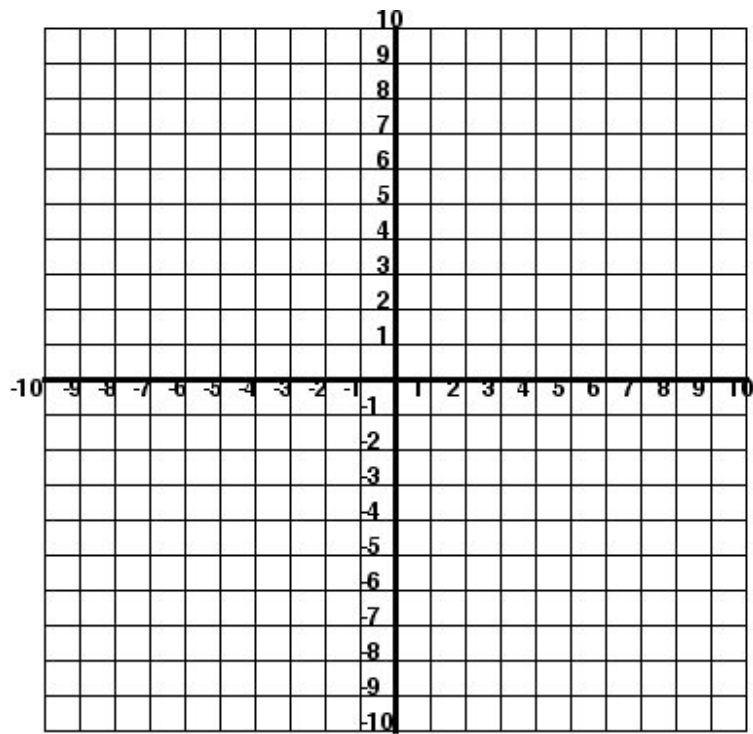
For those still struggling with the concept after the partner activity, pull together one or two small groups to continue practicing.

**O:** The goal of this lesson is to practice writing the rule of a function. The activities in this lesson are intended to move the student from the teacher guided items to independent rigorous problems for writing the rule of a function on the Internet activity.

**FORMATIVE ASSESSMENT:**

- Ongoing teacher observation during partner work work, student interaction, and computer activity
- Partner worksheet
- Exit Ticket

Graph for warm up.



Partner Worksheet.

Names: \_\_\_\_\_

Write the rule in equation form for each table.

1. Equation:

$x$	$y$
1	7
2	9
3	11
4	13
5	15
6	17

2. Equation:

$x$	$y$
2	5
3	10
4	17
5	26
6	37
7	50

3. Equation:

$x$	$y$
2	14
4	28
5	35
7	49
11	77
12	84

4. Equation:

$x$	$y$
1	10
3	22
4	28
9	58

5. Equation:

$x$	$y$
-1	-3.5
2	5.5
3	8.5
5	14.5
6	17.5
8	23.5

Exit Ticket

Equation:

$x$	$y$
1	4
2	7
4	13
5	16