RAFT IDEAS

Topics: Functions, Variables, Algebraic Equations

Materials List

- ✓ File folder or presentation folder, 1 per function machine
- ✓ Cardstock or paper
- ✓ Scissors, craft knife and/or equal

This activity can be used to teach:

- Algebra (Common Core Math Standards: Operations. & Algebraic Thinking, Grade 3, 3, 4, & 6; Grade 4, 3 & 5)
- Equations (Common Core Math Standards: Grade 6, Expressions & Equations, 6)
- Functions (Common Core Math Standards: Grade 8, Functions, 1, 2, & 4)
- Problem Solving and Reasoning (Common Core Math Standards: Mathematical Practices Grades 3 - 8)

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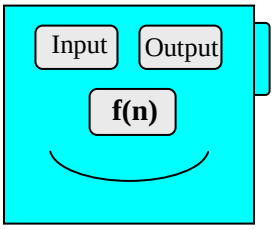
Meet My Function Machine!

Can You Guess My Function?



Create a function machine that transforms an input number into a unique output number. Exchange function machines and discover the rule behind the function!

Assembly (Idea: Teacher makes several samples; students make own)

1. Cut windows for two "eyes" and one "nose" into the front of the folder. Make each window approximately 2.5 cm (1") by 7.5 cm (3").
2. Align the top of the cardstock under the front of the folder and along the top edge.
3. In the window spaces for the eyes, write the word "input" for the left eye and "output" for the right eye onto the cardstock. Write f(n) on the cardstock in the nose window.
4. Choose a function to model, see page 2 for sample functions by grade level.
5. Move the cardstock up to align the eye and nose windows with a blank area. In this section write a new value for the input and a corresponding new value for the output so they appear in the correct eye windows of the folder.
6. Continue to write f(n)in the nose window, and corresponding values for input and output numbers down the page so they will appear in the "windows" of the folder. All input values on one page of cardstock use the same function, and result in corresponding outputs.
7. Circle the last pair of input/output values on the page. Write the "function" or rule so it will appear in the last nose window.

To Do and Notice

1. Students exchange function machines including cardstock inserts.
2. Slip a function machine page into the folder where the words input & output appear in eye windows.
3. Slowly lift up the page until an input and output value appears in the first eye windows of the folder. Write on scratch paper what the function might be.
4. Pull up the same page until another input and output appear in the eye windows of the folder. Revise prediction for the function rule as needed.
5. Continue lifting up the page until the last input and output appear (these are circled). At this point, the function is about to be revealed.
6. Pulled up the page and reveal the function. Compare to predicted function.
7. Continue with more functions and cardstock inserts as desired.

The Math Behind the Activity

An easy explanation for the concept of functions is to think of them as machines: put something into the machine, and it produces something back out. In general, a function is a set of rules for taking an input (domain value) and producing a corresponding unique output (range value). In a function, there is only one output for each input. For example, suppose there is a function which when 3 is input the output is 5. If the input is 8, the output is 10. This could be the function that "takes a number and adds two to it". Each input produces one unique output. In function

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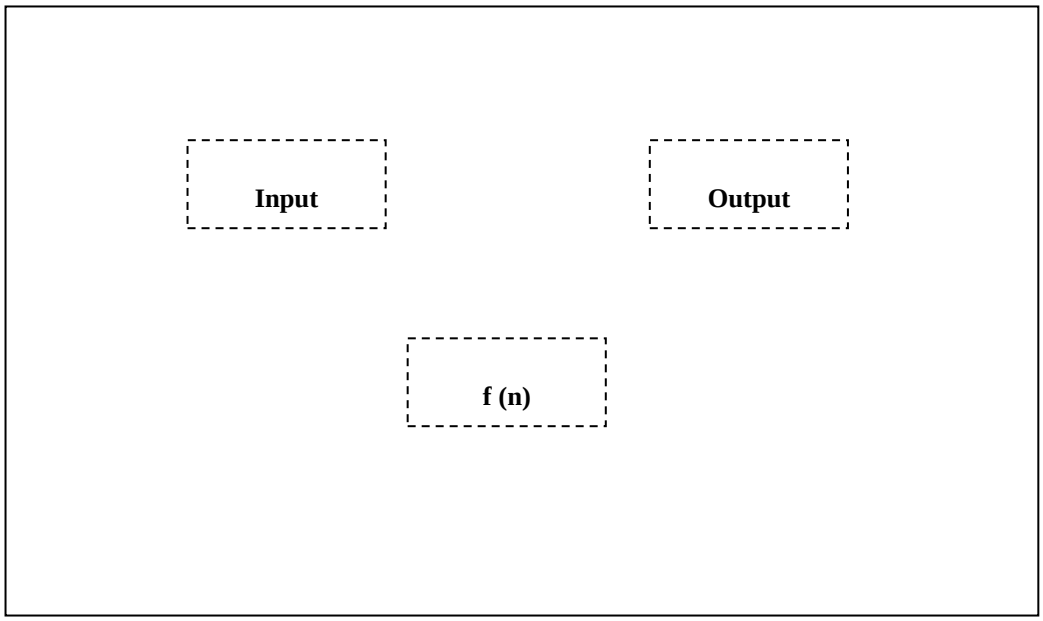
notation, this is written as f(x) = x + 2. To find a function rule, a number of inputs must be tested to determine the specific function for correspondingly unique outputs (e.g., an input of 2 and output of 4 could have different function rules, such as x + 2, x^2, or 2x) Without more pairs of input and output values, the function could be difficult to determine. Functions may include more than one number as input, such as f(x, y) = x + y. If this function had an input of 4 and 8, the function output would be 12.

Taking it Further

1. Create pages that give the function rule and the output values, but the input values need to be determined.
2. Create pages that give the function rule and the input values, but the output values need to be determined.
3. Tape the top of a small piece of paper, or "nose flap", over the nose window. Write f(n) on the flap.
4. Add stickers or draw more details on the "face" of the machine. Give it a name!
5. For lower grades use shapes with operations in functions.

Web Resources (Visit www.raft.net/raft-idea?isid=591 for more resources!)

- Algebraic Functions - http://www.freemathhelp.com/functions.html
- Describing Functions - http://mathforum.org/library/drmath/view/52837.html
- Khan Academy resources on functions -https://www.khanacademy.org/math/algebra/algebra-functions
- Teacher designed math courses – https://njctl.org/courses/math



Sample grade level functions:

Note: Unsimplified functions work best when the function is given and either the input or output is unknown.

Grade 3:

- f(x) = 2x
- f(x) = x + x + x
- f(x) = 3x + 2

Grade 4:

- f(x) = 3(x) + (2x)
- f(x) = 5.32 (x)
- f(x) = 7 – x
- f(x) = 4x + 3

Grade 5:

- f(x) = 3(x + 5)
- f(x) = 10.5x + 2
- f(x) = x - 10
- f(x) = 3(x – 2) + 2(4 – x)
- f(x) = -9 + 2x

Grade 6:

- f(x) = ½ x + ⅜ x
- f(x) = x(⅔ · ⅜)
- f(x) = x / 22
- f(x) = x(5/x) + x

Grades 7 & 8:

- f(x) = x^2(5/x) + 1
- f(x) = 3(2x + 5)
- f(x) = $6x^3 \div 3\ x^2$
- f(x) = -10 x^2
- f(x) = x^2 + 2x + 1
- f(x) = $2x^3$ + 5