

## Input–Output Machines: Cause and Effect Map

### Materials

Input–Output  
Machines  
reproducible

Input–Output  
Problems  
reproducible

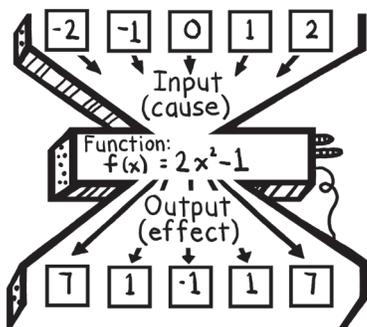
### Skills Objectives

Interpret and use function notation to identify variables and solve problems.

Use algebraic expressions to represent and analyze mathematical situations.

A **Cause and Effect Map** typically shows the relationship between a cause and its effect. In this activity, students use a modified version to show the relationship between the input and output values in a “function machine.” The domain values of  $x$  are the input (cause) and the range values of  $f(x)$  are the output (effect).

1. Review with students how to read function notation such as  $f(x) = 2x^2 - 1$ . Point out that  $f(x)$  is read as “ $f$  of  $x$ ” or “the function of  $x$ ” and is used in place of  $y$ .
2. Give students two copies of the **Input–Output Machines reproducible (page 29)**, and display a large copy of the machine to guide instruction. Write  $f(x) = 2x^2 - 1$  on the machine, and tell students that it is the “directions” or the *function rule* for that machine. Explain that each machine causes the numbers put inside of it to change by a specific function—a cause-and-effect relationship.
3. Demonstrate how the machine works by writing the input (cause) numbers  $-2, -1, 0, 1, 2$  in the top boxes, and writing the output (effect) numbers  $7, 1, -1, 1, 7$  in the bottom boxes. Work with students to prove that each input results in the corresponding output when used in place of  $x$  in the equation  $f(x) = 2x^2 - 1$ . For example:  $f(-2) = 2(-2)^2 - 1 = 8 - 1 = 7$ , so  $f(-2) = 7$ .
4. Give students a copy of the **Input–Output Problems reproducible (page 30)**, and have them work individually or with a partner to solve each problem using their Input–Output Machines. You might choose to do the first word problem together. Monitor students’ progress, and offer assistance as needed.
5. When students are finished, review the answers together. Invite volunteers to show how they solved each problem.



# Input-Output Machines

**Directions:** Use these machines to solve the input-output problems.

