



<b>function</b>	A function $f$ of a variable $x$ is a rule that assigns to each number $x$ in the function's domain a single number $f(x)$ . The word "single" in this definition is very important
<b>input</b>	The number or value that is entered, for example, into a function machine. The number that goes into the machine is the input
<b>linear function</b>	A function of the form $f(x) = mx + b$ where $m$ and $b$ are some fixed numbers. The names "m" and "b" are traditional. Functions of this kind are called "linear" because their graphs are straight lines
<b>output</b>	The number or value that comes out from a process. For example, in a function machine, a number goes in, something is done to it, and the resulting number is the output

## Lesson Outline

### 1. Focus and Review

Remind students what has been learned in previous lessons that will be pertinent to this lesson and/or have them begin to think about the words and ideas of this lesson.

### 2. Objectives

Let the students know what it is they will be doing and learning today. Say something like this:

- | Today, class, we are going to learn about functions and their representations
- | We are going to use the computers to learn about functions and their representations, but please do not turn your computers on until I ask you to. I want to show you a little about this activity first

### 3. Teacher Input

Introduce the idea of functions as machines, by leading a class [discussion](#) on functions.

### 4. Guided Practice

- | Have the students construct machines to test each other with. Start them with single operation machines, and suggest that they build tables for the input/output pairs. Reinforce the convention that mathematicians avoid confusion by always putting the input first in an *ordered pair* enclosed in parentheses and separated by commas:

(x,y)

Give them one or two tables with a few outputs for them to fill in.

Ask them to describe in words what the function does. For

Example:

INPUT	OUTPUT	INPUT	OUTPUT
5	-1	-5	-15

3	-3	2	6
-1	-7	4	12
4	-2	0	0
-5	-11	3	9
2	-4	-2	-6
10		10	
-9		-7	

- | After they practice describing functions in English sentences, discuss the convention of letting a letter (often *but not always x*) stand in for the input and another (often *but not always y*) stand in for the output. Have them write all their earlier functions as algebra rules with x as input and y as output.

- | Formalize the terminology:

- | *Variable* A letter standing in for an unknown or changeable number
  - | *Independent Variable* The input into a function, often represented by x.
  - | *Dependent Variable* The output from a function, often represented by y.
  - | *Functions* A process that takes one or more numbers as input and produces a single number as output

### 5. Independent Practice

- | Have the students practice their new function building and pattern recognition skills with the [Function Machine Game](#) . Be sure to have students record how many numbers they needed to look at before correctly guessing the function structure. Have them write the functions they worked with in three ways:

- | English sentence

- | Table of Values

- | Algebra Rule

- | Have them try to think of situations in their lives that might be governed by some of the functions they worked with. For example,

$$y = x + 1$$

might be the function describing growing one year older on your birthday.

$$y = 2 * x$$

might be the function "everything tastes twice as good during the holiday."

### 6. Closure

- | You may wish to bring the class back together for a discussion of the findings. Once the students have been allowed to share what they found, summarize the results of the lesson.

## Alternate Outline

This lesson can be rearranged in several ways.

- | Add a "name that function" contest (modeled on name that tune) in which teams of students compete to figure out the function. Here is a set of possible rules for such a game:
  - | Show two input/output pairs to both teams - two students on a team works very well.
  - | Have each team state how many more pairs they think that they would need to see to "name that function." The team who claims the fewest needed pairs goes first.
  - | If a team guesses wrong the other team gets to try, after seeing one more pair. Teams alternate turns until one guesses correctly.

This game can be played in about 10 minutes per pair of teams, making it time consuming if the entire class is to have a turn.

- | Introduce non-linear functions by allowing exponentiation (whole numbers to start) and division by x

## Suggested Follow-Up

After these discussions and activities, students will have an intuitive understanding of functions and will have seen many examples of linear functions. The next lesson [More Complicated Functions](#) will introduce students more general linear functions.

