

## Lesson 4-6: Formalizing Relations and Functions

A **relation** is a pairing of numbers in one set, called the **domain**, with numbers in another set, called the **range**. A relation is often represented as a set of ordered pairs  $(x, y)$ . In this case, the domain is the set of  $x$ -values and the range is the set of  $y$ -values.

**Essential Understanding** A function is a special type of relation in which each value in the domain is paired with exactly one value in the range.

### Problem 1 Identifying Functions Using Mapping Diagrams

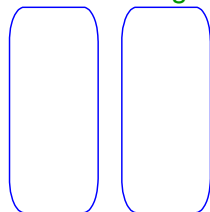
Identify the domain and range of each relation. Represent the relation with a mapping diagram. Is the relation a function?

**A**  $\{(-2, 0.5), (0, 2.5), (4, 6.5), (5, 2.5)\}$

The domain is  $\{-2, 0, 4, 5\}$ .

The range is  $\{0.5, 2.5, 6.5\}$ .

domain range

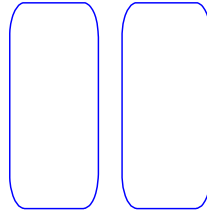


**B**  $\{(6, 5), (4, 3), (6, 4), (5, 8)\}$

The domain is  $\{4, 5, 6\}$ .

The range is  $\{3, 4, 5, 8\}$ .

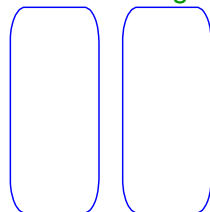
domain range



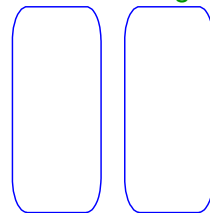
**Got It?** 1. Identify the domain and range of each relation. Represent the relation with a mapping diagram. Is the relation a function?

a.  $\{(4.2, 1.5), (5, 2.2), (7, 4.8), (4.2, 0)\}$     b.  $\{(-1, 1), (-2, 2), (4, -4), (7, -7)\}$

domain range



domain range

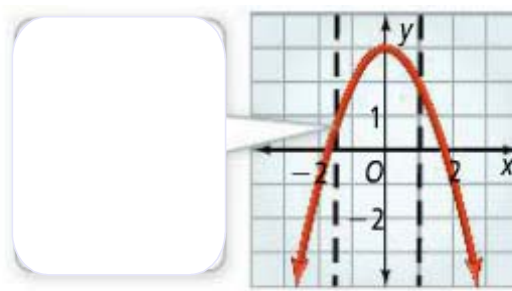
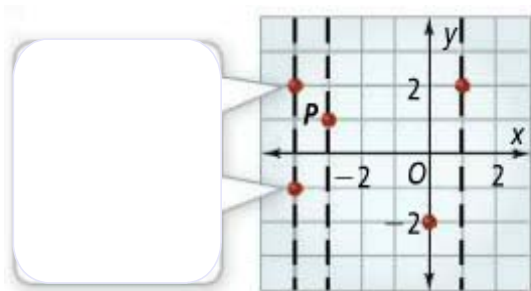


Another way to decide if a relation is a function is to analyze the graph of the relation using the **vertical line test**. If any vertical line passes through more than one point of the graph, then for some domain value there is more than one range value. So the relation is not a function.

### Problem 2 Identifying Functions Using the Vertical Line Test

Is the relation a function? Use the vertical line test.

- A**  $\{(-4, 2), (-3, 1), (0, -2), (-4, -1), (1, 2)\}$     **B**  $y = -x^2 + 3$



You have seen functions represented as equations involving  $x$  and  $y$ , such as  $y = -3x + 1$ . Below is the same equation written using **function notation**.

$$f(x) = -3x + 1$$

Notice that  $f(x)$  replaces  $y$ . It is read “ $f$  of  $x$ .” The letter  $f$  is the name of the function, not a variable. Function notation is used to emphasize that the function value  $f(x)$  depends on the independent variable  $x$ . Other letters besides  $f$  can also be used, such as  $g$  and  $h$ .

### Problem 3 Evaluating a Function

**Reading** The function  $w(x) = 250x$  represents the number of words  $w(x)$  you can read in  $x$  minutes. How many words can you read in 8 min?

### Problem 4 Finding the Range of a Function

**Multiple Choice** The domain of  $f(x) = -1.5x + 4$  is  $\{1, 2, 3, 4\}$ . What is the range?

Bookwork p 271: 9, 11-15, and 17-27 odd