

# Study Guide

## Relations and Functions

A **relation** is a set of ordered pairs. The set of first elements in the ordered pairs is the **domain**, while the set of second elements is the **range**.

**Example 1** State the domain and range of the following relation.

$$\{(5, 2), (30, 8), (15, 3), (17, 6), (14, 9)\}$$

$$\text{Domain: } \{5, 14, 15, 17, 30\}$$

$$\text{Range: } \{2, 3, 6, 8, 9\}$$

You can also use a table, a graph, or a rule to represent a relation.

**Example 2** The domain of a relation is all odd positive integers less than 9. The range  $y$  of the relation is 3 more than  $x$ , where  $x$  is a member of the domain. Write the relation as a table of values and as an equation. Then graph the relation.

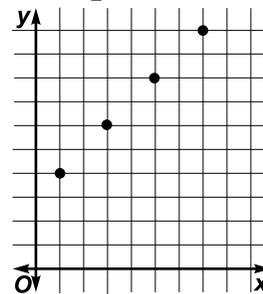
**Table:**

$x$	$y$
1	4
3	6
5	8
7	10

**Equation:**

$$y = x + 3$$

**Graph:**



A **function** is a relation in which each element of the domain is paired with exactly one element in the range.

**Example 3** State the domain and range of each relation. Then state whether the relation is a function.

a.  $\{(-2, 1), (3, -1), (2, 0)\}$

The domain is  $\{-2, 2, 3\}$  and the range is  $\{-1, 0, 1\}$ . Each element of the domain is paired with exactly one element of the range, so this relation is a function.

b.  $\{(3, -1), (3, -2), (9, 1)\}$

The domain is  $\{3, 9\}$ , and the range is  $\{-2, -1, 1\}$ . In the domain, 3 is paired with two elements in the range,  $-1$  and  $-2$ . Therefore, this relation is not a function.

**Example 4** Evaluate each function for the given value.

a.  $f(-1)$  if  $f(x) = 2x^3 + 4x^2 - 5x$

$$\begin{aligned} f(-1) &= 2(-1)^3 + 4(-1)^2 - 5(-1) \quad x = -1 \\ &= -2 + 4 + 5 \text{ or } 7 \end{aligned}$$

b.  $g(4)$  if  $g(x) = x^4 - 3x^2 + 4$

$$\begin{aligned} g(4) &= (4)^4 - 3(4)^2 + 4 \quad x = 4 \\ &= 256 - 48 + 4 \text{ or } 212 \end{aligned}$$

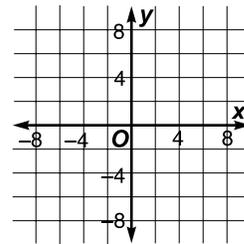
# Practice

## Relations and Functions

State the domain and range of each relation. Then state whether the relation is a function. Write yes or no.

- $\{(-1, 2), (3, 10), (-2, 20), (3, 11)\}$
- $\{(0, 2), (13, 6), (2, 2), (3, 1)\}$
- $\{(1, 4), (2, 8), (3, 24)\}$
- $\{(-1, -2), (3, 54), (-2, -16), (3, 81)\}$

5. The domain of a relation is all even negative integers greater than  $-9$ . The range  $y$  of the relation is the set formed by adding 4 to the numbers in the domain. Write the relation as a table of values and as an equation. Then graph the relation.



Evaluate each function for the given value.

- $f(-2)$  if  $f(x) = 4x^3 + 6x^2 + 3x$
- $f(3)$  if  $f(x) = 5x^2 - 4x - 6$
- $h(t)$  if  $h(x) = 9x^9 - 4x^4 + 3x - 2$
- $f(g + 1)$  if  $f(x) = x^2 - 2x + 1$

10. **Climate** The table shows record high and low temperatures for selected states.

- State the relation of the data as a set of ordered pairs.
- State the domain and range of the relation.
- Determine whether the relation is a function.

Record High and Low Temperatures ( $^{\circ}\text{F}$ )		
State	High	Low
Alabama	112	-27
Delaware	110	-17
Idaho	118	-60
Michigan	112	-51
New Mexico	122	-50
Wisconsin	114	-54

Source: National Climatic Data Center