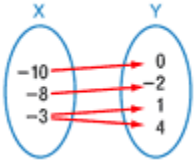
Lesson 4-6

Example 1 Identify Functions

Determine whether each relation is a function. Explain.

a.



This mapping represents a relation that is not a function. The element –3 in the domain is paired with both 1 and 4 in the range. If you are given that $x = 3$, you cannot determine the value of y.

b.

x	y
-15	-1
6	5
-11	4
0	-1
-3	3

The table represents a function since, for each element of the domain, there is only one corresponding element in the range. It does not matter if two elements of the domain are paired with the same element in the range.

c. **{(6, 5), (4, -1), (6, 3), (3, 5), (2, 1)}**

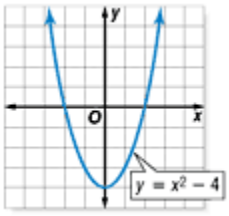
This relation does not represent a function since 6 in the domain is paired with 5 and 3 in the range. It does not matter that 5 in the range is paired with 3 and 6 in the domain.

Example 2 Equations as Functions

Determine whether $y = x^2 - 4$ is a function.

Graph the equation using a table of values.

x	$x^2 - 4$	y	(x, y)
-2	$(-2)^2 - 4$	0	(-2, 0)
-1	$(-1)^2 - 4$	-3	(-1, -3)
0	$(0)^2 - 4$	-4	(0, -4)
1	$(1)^2 - 4$	-3	(1, -3)
2	$(2)^2 - 4$	0	(2, 0)



Plot the points and sketch a curve to fit the points. Place your pencil at the left of the graph to represent a vertical line. Slowly move the pencil to the right across the graph.

For each value of x, this vertical line passes through no more than one point on the graph. Thus, the line represents a function.

Example 3 Functional Values

If $g(x) = -3x - 4$, find each value.

a. $g(0)$

$g(0) = -3(0) - 4$ Replace x with 0.
$= 0 - 4$ Multiply.
$= -4$ Subtract.

b. $g(-3) - 2$

$g(-3) - 2 = [-3(-3) - 4] - 2$ Replace x with -3.
$= 5 - 2$ Simplify.
$= 3$ Subtract.

c. $g(2x - 1)$

$g(2x - 1) = -3(2x - 1) - 4$ Replace x with $2x - 1$.
$= -6x + 3 - 4$ Distributive Property
$= -6x - 1$ Simplify.

Example 4 Nonlinear Functional Values

If $f(a) = 3a^2 - 2a$, find each value.

a. $f(2)$

$f(2) = 3(2)^2 - 2(2)$ Replace a with 2.
$= 12 - 4$ Multiply
$= 8$ Simplify.

b. $f(-2b)$

$f(-2b) = 3(-2b)^2 - 2(-2b)$ Replace a with $-2b$.
$= 3(4b^2) + 4b$ Evaluate the exponent.
$= 12b^2 + 4b$ Simplify.

c. $-3[f(c)]$

$-3[f(c)] = -3[3c^2 - 2c]$ Evaluate $f(c)$ by replacing a with c.
$= -3(3c^2 - 2c)$ Multiply the value of $f(c)$ by -3.
$= -9c^2 + 6c$ Simplify.

Example 5 Nonstandard Functional Notation

Multiple Choice Test Item

If $\|y\| = 5 - 2y$, then $\|-2\| =$

A. 7 **B.** -9 **C.** 9 **D.** 1

Read the Test Item

The notation $\|y\|$ is just different notation for $f(y)$.

Solve the Test Item

Replace y with –2.

$$\|y\| = 5 - 2y$$

$$\|-2\| = 5 - 2(-2) \quad \text{Replace } y \text{ with } -2.$$

$$= 5 + 4 \quad \text{Multiply}$$

$$= 9 \quad \text{Simplify.}$$

The answer is C.