

# Functions (Pages 256–261)

A **function** is a relation in which each element of the domain is paired with *exactly* one element of the range. Equations that are functions can be written in a form called **functional notation**,  $f(x)$  (read “ $f$  of  $x$ ”). In a function,  $x$  is an element of the domain and  $f(x)$  is the corresponding element in the range. In  $f(3)$ ,  $f(3)$  is the **functional value** of  $f$  for  $x = 3$ .

**Vertical Line Test**

If each vertical line passes through no more than one point of the graph of a relation, then the relation is a function.

## EXAMPLES

- A** Is  $\{(1, 2), (1, 3)\}$  a function? Is  $\{(1, 4), (3, 2), (5, 4)\}$  a function?

*1st relation: not a function*

*This relation has 1 paired with both 2 and 3.*

*2nd relation: a function*

*In this relation, each  $x$ -value is paired with no more than one  $y$ -value. A function can have a  $y$ -value paired with more than one  $x$ -value.*

- B** If  $f(x) = 3x - 1$  and  $g(x) = 2x$ , find  $f(1)$  and  $g(3)$ .

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

$$f(1) = 3(1) - 1 \text{ or } 2 \quad \text{Replace } x \text{ with } 1.$$

$$g(x) = 2x$$

$$g(3) = 2(3) \text{ or } 6 \quad \text{Replace } x \text{ with } 3.$$

## PRACTICE

Determine whether each relation is a function.

1.

$x$	$y$
-1	10
-2	13
-3	16

2.

$x$	$y$
2	0
2	-1
3	-4

3.

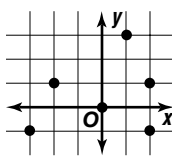
$x$	$y$
33	10
35	8
36	10

- 4.
- $\{(7, 4), (6, 3), (5, 2)\}$

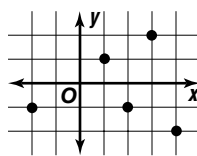
- 5.
- $\{(15, 0), (15, -2)\}$

- 6.
- $\{(0, 1), (2, 1), (0, 3)\}$

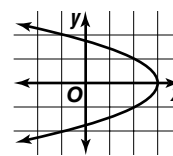
7.



8.



9.



If  $f(x) = -3x$  and  $g(x) = x - 5$ , find each value.

10.  $f(7)$

11.  $g(7)$

12.  $g(-8)$

13.  $f(-1)$

14.  $f(a)$

15.  $g(m)$

16.  $g(9)$

17.  $f(2)$



- 18. Standardized Test Practice** Martha pays a flat \$50 a month for the use of her cell phone. She also pays \$0.30 for each minute that she talks over 6 hours. The cost of her phone bill can be represented by  $f(x) = 50 + 0.30x$ , where  $x$  is the number of minutes past 6 hours that she uses the phone. Evaluate  $f(60)$  to find the amount of her phone bill if she uses the phone for 7 hours.

A \$68.30

B \$68.00

C \$50.30

D \$18.00

Answers: 1. yes 2. no 3. yes 4. yes 5. no 6. no 7. no 8. yes 9. no 10. -21 11. 2 12. -13 13. 3 14. -3a 15.  $m - 5$  16. 4 17. -6 18. B