

4.1 Domain and Range of a Function



STATE STANDARDS

MA.8.A.1.1
MA.8.A.1.5

Essential Question

How can you find the domain and range of a function?

1 ACTIVITY: The Domain and Range of a Function

Work with a partner. The table shows the number of adult and child tickets sold for a school concert.

Input	Number of Adult Tickets, x	0	1	2	3	4
Output	Number of Child Tickets, y	8	6	4	2	0

The variables x and y are related by the linear equation $4x + 2y = 16$.

- Write the equation in **function form** by solving for y .
- The **domain** of a function is the set of all input values. Find the domain of the function.

Domain =

Why is $x = 5$ not in the domain of the function?

Why is $x = \frac{1}{2}$ not in the domain of the function?

- The **range** of a function is the set of all output values. Find the range of the function.

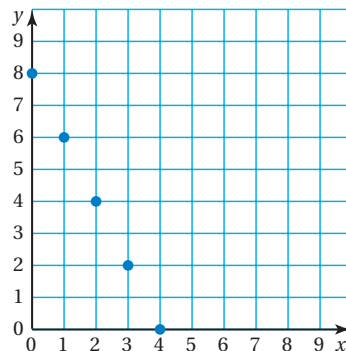
Range =

- Functions can be described in many ways.

- by an equation
- by an input-output table
- in words
- by a graph
- as a set of ordered pairs

Use the graph to write the function as a set of ordered pairs.

(,), (,),
 (,), (,),
 (,)



2 ACTIVITY: Finding Domains and Ranges

Work with a partner.

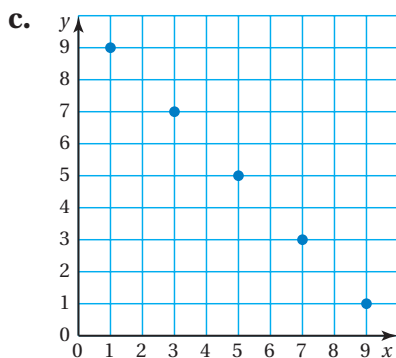
- Copy and complete each input-output table.
- Find the domain and range of the function represented by the table.

a. $y = -3x + 4$

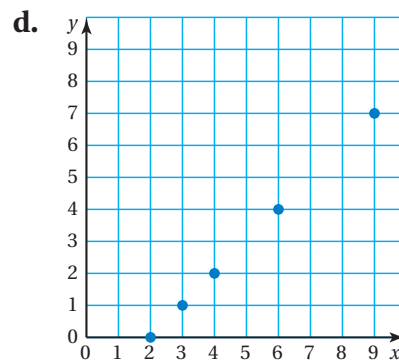
x	-2	-1	0	1	2
y					

b. $y = \frac{1}{2}x - 6$

x	0	1	2	3	4
y					



x					
y					



x					
y					

What Is Your Answer?

- IN YOUR OWN WORDS** How can you find the domain and range of a function?
- The following are general rules for finding a person's foot length.

To find the length y (in inches) of a woman's foot, divide her shoe size x by 3 and add 7.



To find the length y (in inches) of a man's foot, divide his shoe size x by 3 and add 7.3.



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- Write an equation for one of the statements.
- Make an input-output table for the function in part (a).
Use shoe sizes $5\frac{1}{2}$ to 12.
- Label the domain and range of the function on the table.

Practice

Use what you learned about the domain and range of a function to complete Exercise 3 on page 152.

Key Vocabulary

function, p. 150
domain, p. 150
range, p. 150
function form, p. 150

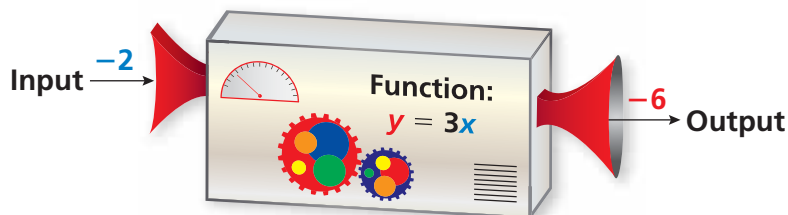
Remember

The ordered pair (x, y) shows the output y for an input x .

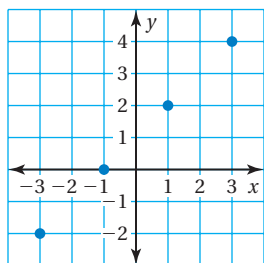
Key Idea

Functions

A **function** is a relationship that pairs each *input* with exactly one *output*. The **domain** is the set of all possible input values. The **range** is the set of all possible output values.

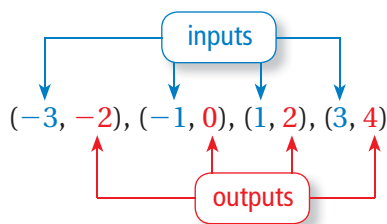


EXAMPLE 1 Finding Domain and Range from a Graph



Find the domain and range of the function represented by the graph.

Write the ordered pairs. Identify the inputs and outputs.

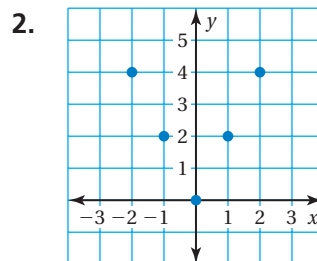
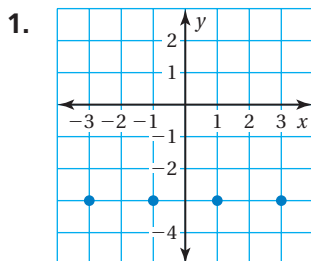


∴ The domain is $-3, -1, 1, \text{ and } 3$. The range is $-2, 0, 2, \text{ and } 4$.

On Your Own

Now You're Ready
Exercises 4–6

Find the domain and range of the function represented by the graph.



An equation is in **function form** if it is solved for y .

$$x + y = 1$$

not in function form

$$y = -x + 1$$

in function form

EXAMPLE 2 Finding the Range of a Function

Input, x	$-2x + 8$	Output, y
-2	$-2(-2) + 8$	12
0	$-2(0) + 8$	8
2	$-2(2) + 8$	4
4	$-2(4) + 8$	0
6	$-2(6) + 8$	-4

The domain of the function represented by $2x + y = 8$ is $-2, 0, 2, 4,$ and 6 . What is the range of the function represented by the table?

Write the function in function form.

$$2x + y = 8$$

$$y = -2x + 8$$

Use this form to make an input-output table.

••• The range is $12, 8, 4, 0,$ and -4 .

EXAMPLE 3 Real-Life Application



The table shows the percent y (in decimal form) of the moon that was visible at midnight x days after January 24, 2011. (a) Interpret the domain and range. (b) What percent of the moon was visible on January 26, 2011?

x	y
0	0.76
1	0.65
2	0.54
3	0.43
4	0.32

- a. Zero days after January 24 is January 24. One day after January 24 is January 25. So, the domain of $0, 1, 2, 3,$ and 4 represents January 24, 25, 26, 27, and 28.

The range is $0.76, 0.65, 0.54, 0.43,$ and 0.32 . These amounts are decreasing, so the moon was less visible each day.

- b. January 26, 2011 corresponds to the input $x = 2$. When $x = 2, y = 0.54$. So, 0.54 , or 54% of the moon was visible on January 26, 2011.

On Your Own

Now You're Ready
Exercises 9–11

Copy and complete the input-output table for the function. Then find the domain and range of the function represented by the table.

3. $y = 2x - 3$

x	-1	0	1	2
y				

4. $x + y = -3$

x	0	1	2	3
y				

5. The table shows the percent y (in decimal form) of the moon that was visible at midnight x days after December 17, 2012.

x	0	1	2	3	4
y	0.2	0.3	0.4	0.5	0.6

- (a) Interpret the domain and range.
(b) What percent of the moon was visible on December 21, 2012?

4.1 Exercises

Vocabulary and Concept Check

- VOCABULARY** Is the equation $2x - 3y = 4$ in function form? Explain.
- DIFFERENT WORDS, SAME QUESTION** Which is different? Find “both” answers.

Find the range of the function represented by the table.

Find the inputs of the function represented by the table.

Find the x -values of the function represented by $(2, 7)$, $(4, 5)$, and $(6, -1)$.

Find the domain of the function represented by $(2, 7)$, $(4, 5)$, and $(6, -1)$.

x	2	4	6
y	7	5	-1

Practice and Problem Solving

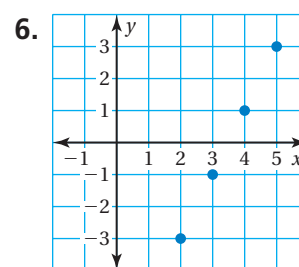
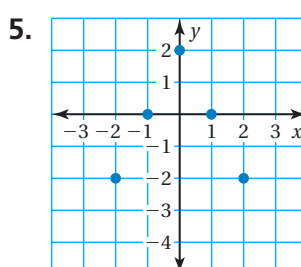
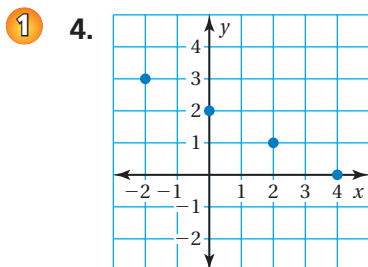
- The number of earrings and headbands you can buy with \$24 is represented by the equation $8x + 4y = 24$. The table shows the number of earrings and headbands.



- Write the equation in function form.
- Find the domain and range.
- Why is $x = 6$ not in the domain of the function?

Earrings, x	0	1	2	3
Headbands, y	6	4	2	0

Find the domain and range of the function represented by the graph.



X

The domain is $-2, 0, 2,$ and 4 .
The range is $-3, -1, 1, 3$.

- ERROR ANALYSIS** Describe and correct the error in finding the domain and range of the function represented by the graph.
- REASONING** Find the domain and range of the function represented by the table.

Tickets, x	2	3	5	8
Cost, y	\$14	\$21	\$35	\$56

Copy and complete the input-output table for the function. Then find the domain and range of the function represented by the table.

2 9. $y = 6x + 2$

x	-1	0	1	2
y				

10. $y = -\frac{1}{4}x - 2$

x	0	4	8	12
y				

11. $y = 1.5x + 3$

x	-1	0	1	2
y				

12. **VAULTING** In the sport of vaulting, a vaulter performs a routine while on a moving horse. For each round x of competition, the vaulter receives a score y from 1 to 10.

- Find the domain and range of the function represented by the table.
- Interpret the domain and range.
- What is the mean score of the vaulter?

x	y
1	6.856
2	7.923
3	8.135



13. **MANATEE** Florida's state marine mammal is the manatee. A manatee eats about 12% of its body weight each day.

- Write an equation in function form that represents the amount y (in pounds) of food a manatee eats each day for its weight x .
- Create an input-output table for the equation in part (a). Use the inputs 150, 300, 450, 600, 750, and 900.
- Find the domain and range of the function represented by the table.
- An aquatic center has manatees that weigh 300 pounds, 750 pounds, and 1050 pounds. How many pounds of food do all three manatees eat in a day? in a week?



14. **Critical Thinking** Describe the domain and range of the function.

- $y = |x|$
- $y = -|x|$
- $y = |x| - 6$
- $y = -|x| + 4$



Fair Game Review what you learned in previous grades & lessons

Graph the linear equation.

15. $y = 2x + 8$ 16. $5x + 6y = 12$ 17. $-x - 3y = 2$ 18. $y = 7x - 5$

19. **MULTIPLE CHOICE** The minimum number of people needed for a group rate at an amusement park is 8. Which inequality represents the number of people needed to get the group rate?

- (A) $x \leq 8$ (B) $x > 8$ (C) $x < 8$ (D) $x \geq 8$