Relations and Functions

Learning Target:	Understand the concept of a function.
Success Criteria:	 I can represent a relation as a set of ordered pairs. I can determine whether a relation is a function. I can find the domains and ranges of relations and functions represented by mapping diagrams and ordered pairs. I can use functions to solve real-life problems.

Exploration 1 Interpreting Diagrams

Work with a partner. Describe the relationship between the *inputs* and outputs in each diagram. Then complete each diagram. Is there more than one possible answer? Explain your reasoning.



Exploration 2 Describing Relationships Between Quantities

Work with a partner. The diagrams show the numbers of tickets bought by customers for two different plays and the total costs (in dollars).

ANALYZE A MTR PROBLEM Is it possible for one person to pay \$16 for

2 tickets to Play B and another person to pay \$8 for 2 tickets to Play B? Explain.



- a. For each diagram, how many outputs does each input have?
- **b.** Describe the prices of tickets for each play.

➤ 24

➤ 32

3 -

4

c. A person buys 4 tickets for each play. Can you determine the total cost of all 8 tickets? Explain.

Functions

MA.8.F.1.1 Given a set of ordered pairs, a table, a graph or mapping diagram, determine whether the relationship is a function. Identify the domain and range of the relation.



≯

12

16

20 × 24

3



Key Vocabulary

input, *p. 354* output, *p. 354* relation, *p. 354* mapping diagram, *p. 354* domain, *p. 354* range, *p. 354* function, *p. 355* Ordered pairs can be used to show **inputs** and **outputs**.



Key Ideas

Relations and Mapping Diagrams

A **relation** pairs inputs with outputs. A relation can be represented by ordered pairs or a **mapping diagram**. The **domain** is the set of all possible input values. The **range** is the set of all possible output values.



Example 1 Listing Ordered Pairs of Relations

List the ordered pairs shown in each mapping diagram.





Example 2 Determining Whether Relations Are Functions



16

GO DIGITAL

2

8. OPEN-ENDED Copy and complete the mapping diagram at the left to represent a relation that is a function. Then describe how you can modify the mapping diagram so that the relation is *not* a function.

Example 3 Modeling Real Life





The mapping diagram represents the prices of one-way subway tickets to different zones of a city.

a. Determine whether the price of a subway ticket is a function of the zone number. Then find the domain and range.

Each input has exactly one output.

- So, the price of a subway ticket is a function of the zone number. The domain is 0, 1, 2, and 3. The range is \$2.00, \$3.50, \$5.00, and \$6.50.
- b. Describe the relationship between the price and the zone number.



Identify the relationship between the inputs and the outputs.



As each input increases by 1, the output increases by \$1.50.

So, the price of a one-way subway ticket increases by \$1.50 for each additional zone traveled.

I can do it

on my own.

I can teach

someone else.

Output,

Cost

→ \$85

>\$170

>\$255

>\$340

4

Input,

Nights

1

2-

3-

4-

In-Class Practice



- I don't I can do it understand yet.
- **9.** The mapping diagram represents the costs of reserving a hotel room for different numbers of nights.
 - **a.** Determine whether the cost is a function of the number of nights reserved. Then find the domain and range.
 - **b.** Describe the relationship between the cost and the number of nights reserved.
- **10. Dig Deeper** The graph represents the number of contestants in each round of a talent competition.
 - a. Is the number of contestants a function of the round number?
 - **b.** Predict the number of contestants in the talent competition during Round 7. Explain your reasoning.



7.1 Practice with CalcChat® AND CalcView®

Review & Refresh

You spin the spinner shown twice. Find the probability of the event.

- **1.** Spin blue twice
- **2.** Spin blue and then spin yellow
- **3.** Spin yellow and then spin red

Graph the linear equation.

4. y = 2x - 3 **5.** y = -0.5x **6.** y = -3x + 4



Concepts, Skills, & Problem Solving

INTERPRETING DIAGRAMS Describe the relationship between the *inputs* and *outputs* in the diagram. Then complete the diagram. Is there more than one possible answer? Explain your reasoning. (See Exploration 1.)





LISTING ORDERED PAIRS OF RELATIONS List the ordered pairs shown in the mapping diagram. (See Example 1.)



DETERMINING WHETHER RELATIONS ARE FUNCTIONS Determine whether the relation is a function. Then find the domain and range. (See Example 2.)





15. YOU BE THE TEACHER Your friend determines whether the relation shown is a function. Is your friend correct? Explain your reasoning.

(4, 5), (4, 6), (4, 7), (4, 8)

Each output is paired with exactly one input. So, the relation is a function.

REASONING Draw a mapping diagram that represents the relation. Find the domain and range. Then determine whether the relation is a function. Explain.





T-Shirts	Cost
1	\$10
2	\$18
3	\$24

4

\$28





- **19. MODELING REAL LIFE** The normal pressure at sea level is 1 atmosphere of pressure (1 ATM). As you dive below sea level, the pressure changes. The mapping diagram represents the pressures at different depths. (See Example 3.)
 - **a.** Complete the mapping diagram.
 - **b.** Determine whether the pressure is a function of depth. Find the domain and range.
 - **c.** Describe the relationship between pressure and depth.
 - **d.** List the ordered pairs. Then plot the ordered pairs in a coordinate plane. What do you notice about the points?



- **20. Dig Deeper** The table shows the cost of purchasing 1, 2, 3, or 4 T-shirts from a souvenir shop.
 - a. Is the cost a function of the number of T-shirts purchased?
 - **b.** Describe the relationship between the cost and the number of T-shirts purchased. How does the *cost per T-shirt* change as you purchase more T-shirts?

21. CHOOSE A METHOD The table shows the outputs for several inputs.

Input, <i>x</i>	0	1	2	3	4
Output, y	25	30	35	40	45

- **a.** Use two methods to predict the output for an input of 200.
- **b.** Which method do you prefer? Explain your reasoning.

