



# 3-1

Relations and Functions



## EXPLORE & REASON

The desks in a study hall are arranged in rows like the horizontal ones in the picture.



A. What is a reasonable number of rows for the study hall? What is a reasonable number of desks?



B. **Look for Structure** What number of rows would be impossible? What number of desks would be impossible? Explain. © MP.7



C. What do your answers to Parts A and B reveal about what the graph of rows to desks looks like?



### HABITS OF MIND

**Model with Mathematics** What other representations could you use to display the student information? Select and describe one representation. Explain how the information would be presented. © MP.4



# Topic 3: Relations & Functions

• set of ordered pairs  $x, y$

• relation: each input has exactly one output  $x \rightarrow y$

Notes

Assess

domain

Set of  $x$  values of a function

range

Set of  $y$  values of a function

## EXAMPLE 1 Try It! Recognize Domain and Range

1. Identify the domain and the range of each function.

a.

x	2	3	4	5	6
y	0	1	2	3	4

d: {2, 3, 4, 5, 6}  
r: {0, 1, 2, 3, 4}

b.

x	-3	-1	1	3	4
y	1	3	-2	2	6

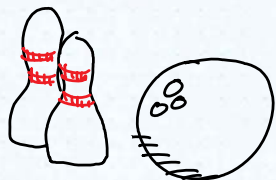
d: {-3, -1, 1, 3, 4}  
r: {1, 3, -2, 2, 6}

## EXAMPLE 2 Try It! Analyze Reasonable Domains and Ranges

2. Analyze each situation. Identify a reasonable domain and range for each situation. Explain.

a. A bowler pays \$2.75 per game.

b. A car travels 25 miles using 1 gallon of gas.



d: {1, 2, 3, ...}  
r: {2.75, 5.50, 8.25, ...}



d: {1, 2, 3, ...}  
r: {25, 50, 75, ...}

Domain

Buying lemons (each) \$\$

discrete (whole #'s)

vs. peanuts (by the lbs) \$\$

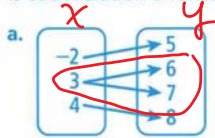
Continuous (decimals)

**HABITS OF MIND** Make Sense and Persevere How do characteristics of a situation impact the domain of a function that describes it? © MP.1

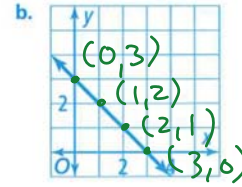


**EXAMPLE 3** Try It! Classify Relations and Functions

3. Is each relation a function? If so, is it one-to-one or not one-to-one??



No... not a function

$$\begin{aligned} & 3 \rightarrow 6 \\ & \& \ 3 \rightarrow 7 \end{aligned}$$


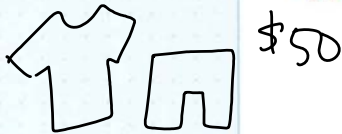
Yes, ...  
 It's a function  
 & one-to-one  
 relationship

One-to-one

• function  
 $\rightarrow x \leftrightarrow y$

**EXAMPLE 4** Try It! Identify Constraints on the Domain

4. Margaret has a monthly clothes budget of \$50. She maps the amount of money she spends each month to the number of items of clothing she buys. What constraints are there on the domain?



$d$ : # items  
 where Margaret's  
 limited to \$50

**HABITS OF MIND**

**Use Appropriate Tools** What are the advantages of using mapping diagrams when analyzing functions? Explain. **MP5**

**Do You UNDERSTAND?**

1. **ESSENTIAL QUESTION** What is a function?

Why is domain and range important when defining a function?

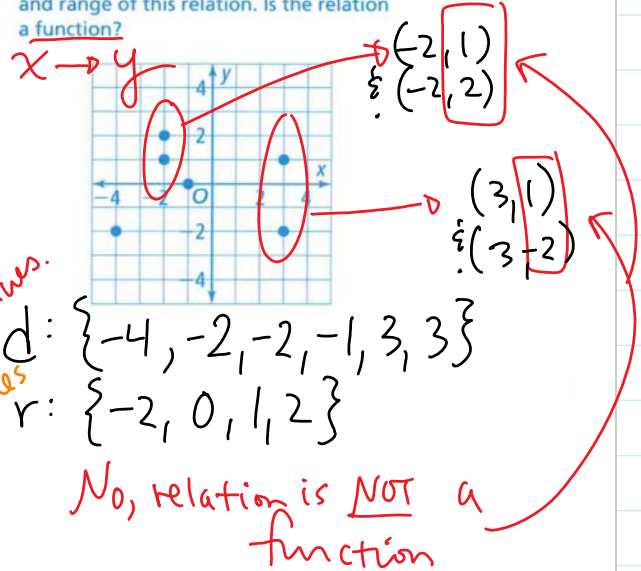
2. **Vocabulary** Maya is tracking the amount of rainfall during a storm. Describe the *domain* and *range* for this situation. Include *continuous* or *discrete* in your description.

3. **Reason** What can you conclude about the domain and the range of a function if a vertical line at  $x = 5$  passes through 2 points? 1 point? No points? Explain. **MP.2**

4. **Error Analysis** Felipe states that every relation is a function, but not every function is a relation. Explain Felipe's error. **MP.3**

**Do You KNOW HOW?**

5. Use the graph to determine the domain and range of this relation. Is the relation a function?



*x-values*  
 $d: \{-4, -2, -2, -1, 3, 3\}$   
*y-values*  
 $r: \{-2, 0, 1, 2\}$   
 No, relation is NOT a function

6. For the set of ordered pairs shown, identify the domain and range. Does the relation represent a function?

$\{(1, 8), (5, 3), (7, 6), (2, 2), (8, 4), (3, 9), (5, 7)\}$   
 $d: \{1, 5, 7, 2, 8, 3, 5\}$   
 $r: \{8, 3, 6, 2, 4, 9, 7\}$   
 Not a function...

7. Each day Jacob records the number of laps and the distance he walks, in miles, on a track. Graph the relation and determine whether the distance that Jacob walks is a function of the number of laps.

$\{(3, 0.75), (6, 1.5), (9, 2.25), (2, 0.5), (7, 1.75), (10, 2.5), (4, 1)\}$

