

## 9.3 Two-Way Tables

### Essential Question

How can you read and make a two-way table?

Two categories of data can be displayed in a *two-way table*.

#### 1 ACTIVITY: Reading a Two-Way Table

Work with a partner. You are the manager of a sports shop. The two-way table shows the numbers of soccer T-shirts that your shop has left in stock at the end of the season.

		T-Shirt Size					Total
		S	M	L	XL	XXL	
Color	Blue/White	5	4	1	0	2	
	Blue/Gold	3	6	5	2	0	
	Red/White	4	2	4	1	3	
	Black/White	3	4	1	2	1	
	Black/Gold	5	2	3	0	2	
Total							65

- Complete the totals for the rows and columns.
- Are there any black-and-gold XL T-shirts in stock? Justify your answer.
- The numbers of T-shirts you ordered at the beginning of the season are shown below. Complete the two-way table.

		T-Shirt Size					Total
		S	M	L	XL	XXL	
Color	Blue/White	5	6	7	6	5	
	Blue/Gold	5	6	7	6	5	
	Red/White	5	6	7	6	5	
	Black/White	5	6	7	6	5	
	Black/Gold	5	6	7	6	5	
Total							

#### Data Analysis

In this lesson, you will

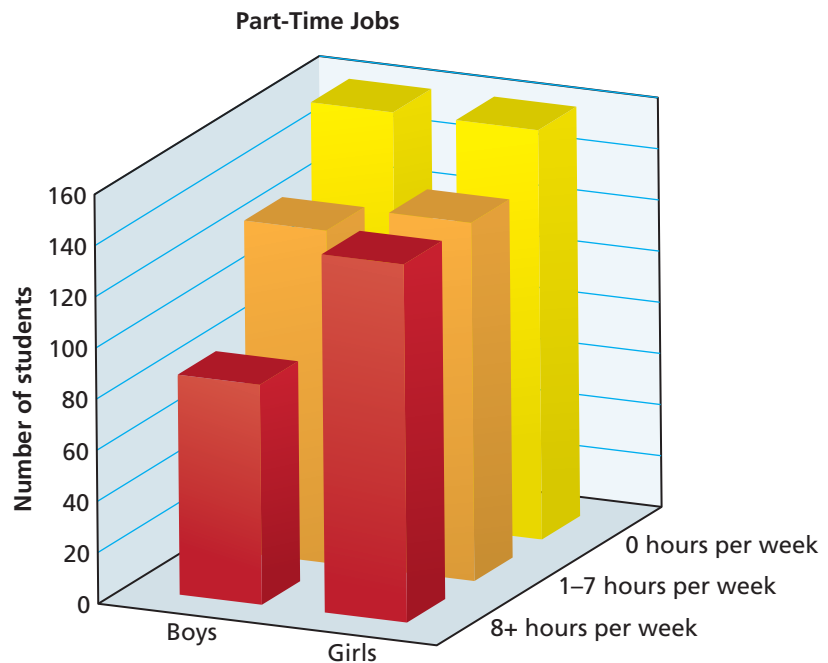
- read two-way tables.
- make and interpret two-way tables.

- REASONING** How would you alter the numbers of T-shirts you order for next season? Explain your reasoning.

**Math Practice****Construct Arguments**

What are the advantages of using a table instead of a graph to analyze data?

Work with a partner. The three-dimensional two-way table shows information about the numbers of hours students at a high school work at part-time jobs during the school year.



- Make a two-way table showing the data. Use estimation to find the entries in your table.
- Write two observations you can make that summarize the data in your table.
- REASONING** A newspaper article claims that more boys than girls drop out of high school to work full-time. Do the data support this claim? Explain your reasoning.

**What Is Your Answer?**

- IN YOUR OWN WORDS** How can you read and make a two-way table?
- Find a real-life data set that you can represent by a two-way table. Then make a two-way table for the data set.

**Practice**

Use what you learned about two-way tables to complete Exercises 3–6 on page 390.

### Key Vocabulary

two-way table,  
p. 388  
joint frequency,  
p. 388  
marginal frequency,  
p. 388

A **two-way table** displays two categories of data collected from the same source.

You randomly survey students in your school about their grades on the last test and whether they studied for the test. The two-way table shows your results. Each entry in the table is called a **joint frequency**.

		Student	
		Studied	Did Not Study
Grade	Passed	21	2
	Failed	1	6

joint frequency

## EXAMPLE 1 Reading a Two-Way Table

**How many of the students in the survey above studied for the test and passed?**

The entry in the “Studied” column and “Passed” row is 21.

So, 21 of the students in the survey studied for the test and passed.

The sums of the rows and columns in a two-way table are called **marginal frequencies**.

## EXAMPLE 2 Finding Marginal Frequencies

**Find and interpret the marginal frequencies for the survey above.**

Create a new column and a new row for the sums. Then add the entries.

		Student		Total
		Studied	Did Not Study	
Grade	Passed	21	2	23
	Failed	1	6	7
Total		22	8	30

23 students passed.  
7 students failed.  
30 students were surveyed.  
22 students studied.  
8 students did not study.

### On Your Own

Now You're Ready  
Exercises 5–8

- You randomly survey students in a cafeteria about their plans for a football game and a school dance. The two-way table shows your results.

- How many students will attend the dance but not the football game?
- Find and interpret the marginal frequencies for the survey.

		Football Game	
		Attend	Not Attend
Dance	Attend	35	5
	Not Attend	16	20

### EXAMPLE 3 Making a Two-Way Table

Rides Bus	
Age	Tally
12-13	/     /     /     /
14-15	/     /
16-17	/     /

You randomly survey students between the ages of 12 and 17 about whether they ride the bus to school. The results are shown in the tally sheets. Make a two-way table that includes the marginal frequencies.

The two categories for the table are the ages and whether or not they ride the bus. Use the tally sheets to calculate each joint frequency. Then add to find each marginal frequency.

Does Not Ride Bus	
Age	Tally
12-13	/     /     /
14-15	/     /
16-17	/     /     /     /

		Age			Total
		12-13	14-15	16-17	
Student	Rides Bus	24	12	14	50
	Does Not Ride Bus	16	13	21	50
Total		40	25	35	100

### EXAMPLE 4 Finding a Relationship in a Two-Way Table

Use the two-way table in Example 3.

- a. For each age group, what percent of the students in the survey ride the bus to school? do not ride the bus to school? Organize the results in a two-way table. Explain what one of the entries represents.

		Age		
		12-13	14-15	16-17
Student	Rides Bus	60%	48%	40%
	Does Not Ride Bus	40%	52%	60%

$\frac{14}{35} = 0.4$   
So, 40% of the 16- and 17-year-old students in the survey ride the bus to school.

- b. Does the table in part (a) show a relationship between age and whether students ride the bus to school? Explain.

Yes, the table shows that as age increases, students are less likely to ride the bus to school.

### On Your Own

#### Now You're Ready Exercise 10

<u>Grade 6 Students</u>
11 pack lunch, 9 buy school lunch
<u>Grade 7 Students</u>
23 pack lunch, 27 buy school lunch
<u>Grade 8 Students</u>
16 pack lunch, 14 buy school lunch

2. You randomly survey students in a school about whether they buy a school lunch or pack a lunch. Your results are shown.
- Make a two-way table that includes the marginal frequencies.
  - For each grade level, what percent of the students in the survey pack a lunch? buy a school lunch? Organize the results in a two-way table. Explain what one of the entries represents.
  - Does the table in part (b) show a relationship between grade level and lunch choice? Explain.

## Vocabulary and Concept Check

- VOCABULARY** Explain the relationship between joint frequencies and marginal frequencies.
- OPEN-ENDED** Describe how you can use a two-way table to organize data you collect from a survey.

## Practice and Problem Solving

You randomly survey students about participating in their class's yearly fundraiser. You display the two categories of data in the two-way table.

- Find the total of each row.
- Find the total of each column.
- How many female students will be participating in the fundraiser?
- How many male students will *not* be participating in the fundraiser?

		Fundraiser	
		No	Yes
Gender	Female	22	51
	Male	30	29

Find and interpret the marginal frequencies.

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		School Play	
		Attend	Not Attend
Class	Junior	41	30
	Senior	52	23

8.

		Cell Phone Minutes	
		Limited	Unlimited
Text Plan	Limited	78	0
	Unlimited	175	15

- GOALS** You randomly survey students in your school. You ask what is most important to them: grades, popularity, or sports. You display your results in the two-way table.
  - How many 7th graders chose sports? How many 8th graders chose grades?
  - Find and interpret the marginal frequencies for the survey.
  - What percent of students in the survey are 6th graders who chose popularity?

		Goal		
		Grades	Popularity	Sports
Grade	6th	31	18	23
	7th	39	16	19
	8th	42	6	17

- 3 4 10. SAVINGS** You randomly survey people in your neighborhood about whether they have at least \$1000 in savings. The results are shown in the tally sheets.

Have at Least \$1000 in Savings

Age	Tally
20-29	
30-39	
40-49	

- Make a two-way table that includes the marginal frequencies.
- For each age group, what percent of the people have at least \$1000 in savings? do not have at least \$1000 in savings? Organize the results in a two-way table.
- Does the table in part (b) show a relationship between age and whether people have at least \$1000 in savings? Explain.

Don't Have at Least \$1000 in Savings

Age	Tally
20-29	
30-39	
40-49	

- 11. EYE COLOR** You randomly survey students in your school about the color of their eyes. The results are shown in the tables.

Eye Color of Males Surveyed		
Green	Blue	Brown
5	16	27

Eye Color of Females Surveyed		
Green	Blue	Brown
3	19	18

- Make a two-way table.
- Find and interpret the marginal frequencies for the survey.
- For each eye color, what percent of the students in the survey are male? female? Organize the results in a two-way table. Explain what two of the entries represent.

- 12. REASONING** Use the information from Exercise 11. For each gender, what percent of the students in the survey have green eyes? blue eyes? brown eyes? Organize the results in a two-way table. Explain what two of the entries represent.

- 13. Precision** What percent of students in the survey in Exercise 11 are either female or have green eyes? What percent of students in the survey are males who do not have green eyes? Find and explain the sum of these two percents.



## Fair Game Review What you learned in previous grades & lessons

Write an equation of the line that passes through the points. (Section 4.6)

14. (0, 1), (-2, -5)      15. (0, -2), (3, 13)      16. (-4, 1), (0, 3)
17. **MULTIPLE CHOICE** Which equation does not represent a linear function? (Section 6.4)

- (A)  $y = 4x$       (B)  $xy = 8$       (C)  $y = -3$       (D)  $6x + 5y = -2$