


Check Skills You'll Need
1. **Vocabulary Review**

A $\frac{?}{?}$ is a number that can be written in the form $\frac{a}{b}$, where a is an integer and b is any nonzero integer.

Write the decimal expansion of each fraction.

2. $\frac{2}{5}$ 3. $\frac{3}{9}$
 4. $\frac{7}{8}$ 5. $\frac{4}{11}$

 **for Help**
Lesson 1-1

What You'll Learn

To construct and interpret two-way frequency tables and two-way relative frequency tables

New Vocabulary two-way table, frequency, relative frequency

Why Learn This?

You can use a two-way frequency table, such as the one at the right, to display the number of science club members who are in favor of planting a garden on school property.

	For	Against	Total
Boys	7	8	15
Girls	9	6	15
Total	16	14	30

A **two-way table** of frequencies is useful for organizing and displaying data that pertains to different categories. The **frequency** of an item is the number of times the item occurs.

EXAMPLE Making a Frequency Table

1 Fifty moviegoers were surveyed about their favorite movie types.

- 13 men and 6 women chose “Action” as their favorite type.
- 8 men and 8 women chose “Drama” as their favorite type.
- 5 men and 4 women chose “Comedy” as their favorite type.
- 4 men and 2 women chose “Animated” as their favorite type.

Make a two-way table of frequencies for the data. Use the frequency table to determine the most popular type of movie in the survey.

Step 1 Choose the categories. Use Men and Women as one set of categories. Use Action, Drama, Comedy, and Animated as the other set of categories.

Step 2 Draw the two-way table. Fill in the table using the data above.

	Action	Drama	Comedy	Animated	Total
Men	13	8	5	4	30
Women	6	8	4	2	20
Total	19	16	9	6	50

Action movies have 19 votes. They are the most popular type of movie.

CONTENT STANDARD

8.SP.4

Test Prep Tip

When constructing a two-way table, it does not matter which category is displayed in columns or which category is displayed in rows.

✓ Quick Check

- Thirty students were surveyed about their favorite type of lunch. Six girls and 8 boys chose turkey sandwiches. Seven girls and 3 boys chose grilled chicken. Four girls and 2 boys chose veggie pizza. Make a two-way table of frequencies for the data. Use the frequency table to determine the least popular lunch choice in the survey.

A two-way table can also be used to display relative frequency. **Relative frequency** is the ratio of a frequency to the value of the corresponding row total, corresponding column total, or total population.

EXAMPLE Making a Relative Frequency Table

- The frequency table shows the hair and eye colors of 25 students. Is there evidence that blue eyes are more common for students with blond hair than for those with black hair? Explain.

		Hair Color			Total
		Blond	Black	Brown	
Eye Color	Blue	3	1	2	6
	Brown	2	7	6	15
	Green	1	1	2	4
	Total	6	9	10	25

- Step 1** Make a two-way table of relative frequencies. Find the relative frequencies for each *column*. Divide each frequency by its corresponding column total.

		Hair Color		
		Blond	Black	Brown
Eye Color	Blue	$\frac{3}{6} = 0.50$	$\frac{1}{9} = 0.\bar{1}$	$\frac{2}{10} = 0.20$
	Brown	$\frac{2}{6} = 0.\bar{3}$	$\frac{7}{9} = 0.\bar{7}$	$\frac{6}{10} = 0.60$
	Green	$\frac{1}{6} = 0.1\bar{6}$	$\frac{1}{9} = 0.\bar{1}$	$\frac{2}{10} = 0.20$
	Total	$\frac{6}{6} = 1.00$	$\frac{9}{9} = 1.00$	$\frac{10}{10} = 1.00$

- Step 2** Analyze the results. According to the table, **0.50**, or **50 %**, of the students with blond hair have blue eyes. Only **0. $\bar{1}$** , or **11. $\bar{1}$ %**, of the students with black hair have blue eyes.

- Step 3** Draw a conclusion. For the students surveyed, there is evidence that blue eyes are more common for students with blond hair than for those with black hair.

✓ Quick Check

- Is there evidence that brown eyes are less common for students with blond hair than for those with brown hair? Explain your reasoning.

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For help with repeating decimals, go to Lesson 1-1, Example 1.

For the two-way table of frequencies in Example 2, you can also find the relative frequencies for each *row*. Divide each frequency by its corresponding row total.

		Hair Color			
		Blond	Black	Brown	Total
Eye Color	Blue	$\frac{3}{6} = 0.50$	$\frac{1}{6} = 0.1\bar{6}$	$\frac{2}{6} = 0.\bar{3}$	$\frac{6}{6} = 1.00$
	Brown	$\frac{2}{15} = 0.1\bar{3}$	$\frac{7}{15} = 0.4\bar{6}$	$\frac{6}{15} = 0.40$	$\frac{15}{15} = 1.00$
	Green	$\frac{1}{4} = 0.25$	$\frac{1}{4} = 0.25$	$\frac{2}{4} = 0.50$	$\frac{4}{4} = 1.00$

Check Your Understanding

- Vocabulary** When would you use a two-way table to display data?

Use the two-way table for Exercises 2–5.

- Complete the table.
- How many coaches participated in the survey?
- How many players participated in the survey?
- How many players participated in the survey?
- Which sport is more popular among the coaches? the players?

		Favorite Sport		
		Football	Baseball	Total
Coaches	5	7	12	
Players	■	6	■	
Total	12	■	25	

Homework Exercises

For more exercises, see **Extra Skills and Word Problems**.

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Exercises	See Example
6	1
7	2

- Twenty students at Central Middle School were surveyed about their favorite course at school. Below are the results.
 - 3 boys and 4 girls chose “Math.”
 - 2 boys and 3 girls chose “Science.”
 - 1 boy and 2 girls chose “Language Arts.”
 - 3 boys and 2 girls chose “Social Studies.”
 - Construct a two-way frequency table for the data.
 - According to the table, what is the least popular course?
- Jeremy surveyed the residents of the homes on Main Street. Is there evidence that homes with four or more bedrooms are more common for residents with three or more children? Explain.

		Number of Children				
		0	1	2	3+	Total
Number of Bedrooms	2	2	3	1	0	6
	3	3	2	10	1	16
	4+	1	0	3	4	8
	Total	6	5	14	5	30

GPS

8. **Guided Problem Solving** Annabelle surveyed several students in her class. The results of her survey are shown in the table. Is there evidence that students who walk to school tend to NOT take music lessons? Explain your reasoning.

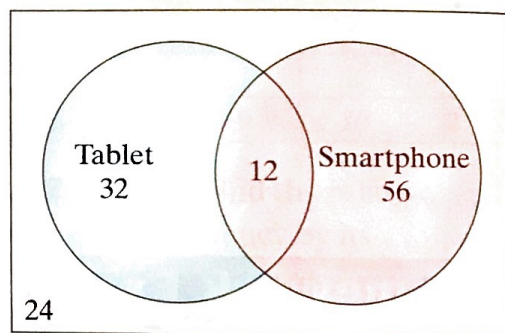
Student Survey

Walked to School	Y	Y	N	Y	N	N	N	Y	N	Y
Music Lesson	N	Y	Y	N	N	Y	N	N	Y	N

- **Make a Plan** Make a two-way table of relative frequencies. In the first column, list Walked to School and Didn't Walk to School. In the first row, list Music Lesson and No Music Lesson.
- How can you use the relative frequencies for each row to determine if there is evidence that the students who walked to school tend to NOT take music lessons?

9. **Open Ended** Design a survey with two categorical variables for your class. Construct a two-way relative frequency table for your data, and interpret the results of your survey.

10. **Challenge** The Venn diagram shows the results of a survey of the types of electronic devices used most often in 124 households. The area within the rectangle but outside the circles represents households that do not use a tablet or a smartphone. Construct a two-way frequency table that displays the data.



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Test Prep and Mixed Review

Practice

Multiple Choice

11. The two-way table shows the results of a survey about whether students should be required to wear school uniforms. According to the table, what percent of teenagers are in favor of wearing school uniforms?
- (A) 18% (B) 43% (C) 32% (D) 61%

	For	Against	Total
Parents	0.43	0.07	0.50
Teens	0.18	0.32	0.50
Total	0.61	0.39	1.00

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Exercises	See Lesson
12-14	7-6

Find the sum of the measures of the interior angles of each polygon.

12. quadrilateral 13. heptagon 14. nonagon