

Standard 8.SP.4 (L)

Two-Way Tables

Not all data is numerical data. **Categorical data** are observations sorted based on characteristics or attributes. Categorical data is also called **qualitative data**. The tables that you used to create scatter plots in earlier lessons are called one-way tables. Another kind of table, a **two-way table**, is a table that displays two-variable (bivariate) categorical data by organizing it into rows and columns. Bivariate data is sorted based on two different categories. One category is shown with the columns, and the other category is shown with the rows.

Read the example below, and study the tables that follow.

A middle-school principal wanted to know what kind of pizza students prefer to eat at lunch: cheese or pepperoni. She asked eighth-grade boys and girls about their preferences and summarized the information in the one-way and two-way tables below.

One-Way Table

	Cheese	Pepperoni	Total
Eighth-grade students	40	60	100

Two-Way Table

	Cheese	Pepperoni	Total
Eighth-grade boys	15	40	55
Eighth-grade girls	25	20	45
Total	40	60	100

The one-way table categorizes the data based on one variable: pizza preference. The two-way table categorizes the data based on pizza preference and student gender. The total number of students in each table is the same: 100.

Each number on the tables represents the frequency of an event. The **frequency** is the number of times an event occurs. For example, the number 15 on the two-way table shows the number of times eighth-grade boys picked cheese pizza.

Think About It: How might we use two-way tables?

Standard 8.SP.4 (M)

Relative Frequency & Two-Way Tables

You have worked with relative frequency in the past. **Relative frequency** is the ratio of the observed number of times an event occurs to the total number of events. Relative frequencies can be expressed as decimals or percents. To write a relative frequency as a percent, multiply the value as a decimal by 100 and add a percent sign.

Look at the example below for a relative frequency of 0.25.

$$0.25 \times 100 = 25\%$$

On Your Own: The two-way table from the previous activity is shown below. Calculate the relative frequencies for each event. Round your answers to the nearest whole number.

	Cheese	Pepperoni	Total
Eighth-grade boys	15	40	55
Eighth-grade girls	25	20	45
Total	40	60	100

- _____ percent of eighth-grade students surveyed are boys.
- _____ percent of eighth-grade students surveyed are girls.
- _____ percent of eighth-grade students prefer cheese pizza.
- _____ percent of eighth-grade students prefer pepperoni pizza.
- _____ percent of eighth-grade boys prefer cheese pizza.
- _____ percent of eighth-grade boys prefer pepperoni pizza.
- _____ percent of eighth-grade girls prefer cheese pizza.
- _____ percent of eighth-grade girls prefer pepperoni pizza.

Relative frequencies are useful because they allow you to determine whether there is an association between two variables or categories.

Standard 8.SP.4 (M)

Constructing Two-Way Tables

Now you will create a two-way table on your own. Read the example below.

A teacher asked 400 eighth-grade students whether they play a sport and whether they are on the honor roll.

There are four possible outcomes.

1. students who play a sport and are on the honor roll
2. students who play a sport and are not on the honor roll
3. students who do not play a sport and are on the honor roll
4. students who do not play a sport and are not on the honor roll

The results of the survey are shown in the table below.

Student Survey Results

Only plays a sport	90
Only on the honor roll	110
Plays a sport and on the honor roll	140
Does not play a sport and not on the honor roll	60

This information can be summarized in a two-way table, like the one below.

	Plays a sport	Does not play a sport	Total
On the honor roll			
Not on the honor roll			
Total			

On Your Own-1: Use the survey results to complete the two-way table above. Be sure to calculate the totals.

continue to next page

On Your Own-2: Use relative frequencies to answer the following questions about the survey and two-way table on page 87.

1. What percent of the students play a sport? _____
2. What percent of the students do not play a sport? _____
3. What percent of the students are on the honor roll? _____
4. What percent of the students are not on the honor roll? _____
5. What percent of the students play a sport and are on the honor roll? _____
6. What percent of the students play a sport and are not on the honor roll? _____
7. What percent of the students do not play a sport and are on the honor roll?

8. What percent of the students do not play a sport and are not on the honor roll?

Standard 8.SP.4 (M)

Conditional Relative Frequency

The two-way table below shows the results of a survey conducted among eighth-grade students regarding their sports preferences. The table is incomplete, but it has enough information to be completed.

	Likes soccer	Does not like soccer	Total
Likes football		50	95
Does not like football	10		
Total			125

Try It: Complete the two-way table above. Then, answer the questions below.

1. What percent of the students like football? _____
2. What percent of the students do not like football? _____
3. What percent of the students like soccer? _____
4. What percent of the students do not like soccer? _____
5. What percent of the students like soccer and football? _____
6. What percent of the students like soccer but not football? _____
7. What percent of the students like football but not soccer? _____
8. What percent of the students do not like football or soccer? _____

In the "Try It" activity above, you found the relative frequencies of different events. You can also use a two-way table to find conditional relative frequencies of different events.

Conditional relative frequency is the ratio of the observed number of times an event occurs to the total number of events in that row or column. Conditional relative frequency is found by dividing the frequency by the row total or column total (instead of the table total). Like relative frequencies, conditional relative frequencies can be expressed as decimals or percents.

continue to next page

Look again at the completed two-way table on page 89. What is the conditional relative frequency of students who like soccer and also like football?

In this situation, the “condition” is that the students must first like soccer. That means that the denominator of the conditional relative frequency ratio will be the total number of students who like soccer (55). The numerator of the ratio will be the number of students who like soccer and football (45).

$$\frac{45}{55} = 0.\overline{81}$$

About 82% of the students who like soccer also like football.

On Your Own: Calculate the conditional relative frequencies below. Round your answers to the nearest whole number. The first one is completed for you.

1. What percent of the students who like soccer also like football? 82%
2. What percent of the students who like soccer do not like football? _____
3. What percent of the students who do not like soccer like football? _____
4. What percent of the students who do not like soccer do not like football? _____
5. What percent of the students who like football also like soccer? _____
6. What percent of the students who like football do not like soccer? _____
7. What percent of the students who do not like football like soccer? _____
8. What percent of the students who do not like football do not like soccer? _____

Talk About It: In the “On Your Own” activity above, the percent of soccer fans who also like football is different from the percent of football fans who also like soccer? Why?