

10.3 Analyze Data



Before

You found measures of central tendency.

Now

You will find frequencies in a two-way frequency table.

Why?

So you can use data about dogs in a store in Exercise 3.

Key Vocabulary

- marginal frequency
- joint frequency

A two-way frequency table shows the number of items in various categories. Every element in the sample must fit into one of the categories and there must be no overlap between categories.

COMMON CORE

CC.9-12.S.ID.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.*

KEY CONCEPT

For Your Notebook

Two-way frequency table

A two-way frequency table divides the data into categories across the top and down the side.

	Apples	Oranges	Total
Boys	15	18	33
Girls	21	16	37
Total	36	34	70

The body of the table gives the **joint frequencies**.

The row and column totals give the **marginal frequencies**.

EXAMPLE 1

Read information from a two-way frequency table

The table shows the results of students naming their favorite subject.

	Math	Science	English	Total
Miss Bailey's homeroom	8	6	5	19
Mr. Cole's homeroom	4	7	9	20
Total	12	13	14	39

- How many students in Miss Bailey's homeroom prefer math?
- How many students from both homerooms prefer science?

Solution

- The cell in the row for Miss Bailey's homeroom and in the column for Math contains 8, so 8 students in her homeroom prefer math.
- The cell in the total row and in the column for Science contains 13, so 13 students prefer Science.

EXAMPLE 2 Make a two-way frequency table

Make a two-way frequency table for the following data.

There are 175 freshmen taking a foreign language. Of these, 88 take Spanish, 46 take French, and the rest take German. No one takes more than one language. There are 42 boys taking Spanish, 31 girls taking French, and a total of 89 girls taking a language.

Solution

The categories are Spanish, French, German, boys, and girls. Fill in the given information. Then look for ways to calculate the missing values.

For example, the number of girls taking Spanish is $88 - 42 = 46$. The number of boys taking a foreign language is $175 - 89 = 86$. The total number of students taking German is $175 - (88 + 46)$.

	Spanish	French	German	Total
Boys	42	15	29	86
Girls	46	31	12	89
Total	88	46	41	175

AVOID ERRORS

Be sure to enter the given information in the correct cells of the table.



GUIDED PRACTICE for Examples 1 and 2

- Using the table in Example 1, tell whether more students in Mr. Cole's homeroom prefer science or English.
- There are 152 students who play golf, basketball, or soccer. No one plays more than one of these sports. There are 22 who play golf, 50 who play basketball, and the rest play soccer. There are 10 boys who play golf, 26 girls who play basketball, and a total of 80 boys who play one of these sports. Make a two-way frequency table for the data.

EXAMPLE 3 Analyze a situation in a two-way table

The table shows where students at a university live.

	Live on Campus	Live off Campus	Total
Men	3216	4010	7226
Women	3824	3758	7582
Total	7040	7768	14,808

- Do more students live on campus or off campus?
- Is it also true that more women live off campus than on campus?

Solution

- Look at the marginal frequencies in the Total row. More students live off campus.
- No. Even though the marginal frequencies show that more students live off campus, looking at just the row for women, you can see that more women live on campus than off campus.

10.3 EXERCISES

HOMEWORK KEY

○ = See **WORKED-OUT SOLUTIONS**
Exs. 3, 7, and 15

★ = **STANDARDIZED TEST PRACTICE**
Exs. 2, 8, 15, and 18

SKILL PRACTICE

- VOCABULARY** copy and complete: The body of a two-way frequency table gives the ? of the categories involved.
- ★ **WRITING** Explain how you find the marginal frequency of a category in a two-way frequency table. Give an example.

EXAMPLE 1
for Exs. 3–5

READING A TWO-WAY TABLE Answer the questions based on the table showing the number of different kinds of puppies at a pet store.

	Labradors	Poodles	Yorkies	Total
Males	7	5	3	15
Females	4	8	6	18
Total	11	13	9	33



- How many male poodles does the pet store have?
- How many female puppies does the pet store have?
- How many more labradors than yorkies does the pet store have?
- COPY AND COMPLETE** Copy and complete the two-way table showing data about cars sold.

EXAMPLE 2
for Exs. 6–8

	2 door	4 door	Total
6 cylinder	586	?	?
8 cylinder	?	840	?
Total	?	1564	2465

- MAKING A TWO-WAY TABLE** You surveyed 82 students in your grade and found that twenty-three have 2 brothers and twenty-eight have 1 brother. Nine students are only children, ten have only 1 sister, seven have only 1 brother, six have 2 sisters and 1 brother, twenty-two have 2 sisters, twenty-seven have no sisters, and eight have 1 sister and 2 brothers. Make a two-way frequency table of the given information.
- ★ **MULTIPLE CHOICE** Use this two-way table to find how many 4 bedroom houses with 3 baths are for sale.

	3 Bedroom	4 Bedroom	Total
1 Bath	10	1	11
2 Bath	68	47	115
3 Bath	31	75	106
Total	109	122	232

(A) 31

(B) 47

(C) 68

(D) 75

EXAMPLE 3
for Exs. 10–12

ANALYZING A TWO-WAY TABLE The table shows the number of votes each student received from the various classes in the Student Government President Election.

	Freshmen	Sophomores	Juniors	Seniors	Total
Matt	92	86	110	110	359
Olivia	77	99	82	71	326
Katy	115	94	90	149	448
Total	284	279	282	288	1133

- If Matt received the most votes from the students in his class, what year student is Matt?
- Did any candidate have the most votes from more than one class? If so, who and which classes? *Explain.*
- Which student won the election?
- CHALLENGE** Create a two-way table from the given information. Water and iced tea come in 12-ounce and 16-ounce bottles. The number of 16-ounce bottles is one less than the number of 12-ounce bottles. There are 11 more bottles of iced tea than water. There are 16 bottles of water and the number of 12-ounce bottles of water is 2 less than twice the number of 16-ounce bottles of water.

PROBLEM SOLVING

In Exercises 13–15, use the given two-way table showing sandwiches sold at a deli to answer the questions.

	Ham	Chicken	Salami	Total
White bread	65	41	37	143
Wheat bread	97	75	62	234
Total	162	116	99	377

EXAMPLE 1
for Exs. 14–16

- SANDWICHES** How many more ham sandwiches on wheat bread were sold than chicken sandwiches on white bread?
- PREDICT** If you choose one sandwich at random would it be more likely to be chicken on wheat bread or ham on white bread? *Explain.*
- ★ SHORT RESPONSE** If you know that a customer is going to order a sandwich on wheat bread, what is the most likely type of sandwich that customer will order? *Explain.*
- MUSIC** There are 33 students in choir and 74 in band. No one is in both. Twenty-three of these students are less than 5 feet tall and 24 are more than 6 feet tall. Six choir members are less than 5 feet tall while twenty-two choir members are between 5 and 6 feet tall.
 - How many students in the choir are more than 6 feet tall?
 - How many students in the band are between 5 and 6 feet tall?
 - If you choose a student at random from the choir and from the band, which student is more likely to be between 5 and 6 feet tall? *Explain.*

17. **VEGETABLES** A gardener planted two tomato and green pepper plants in each of two types of soil to test fertilizers. The table shows the number of tomatoes and green peppers harvested from each set of plants. Which type of soil seems better for each vegetable?

	Tomatoes	Green Peppers	Total
Fertilizer- fortified soil	56	37	93
Soil fertilized every 2 weeks	65	19	84
Total	121	56	77



- Does one treatment appear to better for tomatoes?
 - Does one treatment appear to better for green peppers?
 - Looking at just the totals, which treatment appears to be better? Is this the best choice for both types of plants? *Explain.*
18. **★ EXTENDED RESPONSE** Sangee, Tom, and Maleho have classical and rock CDs. They have a total of 141 CDs, of which 47 are classical. Sangee has 19 rock CDs and 26 classical CDs, Tom has 38 rock CDs, and Maleho has 49 CDs.
- Model** Make a two-way table to display this data.
 - Calculate** If Sangee bought a classical CD, how would his classical CD total compare to Maleho's rock CD total?
 - Analyze** If a CD is chosen at random from those owned by these three boys, would it be more likely to be classical or rock?
19. **CHALLENGE** There were 1809 tickets sold to a play, of which 800 were for the main floor. These tickets consisted of $2x + y$ adult tickets on the main floor, $x - 40$ child tickets on the main floor, $x + 2y$ adult tickets in the balcony, and $3x - y - 80$ child tickets in the balcony.
- Find the values of x and y .
 - Find the number of adult balcony tickets sold.
 - Find the number of child main floor tickets sold.

Investigate Dot Plots

MATERIALS • ruler, graph paper



Model with mathematics.

QUESTION How do you represent data in a dot plot?

Data can be represented by dots in a display called a dot plot. A dot plot shows the frequency of data and how the data are distributed.

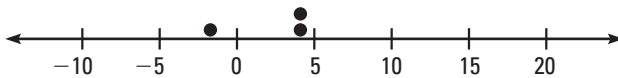
EXPLORE Draw a dot plot

STEP 1 Collect data

Look up the low temperature for a city in the northern United States for each day in January of last year.

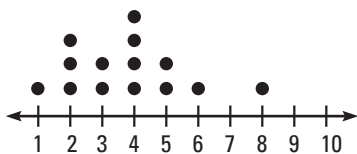
STEP 2 Make a dot plot

Use graph paper to draw a horizontal axis. Label it Temperatures and number it using a reasonable scale. Place a dot above the appropriate temperature to represent the low temperature for each day in January. For example, put a dot over the temperature 4 to indicate that the low temperature on one day was 4°F. The sample graph shows that it was 4°F on two days and -3°F on one day.

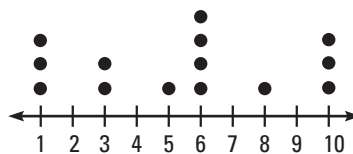


DRAW CONCLUSIONS Use your observations to complete these exercises

- Examine your dot plot. What is the range of the data values?
- Are the data tightly clustered or spread apart?
- Is there a value that occurs more often than the others? If so, what does this mean in the context of the data?
- If you were to add the temperature for February 1st to your dot plot, what would you expect it to be? Explain your reasoning. What types of values would be surprising? Why?
- How would your dot plot change if you collected temperatures from a summer month rather than from January?
- Compare the data in the dot plots.



Plot A



Plot B