

## Using Sampling to Predict

### MAIN IDEA

Predict the actions of a larger group by using a sample.

### New Vocabulary

sample  
 unbiased sample  
 simple random sample  
 biased sample  
 convenience sample  
 voluntary response sample

### Math Online

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- Extra Examples
- Personal Tutor
- Self-Check Quiz

### ▶ GET READY for the Lesson

**CELL PHONES** The manager of a local cell phone company wants to conduct a survey to determine what kind of musical ring tones people typically use.



#### What Kind of Musical Ring Tone Do You Use?

Classical
Rock
Rap/Hip-Hop
Dance
Other

1. Suppose she decides to survey the listeners of a rock radio station. Do you think the results would represent the entire population? Explain.
2. Suppose she decides to survey a group of people standing in line for a symphony. Do you think the results would represent the entire population? Explain.
3. Suppose she decides to mail a survey to every 100th household in the area. Do you think the results would represent the entire population? Explain.

The manager of the cell phone company cannot survey everyone. A smaller group called a **sample** is chosen. A sample should be representative of the population.

Population	Sample
United States citizens	registered voters
California residents	homeowners
Six Flags Marine World visitors	teenagers

For valid results, a sample must be chosen very carefully. An **unbiased sample** is selected so that it is representative of the entire population. A simple random sample is the most common type of unbiased sample.

Unbiased Samples		Concept Summary
Type	Description	Example
<b>Simple Random Sample</b>	Each item or person in the population is as likely to be chosen as any other.	Each student's name is written on a piece of paper. The names are placed in a bowl, and names are picked without looking.

 **Vocabulary Link** . . . . .

**Bias**

**Everyday Use** a tendency or prejudice.

**Math Use** error introduced by selecting or encouraging a specific outcome.

- In a **biased sample**, one or more parts of the population are favored over others. Two ways to pick a biased sample are listed below.

<b>Biased Samples</b>		<b>Concept Summary</b>
<b>Type</b>	<b>Description</b>	<b>Example</b>
<b>Convenience Sample</b>	A convenience sample includes members of a population who are easily accessed.	To represent all the students attending a school, the principal surveys the students in one math class.
<b>Voluntary Response Sample</b>	A voluntary response sample involves only those who want to participate in the sampling.	Students at a school who wish to express their opinion are asked to complete an online survey.

**EXAMPLES**

**Determine Validity of Conclusions**

**1** To determine what kind of movies people like to watch, every tenth person who walks into a video rental store is surveyed. The store carries all kinds of movies. Out of 180 customers surveyed, 62 stated that they prefer action movies. The store manager concludes that about a third of all customers prefer action movies.

The conclusion is valid. Since the population is every tenth customer of a video rental store, the sample is an unbiased random sample.

**2** A television program asks its viewers to visit a Web site to indicate their preference for two presidential candidates. 76% of the viewers who responded preferred candidate A, so the television program announced that most people prefer candidate A.

The conclusion is not valid. The population is restricted to viewers who have Internet access, it is a voluntary response sample, and is biased. The results of a voluntary response sample do not necessarily represent the entire population.

 **CHECK Your Progress**

Determine whether each conclusion is valid. Justify your answer.

- To determine what people like to do in their leisure time, people at a local mall are surveyed. Of these, 82% said they like to shop. The mall manager concludes that most people like to shop during their leisure time.
- To determine what kind of sport junior high school students like to watch, 100 students are randomly selected from each of four junior high schools in a city. Of these, 47% like to watch football. The superintendent concludes that about half of all junior high students like to watch football.

In Lesson 8-7, you used the results of a random sampling method to make predictions. In this lesson, you will first determine if a sampling method is valid and if so, use the results to make predictions.

### Study Tip

**Misleading Predictions**  
Predictions based on biased samples can be misleading. If the students surveyed were all boys, the predictions generated by the survey would not be valid, since both girls and boys attend the junior high school.

### Real-World EXAMPLE

**3 MASCOTS** The Student Council at a new junior high school surveyed 5 students from each of the 10 homerooms to determine what mascot students would prefer. The results of the survey are shown at the right. If there are 375 students at the school, predict how many students prefer a tiger as the school mascot.

Mascot	Number
Tornadoes	15
Tigers	28
Twins	7

The sample is an unbiased random sample since students were randomly selected. Thus, the sample is valid.

$\frac{28}{50}$  or 56% of the students prefer a tiger. So, find 56% of 375.

$$0.56 \times 375 = 210 \quad 56\% \text{ of } 375 = 0.56 \times 375$$

So, about 210 students would prefer a tiger as the school mascot.

### CHECK Your Progress

- c. **AIRLINES** During flight, a pilot determined that 20% of the passengers were traveling for business and 80% were traveling for pleasure. If there are 120 passengers on the next flight, how many can be expected to be traveling for pleasure?

### CHECK Your Understanding

**Examples 1, 2**  
(p. 439)

**Determine whether each conclusion is valid. Justify your answer.**

- To determine the number of umbrellas the average household in the United States owns, a survey of 100 randomly selected households in Arizona is conducted. Of the households, 24 said that they own 3 or more umbrellas. The researcher concluded that 24% of the households in the United States own 3 or more umbrellas.
- A researcher randomly surveys ten employees from each floor of a large company to determine the number of employees who carpool to work. Of these, 31% said that they carpool. The researcher concludes that most employees do not carpool.

**Example 3**  
(p. 440)

- LUNCH** Jared randomly surveyed some students to determine their lunch habits. The results are shown in the table. If there are 268 students in the school, predict how many bring their lunch from home.

Lunch Habit	Number
Bring Lunch from Home	19
Buy Lunch in the Cafeteria	27
Other	4

# Practice and Problem Solving

## HOMework HELP

For Exercises	See Examples
4–9	1, 2
10, 11	3

Determine whether each conclusion is valid. Justify your answer.

- The principal of a high school randomly selects 50 students to participate in a school improvement survey. Of these, 38 said that more world language courses should be offered. As a result, the principal decides to offer both Japanese and Italian language classes.
- To evaluate their product, the manufacturer of light bulbs inspects the first 50 light bulbs produced on one day. Of these, 2 are defective. The manufacturer concludes that about 4% of light bulbs produced are defective.
- To evaluate its service, a restaurant asks its customers to call a number and complete a telephone survey. The majority of those who replied said that they prefer broccoli instead of carrots as the vegetable side dish. As a result, the restaurant decides to offer broccoli instead of carrots.
- To determine which type of pet is preferred by most customers, the manager of a pet store surveys every 15th customer that enters the store.

- To determine which school dance theme most students favor, 20 students from each grade level at Lakewood Middle School are surveyed. The results are shown in the table. Based on these results, the student council decides that the dance theme should be *Unforgettable*.

Theme	Number
<i>Starry Night</i>	23
<i>Unforgettable</i>	26
<i>At the Hop</i>	11

- To determine whether 15 boxes of porcelain tea sets have not been cracked during shipping, the owner of an antique store examines the first two boxes. None of the tea sets have been cracked, so the owner concludes that none of the tea sets in the remaining boxes are cracked.
- LAWNS** A researcher randomly surveyed 100 households in a small community to determine the number of households that use a professional lawn service. Of these, 27% of households use a professional lawn service. If there are 786 households in the community, how many can be expected to use a professional lawn service?



- PASTA** A grocery store asked every 20th person entering the store what kind of pasta they preferred. The results are shown in the table. If the store decides to restock their shelves with 450 boxes of pasta, how many boxes of lasagna should they order?

Pasta	Number
Macaroni	38
Spaghetti	56
Rigatoni	12
Lasagna	44

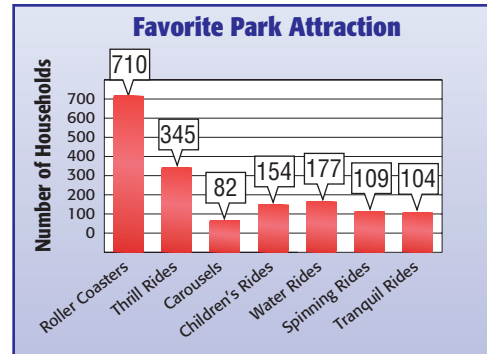
- FURNITURE** The manager of a furniture store asks the first 25 customers who enter the store if they prefer dining room tables made of oak, cherry, or mahogany wood. Of these, 17 said they prefer cherry. If the store manager orders 80 dining room tables in the next shipment, how many should be made of cherry wood?

**Real-World Link . . . .**  
 There are more than 600 shapes of pasta produced worldwide.

13. **RADIO** A radio station asks its listeners to dial one of two numbers to indicate their preference for one of two candidates in an upcoming election. Of the responses received, 76% favored candidate A. If there are 1,500 registered voters, how many will vote for candidate A?
14. **HOBBIES** Pedro wants to conduct a survey about the kinds of hobbies that sixth graders enjoy. Describe a valid sampling method he could use.

**AMUSEMENT PARKS** For Exercises 15 and 16, use the following information.

The manager of an amusement park mailed 2,000 survey forms to households near the park. The results of the survey are shown in the graph at the right.



15. Assume the survey is valid. If there are 5,000 park visitors, about how many would prefer water rides?
16. Based on the survey results, the manager concludes that about 36% of park visitors prefer roller coasters. Is this a valid conclusion? Explain.

**INTERNET** For Exercises 17–19, use the following information.

A survey is to be conducted to find out how many hours students at a school spend on the Internet each weeknight. Describe the sample and explain why each sampling method might not be valid.

17. Ten randomly selected students from each grade level are asked to keep a log during their winter vacation.
18. Randomly selected parents are mailed a questionnaire and asked to return it.
19. A questionnaire is handed out to all students on the softball team.

**COMPARE SAMPLES** For Exercises 20–23, use the following information.

Suppose you were asked to determine the approximate percent of students in your school who are left-handed without surveying every student in the school.

20. Describe three different samples of the population that you could use to approximate the percent of students who are left-handed.
21. Would you expect the percent of left-handed students to be the same in each of these three samples? Explain your reasoning.
22. Describe any additional similarities and differences in your three samples.
23. You could have surveyed every student in your school to determine the percent of students who are left-handed. Describe a situation in which it makes sense to use a sample to describe aspects of a population instead of using the entire population.

24. **FIND THE DATA** Refer to the Data File on pages 16–19. Choose some data and write a real-world problem in which you would make a prediction based on samples.

**EXTRA PRACTICE**  
See pages 690, 711.

**H.O.T. Problems**

25. **CHALLENGE** Is it possible to create an unbiased random sample that is also a convenience sample? Explain and cite an example, if possible.
26. **WRITING IN MATH** Explain why the way in which a survey question is asked might influence the results that are obtained. Cite at least two examples in your explanation.

**TEST PRACTICE**

27. Yolanda wants to conduct a survey to determine what type of salad dressing is preferred by most students at her school. Which of the following methods is the best way for her to choose a random sample of the students at her school?
- A Select students in her math class.  
 B Select members of the Spanish Club.  
 C Select ten students from each homeroom.  
 D Select members of the girls basketball team.
28. The manager of a zoo wanted to know which animals are most popular among visitors. She surveyed every 10th visitor to the reptile exhibit. Of these, she found that 75% like snakes. If there are 860 visitors to the zoo, which of the following claims is valid?
- F About 645 zoo visitors like snakes.  
 G The reptile exhibit is the most popular exhibit.  
 H 25% of zoo visitors prefer mammals.  
 J No valid prediction can be made since the sample is a convenience sample.

**Spiral Review**

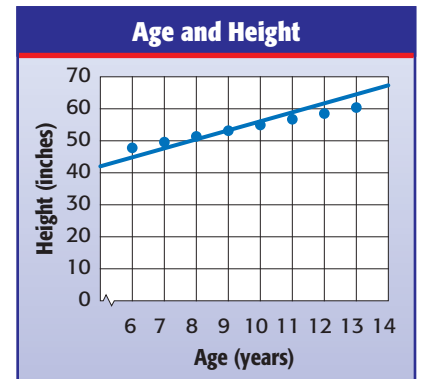
29. **SCHOOL** In a survey of 120 randomly selected students at Jefferson Middle School, 34% stated that science was their favorite class. Predict how many of the 858 students in the school would choose science as their favorite class. (Lesson 8-7)

30. **HEALTH** Use the scatter plot at the right to predict the height of a 16-year-old. (Lesson 8-6)

31. **SHOPPING** Nora bought a pair of running shoes that was discounted 35%. If the original price of the shoes was \$89.90, find the discounted price to the nearest cent. (Lesson 7-7)

Write each percent as a fraction in simplest form. (Lesson 6-9)

32. 17%                      33. 62.5%                      34. 12.8%

**▶ GET READY for the Next Lesson**

**PREREQUISITE SKILL** Determine whether each statement is *true* or *false*. (Lesson 8-6)

35. The vertical scale on a line graph must have equal intervals.  
 36. You do not need to label the axes of a line graph.