

## 10-1 Designing a Study

Determine whether each situation describes a *survey*, an *experiment*, or an *observational study*. Then identify the sample, and suggest a population from which it may have been selected.

1. **SCHOOL** A group of high school students is randomly selected and asked to complete the form shown.



Do you agree with the new lunch rules?

agree

disagree

don't care

2. **DESIGN** An advertising company wants to test a new logo design. They randomly select 20 participants and watch them discuss the logo.

**CCSS ARGUMENTS** Determine whether each situation calls for a *survey*, an *experiment*, or an *observational study*. Explain your reasoning.

3. **LITERACY** A literacy group wants to determine whether high school students that participated in a recent national reading program had higher standardized test scores than high school students that did not participate in the program.
4. **RETAIL** The research department of a retail company plans to conduct a study to determine whether a dye used on a new T-shirt will begin fading before 50 washes.

Determine whether each survey question is *biased* or *unbiased*. If biased, explain your reasoning.

5. Which student council candidate's platform do you support?
6. How long have you lived at your current address?
7. **HYBRIDS** A car manufacturer wants to determine what the demand in the U.S. is for hybrid vehicles. State the objective of the survey, suggest a population, and write two unbiased survey questions.
8. Identify any flaws in the experiment design, and describe how they could be corrected.  
Experiment: A research company wants to determine whether a new vitamin boosts energy levels and decides to test the vitamin at a college campus. A random sample is taken. The experimental group consists of students who are given the vitamin, and the control group consists of instructors who are given a placebo.

Results: When given a physical test, the experimental group outperformed the control group. The company concludes that the vitamin is effective.

9. **SPORTS** A research company wants to conduct an experiment to test the claim of the protein shake shown. State the objective of the experiment, suggest a population, determine the experimental and control groups, and describe a sample procedure.



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10. **FOOD** A grocery store conducts an online study in which customers are randomly selected and asked to provide feedback on their shopping experience.
11. **GRADES** A research group randomly selects 80 college students, half of whom took a physics course in high school, and compares their grades in a college physics course.
12. **HEALTH** A research group randomly chooses 100 people to participate in a study to determine whether eating blueberries reduces the risk of heart disease for adults.
13. **TELEVISION** A television network mails a questionnaire to randomly selected people across the country to determine whether they prefer watching sitcoms or dramas.

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14. **FASHION** A fashion magazine plans to poll 100 people in the U.S. to determine whether they would be more likely to buy a subscription if given a free issue.
15. **TRAVEL** A travel agency randomly calls 250 U.S. citizens and asks them what their favorite vacation destination is.
16. **FOOD** Chee wants to examine the eating habits of 100 random students at lunch to determine how many students eat in the cafeteria.
17. **ENGINEERING** An engineer is planning to test 50 metal samples to determine whether a new titanium alloy has a higher strength than a different alloy.

**Determine whether each survey question is *biased* or *unbiased*. If biased, explain your reasoning.**

18. Do you think that the school needs a new gym and football field?
19. Which is your favorite football team, the Dallas Cowboys or the Pittsburgh Steelers?
20. Do you play any extracurricular sports?
21. Don't you agree that students should carpool to school?
22. **COLLEGE** A school district wants to conduct a survey to determine the number of juniors in the district who are planning to attend college after high school. State the objective of the survey, suggest a population, and write two unbiased survey questions.
23. Identify any flaws in the experiment design, and describe how they could be corrected.

Experiment: A supermarket chain wants to determine whether shoppers are more likely to buy sunscreen if it is located near the checkout line. The experimental group consists of a group of stores in the midwest in which the sunscreen was moved next to the checkout line, and the control group consists of stores in Arizona in which the sunscreen was not moved.

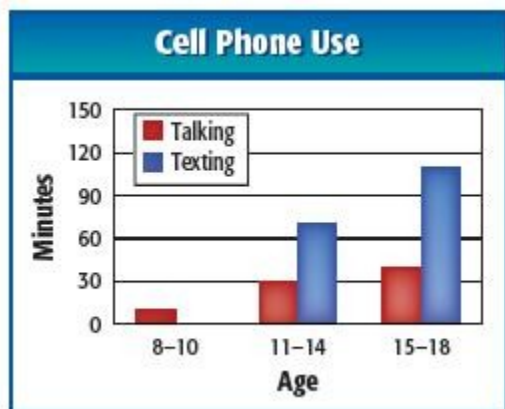
Results: The Arizona stores sold more sunscreen than the midwest stores. The company concluded that moving the sunscreen closer to the checkout line did not increase sales.

## 10-1 Designing a Study

24. **CCSS ARGUMENTS** In chemistry class, Pedro learned that copper objects become dull over time because the copper reacts with air to form a layer of copper oxide. He plans to use the supplies shown below to determine whether a mixture of lemon juice and salt will remove copper oxide from pennies.



- a. State the objective of the experiment, suggest a population, determine the experimental and control groups, and describe a sample procedure.
- b. What factors do you think should be considered when selecting pennies for the experiment? Explain your reasoning.
25. **REPORTS** The graph shown is from a report on the average number of minutes 8- to 18-year-olds in the U.S. spend on cell phones each day.



- a. Describe the sample and suggest a population.
- b. What type of sample statistic do you think was calculated for this report?
- c. Describe the results of the study for each age group.
- d. Who do you think would be interested in this type of report? Explain your reasoning.

## 10-1 Designing a Study

26. **CCSS PERSEVERANCE** In 1936, the Literary Digest reported the results of a statistical study used to predict whether Alf Landon or Franklin D. Roosevelt would win the presidential election that year. The sample consisted of 2.4 million Americans, including subscribers to the magazine, registered automobile owners, and telephone users. The results concluded that Landon would win 57% of the popular vote. The actual election results are shown.

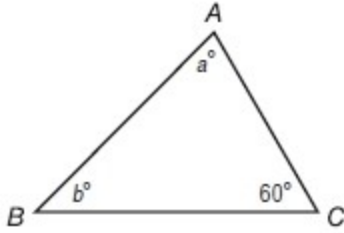


- Describe the type of study performed, the sample taken, and the population.
- How do the predicted and actual results compare?
- Do you think that the survey was biased? Explain your reasoning.



## 10-1 Designing a Study

33. **GEOMETRY** In  $\triangle ABC$ ,  $BC > AB$ .  
Which of the following must be true?



- A**  $AB = BC$   
**B**  $AC > AB$   
**C**  $a > 60$   
**D**  $a = b$
34. **SHORT RESPONSE** What is the solution set of  $4^{4x^2-2x-4} = 4^{-2}$ ?
35. **SAT/ACT** A pie is divided evenly between 3 boys and a girl. If one boy gives one half of his share to the girl and a second boy keeps two thirds of his share and gives the rest to the girl, what portion will the girl have in all?
- F**  $\frac{5}{24}$   
**G**  $\frac{11}{24}$   
**H**  $\frac{1}{2}$   
**J**  $\frac{13}{24}$   
**K**  $\frac{13}{12}$
36. Which equation represents a hyperbola?
- A**  $y^2 = 49 - x^2$   
**B**  $y = 49 - x^2$   
**C**  $y = 49x^2$   
**D**  $y = \frac{49}{x}$
37. Prove that the statement  $9n - 1$  is divisible by 8 is true for all natural numbers.
38. **INTRAMURALS** Ofelia is taking ten shots in the intramural free-throw shooting competition. How many sequences of hits and misses are there that result in her making eight shots and missing two?

**Solve each system of equations.**

39.  $y = x + 3$   
 $y = 2x^2$

40.  $x^2 + y^2 = 36$   
 $y = x + 2$

41.  $y^2 + x^2 = 9$   
 $y = 7 - x$

## 10-1 Designing a Study

$$42. \begin{aligned} y + x^2 &= 3 \\ x^2 + 4y^2 &= 36 \end{aligned}$$

$$43. \begin{aligned} x^2 + y^2 &= 64 \\ x^2 + 64y^2 &= 64 \end{aligned}$$

$$44. \begin{aligned} y^2 &= x^2 - 25 \\ x^2 - y^2 &= 7 \end{aligned}$$

**Find the distance between each pair of points with the given coordinates.**

45.  $(9, -2), (12, -14)$

46.  $(-4, -10), (-3, -11)$

47.  $(1, -14), (-6, 10)$

48.  $(-4, 9), (1, -3)$

49.  $(2.3, -1.2), (-4.5, 3.7)$

50.  $(0.23, 0.4), (0.68, -0.2)$

**Simplify. Assume that no variable equals 0.**

51.  $(5cd^2)(-c^4d)$

52.  $(7x^3y^{-5})(4xy^3)$

53.  $\frac{a^2n^6}{an^5}$

54.  $(n^4)^4$

55.  $\frac{-y^5z^7}{y^2z^5}$

56.  $(-2r^2t)^3(3rt^2)$

**Write a quadratic equation with the given root(s). Write the equation in the form  $ax^2 + bx + c = 0$ , where  $a, b,$  and  $c$  are integers.**

57.  $-3, 9$

58.  $-\frac{1}{3}, -\frac{3}{4}$

59.  $4, -5$

60. **TESTS** Ms. Bonilla's class of 30 students took a biology test. If 20 of her students had an average of 83 on the test and the other students had an average score of 74, what was the average score of the whole class?

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61. **DRIVING** During a 10-hour trip, Kwan drove 4 hours at 60 miles per hour and 6 hours at 65 miles per hour. What was her average rate, in miles per hour, for the entire trip?