pp. 600-601 (#3-6, #8-18 evens, #19-22)

3. 50%

4. 15.85%

5. 2.5%

6. 27%

8. 0.84

10. 0.84

12. 0.4985

14. 0.4985

16. 0.84

18. 0.0015

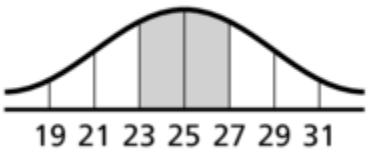
19. **a.** 81.5%

b. 0.15%

20. **a.** 97.5%

b. 16%

21. The values on the horizontal axis show a standard deviation of 1 instead of 2.



The probability that x is between 23 and 27 is 0.68.

22. The probability was calculated for x is at most 21 instead of x is at least 21.

The probability that x is at least 21 is $1 - (0.0015 + 0.0235) = 0.975$.

pp. 601-602 (#23-36)

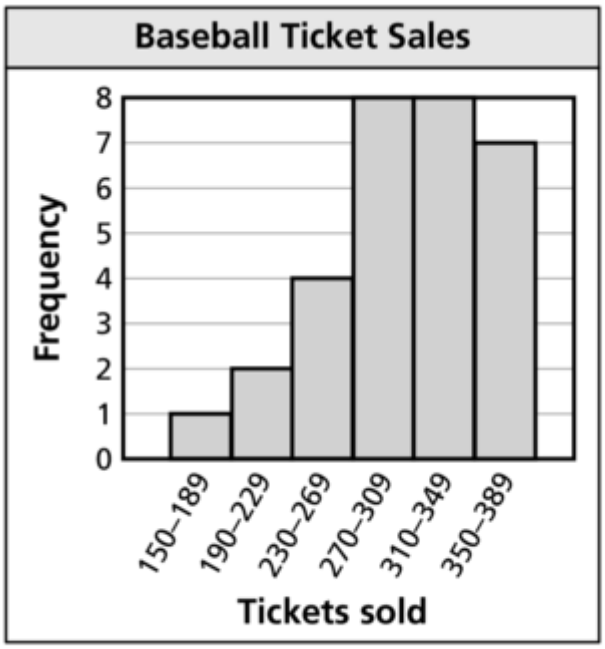
23. 0.0668

24. 0.0548

25. no

26. yes

27.



no; The histogram is skewed left, not bell-shaped.

28. **a.** 2.28%

b. 69.15%

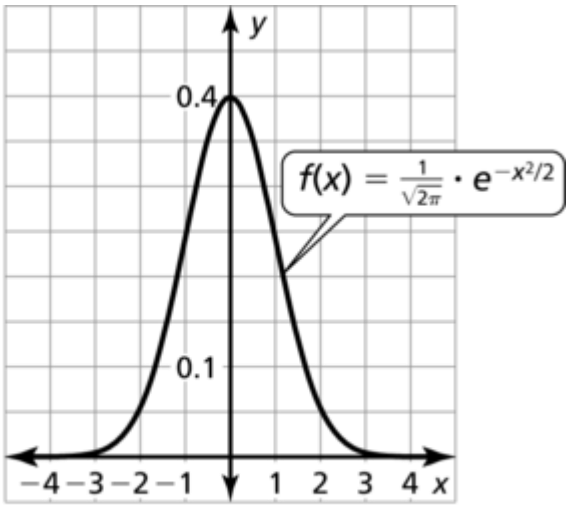
c. 83.51%

d. 13.36%

29. **a.** about 4.52×10^{-9}

b. yes; The probability that a box contains an amount of cereal significantly less than the mean is very small.

30.



Sample answer: 0.996

31. one standard deviation above the mean

32. $\mu = 10, \sigma = 3$

33. **a.** 88th percentile

b. 93rd percentile

c. ACT; Your percentile on the ACT was higher than your percentile on the SAT.

34. Find the z-score for the ACT. Substitute this value along with the mean and the standard deviation for the SAT in the formula for z-score, and solve for x. This value is the equivalent SAT score.

35. no; When the mean is greater than the median, the distribution is skewed right.

36. 0.1336

p. 607 (#3-18)

3. a claim about a characteristic of a population

4. Decide the hypothesis is true when it is false. Decide the hypothesis is false when it is true.

5. population; Every high school student is counted.

6. sample; The colors of a subset of the population are recorded.

7. sample; The survey is given to a subset of the population of spectators.

8. population; The age of every dentist in the United States is recorded.

9. population: every adult age 18 and over in the United States, sample: the 1152 adults age 18 and over who were surveyed; The sample consists of 403 adults who pretend to use their smartphone to avoid talking to someone, and 749 adults who do not.

10. population: every adult age 18 and over in the United States, sample: the 1777 adults age 18 and over who were surveyed; The sample consists of 1279 adults who do some kind of spring cleaning every year, and 498 adults who do not.

11. population: every high school student in the district, sample: the 1300 high school students in the district who were surveyed; The sample consists of 1001 high school students who like the new healthy cafeteria food choices, and 299 high school students who do not.

12. population: all households in the United States with at least one child, sample: the 2000 households in the United States with at least one child that were surveyed; The sample consists of 1280 households that eat dinner together every night, and 720 households that do not.

13. statistic; The average annual salary of a subset of the population was calculated.

14. parameter; The percentage of every senator in the United States Senate was calculated.

15. parameter; The percentage of every student in the school was calculated.

16. statistic; The percentage of a subset of the population was calculated.

17. The sample number in the statement is not the size of the entire sample; The population consists of all the students in the high school. The sample consists of the 1270 students that were surveyed.

18. Because all the players in a group were used, the mean is a parameter; Because the mean age of 26 is based on every member of a football team, it is a parameter.

p. 607 (19-26)

19. **a.** The maker's claim is most likely true.

b. The maker's claim is most likely false.

20. **a.** The maker's claim is most likely false.

b. The maker's claim is most likely true.

21. possibly, but extremely unlikely; The result is unlikely to occur by chance. The sample size of the population is too small to make such a conclusion.

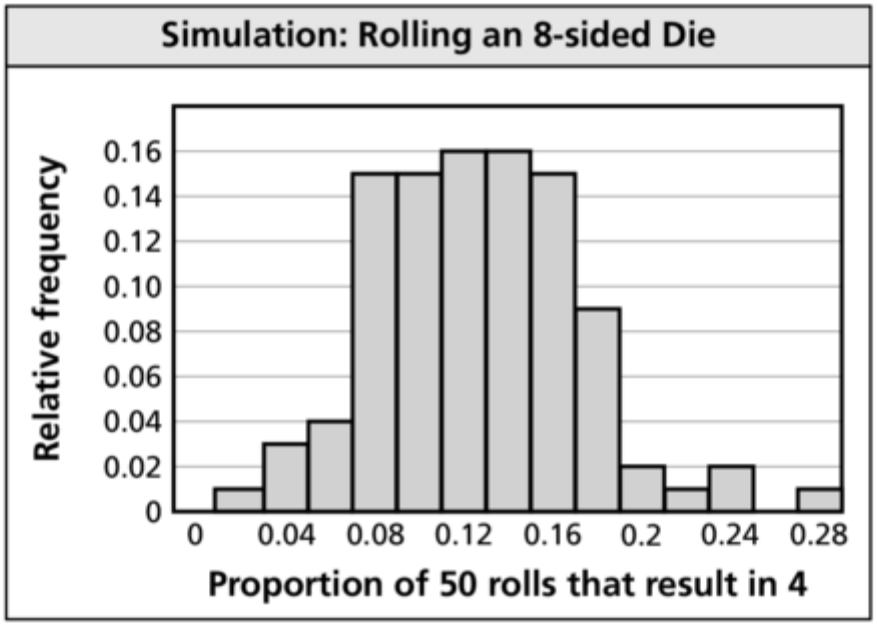
22. population: all the majors of students at a university, sample: majors of students at the university who take chemistry; All the students' majors at the university make up the entire group, and the majors of students who take chemistry make up a subset of the entire group.

23. *Sample answer:* population: all American adults, sample: the 801 American adults surveyed; The sample consists of 606 American adults who say the world's temperature will go up over the next 100 years,
174 American adults who say it will go down, and
21 American adults who have no opinion.

24. yes; The sample mean is an estimate of the population mean, and 7.5 hours is relatively close to 8 hours.

25. simulation 2; Simulation 2 gives a better indication of outcomes that are not likely to occur by chance.

26. **a.** *Sample answer:*



b. The maker's claim is most likely false; The maker's claim is most likely true.

pp. 614-615 (#5-20)

5. convenience sample

6. random sample

7. systematic sample

8. stratified sample

9. convenience sample; Dog owners probably have a strong opinion about an off-leash area for dogs.

10. self-selected sample; Only those coaches with a strong opinion about wooden bats will respond.

11. cluster sample; Booth holders in section 5 are likely to have a different opinion than booth holders in other sections about the location of their booth.

12. systematic sample; Employees who attend the health fair are likely to have a different opinion than employees who do not attend the health fair about health-related programs.

13. Not every survey that was mailed out will be returned, so it is not a systematic sample; Because households in the neighborhood can choose whether or not to return the survey, the sample is a self-selected sample.

14. The sample was not selected from the population; Because all of the high school students are not part of the population of members of the U.S. workforce, the sample is biased.

15. no; The sample represents the population.

16. yes; Voters who are not business owners do not have a chance to be surveyed.

17. yes; Only customers with a strong opinion about their experience are likely to complete the survey.

18. no; The sample represents the population.

19. *Sample answer:* Assign each student in the school a different integer from 1 to 1225. Generate 250 unique random integers from 1 to 1225 using the random number function in a spreadsheet program. Choose the 250 students who correspond to the 250 integers generated.

20. *Sample answer:* Assign each head football coach a different integer from 1 to 120. Generate 15 unique random integers from 1 to 120 using the random number function in a spreadsheet program. Choose the 15 coaches who correspond to the 15 integers generated.

pp. 615-616 (#21-49)

21. simulation

22. survey

23. observational study

24. experiment

25. encourages a yes response; *Sample answer:* Reword the question, for example: Should the budget of our city be cut?

26. encourages a response of watching a movie; *Sample answer:* Reword the question, for example: Would you rather watch a movie or read a book?

27. implies that the arsenic level is a health risk; *Sample answer:* Reword the question, for example: Do you think the government should address the issue of arsenic in tap water?

28. Respondents may be unwilling to answer truthfully when this question is asked by a child; *Sample answer:* Provide a method for the respondents to answer anonymously.

29. no; Responses to the question will accurately reflect the opinions of those being surveyed.

30. yes; The wording encourages a yes response.

31. yes; Visitors are unlikely to admit to a police officer that they do not wear their seatbelt.

32. yes; Not enough information is provided about the amendments to the Clean Air Act for respondents to give an accurate opinion.

33. **a.** *Sample answer:* The researcher did not take into account previous heart conditions.

b. *Sample answer:* Divide the population into groups based on past heart conditions and whether or not they take fiber supplements. Select a random sample from each group.

34. **a.** stratified sample

b. Because the counties (groups) are very different in population (size), selecting the same number of people from each county will underrepresent people living in counties with a large population, and overrepresent people living in counties with a small population.

35. self-selected sample and convenience sample; In a self-selected sample, only people with strong opinions are likely to respond. In a convenience sample, parts of the population have no chance of being selected for the survey.

36. In a blind experiment, the people administering the treatment know which treatment each participant is receiving. In a double-blind experiment, they do not; *Sample answer:* An advantage of the double-blind experiment is that a person administering the treatment cannot accidentally influence the person receiving the treatment.

37. **a.** to determine the employment rate of graduates in their field of study

b. all graduating seniors of the college

c. *Sample answer:* Are you employed? If yes, is your job in your field of study?

38. the second sample; In a larger sample, unusual responses will have less of an effect.

39. no; *Sample answer:* Some groups in the population, like the homeless, are difficult to contact.

40. **a.** survey

b. *Sample answer:* Put an optional survey card in each back seat pocket for passengers to complete and mail back to the airline; Passengers with enough leg room are less likely to complete and return the survey.

c. *Sample answer:* Group passengers by type of plane and class of seat. Select a random sample from each group, and have a flight attendant hand a survey to the selected passengers which they may complete anonymously and return to a box the flight attendant brings around; All segments of the population have a chance of being selected, and passengers are likely to give honest responses on an anonymous survey.

d. *Sample answer:* biased: Do you feel you do not have enough leg room in a cramped seat area?; unbiased: Do you have enough leg room?

41. **a.** self-selected sample

b. people who spend a lot of time on the Internet and visit that particular site; The survey is probably biased.

42. 32

43. 9

44. -4

45. $\frac{1}{4}$

46. 4^7 or 16,384

47. $\frac{\sqrt[3]{18}}{18}$

48. 4

49. 3

pp. 623-624 (#1-17, #22-23)

1. replication

2. The control group is the group under ordinary conditions that is subjected to no treatment. The treatment group is the group that is subjected to the treatment.

3. The study is a randomized comparative experiment; The treatment is the drug for insomnia. The treatment group is the individuals who received the drug. The control group is the individuals who received the placebo.

4. The study is not a randomized comparative experiment; The individuals were not randomly assigned to a control group and a treatment group. The conclusion that students who drink milk at lunch will have fewer cavities may or may not be valid. There may be other reasons why students in the "milk" group have fewer cavities. *Sample answer:* For instance, they may also brush their teeth on a more regular basis, which could affect the number of cavities they have.

5. The individuals who do not use either of the conditioners were not monitored; The control group is the individuals who use the regular conditioner.

6. The study is not an observational study because the variable is controlled; The study is a randomized comparitive experiment.

7. observational study; *Sample answer:* Randomly choose one group of individuals who smoke. Then, randomly choose one group of individuals who do not smoke. Find the body mass index of the individuals in each group.

8. experiment; *Sample answer:* Randomly select the same number of diners to be put in each of two groups. Give pasta sauce made from one recipe to one of the groups, and give pasta sauce made from the other recipe to the other group. Keep all other variables constant and survey the diners to see if they liked the recipe they were given.

9. experiment; *Sample answer:* Randomly select the same number of strawberry plants to be put in each of two groups. Use the new fertilizer on the plants in one group, and use the regular fertilizer on plants in the other group. Keep all other variables constant and record the weight of the fruit produced by each plant.

10. observational study; *Sample answer:* Randomly choose one group of homes close to parks and schools. Then, randomly choose one group of homes not close to parks and schools. Find the property values of homes in each group.

11. **a.** *Sample answer:* Because the heart rates are monitored for two different types of exercise, the groups cannot be compared. Running on a treadmill may have a different effect on heart rate than lifting weights; Check the heart rates of all the athletes after the same type of exercise.

b. no potential problems

12. **a.** no potential problems

b. *Sample answer:* Because the subjects volunteer for a particular group, the groups are not similar. Someone who volunteers to read may also have other habits that could raise IQ scores; Randomly assign the volunteers to the treatment group or the control group.

13. *Sample answer:* The sample size is not large enough to provide valid results; Increase the sample size.

14. It is not possible to control variables of objects in space.

15. no; Your friend would have to perform an observational study, and an observational study can show correlation, but not causality.

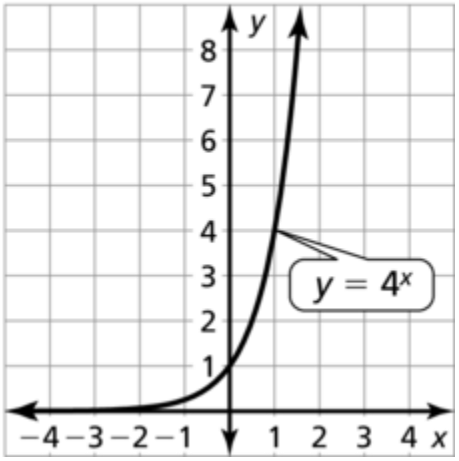
16. **a.** yes; *Sample answer:* The individuals were randomly assigned to a control group with no ads, and a treatment group with ads.

b. watching TV with ads for candidate B

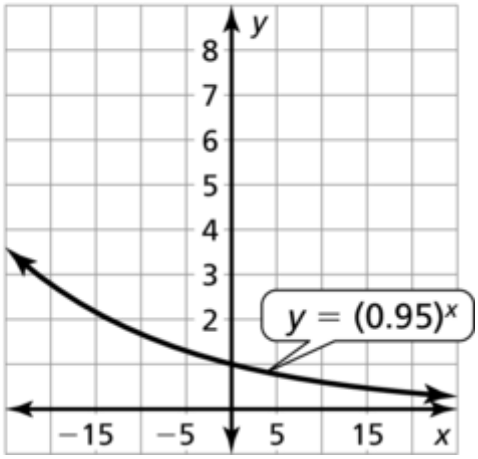
c. no; *Sample answer:* The increase in preference for candidate B with the ads may be too small to be significant.

17. *Sample answer:* The placebo effect is response to a dummy treatment that may result from the trust in the researcher or the expectation of a cure; It can be minimized by comparing two groups so the placebo effect has the same effect on both groups.

22. exponential growth



23. exponential decay



pp. 630-631 (#3-10, #12-16 evens)

3. 60.4

4. about $51,029

5. **a.** about 0.267

b. about 0.267

6. not at all confident; Although the population mean will be close to 3 hours, the probability of it being exactly 3 hours is very small.

7. **a.** yes; The first 2 surveys show more than the 66.7% of votes needed to override the veto.

b. no; As the sample size increases, the percent of votes approaches 55.1%, which is not enough to override the veto.

8. **a.** yes; The first two samples show that a majority of the students want the test on Friday.

b. no; As the sample size increases, the percent of students who want the test on Friday approaches 45%, which is a minority.

9. **a.** The company's claim is probably accurate.

b. The company's claim is probably not accurate.

c. *Sample answer:* 0.42 to 0.68

10. **a.** The company's claim is probably accurate.

b. The company's claim is probably not accurate.

c. *Sample answer:* 0.15 to 0.43

12. about $\pm 3.2\%$

14. about $\pm 1.3\%$

16. about $\pm 3.7\%$

pp. 631-632 (#17-27)

17. **a.** about $\pm 3.1\%$

b. between 37.9% and 44.1%

18. **a.** about $\pm 3.1\%$

b. between 72.9% and 79.1%

19. The wrong percentage was substituted in the formula;

$\pm 0.04 = \pm\frac{1}{\sqrt{n}}$; $0.0016 = \frac{1}{n}$; $n = 625$

20. The margin of error is 2%, not 1%; It is likely that the exact percent of all consumers who prefer game A over game B is between 59% and 63%.

21. no; A sample size of 1 would have a margin of error of 100%.

22. simulation *a*; simulation *c*; Simulation *a* has the smallest standard deviation, and simulation *c* has the largest standard deviation.

23. about 453 residents

24. $4n$; 4 times; The margin of error is inversely proportional to the square root of the sample size, so cutting the margin of error in half requires multiplying the sample size by 2^2, or 4.

25. **a.** 500 voters

b. about $\pm 4.5\%$

c. candidate A: between 42.5% and 51.5%, candidate B: between 48.5% and 57.5%

d. no; 273 voters

26. **a.** $n > 9$

b. $n > 891$

c. The smaller the percentage of a large population that have a certain characteristic, the larger the sample must be to reasonably represent the population.

27. more than 2500; To be confident that sports drink X is preferred, the margin of error would need to be less than 2%.

pp. 637-638 (#1-13, #21-22)

1. resampling

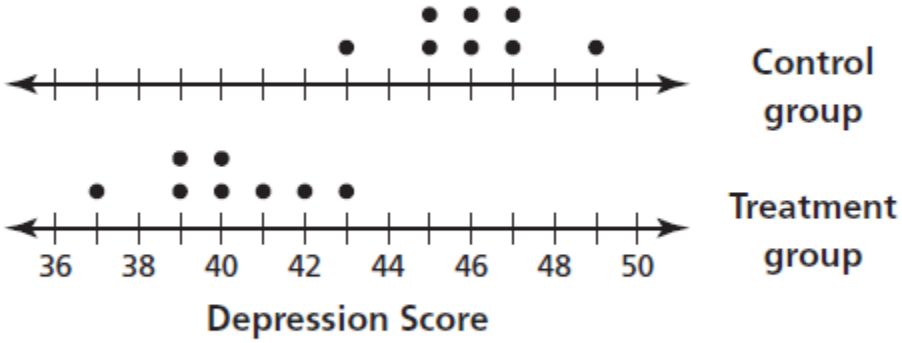
2. What is the square root of the average of the differences from −2.85?; about 5.03; −2.85

3. **a.** 46

b. 40.125

c. −5.875

d.



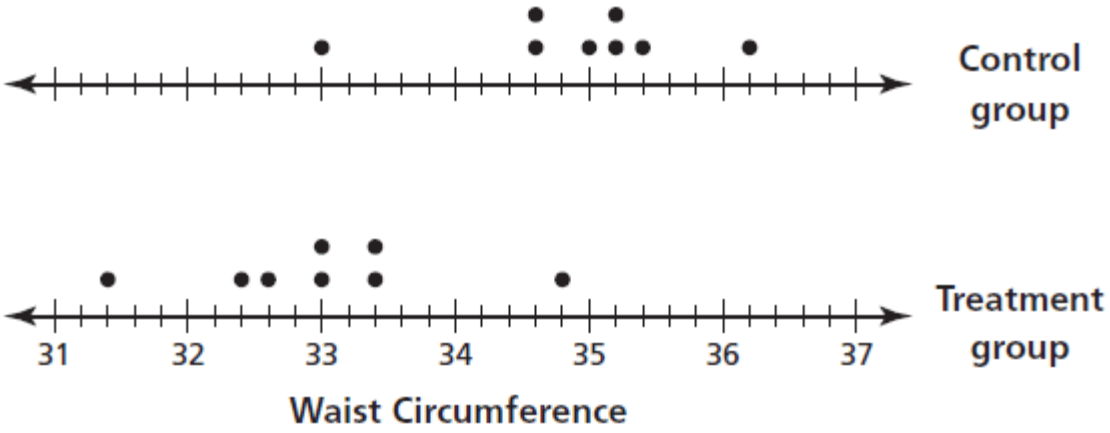
e. The music therapy may be effective in reducing depression scores of college students.

4. a. 34.9

b. 33

c. −1.9

d.



e. The low-level laser therapy may be slightly effective in reducing the waist circumference of adults.

5. The order of the subtraction is reversed; $\bar{x}_{\text{treatment}} - \bar{x}_{\text{control}} = 11 - 16 = -5$; So, you can conclude the treatment decreases the score.

6. The treatment has an effect on the waist circumference of adults. The effect increases the waist circumference; The treatment has an effect on the waist circumference of adults. The effect decreases the waist circumference; The treatment has no effect on the waist circumference of adults.

7. *Sample answer:* −1.75

8. *Sample answer:* 1.15

9. The hypothesis is most likely false; Music therapy decreases depression scores.

10. The hypothesis is probably true; Music therapy does not have an effect on depression scores.

11. The histogram in Exercise 9 has a roughly normal distribution and shows the mean differences from 200 resamplings. The histogram in Exercise 11 is random and shows the mean differences from 20 resamplings; the histogram in Exercise 9 because it uses a large number of resamplings and the roughly normal distribution suggests music therapy decreases depression scores

12. negative; slightly effective; Most of the treatment values are less than most of the control values.

13. yes; As the number of samplings increase, the individual values should end up in each group approximately the same number of times, so the positive and negative differences in the means should balance out to 0.

21. yes; $g(x) = \frac{1}{2x} + \frac{1}{2}$

22. yes; $g(x) = \frac{2}{x + 4}$

pp. 640-642 (#1-14)

1. 0.0015

2. 0.0082

3. population: all U.S. motorists, sample: the 1000 drivers surveyed

4. statistic; The mean was calculated from a sample.

5. The host's claim is most likely false.

6. stratified sample; not biased

7. observational study

8. It encourages a yes response; *Sample answer:* Reword the question, for example: Should the city replace the police cars it is currently using?

9. experiment; *Sample answer:* Randomly select the same number of customers to give each type of bread to. Record how many customers from each group return.

10. *Sample answer:* The volunteers may not be representative of the population; Randomly select from members of the population for the study.

11. The study is a randomized comparative experiment; The treatment is using the new design of the car wash. The treatment group is the individuals who use the new design of the car wash. The control group is the individuals who use the old design of the car wash.

12. between 58.9% and 65.1%

13. no; As the sample size increases, the percent of votes approaches 46.8%, which is not enough to win.

14. *Sample answer:* Combine the measurements from both groups and assign a number to each value. Let the numbers 1 through 10 represent the data in the original control group, and let the numbers 11 through 20 represent the data in the original treatment group. Use a random number generator. Randomly generate 20 numbers from 1 through 20 without repeating a number. Use the first 10 numbers to make the new control group, and the next 10 to make the new treatment group; Repeatedly make new control and treatment groups and see how often you get differences between the new groups that are at least as large as the one you measured.