

## 11-6 Confidence Intervals and Hypothesis Testing

1. **LUNCH** A sample of 145 high school seniors was asked how many times they go out for lunch per week. The mean number of times was 2.4 with a standard deviation of 0.7. Use a 90% confidence level to calculate the maximum error of estimate.

**ANSWER:**

0.096

2. **PRACTICE** A poll of 233 randomly chosen high school athletes showed that they spend an average of 1.6 hours practicing their sport during the off-season. The standard deviation is 0.5 hour. Determine a 99% confidence interval for the population mean.

**ANSWER:**

$1.52 \leq \mu \leq 1.68$

**Identify the null and alternative hypotheses for each statement. Then identify the statement that represents the claim.**

3. Lori thinks it takes a fast-food restaurant less than 2 minutes to serve her meal after she orders it.

**ANSWER:**

$H_0: \mu \geq 2$ ;  $H_a: \mu < 2$  (claim)

4. A snack label states that one serving contains one gram of fat.

**ANSWER:**

$H_0: \mu = 1$  (claim);  $H_a: \mu \neq 1$

5. Mrs. Hart's review game takes at least 20 minutes to complete.

**ANSWER:**

$H_0: \mu \geq 20$  (claim);  $H_a: \mu < 20$

6. The tellers at a bank can complete no more than 18 transactions per hour.

**ANSWER:**

$H_0: \mu \leq 18$  (claim);  $H_a: \mu > 18$

**CCSS REASONING Identify the hypotheses and claim, decide whether to reject the null hypothesis, and make a conclusion about the claim.**

7. **COMPACT DISCS** A manufacturer of blank compact discs claims that each disc can hold at least 84 minutes of music. Using a sample of 219 compact discs, Cayla calculated a mean time of 84.1 minutes per disc with a standard deviation of 1.9 minutes. Test the hypothesis at 5% significance.

**ANSWER:**

$H_0: \mu \geq 84$  (claim);  $H_a: \mu < 84$ ; Do not reject  $H_0$ ;

The manufacturer's claim that the discs can hold at least 84 minutes cannot be rejected.

8. **GOLF TEES** A company claims that each golf tee they produce is 5 centimeters in length. Using a sample of 168 tees, Angelene calculated a mean of 5.1 centimeters with a standard deviation of 0.3. Test the hypothesis at 10% significance.

**ANSWER:**

$H_0: \mu = 5$  (claim);  $H_a: \mu \neq 5$ ; Reject  $H_0$ ; The company's claim that each tee is 5 centimeters is rejected.

9. **MUSIC** A sample of 76 albums had a mean run time of 61.3 minutes with a standard deviation of 5.2 minutes. Use a 95% confidence level to calculate the maximum error of estimate.

**ANSWER:**

1.17

10. **COLLEGE** A poll of 218 students at a university showed that they spend 11.8 hours per week studying. The standard deviation is 3.7 hours. Determine a 90% confidence interval for the population mean.

**ANSWER:**

$11.39 \leq \mu \leq 12.21$

## 11-6 Confidence Intervals and Hypothesis Testing

**Identify the null and alternative hypotheses for each statement. Then identify the statement that represents the claim.**

11. Julian sends at least six text messages to his best friend every day.

**ANSWER:**

$$H_0: \mu \geq 6 \text{ (claim); } H_a: \mu < 6$$

12. A car company states that one of their vehicles gets 27 miles per gallon.

**ANSWER:**

$$H_0: \mu = 27 \text{ (claim); } H_a: \mu \neq 27$$

13. A company advertisement states that it takes no more than 2 hours to paint a 200-square-foot room.

**ANSWER:**

$$H_0: \mu \leq 2 \text{ (claim); } H_a: \mu > 2$$

14. A singer plays at least 18 songs at every concert.

**ANSWER:**

$$H_0: \mu \geq 18 \text{ (claim); } H_a: \mu < 18$$

**Identify the hypotheses and claim, decide whether to reject the null hypothesis, and make a conclusion about the claim.**

15. **PIZZA** A pizza chain promises a delivery time of less than 30 minutes. Using a sample of 38 deliveries, Chelsea calculated a mean delivery time of 29.6 minutes with a standard deviation of 3.9 minutes. Test the hypothesis at 1% significance.

**ANSWER:**

$$H_0: \mu \geq 30; H_a: \mu < 30 \text{ (claim); Do not reject } H_0;$$

There is not enough evidence to support the pizza chain's claim of a delivery time of less than 30 minutes cannot be rejected.

16. **CHEESE** A company claims that each package of cheese contains exactly 24 slices. Using a sample of 93 packages, Mr. Matthews calculated a mean of 24.1 slices with a standard deviation of 0.5. Test the hypothesis at 5% significance.

**ANSWER:**

$$H_0: \mu = 24 \text{ (claim); } H_a: \mu \neq 24; \text{ Do not reject } H_0;$$

The company's claim that each package contains 24 slices is not rejected.

17. **DECISION MAKING** The number of peaches in 40 random cans is shown below. Should the manufacturer place a label on the can promising exactly 12 peaches in every can? Explain your reasoning.

13, 14, 13, 14, 12, 12, 12, 11, 15, 12, 13, 13, 14, 13, 14, 12, 15, 11, 11, 14, 13, 14, 14, 13, 12, 12, 12, 12, 13, 13, 11, 14, 14, 13, 14, 13, 13, 14, 12, 12

**ANSWER:**

$H_0: \mu = 12; H_a: \mu \neq 12$ ; The mean of the sample data is 12.9 with a standard deviation of about 1.08. The z-statistic is about 5.27, which falls in the critical region at 1% significance. Therefore, the null hypothesis is rejected and the company should not make the claim on the label.

18. **CCSS ARGUMENTS** The number of chocolate chips in 40 random cookies is shown below. Should the manufacturer place a label on the package promising exactly 20 chips on every cookie? Explain your reasoning.

21, 19, 20, 20, 19, 19, 18, 21, 19, 17, 19, 18, 18, 20, 20, 19, 18, 20, 19, 20, 21, 21, 19, 17, 17, 18, 19, 19, 20, 17, 22, 21, 21, 20, 19, 18, 19, 17, 17, 21

**ANSWER:**

$H_0: \mu = 20; H_a: \mu \neq 20$ ; The mean of the sample data is 19.175 with a standard deviation of 1.375. The z-statistic is about  $-3.79$ , which falls in the critical region at 1% significance. Therefore, the null hypothesis is rejected and the company should not make the claim on the label.

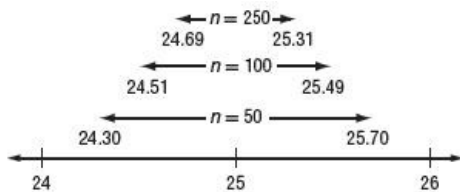
## 11-6 Confidence Intervals and Hypothesis Testing

19. **MULTIPLE REPRESENTATIONS** In this problem, you will explore how the confidence interval is affected by the sample size and the confidence level. Consider a sample of data where  $\bar{x} = 25$  and  $s = 3$ .

- a. **GRAPHICAL** Graph the 90% confidence interval for  $n = 50, 100,$  and  $250$  on a number line.  
 b. **ANALYTICAL** How does the sample size affect the confidence interval?  
 c. **GRAPHICAL** Graph the 90%, 95%, and 99% confidence intervals for  $n = 150$ .  
 d. **ANALYTICAL** How does the confidence level affect the confidence interval?  
 e. **ANALYTICAL** How does decreasing the size of the confidence interval affect the accuracy of the confidence interval?

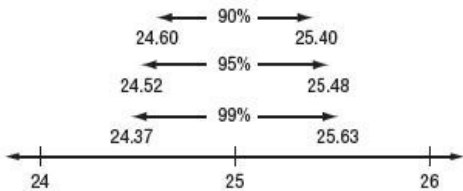
**ANSWER:**

a.



- b. Sample answer: With everything else held constant, increasing the same size will decrease the size of the confidence interval.

c.



- d. Sample answer: With everything else held constant, increasing the confidence level will increase the size of the confidence interval.  
 e. Sample answer: Expanding the confidence interval reduces the accuracy of the estimate. So decreasing the size of the confidence interval increases the accuracy of the estimate.

20. **ERROR ANALYSIS** Tim and Judie want to test whether a delivery service meets their promised time of 45 minutes or less. Their hypotheses are shown below. Is either of them correct?

*Tim*

$H_0: \mu < 45$  (claim)

$H_a: \mu \geq 45$

*Judie*

$H_0: \mu \leq 45$

$H_a: \mu > 45$  (claim)

**ANSWER:**

Neither; Sample answer: The null hypothesis is a statement of equality, so Tim is incorrect. The claim is that the delivery time is less than or equal to 45, so Judie is also incorrect.

21. **CHALLENGE** A 95% confidence interval for the mean weight of a 20-ounce box of cereal was  $19.932 \leq \mu \leq 20.008$  with a sample standard deviation of 0.128 ounces. Determine the sample size that led to this interval.

**ANSWER:**

44

22. **REASONING** Determine whether the following statement is sometimes, always, or never true. Explain your reasoning.

*If a confidence interval contains the  $H_0$  value of  $\mu$ , then it is not rejected.*

**ANSWER:**

Sample answer: Always; if the null hypothesis value of  $\mu$  falls within the confidence interval, then it is not rejected.

23. **WRITING IN MATH** How can a statistical test be used in a decision-making process?

**ANSWER:**

Sample answer: You can use a statistical test to help you to determine the strength of your decision.

## 11-6 Confidence Intervals and Hypothesis Testing

24. **OPEN ENDED** Design and conduct your own research study, and draw conclusions based on the results of a hypothesis test. Write a brief summary of your findings.

**ANSWER:**

Sample answer: A pizza company claims to put 100 pepperonis on its large pizza.

$$H_0: \mu = 100;$$

$$H_1: \mu > 100;$$

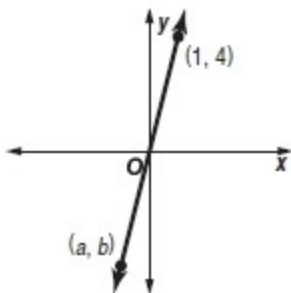
data collected: 100, 102, 101, 101, 100, 99, 99, 103, 102, 103, 103, 101, 102, 99, 105, 103, 102, 100, 101, 104;

$$\bar{x} = 101.5, s = 1.70;$$

a 95% confidence interval is  $100.74 < \bar{x} < 102.26$ .

$H_0$  does not fall within the confidence interval, so we reject the null hypothesis and accept the alternative hypothesis.

25. **GEOMETRY** In the graph below, line  $l$  passes through the origin. What is the value of  $\frac{a}{b}$ ?



A  $-4$

B  $-\frac{1}{4}$

C  $\frac{1}{4}$

D  $4$

**ANSWER:**

C

26. **SAT/ACT** If  $5 + i$  and  $5 - i$  are the roots of  $x^2 - 10x + c = 0$ , what is the value of  $c$ ?

F  $-26$

G  $-25$

H  $25$

J  $26$

**ANSWER:**

J

27. The Service Club at Jake's school was founded 8 years ago. The number of members of the club by year is shown in the table. Which linear equation best models the data?

Year	Participation
0	11
2	13
4	15
6	19
8	22

A  $y = 1.4x$

B  $y = 1.4x + 10.4$

C  $y = 1.6x$

D  $y = 1.6x + 11.1$

**ANSWER:**

B

28. **SHORT RESPONSE** Solve for  $x$ :  $\log_2(x - 6) = 3$ .

**ANSWER:**

14

29. **HEALTH** The heights of students at Madison High School are normally distributed with a mean of 66 inches and a standard deviation of 2 inches. Of the 1080 students in the school, how many would you expect to be less than 62 inches tall?

**ANSWER:**

27 students

## 11-6 Confidence Intervals and Hypothesis Testing

30. **CAR WASH** The Spanish Club is washing cars to raise money. They have determined that 65% of the customers donate more than the minimum amount for the car wash. What is the probability that at least 4 of the next 5 customers will donate more than the minimum?

ANSWER:

42.8%

Find  $a_n$  for each geometric sequence.

31.  $a_1 = \frac{1}{3}, r = 3, n = 8$

ANSWER:

729

32.  $a_1 = \frac{1}{64}, r = 4, n = 9$

ANSWER:

1024

33.  $a_4 = 16, r = 0.5, n = 8$

ANSWER:

1

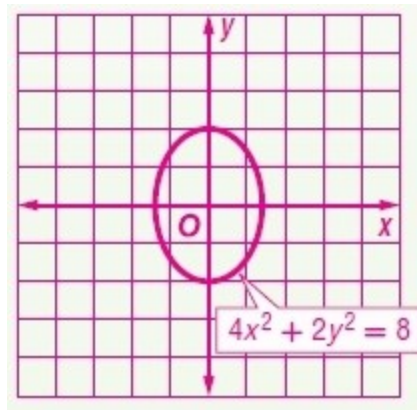
Write each equation in standard form. State whether the graph of the equation is a *parabola*, *circle*, *ellipse*, or *hyperbola*. Then graph the equation.

34.  $4x^2 + 2y^2 = 8$

ANSWER:

ellipse

$$\frac{y^2}{4} + \frac{x^2}{2} = 1$$

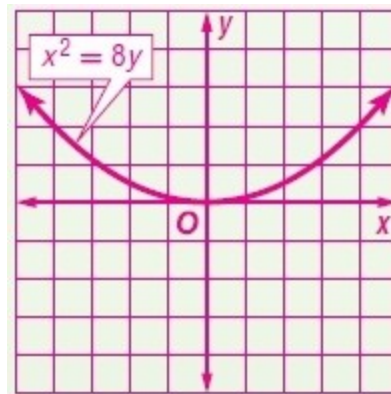


35.  $x^2 = 8y$

ANSWER:

parabola

$$y = \frac{1}{8}x^2$$



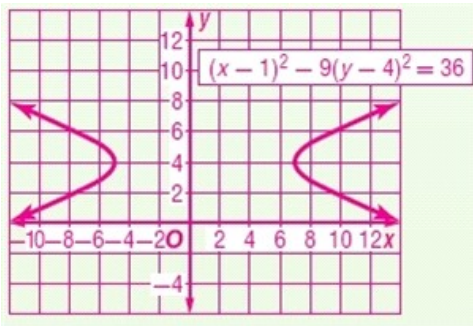
## 11-6 Confidence Intervals and Hypothesis Testing

36.  $(x - 1)^2 - 9(y - 4)^2 = 36$

ANSWER:

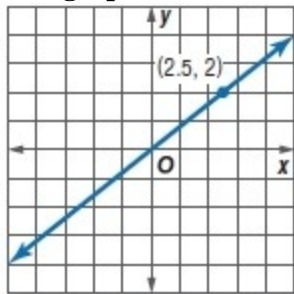
hyperbola

$$\frac{(x-1)^2}{36} - \frac{(y-4)^2}{4} = 1$$



Write an equation in slope-intercept form for each graph.

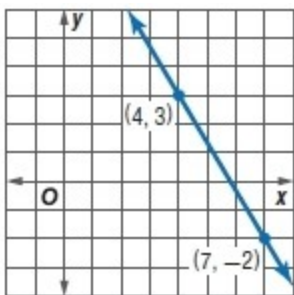
37.



ANSWER:

$$y = 0.8x$$

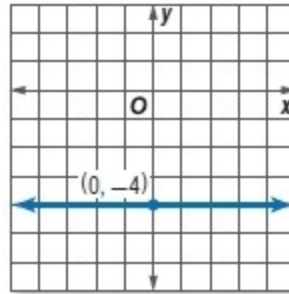
38.



ANSWER:

$$y = -\frac{5}{3}x + \frac{29}{3}$$

39.

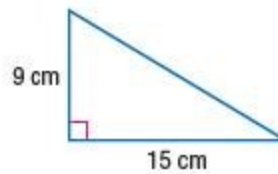


ANSWER:

$$y = -4$$

Find each missing measure. Round to the nearest tenth, if necessary.

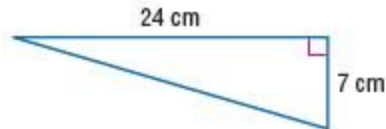
40.



ANSWER:

$$17.5$$

41.



ANSWER:

$$25$$

42.



ANSWER:

$$13.7$$