8-9 Misleading Statistics

MAIN IDEA

Recognize when statistics and graphs are misleading.

Math Online

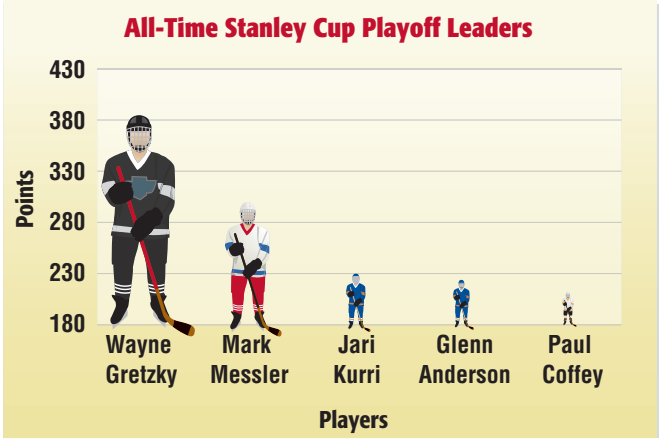
glencoe.com

- Extra Examples
- Personal Tutor
- Self-Check Quiz

GET READY for the Lesson

HOCKEY The graph shows the all-time Stanley Cup playoff leaders.

1. According to the size of the hockey players, how many times more points does Mark Messier appear to have than Jari Kurri? Explain.
2. Do you think this graph is representative of the players' number of points?



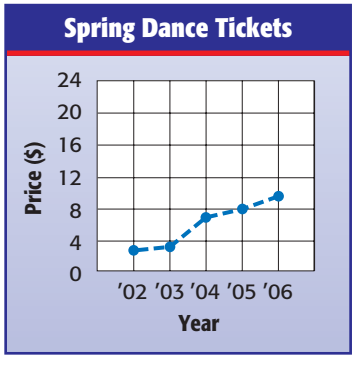
Source: *ESPN Sports Almanac*

Graphs let readers analyze and interpret data easily, but are sometimes drawn to influence conclusions by misrepresenting the data. The use of different scales can influence conclusions drawn from graphs.

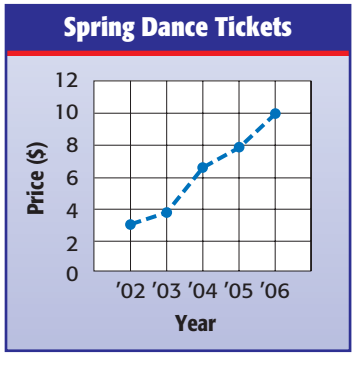
EXAMPLE 1 Changing the Interval of Graphs

SCHOOL DANCES **The graphs show how the price of spring dance tickets increased.**

Graph A



Graph B



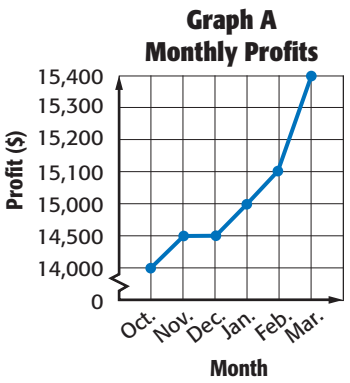
Do the graphs show the same data? If so, explain how they differ.
The graphs show the same data. However, the graphs differ in that Graph A uses an interval of 4, and Graph B uses an interval of 2.

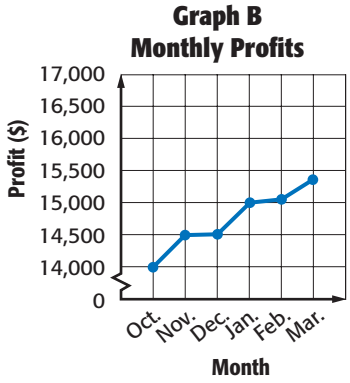
Which graph makes it appear that the prices increased more rapidly? Graph B makes it appear that the prices increased more rapidly even though the price increase is the same.

Which graph might Student Council use to show that while ticket prices have risen, the increase is not significant? Explain. They might use Graph A. The scale used on the vertical axis of this graph makes the increase appear less significant.

CHECK Your Progress

a. **BUSINESS** The line graphs show monthly profits of a company from October to March. Which graph suggests that the business is extremely profitable? Is this a valid conclusion? Explain.





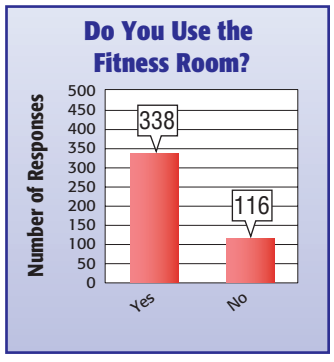
Study Tip

Changing Scales
To emphasize a change over time, reduce the scale interval on the vertical axis.

Sometimes the data used to create the display comes from a biased sample. In these cases, the data and the display are both biased and should be considered invalid.

EXAMPLE 2 Identify Biased Displays

FITNESS The president of a large company mailed a survey to 500 of his employees in order to determine if they use the fitness room at work. The results are shown in the graph. Identify any sampling errors and explain why the sample and the display might be biased.

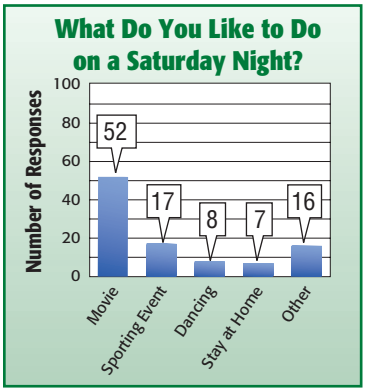


Not all of the surveys were returned since $338 + 116 < 500$. This is a biased, voluntary response sample. The sample is not representative of the entire population since only those who wanted to participate in the survey are involved in the sampling.

The display is biased because the data used to create the display came from a biased sample.

CHECK Your Progress

b. **MOVIES** The manager of a movie theater asked 100 of his customers what they like to do on a Saturday night. The results are shown in the graph. Identify any sampling errors and explain why the sample and the display might be biased.



Statistics can also be used to influence conclusions.

EXAMPLE Misleading Statistics

Real-World Link
The tallest roller coaster in the world is the Kingda Ka in Jackson, New Jersey, with a height of 456 feet.
Source: Ultimate Roller Coaster

3 **MARKETING** **Refer to the table that gives the height of roller coasters at an amusement park. The park boasts that the average height of their roller coasters is 170 feet. Explain how this is misleading.**

Park Rollercoaster Heights	
Coaster	**Height (ft)**
Viper	109
Monster	135
Red Zip	115
Tornado	365
Riptide	126

mean: $\frac{109 + 135 + 115 + 365 + 126}{5} = \frac{850}{5}$
$= 170$

median: 109, 115, 126, 135, 365

mode: none

The average used by the park was the mean. This measure is much greater than most of the heights listed because of the outlier, 365 feet. So, it is misleading to use this measure to attract visitors.

A more appropriate measure to describe the data would be the median, 126 feet, which is closer to the height of most of the coasters.

CHECK Your Progress

c. **FOOD** A restaurant claims its average menu price is $3.50. Use the table to explain how this is misleading.

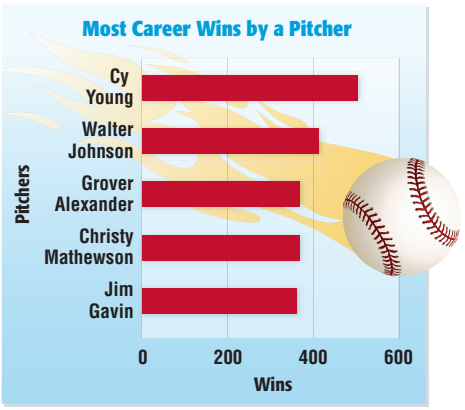
Menu	
Burger	$4.00
Fish Sandwich	$4.45
Chicken Sandwich	$4.35
Garden Salad	$3.90
Coffee	$0.80

CHECK Your Understanding

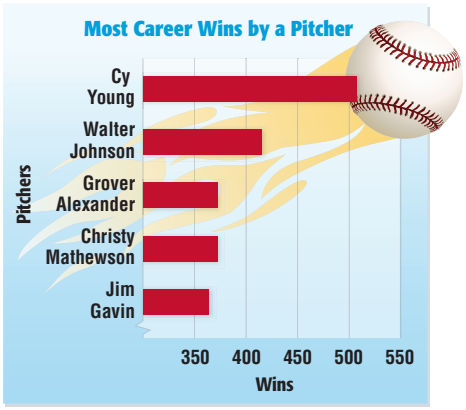
Example 1 (pp. 444–445)

1. **BASEBALL** Refer to the graphs below. Which graph suggests that Cy Young had three times as many wins as Jim Galvin? Is this a valid conclusion? Explain.

Graph A

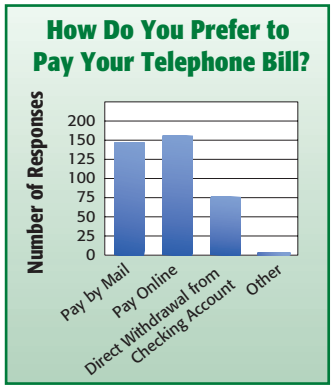


Graph B



Example 2 (pp. 445–446)

2. **PHONES** The manager of a telephone company mailed a survey to 400 households asking each household how they prefer to pay their monthly bill. The results are shown in the graph at the right. Identify any sampling errors and explain why the sample and the display might be biased.



Example 3 (p. 446)

3. **TUNNELS** The table lists the five largest land vehicle tunnels in the U.S. Write a convincing argument for which measure of central tendency you would use to emphasize the average length of the tunnels.

U.S. Vehicle Tunnels on Land

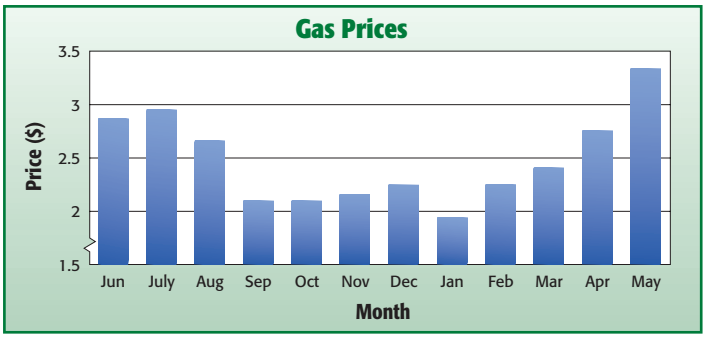
Name	Length (ft)
Anton Anderson Memorial	13,300
E. Johnson Memorial	8,959
Eisenhower Memorial	8,941
Allegheny	6,072
Liberty Tubes	5,920

Practice and Problem Solving

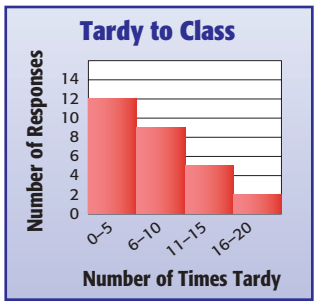
HOMEWORK HELP

For Exercises	See Examples
4, 8	1
5, 9	2
6, 7	3

4. **GAS** The bar graph shows monthly gas prices for 2006–2007. Why is the graph misleading?



5. **SCHOOL** To determine how often his students are tardy, Mr. Kessler considered his first period class. The results are shown in the graph at the right. Identify any sampling errors and explain why the sample and the display might be biased.



TRAVEL **For Exercises 6 and 7, use the table.**

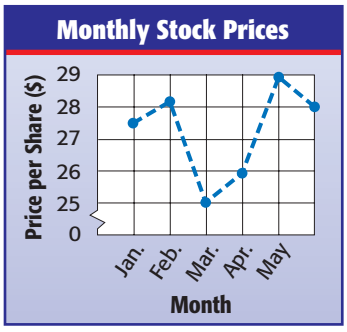
Annual Sight-Seeing Visitors	
Sight	**Visitors***
Cape Cod	4,600,000
Grand Canyon	4,500,000
Lincoln Memorial	4,000,000
Castle Clinton	4,600,000
Smoky Mountains	10,200,000

Source: *The World Almamac*
*Approximation

6. Find the mean, median, and mode of the data. Which measure might be misleading in describing the average annual number of visitors who visit these sights? Explain.
7. Which measure would be best if you wanted a value close to the most number of visitors? Explain.
8. **STOCK** The graphs below show the increases and decreases in the monthly closing prices of Skateboard Depot's stock.

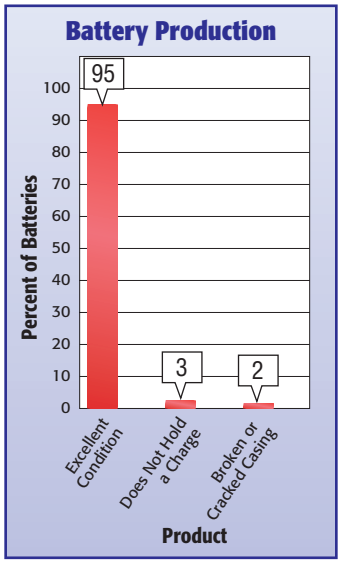
Graph A

Graph B



Suppose you are a stockbroker and want to show a customer that the price of the stock has been fairly stable since January. Write a convincing argument as to which graph you should show the customer.

9. **MANUFACTURING** To evaluate their product, the manager of an assembly line inspects the first 100 batteries that are produced out of 30,000 total batteries produced that day. He displays the results in the graph at the right and then releases it to the local newspaper. Identify any sampling errors and explain why the sample and the display might be biased.



APARTMENTS **For Exercises 10 and 11, create a display that would support each argument given the monthly costs to rent an apartment for the last five years are $500, $525, $560, $585, and $605.**

10. Rent has remained fairly stable.
11. Rent has increased dramatically.

EXTRA PRACTICE
See pages 690, 711.

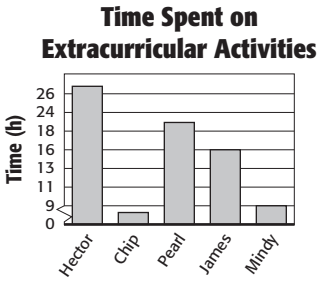
H.O.T. Problems

12. **CHALLENGE** Does adding values that are much greater or much less than the other values in a set of data affect the median of the set? Give an example to support your answer.

13. **WRITING IN MATH** Describe at least two ways in which the display of data can influence the conclusions reached.

TEST PRACTICE

14. The bar graph shows the average number of hours each week that a group of students attend an extracurricular activity after school.



Which statement best tells why the graph may be misleading if you want to use the graph to compare the number of hours the students attend an extracurricular activity?

A The vertical scale should show days instead of hours.

B The graph does not show which activity each person attended.

C The intervals on the vertical scale are inconsistent.

D The graph's title is misleading.

15. A department store mailed 100 surveys to teenagers about their preferred style of jeans. The graph shows the results.

Which of the following is true concerning the sample and the display?

F Both the display and the sample are unbiased.

G The display is biased because the sample is a biased, voluntary response sample.

H The display is biased because the sample is a biased, convenience sample.

J The sample is biased but the display is unbiased.

Spiral Review

16. **CARS** To determine what kind of automobile is preferred by most customers, the owner of an auto dealership surveys every 10th person who enters the dealership. Of these, 54% state that they prefer 4-door sedans. Based on these results, if the dealership stocks 150 cars, about how many of them should be 4-door sedans? (Lesson 8-8)

17. **MP3 PLAYERS** In a survey, 46% of randomly selected teens said they own an MP3 player. Predict how many of the 850 teens at Harvey Middle School own an MP3 player. (Lesson 8-7)