

Chapter 2

Resource Masters



Mathematics

Applications and Concepts

Course 2



New York, New York Columbus, Ohio Chicago, Illinois Peoria, Illinois Woodland Hills, California

2-1**Study Guide and Intervention****Frequency Tables**

A **frequency table** uses tally marks to show how many times each piece of **data** appears. If the data is numerical, the table should have a **scale** which includes the least and the greatest numbers. Also, each table should have an **interval** which separates the scale into equal parts.

EXAMPLE 1 **ATHLETIC SHOES** The table shows prices of 20 types of athletic shoes at a recent sidewalk sale. Make a frequency table and then determine how many types are available for less than \$80.

60	45	120	75	50
70	95	135	65	47
43	110	84	70	53
100	75	70	85	130

Step 1 Choose an appropriate interval and scale for the data. The scale should include the least price, \$43, and the greatest price, \$135.

Step 2 Draw a table with three columns and label the columns *Price*, *Tally*, and *Frequency*.

Step 3 Complete the table.

Step 4 Two categories include prices less than \$80.

$$\$40\text{--}\$59 = 5 \text{ types}$$

$$\$60\text{--}\$79 = 7 \text{ types}$$

So, $5 + 7$ or 12 types of shoes cost less than \$80.

Price(\$)	Tally	Frequency
40–59		5
60–79		7
80–99		3
100–119		2
120–139		3

EXERCISES

For Exercises 1 and 2, use the table below.

3	7	10	0	2
12	18	3	1	15
10	11	8	5	9
8	12	6	8	12

1. Make a frequency table of the data.

2. Use your frequency table to determine how many students studied 10 hours or more.

2-1**Practice: Skills*****Frequency Tables***

Make a frequency table of each set of data.

1.

Students' Choices of Toothpaste				
R	S	R	W	T
T	T	R	T	W
R	W	T	S	T
R	W	W	T	T

R = regular, W = whitening,
T = tartar control, S = sensitive

2.

Ages of Students in a Class				
11	10	11	12	12
13	11	10	12	10
11	11	12	11	13

3. Use your frequency table from Exercise 1. Which type of toothpaste is preferred by more students than any other type?
4. Use your frequency table from Exercise 2. Which age is least common among the students in the class?

ALBUMS For Exercises 5–7, use the data at the right. It shows the number of albums, sold to the nearest million, of the top-selling albums of all time.

5. Make a frequency table of the data. Use the intervals 14–16, 17–19, 20–22, 23–25, and 26–28.

Albums Sold (millions)	Tally	Frequency
14–16		
17–19		
20–22		
23–25		
26–28		

Number of Albums Sold (millions)				
26	19	18	16	21
16	16	27	15	14
22	17	15	19	16
16	15	14	23	15
18	15	16	15	15

6. How many albums sold more than 25 million copies?
7. How many albums sold less than 20 million copies?

2-1

Practice: Word Problems

Frequency Tables

FAVORITE COLORS For Questions 1–3, use the table below. It shows the favorite colors of the students in Mr. Swatzky’s class.

Favorite Colors of Mr. Swatzky’s Students									
B	R	R	O	B	Y	G	G	P	B
Y	B	B	Y	R	O	B	R	B	Y
G	B	O	Y	B	Y	G	G	G	G
P	Y	R	R	G					

B = blue, R = red, G = green, Y = yellow,
O = orange, P = purple

HOLIDAYS For Questions 4–6, use the table below. It shows the number of holidays in each month of 2003.

2003 Holidays			
3	5	5	5
4	4	1	0
2	6	5	2

- | | |
|--|---|
| <p>1. Make a frequency table of the data.</p> | <p>2. If one student changed his or her vote from blue to yellow, what would be the favorite color of most students?</p> |
| <p>3. If one student changed his or her vote from red to purple, what would be the favorite color of the fewest students?</p> | <p>4. What is wrong with using the intervals 1–2, 3–4, and 5–6 to represent the data in a frequency table?</p> |
| <p>5. Make a frequency table of the data.</p> | <p>6. What is the interval and scale of your frequency table from Question 5?</p> |

2-1**Reading to Learn Mathematics*****Frequency Tables***

Pre-Activity *Read the introduction at the top of page 54 in your textbook.
Write your answers below.*

1. What is the cost of the least expensive scooter? the most expensive?
2. How many scooters cost \$51 to \$75?
3. How could you reorganize the prices so that they are easier to find and read?

Reading the Lesson

4. When you create a frequency table of numerical data, what two numbers must the scale include?
5. Give an example of a set of data for which you could create a frequency table having no scale or interval.
6. If you were to create a frequency table for the data that you described in Exercise 5, what would be the labels at the top of each column?

Helping You Remember

7. Think of the first names of all of the students in your class. Suppose you wanted to find out how many first names begin with the same letter of the alphabet. How would a frequency table help you sort the data? What else will the table tell you?

2-1**Enrichment****Breaking the Code**

Many secret messages are written in code. One way to construct a code is to use a *substitution alphabet*. For example, the letter A might be coded into Y, the letter B into R, and so on until every letter is coded.

To break a code of this type, it is helpful to know that the letters of the alphabet occur with different frequencies. For example, the letter E occurs an average of 13 times out of every 100 letters. In any message, however, the frequencies will vary.

Letters	Frequency (per hundred)
E	13
T	9
A, O	8
N	7
I, R	6.5
S, H	6

Use the clues below to break this coded message.

“FOZ BUJRSJBKD CJMMJSGDFE,” UZQKUAZC VOZUDNSA ONDQZV, “DKE JR FOZ MKSF NM FOZUZ HZJRT FNN QGSO ZYJCZRSZ. POKF PKV YJFKD PKV NYZUDKJC KRC OJCCZR HE POKF PKV JUUZDZYKRF.”

1. On another sheet of paper, make a frequency distribution chart for the letters in the message. Which seven letters in the message appear most frequently?
2. The most frequently used letter in the alphabet is E, so write an E underneath each place this letter occurs in the message.
3. The word *the* is very common and appears twice in the message. Use this fact to determine which letters stand for T and H.
4. The word *was* occurs three times in the last sentence. What letters represent W, A, and S in the message?
5. The message is a quote from a famous detective whose last name begins with H. Complete the detective’s name and you will have three more letters.
6. What is the message?

2-2

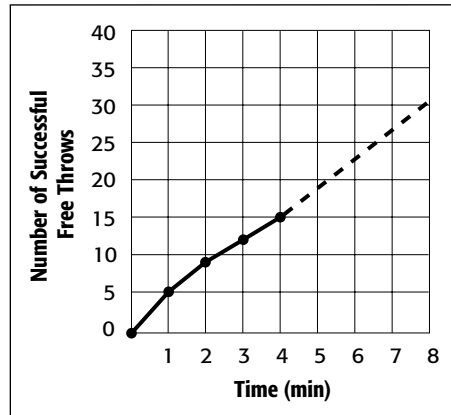
Study Guide and Intervention

Making Predictions

A **scatter plot** displays two sets of data on the same graph and shows trends in data. A **line graph** is a graph made by connecting the data points from a set of data. A line graph can be useful in predicting future events.

EXAMPLE 1 **BASKETBALL** The table shows how many successful free throws Brett made. Make a line graph and predict how many successful free throws he will make in 8 minutes.

Time (min)	Number of Successful Free Throws
0	0
1	5
2	9
3	12
4	15



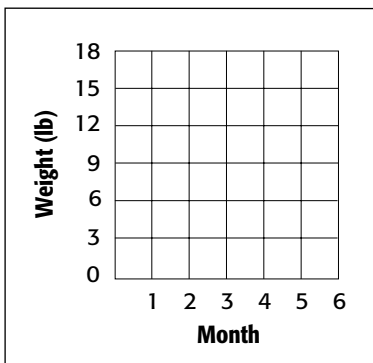
Brett will make about 31 free throws in 8 minutes.

EXERCISES

GROWTH RATE For Exercises 1 and 2, use the table that shows a puppy's weight by month.

Month	Weight (lb)
0	7
1	9
2	10
3	13

1. Make a line graph of the data.



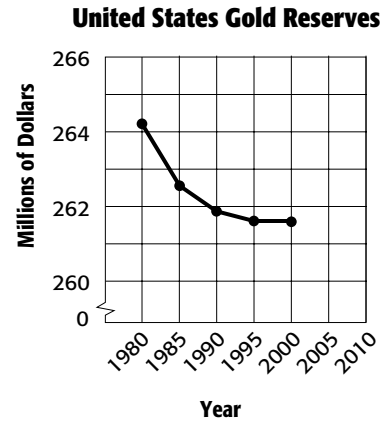
2. Predict her weight at six months.

2-2

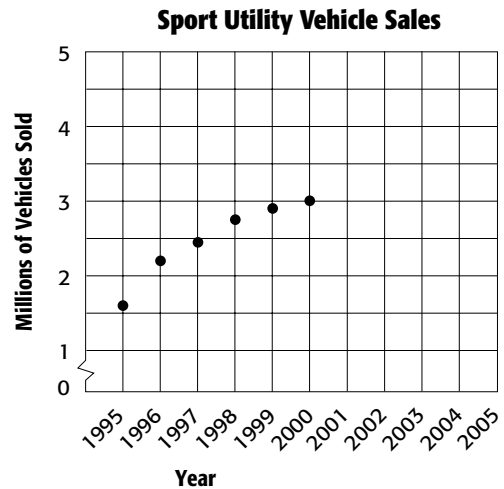
Practice: Skills

Making Predictions

1. **GOLD** The graph shows the gold reserves in the U.S. from 1980 to 2000. If the trend continues, about how many millions of dollars will be in gold reserve in the U.S. in 2010?

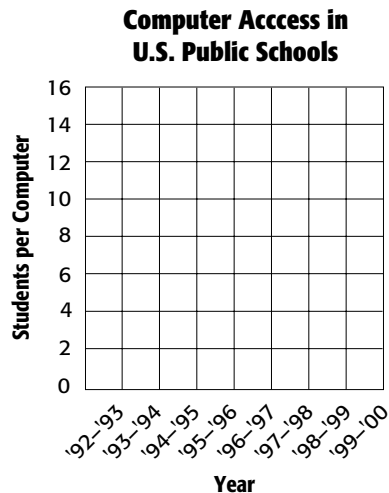


2. **VEHICLES** The scatter plot shows the number of sport utility vehicles sold in the U.S. from 1995 to 2000. If the trend continues, about how many sport utility vehicles will be sold in the U.S. in 2005?



3. **COMPUTERS** The table below shows the number of students per computer in U.S. public schools. Make a line graph of the data.

School Year	Students per Computer
'92-'93	16
'93-'94	14
'94-'95	10.5
'95-'96	10
'96-'97	7.8
'97-'98	6.1
'98-'99	5.7
'99-'00	5.4



4. Use your line graph from Exercise 3 to predict the number of students per computer in '04-'05, if the trend continues.

2-2

Practice: Word Problems

Making Predictions

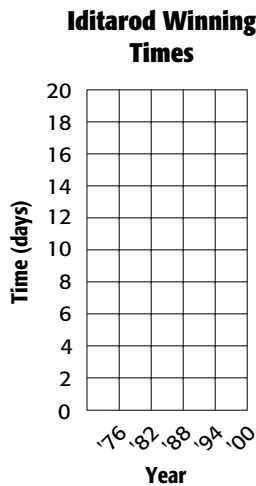
IDITAROD RACE For Exercises 1 and 2, use the data in the table. It shows the number of days it took the winner to complete the Iditarod race.

Iditarod Race Winning Times	
Year	Winning Time (rounded to the nearest day)
1976	19
1982	16
1988	11
1994	11
2000	9

ENTERTAINMENT For Exercises 3 and 4, use the table. It shows the gross amount collected during several Broadway seasons.

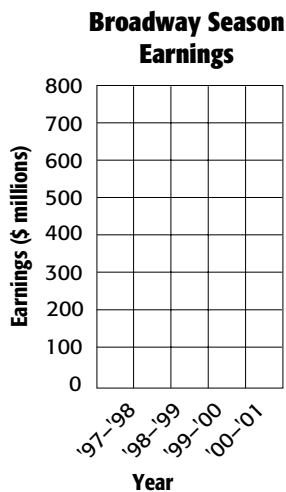
Broadway Season Earnings	
Year	Earnings (\$ million)
1997–1998	558
1998–1999	588
1999–2000	603
2000–2001	666

1. Make a line graph of the data.



2. Use your line graph from Exercise 2 to predict the winning time in 2006, if the trend continues.

3. Make a scatter plot of the data.



4. Use your scatter plot to predict about how much money a Broadway season will gross in 2005–2006, if the trend continues.

2-2**Reading to Learn Mathematics*****Making Predictions***

Pre-Activity *Complete the Mini Lab at the top of page 60 in your textbook. Write your answers below.*

1. By how much did the height of the water change after each addition of five marbles?
2. Predict the height of the water when thirty marbles are in the drinking glass. Explain how you made your prediction.
3. Test your prediction by placing ten more marbles in the glass.
4. Draw a graph of the data that you recorded in the table.

Reading the Lesson

5. Give an example of a set of data for which you could create a line graph.
6. What does it mean if the points on a scatter plot do not appear to lie on a straight line?

Helping You Remember

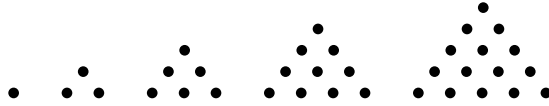
7. In your own words, describe what you would use a line graph to show. Describe what you would use a scatter plot to show.

2-2

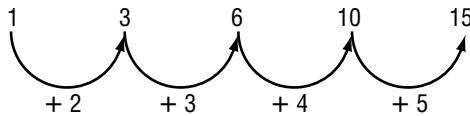
Enrichment

Number Patterns

The dot diagram below illustrates a number pattern.



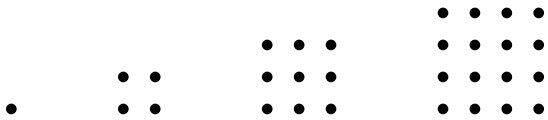
You can discover what number in the pattern comes next by drawing the next figure in the dot pattern. You can also use thinking with numbers. Try to see how two consecutive numbers in the pattern are related.



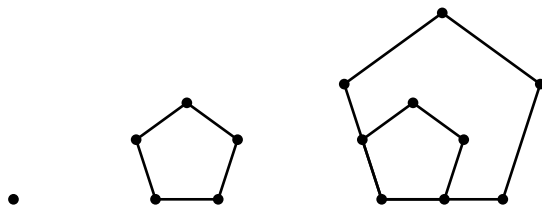
It looks like the next number in the pattern is obtained by adding 6 to 15. The next number in the pattern is 21. You can check this by drawing the next figure in the dot pattern.

Write the next two numbers in the number pattern for each dot diagram.

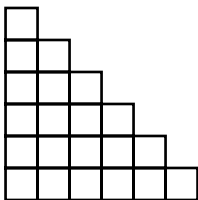
1.



2.



3. A staircase is being built from cubes. How many cubes will it take to make a staircase 25 cubes high?



2-3

Study Guide and Intervention

Line Plots

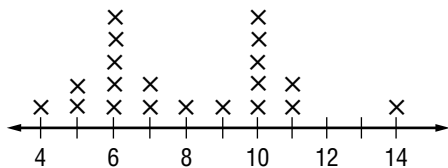
A **line plot** is a diagram that shows the frequency of data on a number line.

EXAMPLE 1 **SHOE SIZE** The table shows the shoe size of students in Mr. Kowa’s classroom. Make a line plot of the data.

Shoe Sizes			
10	6	4	6
5	11	10	10
6	9	6	8
7	11	7	14
5	10	6	10

Step 1 Draw a number line. Because the smallest size is 4 and the largest size is 14, you can use a scale of 4 to 14 and an interval of 2.

Step 2 Put an “×” above the number that represents the shoe size of each student.



EXAMPLE 2 Use the line plot in Example 1. Identify any clusters, gaps, or outliers and analyze the data by using these values. What is the range of data?

Many of the data cluster around 6 and 10. You could say that most of the shoe sizes are 6 or 10. There is a gap between 11 and 14, so there are no shoe sizes in this range. The number 14 appears removed from the rest of the data, so it would be considered an outlier. This means that the shoe size of 14 is very large and is not representative of the whole data set.

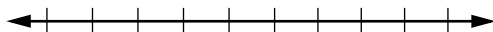
The greatest shoe size is 14, and the smallest is 4. The range is $14 - 4$ or 10.

EXERCISES

PETS For Exercises 1–3 use the table at the right that shows the number of pets owned by different families.

Number of Pets			
2	1	2	0
3	1	1	2
8	3	1	4

1. Make a line plot of the data.



2. Identify any clusters, gaps, or outliers.

3. What is the range of the data?

2-3

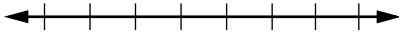
Practice: Skills

Line Plots

For Exercises 1-3, use the data at the right that shows the number of fish each person caught on a fishing trip.

Number of Fish				
3	1	0	1	0
1	2	3	1	4
2	1	2	3	0
1	2	3	2	7

1. Make a line plot of the data.



2. What is the range of the data?
3. Identify any clusters, gaps, or outliers and analyze the data by describing what these values represent.

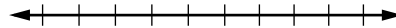
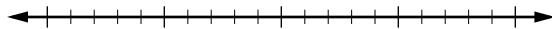
Make a line plot for each set of data. Identify any clusters, gaps, or outliers.

4.

Test Scores			
83	84	92	91
82	81	80	94
85	95	96	84
94	98	93	90

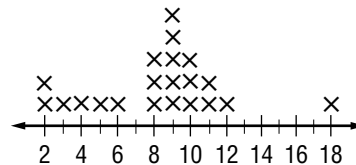
5.

Rainfall (in.)			
3	2	4	3
1	8	7	3
2	9	4	0



For Exercises 6-8, use the line plot at the right.

6. What is the range of the data?
7. What number occurred most often?
8. Identify any clusters, gaps, or outliers.



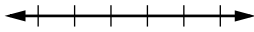
2-3

Practice: Word Problems

Line Plots

TELEVISION SETS For Exercises 1–6, use the table below. It shows the number of television sets owned by 30 different families.

Number of TVs					
2	1	2	4	3	0
2	3	2	3	4	2
1	2	2	3	4	0
3	1	3	2	1	2
5	3	4	3	0	0

<p>1. Make a line plot for the data.</p> 	<p>2. How many televisions do most families own?</p>
<p>3. What is the greatest number of televisions owned by a family?</p>	<p>4. What is the range of the data?</p>
<p>5. Identify any clusters, gaps, or outliers, if any exist, and explain what they mean.</p>	<p>6. Describe how the range of the data would change if 5 were not part of the data set.</p>

2-3**Reading to Learn Mathematics*****Line Plots***

Pre-Activity *Read the introduction at the top of page 64 in your textbook. Write your answers below.*

1. Do any of the values seem much greater or much less than the other data values?
2. Do some of the buildings have the same number of stories? Is this easy to see? Explain.
3. What better ways can you suggest for organizing these data?

Reading the Lesson

4. If the least number of a data set is 75 and the greatest number in the set is 200, what is the range?
5. Give an example of a set of data for which you could create a line plot.
6. If you see a gap in a line plot, what do you know about that interval?

Helping You Remember

7. How is a line plot similar to a frequency table? How is it different?

2-3**Enrichment****Enhanced Line Plots**

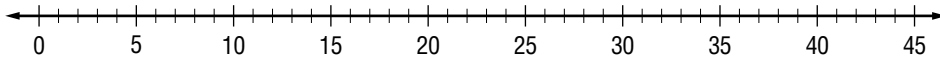
You have learned to create line plots to analyze given data. Sometimes altering a line plot can show even more information about a data set.

SPORTS For Exercises 1–4, use the following data about the Super Bowl.

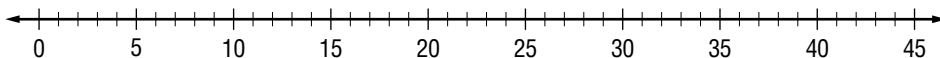
The National Football League began choosing its champion in the Super Bowl in 1967. The list below shows the margin of victory and the winning league for the first 36 Super Bowl games. In the list, A indicates that the winning team is from the American Football Conference (AFC), N indicates that the winning team is from the National Football Conference.

Year	Margin	Year	Margin	Year	Margin	Year	Margin
1	25-N	10	7-N	19	17-N	28	23-N
2	10-A	11	9-A	20	3-A	29	7-A
3	10-N	12	18-A	21	3-A	30	17-A
4	1-N	13	22-N	22	4-A	31	4-N
5	15-A	14	35-N	23	19-N	32	14-N
6	19-N	15	27-A	24	10-N	33	17-A
7	4-A	16	16-A	25	21-N	34	5-N
8	29-A	17	17-N	26	12-A	35	45-N
9	13-N	18	36-N	27	32-N	36	7-A

1. Make a line plot of the data.



2. What do you observe about the winning margins?
3. Make a new line plot for the winning margins by replacing each \times with A for an AFC win or N for an NFC win. What do you observe about the winning margins when looking at this enhanced line plot?



4. The list of Super Bowl margins is given in order of years: first 25-N, then 19-N, and so on. Describe any patterns you see in the margins or in the winning league over the years of the Super Bowl.

2-4**Study Guide and Intervention*****Mean, Median, and Mode***

The **mean** is the sum of the data divided by the number of data items. The **median** is the middle number of the ordered data, or the mean of the middle two numbers. The **mode** is the number (or numbers) that occur most often. The mean, median, and mode are each **measures of central tendency**.

EXAMPLE 1 The table shows the number of hours students spent practicing for a music recital. Find the mean, median, and mode of the data.

Numbers of Hours Spent Practicing				
3	12	10	8	7
18	11	12	10	3
8	6	0	1	5
8	2	15	9	12

$$\text{mean} = \frac{3 + 12 + 10 + \dots + 12}{20} = \frac{160}{20} \text{ or } 8.$$

To find the median, the data must be ordered.

0, 1, 2, 3, 3, 5, 6, 7, 8, 8, 8, 9, 10, 10, 11, 12, 12, 12, 15, 18

$$\frac{8 + 8}{2} = 8$$

To find the mode, look for the number that occurs most often. Since 8 and 12 each occur 3 times, the modes are 8 and 12.

EXERCISES

Find the mean, median, and mode for each set of data. Round to the nearest tenth if necessary.

1. 27, 56, 34, 19, 41, 56, 27, 25, 34, 56 2. 7, 3, 12, 4, 6, 3, 4, 8, 7, 3, 20

3. 1, 23, 4, 6, 7, 20, 7, 5, 3, 4, 6, 7, 11, 6 4. 3, 3, 3, 3, 3, 3, 3

5. 2, 4, 1, 3, 5, 6, 1, 1, 3, 4, 3, 1 6. 4, 0, 12, 10, 0, 5, 7, 16, 12, 10, 12, 12

2-4

Practice: Skills

Mean, Median, and Mode

Find the mean, median, and mode for each set of data. Round to the nearest tenth if necessary.

1. 5, 9, 6, 6, 11, 8, 4

2. 1, 3, 5, 2, 4, 8, 4, 7, 2

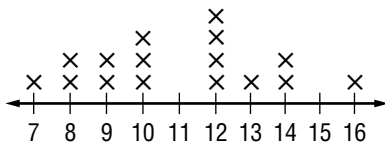
3. 1, 9, 4, 7, 5, 3, 16, 11

4. 3, 4, 4, 4, 4, 3, 6

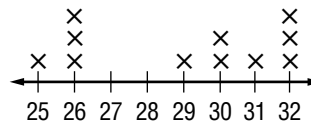
5. 3, 7, 2, 5, 5, 6, 5, 10, 11, 5

6. 19, 17, 24, 11, 19, 25, 15, 15, 19, 16, 16

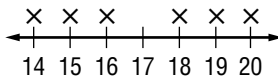
7.



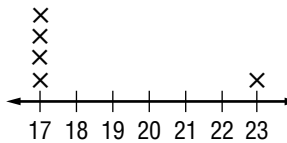
8.



9.



10.



11.

Prize (\$)	Tally	Frequency
6.00		9
7.00		10
7.50		5
8.00		1

12.

Size	Tally	Frequency
6		13
7		7
8		7
9		3

13.

Time (min)	Tally	Frequency
8		10
9		10
10		5

14.

Hits	Tally	Frequency
0		5
1		6
2		3
3		1

2-4**Practice: Word Problems*****Mean, Median, and Mode***

SCHOOL For Exercises 1–6, use the table below. It shows the number of times per day that students go to their lockers.

Student Locker Visits							
2	2	0	1	2	2	3	4
0	5	2	5	2	5	2	4
2	4	6	4	5	6	5	6
2	2	0	1	4	6	10	2

<p>1. Make a frequency table of the data.</p>	<p>2. What is the range of the data?</p>
<p>3. Find the mean, median, and mode of the data. Round to the nearest tenth if necessary.</p>	<p>4. Would the mean, median, or mode best represent the data? Explain.</p>
<p>5. Explain why the mean does not best represent the data.</p>	<p>6. If the value 10 were dropped from the data, find the median and the mode of the remaining data.</p>

2-4**Reading to Learn Mathematics*****Mean, Median, and Mode***

Pre-Activity *Complete the Mini Lab at the top of page 69 in your textbook. Write your answers below.*

1. How many cubes are in each stack?
2. In the past five days, it snowed an average of ____?____ inches per day.
3. Suppose on the sixth day it snowed 9 inches. If you moved the cubes again, how many cubes would be in each stack?

Reading the Lesson

4. Look at the data set 2, 5, 5, 6, 8, 11, 12. What is the mean? the median? the mode?
5. Match the measure of central tendency with the description of when it would be most useful.

median _____

a. The data set has many identical numbers.

mean _____

b. There are no big gaps in the middle of the data.

mode _____

c. The data set has no outliers.

6. If you wanted to find the average height of all of the students in a classroom, which would be the most accurate to use—mean, median, or mode? Why?

Helping You Remember

7. In baseball, a player has a batting average. What does this average measure? What kind of data would you need to calculate a batting average?

2-4**Enrichment****Quartiles**

The median is a number that describes the “center” of a set of data. Here are two sets with the same median, 50, indicated by \bigcirc .

25	30	∇ 35	40	45	\bigcirc 50	55	60	\triangle 65	70	75
0	10	∇ 20	40	50	\bigcirc 50	60	70	\triangle 80	90	100

But, sometimes a single number may not be enough. The numbers shown in the triangles can also be used to describe the data. They are called *quartiles*. The lower quartile is the median of the lower half of the data. It is indicated by ∇ . The upper quartile is the median of the upper half. It is indicated by \triangle .

Circle the median in each set of data. Draw triangles around the quartiles.

1. 29 52 44 37 27 46 43 60 31 54 36

2. 1.7 0.4 1.4 2.3 0.3 2.7 2.0 0.9 2.7 2.6 1.2

3. 1,150 1,600 1,450 1,750 1,500 1,300 1,200

4. 5 2 9 7 9 3 7 8 7 2 5 6 9 5 1

Use the following set of test scores to solve the problems.

71 57 29 37 53 41 25 37 53 27
62 55 75 48 66 53 66 48 75 66

5. Which scores are “in the lower quartile”?

6. How high would you have to score to be “in the upper quartile”?

2-5**Study Guide and Intervention****Stem-and-Leaf Plots**

In a **stem-and-leaf plot**, the data are organized from least to greatest. The digits of the least place value usually form the **leaves**, and the next place value digits form the **stems**.

EXAMPLE 1 Make a stem-and-leaf plot of the data below. Then find the range, median, and mode of the data.
42, 45, 37, 46, 35, 49, 47, 35, 45, 63, 45

Order the data from least to greatest.

35, 35, 37, 42, 45, 45, 45, 46, 47, 49, 63

The least value is 35, and the greatest value is 63.

So, the tens digits form the stems, and the ones digits form the leaves.

range: greatest value – least value = $63 - 35$ or 28

median: middle value, or 45

mode: most frequent value, or 45

Stem	Leaf
3	5 5 7
4	2 5 5 5 6 7 9
5	
6	3

$$6|3 = 63$$

EXERCISES

Make a stem-and-leaf plot for each set of data. Then find the range, median, and mode of the data.

1. 15, 25, 16, 28, 1, 27, 16, 19, 28

2. 1, 2, 3, 2, 3, 1, 4, 2, 5, 7, 12, 11, 11, 3, 10

3. 3, 5, 1, 17, 11, 45, 17

4. 4, 7, 10, 5, 8, 12, 7, 6

2-5

Practice: Skills

Stem-and-Leaf Plots

Make a stem-and-leaf plot for each set of data.

1. 23, 36, 25, 13, 24, 25, 32, 33, 17, 26, 24 2. 3, 4, 6, 17, 12, 5, 17, 4, 26, 17, 18, 21, 16, 15, 20

3. 26, 27, 23, 23, 24, 26, 31, 45, 33, 32, 41 4. 347, 334, 346, 330, 348, 347, 359, 344, 357, 40, 21, 20

HOT DOGS For Exercises 5–7, use the stem-and-leaf plot at the right that shows the number of hot dogs eaten during a contest.

Stem	Leaf
0	8 8 9
1	1 2 2 4 7 7 7
2	1 1 2

$2|1 = 21$

5. How many hot dogs are represented on the stem-and-leaf plot?
 6. What is the range of the number of hot dogs eaten?
 7. Find the median and mode of the data.

Determine the mean, median, and mode of the data shown in each stem-and-leaf plot.

8.

Stem	Leaf
0	1 2 2 3
1	3 4 5 5
2	0 0 0 1 3

$2|0 = 20$

9.

Stem	Leaf
2	0 0 0 2 3 5 7
3	1 2
4	0

$4|0 = 40$

10.

Stem	Leaf
22	1 1 2 7
23	3 3 9
24	0 6 8

$24|0 = 240$

11.

Stem	Leaf
0	1 3 3 4 7
1	2 2 2 4 5 6
2	0 0 0 1

$2|0 = 20$

2-5**Practice: Word Problems*****Stem-and-Leaf Plots***

ENDANGERED SPECIES For Exercises 1–6, use the table below. It shows the number of endangered species in the U.S.

Endangered Species in U.S.			
Group	Number of Species	Group	Number of Species
mammals	63	clams	61
birds	78	snails	20
reptiles	14	insects	33
amphibians	10	arachnids	12
fishes	70	crustaceans	18

1. Make a stem-and-leaf plot of the data.	2. What group has the greatest number of endangered species in the U.S.?
3. What group has the least number of endangered species in the U.S.?	4. What is the range of the data?
5. Use your stem-and-leaf plot to determine the median and mode.	6. How many groups have less than 30 endangered species in the U.S.?

2-5**Reading to Learn Mathematics*****Stem-and-Leaf Plots***

Pre-Activity *Read the introduction at the top of page 76 in your textbook.
Write your answers below.*

1. What was the age of the youngest signer?

2. What methods do you already have for showing the distribution of ages?

Reading the Lesson

3. What can you determine easily from a stem-and-leaf plot?

4. How do you determine the stems of a stem-and-leaf plot? How do you determine the leaves?

5. If you look at a stem-and-leaf plot, how can you tell what the stems and leaves represent?

Helping You Remember

6. Describe how the arrangement of stems and leaves in a stem-and-leaf plot relates to a plant or tree.

2-6

Study Guide and Intervention

Box-and-Whisker Plots

A **box-and-whisker plot** is a diagram that divides data into four equal parts. To do this, first find the median of the data, and then find the median of the lower half, called the **lower quartile**, and the median of the upper half, called the **upper quartile**.

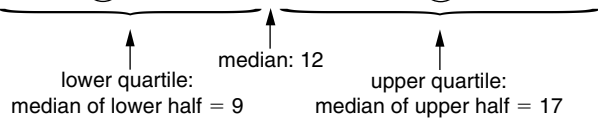
EXAMPLE 1 Make a box-and-whisker plot of the data below.

12, 23, 6, 17, 9, 10, 19, 7, 11, 15, 7, 12, 13, 20

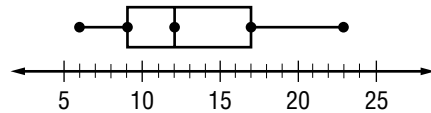
Step 1 Order the data from least to greatest.

6, 7, 7, **9**, 10, 11, 12, 12, 13, 15, **17**, 19, 20, 23

Step 2 Find the median and the quartiles.



Step 3 Draw a number line and graph the values you found in Step 2 as points above the line. Also graph the least value (**lower extreme**) and the greatest value (**upper extreme**).

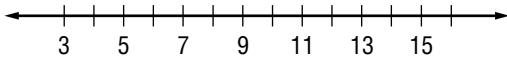


Step 4 Draw the box and whiskers.

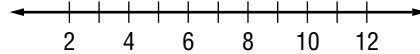
EXERCISES

Make a box-and-whisker plot for each set of data.

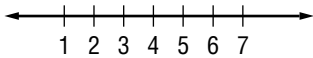
1. 15, 16, 7, 8, 5, 5, 3, 4, 8,
12, 10, 9, 6, 13



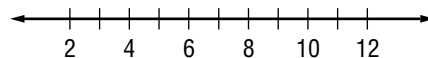
2. 4, 6, 3, 7, 10, 11, 4, 5, 6, 2, 7



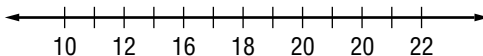
3. 1, 5, 2, 2, 6, 3, 7



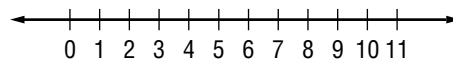
4. 8, 2, 7, 4, 12, 8, 11



5. 17, 22, 11, 11, 11, 10, 19,
18, 16, 11, 18



6. 3, 5, 1, 4, 2, 4, 3, 5, 2, 1



2-6

Practice: Skills

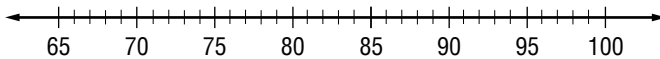
Box-and-Whisker Plots

SPORTS For Exercises 1–6, refer to the table at the right. It shows the regular season games lost by each professional baseball team in the National League in 2001.

Number of Losses			
74	76	80	86
69	69	74	94
100	70	72	76
89	94	96	83

1. Find the lower extreme, LQ, median, UQ, and upper extreme.

2. Draw a box-and-whisker plot of the data.



3. What fraction of the data is between 73 and 78?

4. Between what two numbers is the largest range of the four quartiles?

5. Find the interquartile range.

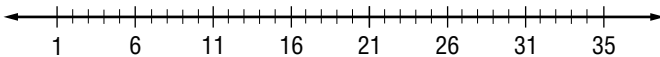
6. Are there any outliers? If so, identify them.

LIFE SCIENCE For Exercises 7–12, refer to the table at the right. It shows average life spans of 21 mammals.

Life Span (yr)				
5	12	4	3	12
12	6	5	8	35
7	8	12	10	12
10	3	7	1	12
10				

7. Find the lower extreme, LQ, median, UQ, and upper extreme.

8. Draw a box-and-whisker plot of the data.



9. What fraction of the data is between 5 and 12?

10. Find the interquartile range.

11. What are the limits on outliers?

12. Are there any outliers? If so, identify them.

2-6**Practice: Word Problems*****Box-and-Whisker Plots***

SOCCER For Exercises 1–6, use the table below. It shows the number of wins in a recent major league soccer season.

Major League Soccer Wins					
16	13	7	8	10	4
14	13	11	5	16	13

<p>1. Find the lower extreme, LQ, median, UQ, and upper extreme.</p>	<p>2. Construct a box-and-whisker plot of the data in the table.</p>
<p>3. What fraction of the data is greater than 7.5?</p>	<p>4. What fraction of the data is between 7.5 and 13.5?</p>
<p>5. Determine the interquartile range.</p>	<p>6. Use the interquartile range to determine the limits for the outliers. Are there any outliers?</p>

2-6**Reading to Learn Mathematics*****Box-and-Whisker Plots***

Pre-Activity *Read the introduction at the top of page 80 in your textbook. Write your answers below.*

1. What is the median of the data?

2. Into how many parts does the median divide the data?

Reading the Lesson

3. What do the terms *lower quartile*, *upper quartile*, and *interquartile range* have to do with the word *quarter*?

4. Complete the sentence. Outliers are data that are more than _____ times the interquartile range from the quartiles.

5. What is the first step in creating a box-and-whisker plot?

Helping You Remember

6. A box-and-whisker plot divides a data set into four parts. Write a series of steps that tells how to divide a data set of fifteen numbers into four parts.

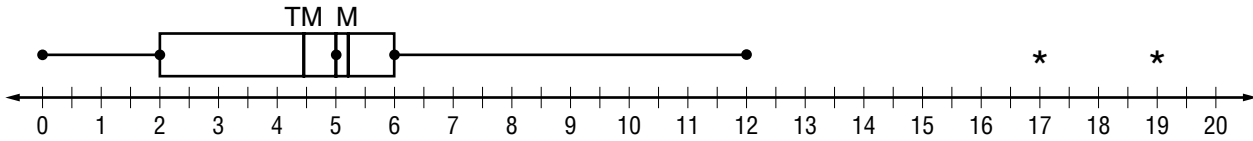
2-6

Enrichment

The Trimmed Mean

Sometimes a mean can be distorted by outliers. To avoid this, exclude any outliers and compute a new mean. This new measure is called the *trimmed mean*.

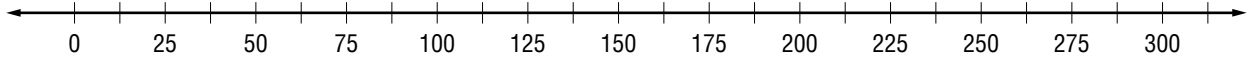
Data Points	0	2	3	4	5	6	9	10	11	12	17	19
Frequency	6	3	6	1	5	5	1	1	1	2	1	1



Construct a box-and-whisker plot for each frequency table. Mark the mean M and the trimmed mean TM .

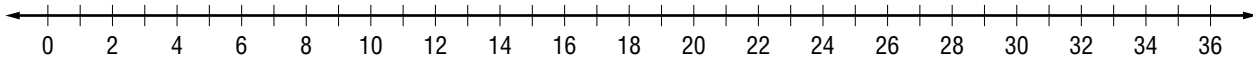
1. Areas of 48 States, Rounded to Nearest 25 Thousand Square Miles

Area (thousands)	0	25	50	75	100	125	150	275
Number of States	8	4	17	10	4	2	2	1



2. Projected Populations in 2010, Rounded to Nearest 2 Million

Population (millions)	0	2	4	6	8	10	12	16	18	22	36
Number of States	6	13	10	7	3	3	2	1	1	1	1



Use reference materials to predict the outliers.

3. Exercise 1

4. Exercise 2

2-7

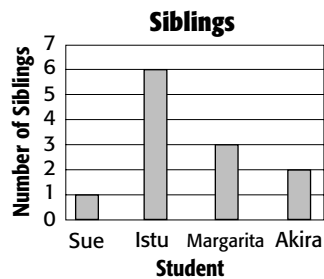
Study Guide and Intervention

Bar Graphs and Histograms

A **bar graph** is one method of comparing data by using solid bars to represent quantities. A **histogram** is a special kind of bar graph. It uses bars to represent the frequency of numerical data that have been organized into intervals.

EXAMPLE 1 **SIBLINGS** Make a bar graph to display the data in the table below.

Student	Number of Siblings
Sue	1
Isfu	6
Margarita	3
Akira	2

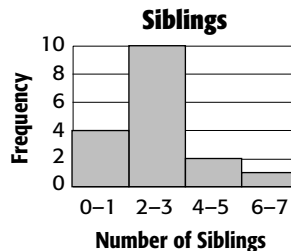


Step 1 Draw a horizontal and a vertical axis. Label the axes as shown. Add a title.

Step 2 Draw a bar to represent each student. In this case, a bar is used to represent the number of siblings for each student.

EXAMPLE 2 **SIBLINGS** The number of siblings of 17 students have been organized into a table. Make a histogram of the data.

Number of Siblings	Frequency
0-1	4
2-3	10
4-5	2
6-7	1



Step 1 Draw and label horizontal and vertical axes. Add a title.

Step 2 Draw a bar to represent the frequency of each interval.

EXERCISES

1. Make a bar graph for the data in the table.

Student	Number of Free Throws
Luis	6
Laura	10
Opal	4
Gad	14

2. Make a histogram for the data in the table.

Number of Free Throws	Frequency
0-1	1
2-3	5
4-5	10
6-7	4

2-7

Practice: Skills

Bar Graphs and Histograms

ZOOS For Exercises 1 and 2, use the table. It shows the number of species at several zoological parks.

Zoo	Species
Los Angeles	350
Lincoln Park	290
Cincinnati	700
Bronx	530
Oklahoma City	600

1. Make a bar graph of the data.

Animal Species in Zoos



2. Which zoological park has the most species?

ZOOS For Exercises 3 and 4, use the table at the right. It shows the number of species at 37 major U.S. public zoological parks.

Number of Species				
200	700	290	600	681
300	643	350	794	400
360	600	134	200	800
305	384	500	330	250
530	715	303	200	475
465	340	347	300	708
184	800	375	350	450
337	221			

3. Make a histogram of the data. Use intervals of 101–200, 201–300, 301–400, 401–500, 501–600, 601–700, and 701–800 for the horizontal axis.

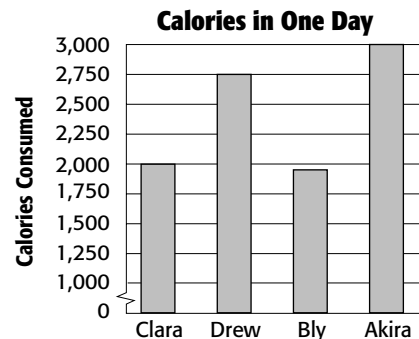
Animal Species in Zoos



4. Which interval has the largest frequency?

HEALTH For Exercises 5 and 6, use the graph at the right.

5. What does each bar represent?
6. Determine whether the graph is a bar graph or a histogram. Explain how you know.



2-7

Practice: Word Problems

Bar Graphs and Histograms

PUPPIES For Exercises 1 and 2, use the table below. It shows the results of a survey in which students were asked what name they would most like to give a new pet puppy.

Name	Votes
Max	15
Tiger	5
Lady	13
Shadow	10
Molly	9
Buster	2

EARTH SCIENCE In Exercises 3–6, use the table below. It shows the highest wind speeds in 30 U.S. cities.

Highest Wind Speeds (mph)									
52	75	60	80	55	54	91	60	81	58
53	73	46	76	53	46	73	46	51	49
57	58	56	47	65	49	56	51	54	51

<p>1. Make a bar graph to display the data.</p> <p style="text-align: center;">Favorite New Puppy Names</p> <div style="border: 1px solid black; height: 100px; margin: 10px auto; width: 80%;"></div>	<p>2. Use your bar graph from Exercise 1. Compare the number of votes the name Shadow received to the number of votes the name Tiger received.</p>
<p>3. Make a histogram of the data.</p> <p style="text-align: center;">Highest Wind Speeds</p> <div style="border: 1px solid black; height: 100px; margin: 10px auto; width: 80%;"></div>	<p>4. What is the top wind speed of most of the cities?</p>
<p>5. How many cities recorded wind speeds of 80 miles per hour or more?</p>	<p>6. How many cities recorded their highest wind speeds at 60 miles per hour or more?</p>

2-7**Reading to Learn Mathematics*****Bar Graphs and Histograms***

Pre-Activity *Read the introduction at the top of page 85 in your textbook. Write your answers below.*

1. What are the fastest and slowest speeds recorded in the table?
2. How can you create a visual representation to summarize the data?
3. Do any of these representations show both the animal name and its speed?

Reading the Lesson

4. Look at Example 1. What are the things that a bar graph should have?
5. Why are all of the bars in a histogram the same width without space between them?

Helping You Remember

6. How is a histogram similar to a bar graph? How is it different?

Enrichment**African Americans in History**

A magazine published this list of fifty African Americans who made significant contributions to American history and culture.

50 Influential Figures in African-American History

Robert S. Abbott (1870–1940)	James Weldon Johnson (1871–1938)
Richard Allen (1760–1831)	Ernest E. Just (1883–1941)
Louis Armstrong (1900–1971)	Joe Louis (1914–1981)
Ella Baker (1903–1986)	Martin Luther King, Jr. (1929–1968)
James Baldwin (1924–1987)	Malcolm X (1925–1965)
Benjamin Banneker (1736–1806)	Benjamin E. Mays (1894–1984)
Ida B. Wells-Barnett (1862–1931)	Jesse Owens (1913–1980)
Mary McLeod Bethune (1875–1955)	Adam Clayton Powell, Jr. (1908–1972)
Ralph J. Bunche (1904–1971)	A. Philip Randolph (1889–1979)
George Washington Carver (1861?–1943)	Paul Robeson (1898–1976)
Martin R. Delany (1812–1885)	Jackie Robinson (1919–1972)
Frederick Douglass (1817–1895)	Mary Church Terrell (1863–1954)
Charles R. Drew (1904–1950)	Howard Thurman (1900–1981)
W. E. B. Du Bois (1868–1963)	William Monroe Trotter (1872–1934)
Paul Laurence Dunbar (1872–1906)	Sojourner Truth (1797?–1883)
Edward Kennedy Ellington (1899–1974)	Harriet Tubman (1821?–1913)
Marcus Garvey (1887–1940)	Henry McNeal Turner (1834–1915)
Prince Hall (1735?–1807)	Nat Turner (1800–1831)
Fannie Lou Hamer (1917–1977)	David Walker (1785–1830)
W. C. Handy (1873–1958)	Madame C. J. Walker (1867–1919)
Frances E. W. Harper (1825–1911)	Booker T. Washington (1856–1915)
Charles H. Houston (1895–1950)	Phillis Wheatley (1753?–1784)
Langston Hughes (1902–1967)	Daniel Hale Williams (1856–1931)
Zora Neale Hurston (1901?–1960)	Carter G. Woodson (1875–1950)
Jack Johnson (1878–1946)	Richard Wright (1908–1960)

1. On a separate sheet of paper, construct a histogram that displays the years of birth for these fifty people. Organize the data in twenty-year intervals, such as 1841–1860 and 1861–1880. If there is a question mark next to a person's year of birth, use that year in the histogram.
2. Refer to the histogram you constructed in Exercise 1. In which interval were the most people born? In which interval were the fewest born? What historical events can you associate with the times these people were living?

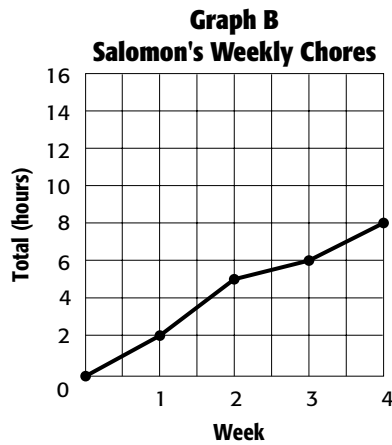
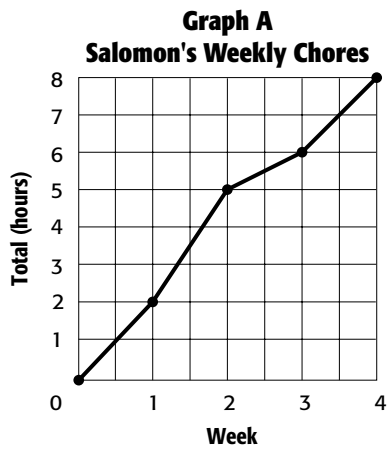
2-8

Study Guide and Intervention

Misleading Statistics

Graphs can be misleading for many reasons: there is no title, the scale does not include 0; there are no labels on either axis; the intervals on a scale are not equal; or the size of the graphics misrepresents the data.

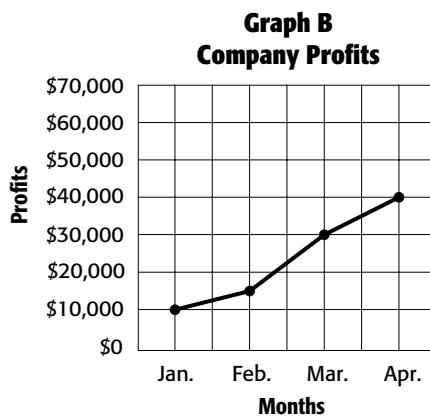
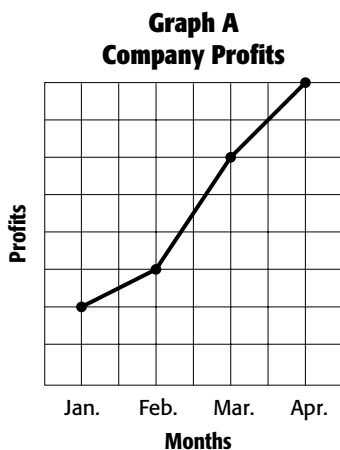
EXAMPLE 1 **WEEKLY CHORES** The line graphs below show the total hours Salomon spent doing his chores one month. Which graph would be best to use to convince his parents he deserves a raise in his allowance? Explain.



He should use graph A because it makes the total hours seem much larger.

EXERCISES

PROFITS For Exercises 1 and 2, use the graphs below. It shows a company's profits over a four-month period.



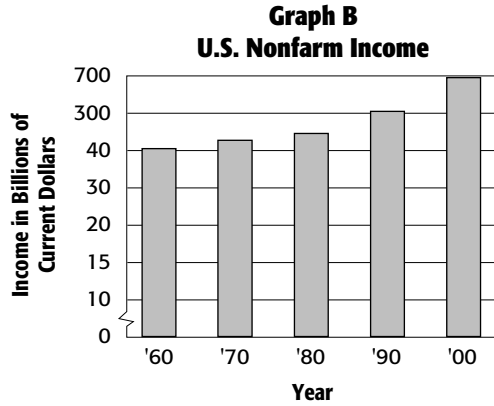
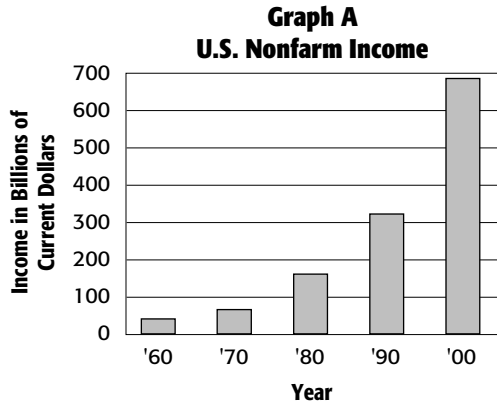
- Which graph would be best to use to convince potential investors to invest in this company?
- Why might the graph be misleading?

2-8

Practice: Skills

Misleading Statistics

1. **INCOME** The bar graphs below show the total U.S. national income (nonfarm). Which graph could be misleading? Explain.



GEOGRAPHY For Exercises 2–4, use the table that shows the miles of shoreline for five states.

Miles of Shoreline	
State	Length of Shoreline (mi)
Virginia	3,315
Maryland	3,190
Washington	3,026
North Carolina	3,375
Pennsylvania	89

- Find the mean, median, and mode of the data.
- Which measure of central tendency is misleading in describing the miles of shoreline for the states? Explain.
- Which measure of central tendency most accurately describes the data?

2-8**Practice: Word Problems*****Misleading Statistics***

QUIZ SCORES For Exercises 1 and 2, use the data shown in the table below. The table shows the quiz grades for Ms. Andrey's and Mr. Luna's classes.

Quiz Scores	
Ms. Andrey's Class	Mr. Luna's Class
10	20
15	20
25	25
25	29
12	26

BOOK SALES For Exercises 3 and 4, use the table below. It shows the number of books sold each day for 20 days.

Book Sales Per Day			
23	18	23	15
24	16	0	11
19	10	13	17
12	23	11	16
36	24	12	27

- | | |
|--|---|
| <p>1. Ms. Andrey claims the average score on a quiz in her class was 25. Mr. Luna claims the average score on a quiz in his class is 25. Explain how they arrived at these figures.</p> | <p>2. What additional information could be useful in analyzing the data?</p> |
| <p>3. Find the mean, median, and mode of the data. Which measure of central tendency would be misleading in describing the book sales? Explain.</p> | <p>4. Which value would most accurately describe the data? Explain.</p> |

2-8**Reading to Learn Mathematics*****Misleading Statistics***

Pre-Activity *Read the introduction at the top of page 92 in your textbook. Write your answers below.*

1. Approximately how many more passengers per lane can a 40-foot bus transport in an hour than a car can transport?
2. Is the bus on the graph about twice as large as the car? Explain.
3. Do you think the graph appeared in a brochure for a train/bus transit company or for a car company? What makes you think so?

Reading the Lesson

4. Give an example of a data set you could represent with a graph and how you could represent it in a misleading way.
5. Study Example 1 on page 92. How does the definition you learned for the word *interval* help identify what is wrong with Graph B?

Helping You Remember

6. Missing labels on graphs and uneven intervals on a scale are two ways a set of statistics can be misleading. Listen for a statistic used on the radio or in a newspaper. Is it a reasonable statement? What other information might you like to have before you consider a statistic to be reasonable?

Choosing a Representative Sample

Statisticians often use **samples** to represent larger groups. For example, television ratings are based on the opinions of a few people who are surveyed about a program. The people surveyed are just part of the whole group of people who watched the program. When using samples, people taking surveys must make sure that their samples are representative of the larger group in order to ensure that their conclusions are not misleading.

ADVERTISING A company that makes athletic shoes is considering hiring a professional basketball player to appear in their commercials. Before hiring him, they are doing research to see if he is popular with teens. Would they get good survey results from taking a survey about the basketball player from each of these surveys?

1. 200 teens at a basketball game of the basketball player's team
2. 25 teens at a shopping mall
3. 500 students at a number of different middle and high schools

Decide whether each location is a good place to find a representative sample for the selected survey. Justify your answer.

4. number of hours of television watched in a month at a shopping mall
5. favorite kind of entertainment at a movie theater
6. whether families own pets in an apartment complex
7. taste test of a soft drink at a grocery store
8. favorite teacher in a school cafeteria
9. teenagers' favorite magazine at five different high schools