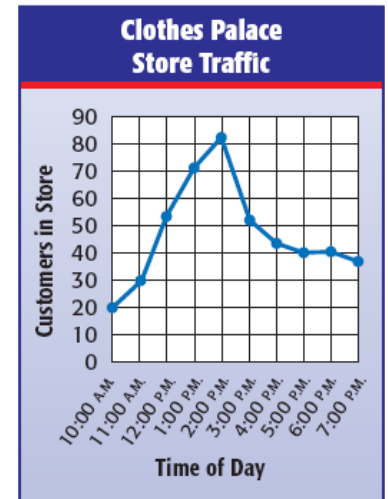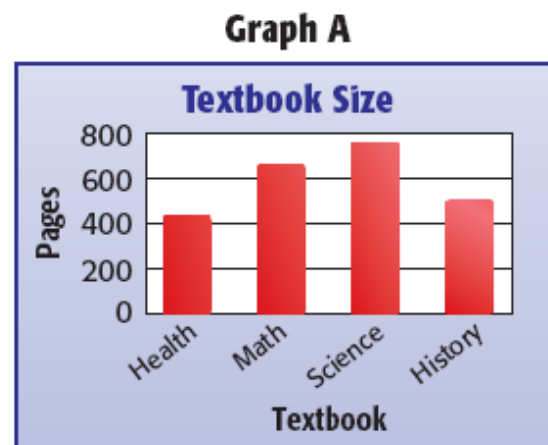# Types of Graphs: Different Ways to Represent Data

Line Graphs

- Line graphs are used to display continuous data.

- Line graphs can be useful in predicting future events when they show trends over time.

Bar Graphs

- Bar graphs are used to display categories of data.

- A bar graph is one method of comparing data by using solid bars to represent unique quantities.

Histograms

- A special kind of bar graph that uses bars to represent the frequency of numerical data that have been organized into intervals.

- Because the intervals are all equal, all of the bars have the same width

- Because the intervals are continuous (connected; ongoing), there is no space between the bars.
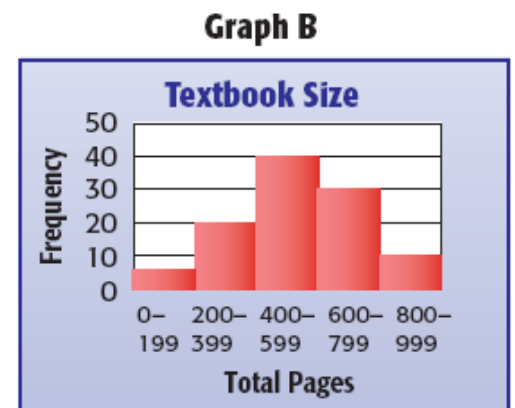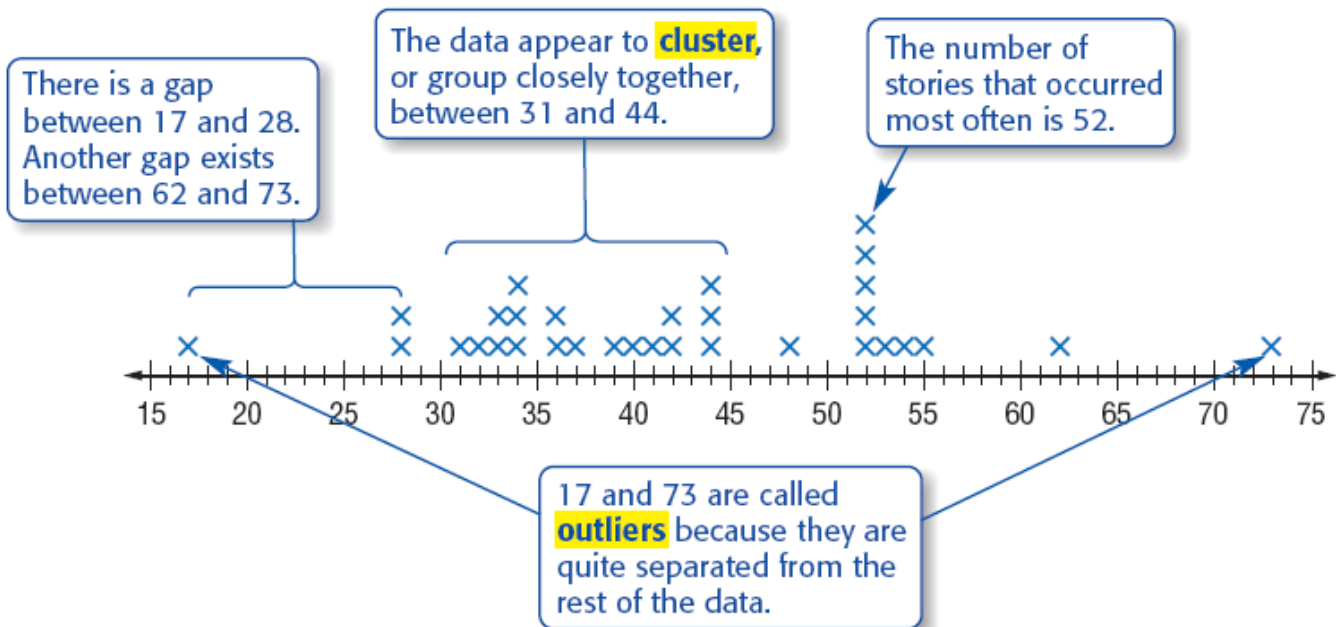
Frequency Table

- Frequency tables show the number of pieces of data that fall within given intervals.

Rulers of England		
Reign (years)	**Tally**	**Frequency**
1–15	ЦНↃ ЦНↃ ЦНↃ III	18
16–30	ЦНↃ ЦНↃ I	11
31–45	ЦНↃ I	6
46–60	IIII	4
61–75	I	1

Line Plot

- Line plots are diagrams that show the frequency of data on a number line. An "x" is placed above a number on a number line each time that data value occurs.
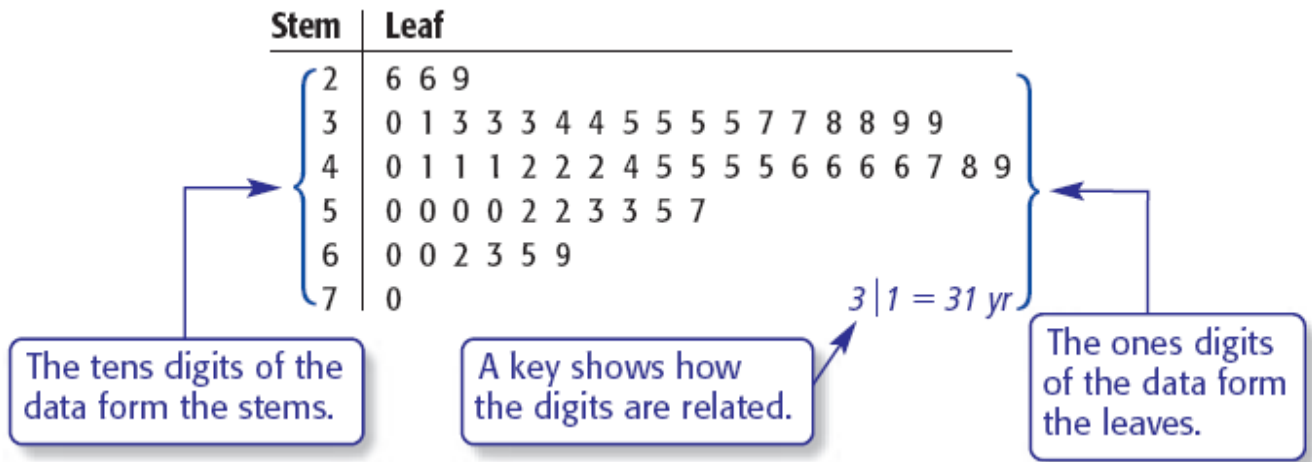
You can make some observations about the *distribution* of data, or how data are grouped together or spread out, using the line plot in Example 1.

There is a gap between 17 and 28. Another gap exists between 62 and 73.

The data appear to **cluster**, or group closely together, between 31 and 44.

The number of stories that occurred most often is 52.

17 and 73 are called **outliers** because they are quite separated from the rest of the data.

In a line plot, you can also easily find the **range** of the data, or the difference between the greatest and least numbers in the data set. This value is helpful in seeing how spread out the data are.
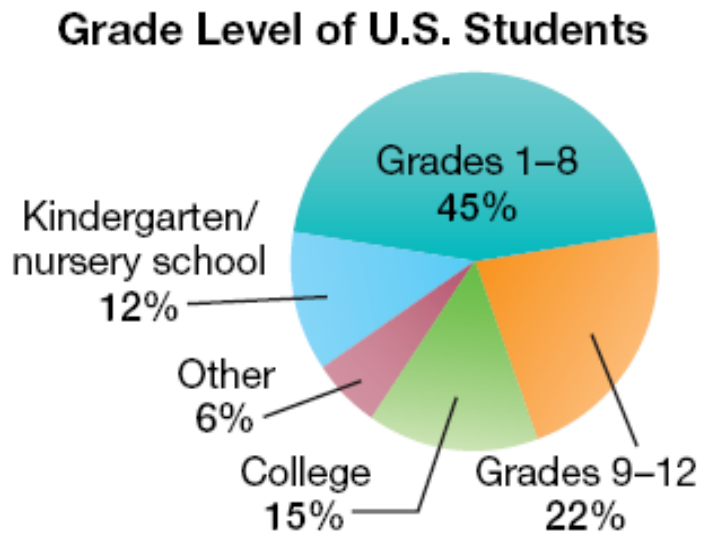
Stem and Leaf Plot

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

Stem	Leaf
2	6 6 9
3	0 1 3 3 3 4 4 5 5 5 5 7 7 8 8 9 9
4	0 1 1 1 2 2 2 4 5 5 5 5 6 6 6 6 7 8 9
5	0 0 0 0 2 2 3 3 5 7
6	0 0 2 3 5 9
7	0

$3 | 1 = 31$ yr

The tens digits of the data form the stems.

A key shows how the digits are related.

The ones digits of the data form the leaves.

Circle Graph

- Circle graphs are used to show a relationship of the parts to a whole.
- Percentages are used to show how much of the whole each category occupies.

Grade Level of U.S. Students

- Grades 1–8 45%
- Kindergarten/nursery school 12%
- Other 6%
- College 15%
- Grades 9–12 22%

Box and Whisker Plot

- A box-and-whisker plot is a diagram that summarizes data by dividing it into four parts (quartiles).
- Box and whiskers show us the spread (range) and median (middle) of the data.

20 30 40 50 60 70 80 90
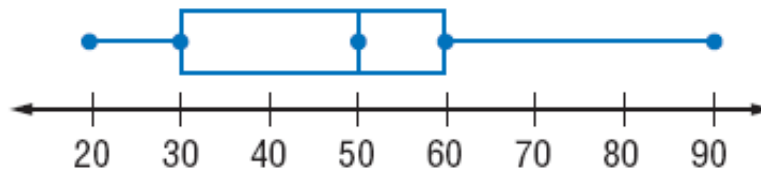
2-1 Study Guide and Intervention

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.

Prices of Athletic Shoes ($)				
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–$59 = 5 types
$60–$79 = 7 types
So, 5 + 7 or 12 types of shoes cost less than $80.

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

EXERCISES

For Exercises 1 and 2, use the table below.

Hours Spent Studying for Math Exam				
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: 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

1. Make a frequency table of the data.

2. If one student changed his or her vote from blue to yellow, what would be the favorite color of most students?

3. If one student changed his or her vote from red to purple, what would be the favorite color of the fewest students?

4. What is wrong with using the intervals 1–2, 3–4, and 5–6 to represent the data in a frequency table?

5. Make a frequency table of the data.

6. What is the interval and scale of your frequency table from Question 5?
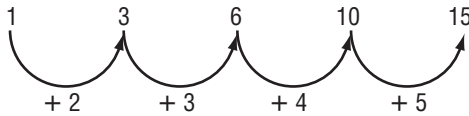
Lesson 2–1

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.
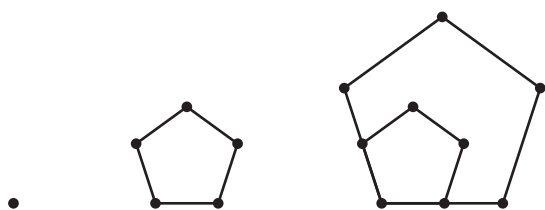

It looks like the next number in the pattern is obtained by adding 6 to 15. The next number in the pattern is 21. You can check this by drawing the next figure in the dot pattern.

Write the next two numbers in the number pattern for each dot diagram.
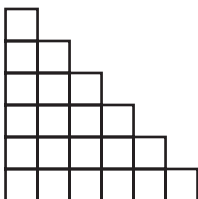
1.

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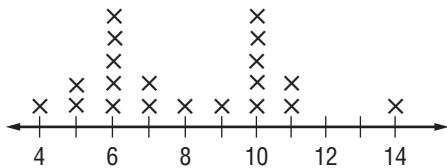
EXAMPLE 2 **Use the line plot in Example 1. Identify any clusters, gaps, or outliers and analyze the data by using these values. What is the range of data?**

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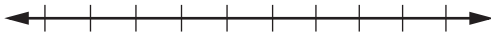
The greatest shoe size is 14, and the smallest is 4. The range is 14 − 4 or 10.

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?

Lesson 2–3

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

1. Make a line plot for the data.

2. How many televisions do most families own?

3. What is the greatest number of televisions owned by a family?

4. What is the range of the data?

5. Identify any clusters, gaps, or outliers, if any exist, and explain what they mean.

6. Describe how the range of the data would change if 5 were not part of the data set.

Lesson 2–3

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.

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

$6 \mid 3 = 63$

range: greatest value − least value = 63 − 35 or 28
median: middle value, or 45
mode: most frequent value, or 45

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: 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.?

2-2 Study Guide and Intervention

Bar Graphs and Line Graphs

A **graph** is a visual way to display data. A **bar graph** is used to compare data.
A **line graph** is used to show how data changes over a period of time.

EXAMPLE 1 Make a bar graph of the data. Compare the number of students in jazz class with the number in ballet class.
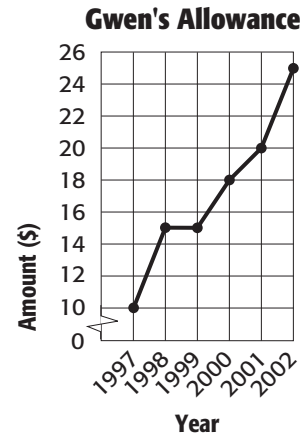
Step 1 Decide on the scale and interval.
Step 2 Label the horizontal and vertical axes.
Step 3 Draw bars for each style.
Step 4 Label the graph with a title.

About twice as many students take ballet as take jazz.

Dance Class Attendance
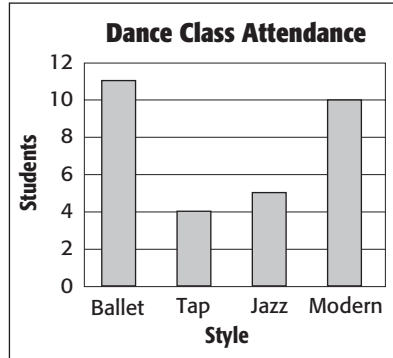
Dance Classes	
Style	Students
Ballet	11
Tap	4
Jazz	5
Modern	10

EXAMPLE 2 Make a line graph of the data. Then describe the change in Gwen's allowance from 1998 to 2002.

Gwen's Allowance

Year	1997	1998	1999	2000	2001	2002
Amount ($)	10	15	15	18	20	25

Step 1 Decide on the scale and interval.
Step 2 Label the horizontal and vertical axes.
Step 3 Draw and connect the points for each year.
Step 4 Label the graph with a title.

Gwen's allowance did not change from 1998 to 1999 and then increased from 1999 to 2002.

EXERCISES

Make the graph listed for each set of data.

1. bar graph

Riding the Bus	
Student	Time (min)
Paulina	10
Omar	40
Ulari	20
Jacob	15
Amita	35

2. line graph

Getting Ready for School	
Day	Time (min)
Monday	34
Tuesday	30
Wednesday	37
Thursday	20
Friday	25

2-2 Practice: Skills

Bar Graphs and Line Graphs

Make a bar graph for each set of data.

1.

Cars Made in 2000	
Country	**Cars (millions)**
Brazil	1
Japan	8
Germany	5
Spain	2
U.S.A.	6

2.

People in America in 1630	
Colony	**People (hundreds)**
Maine	4
New Hampshire	5
Massachusetts	9
New York	4
Virginia	25

Use the bar graph made in Exercise 1.

3. Which country made the greatest number of cars?

4. How does the number of cars made in Japan compare to the number made in Spain?

For Exercises 5 and 6, make a line graph for each set of data.

5.

Yuba County, California	
Year	**Population (thousands)**
1990	59
1992	61
1994	62
1996	61
1998	60
2000	60

6.

Everglades National Park	
Month	**Rainfall (inches)**
January	2
February	2
March	2
April	2
May	7
June	10

7. **POPULATION** Refer to the graph made in Exercise 5. Describe the change in Yuba County's population from 1990 to 2000.

8. **WEATHER** Refer to the graph made in Exercise 6. Describe the change in the amount of rainfall from January to June.

Lesson 2–2

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.**

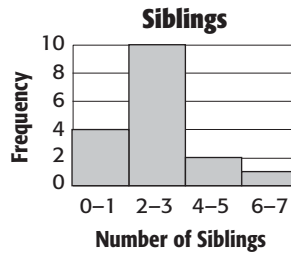| Student	Number of Siblings
Sue	1
Isfu	6
Margarita	3
Akira	2
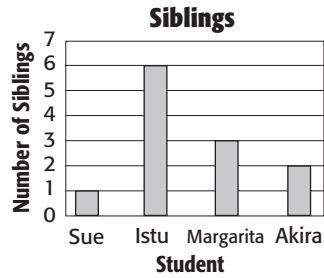
Step 1 Draw a horizontal and a vertical axis. Label the axes as shown. Add a title.

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: 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

1. Make a bar graph to display the data.

Favorite New Puppy Names

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.

3. Make a histogram of the data.

Highest Wind Speeds

4. What is the top wind speed of most of the cities?

5. How many cities recorded wind speeds of 80 miles per hour or more?

**6.** How many cities recorded their highest wind speeds at 60 miles per hour or more?

Lesson 2–7

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.**

Graph A
Salomon's Weekly Chores

Graph B
Salomon's Weekly Chores
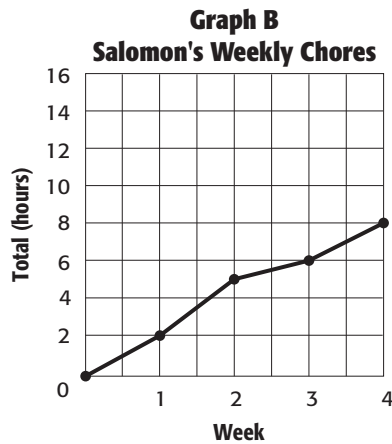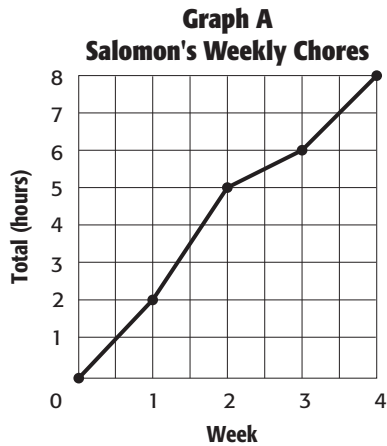
He should use graph A because it makes the total hours seem much larger.

EXERCISES

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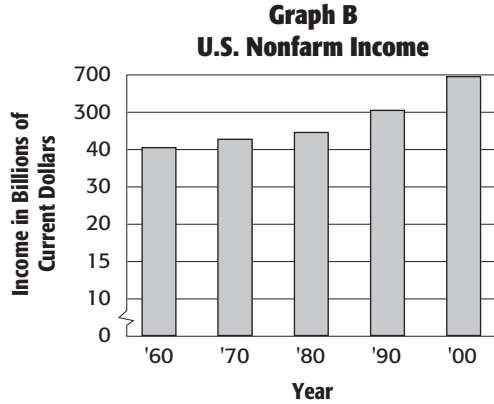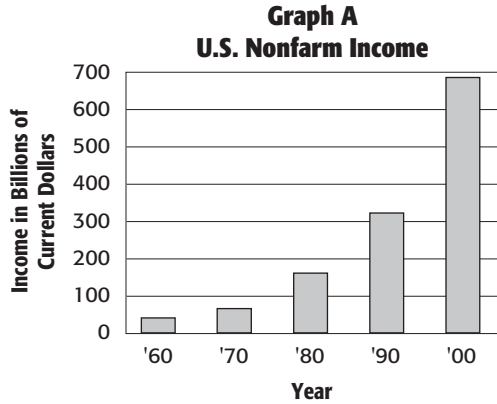
Graph A
Company Profits

Graph B
Company Profits
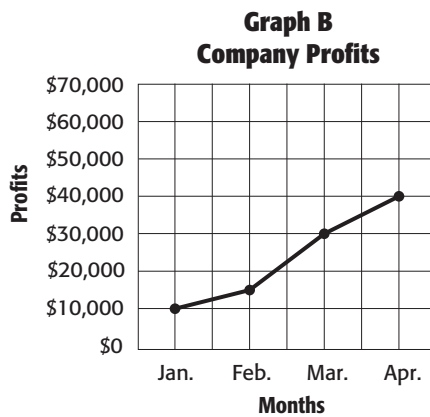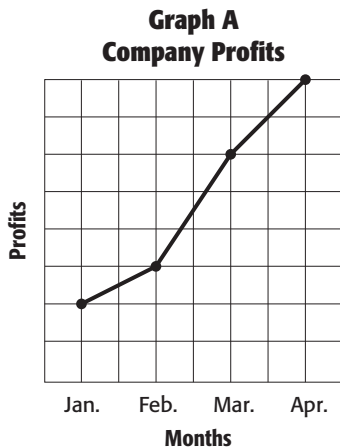
1. Which graph would be best to use to convince potential investors to invest in this company?

2. 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.

Graph A
U.S. Nonfarm Income

Graph B
U.S. Nonfarm Income

**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

2. Find the mean, median, and mode of the data.

3. Which measure of central tendency is misleading in describing the miles
of shoreline for the states? Explain.

4. Which measure of central tendency most accurately describes the data?

Lesson 2–8