1

Representing Data

Data surrounds you everywhere you turn. It is up to you to identify and compare daily information. Have you considered how athletic statistics are determined, how newspaper and magazine surveys are supported, or how industries use information to predict sales?

A graph is a visual way of displaying data. There are many decisions to make when you create a graph. What type of graph will you use? What portion of the data will you display? How will the display communicate your message?

What You Will Learn

- ❏ to compare how different graphs represent the same data
- ❏ to identify the advantages and disadvantages of different graphs
- ❏ to explore how data can be misrepresented
- ❏ to justify using a specific graph to represent data
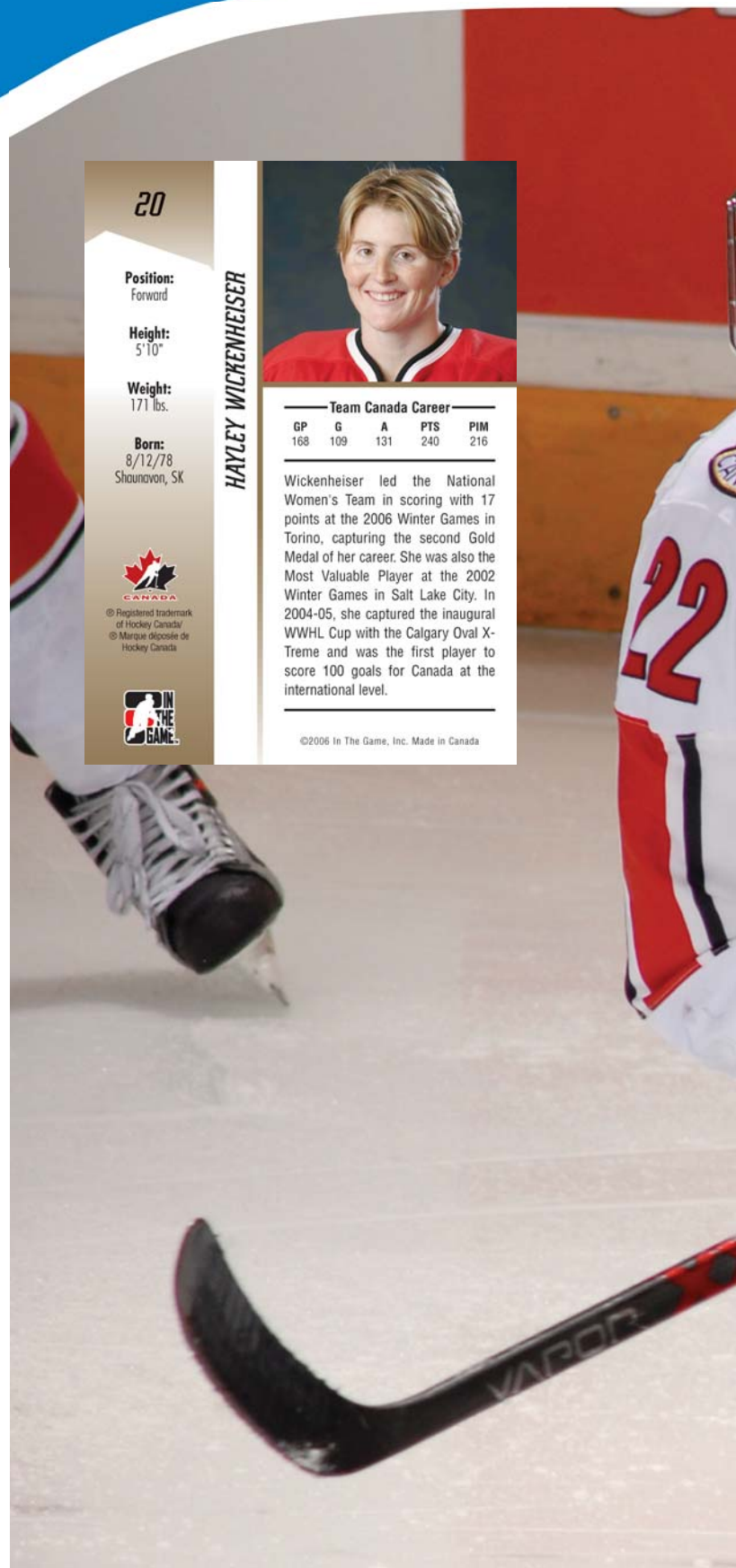
20

Position:
Forward

Height:
5'10"

Weight:
171 lbs.

Born:
8/12/78
Shaunavon, SK

® Registered trademark
of Hockey Canada/
® Marque déposée de
Hockey Canada

IN THE GAME.

HAYLEY WICKENHEISER

Team Canada Career

GP	G	A	PTS	PIM
168	109	131	240	216

Wickenheiser led the National Women's Team in scoring with 17 points at the 2006 Winter Games in Torino, capturing the second Gold Medal of her career. She was also the Most Valuable Player at the 2002 Winter Games in Salt Lake City. In 2004-05, she captured the inaugural WWHL Cup with the Calgary Oval X-Treme and was the first player to score 100 goals for Canada at the international level.

©2006 In The Game, Inc. Made in Canada

Literacy Link

A KWL chart can help you understand and learn new material more easily

- The K in KWL stands for **Know**.
- The W in KWL stands for **Want.**
- The L in KWL stands for **Learned.**

Copy the following KWL chart into your math journal or notebook. Brainstorm with a partner what you already know about representing data.

- Record your ideas in the first column.
- List any questions you have about representing data in the second column.
- After you complete the chapter, complete the final column of the KWL chart.

Representing Data

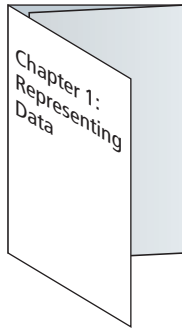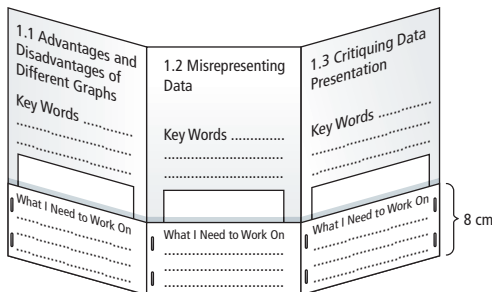| What I *Know*	What I *Want* to Know	What I *Learned*

Making the Foldable

Materials

- 11 × 17 sheet of paper
- ruler
- stapler
- several sheets of notebook paper cut into quarters or large index cards
- scissors (optional)

Step 1 Fold an 11 × 17 sheet of paper into thirds lengthwise.

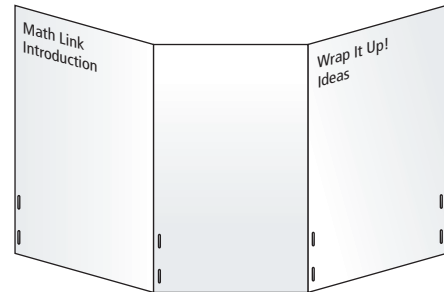**Step 2** Label the outside of your Foldable as shown.

Chapter 1: Representing Data

Step 3 Unfold the paper. Fold the bottom edge upward approximately 8 cm. Staple the outer edges and along each crease to make three pockets.

1.1 Advantages and Disadvantages of Different Graphs
Key Words
What I Need to Work On

1.2 Misrepresenting Data
Key Words
What I Need to Work On

1.3 Critiquing Data Presentation
Key Words
What I Need to Work On

8 cm

Step 4 Label each section and pocket as shown.

Step 5 Label the back of the Foldable as shown.

Math Link Introduction

Wrap It Up! Ideas

Using the Foldable

Use the back of the Foldable for your answers to the Math Link introduction on page 5.

As you work through each section of Chapter 1, make notes about examples and Key Ideas on quarter sheets of paper or index cards and put them in the appropriate pocket. Place your responses to the Math Link for each section in the same place.

Write the Key Words above the appropriate pocket.

Keep track of what you need to work on. Check off each item as you deal with it.

As you think of ideas for the Wrap It Up!, record them on the back of the Foldable.

MATH LINK

Music Industry

Music producers sell hundreds of millions of recordings each year. Although music is popular, predicting the sales of a new release can be challenging due to new technology. Will a new release be a hit or a flop? Music producers collect information to help them predict sales. For example, is the artist new? Is the artist currently touring? Who does the music appeal to? How could you organize the information that music producers gather?
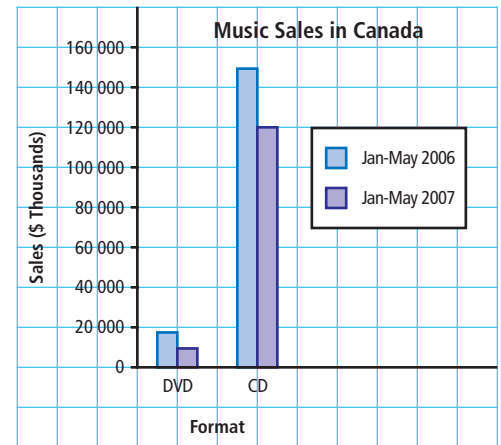
1. The circle graph shows the music preferences of young Canadian adults between the ages of 14 and 19.

   a) What was the favourite type of music? What is the least favourite type of music?

   b) Research the music preferences of young adults between the ages of 14 and 19 in your province or territory. Does this circle graph provide a good representation of preferences where you live? Explain.

Music Preferences in Young Canadian Adults (Ages 14 to 19)

- Classical 2%
- Country 10%
- Rock and Roll 13%
- Alternative 25%
- Rap 50%
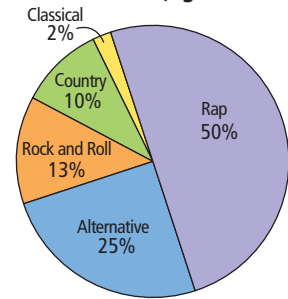
2. The double bar graph shows Canadian sales of music in different formats.

   a) What were the sales for DVDs in 2006?

   b) Compare the sales for CDs in 2006 and 2007.

   c) How do you see this data changing over time? Explain your reasoning.

Music Sales in Canada

Sales ($ Thousands) vs Format (DVD, CD)
- Jan-May 2006
- Jan-May 2007

3. The table shows the music market shares for several music producers.

Music Producer	Market Share (%)
Sony BMG	26
Universal Music Group	32
Warner Music Group	15
EMI Group	9
Independent Labels	18

   a) Represent the data using a bar graph and a circle graph.

   b) Which graph do you prefer? Explain.

In this chapter, you will collect, analyse, and display data about the music industry. What is your favourite type of music?

Advantages and Disadvantages of Different Graphs

How tall are the students in your class? Is everyone nearly the same height? Or are the heights spread out? What is the most common height for the boys and the girls?

Explore the Math

interval
• the spread between the smallest and the largest numbers in a range of numbers

What are the best ways to display a large quantity of data?

1. Work in groups of three or four. To the nearest centimetre, measure and record the height of each member of your group.

2. Record the results for the entire class on the board. Include the height and gender of each student.

3. Decide on an interval , and then organize the data into groups. You may wish to use 10 cm as the interval for the height of students in your class. Round the shortest height down to the nearest 10 cm. For example, if the shortest height is 122 cm, start the first interval at 120 cm. Develop a frequency table using the model below.

Interval	Tally	Frequency
120 to 129 cm		
130 to 139 cm		

A frequency table lists items and uses tally marks to record the number of times each item occurs.

4. Display your data using a graph of your choice.

5. a) Compare the information on your graph with that of other groups. How does the type of graph you used affect the amount and the type of information it displays?
   b) List advantages and disadvantages of the type of graph you used.

6. Separate the data into two categories. For example, you might compare boys and girls.

7. Choose one type of graph to display both sets of data.

8. a) Compare the data on the two graphs that you made.
   b) List advantages and disadvantages of the type of graph you used in step 7.
   c) Compare the information on your second graph with that of other groups. Did you reach the same conclusions? Explain.
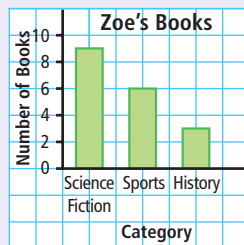
Reflect on Your Findings

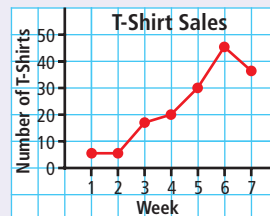**9.** How might you decide which graph is best for representing a large quantity of data?
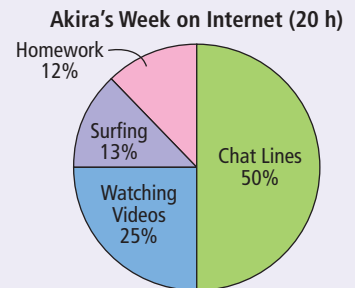

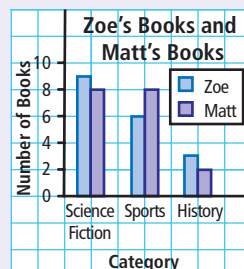### Literacy Link

Types of Graphs

Bar Graph

Zoe's Books — Number of Books vs. Category (Science Fiction, Sports, History)

Line Graph

T-Shirt Sales — Number of T-Shirts vs. Week

Circle Graph

Akira's Week on Internet (20 h): Homework 12%, Surfing 13%, Chat Lines 50%, Watching Videos 25%

Double Bar Graph

Zoe's Books and Matt's Books — Number of Books vs. Category (Zoe, Matt)

Double Line Graph

Population Trends — Population vs. Year (Riverside, Hillview)

Pictograph

Varieties of Apples Sold: Fuji, Golden Delicious, Jonagold, MacIntosh, Red Delicious. 🍎 represents 10 apples
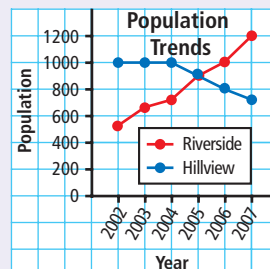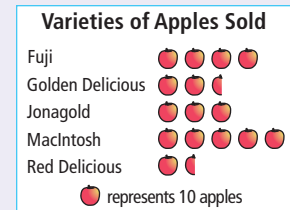
Did You Know?

Many cultures have their own version of pizza with unique toppings. For example, Canadian pizza toppings may include bacon, pepperoni, and mushrooms. In India, pizza toppings include ginger, paneer, which is a form of cottage cheese, and chicken tikka.

Example 1: Compare Two Graphs

During one weekend, the owners of Pascal's Pizzeria recorded how they received pizza orders and then presented the data using a circle graph and a pictograph.

Weekend Pizza Sales (125 orders)
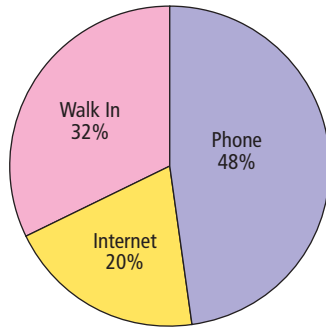
a) How many more pizzas were ordered by phone than on the Internet? Which graph shows this more clearly? Explain.

b) Almost half of the total number of orders came by phone. Which graph shows this more clearly? Explain.

c) Which graph better shows the number of pizzas ordered by Internet? Justify your choice.

d) Would a line graph be a useful way to display the data? Explain why or why not.

e) What other type of graph could be used to display the data?

Solution

a) There were 35 more pizzas ordered by phone than on the Internet.

The pictograph uses symbols to compare the number of pizza orders from the phone, the Internet, and walk ins. The pictograph shows more clearly that there were more than twice as many phone orders as Internet orders.

b) The circle graph shows that 48% of the pizzas were ordered by phone. The circle graph shows this more clearly because almost half of the circle is shaded to represent phone orders.

c) The pictograph shows the number of pizzas ordered by Internet better than the circle graph. The pictograph uses 2.5 pizza symbols to represent the orders from the Internet.

Since each symbol represents 10 pizzas, then $2.5 \times 10 = 25$ pizzas.

You would have to perform extra calculations to determine the number of pizzas ordered by Internet using the information on the circle graph.
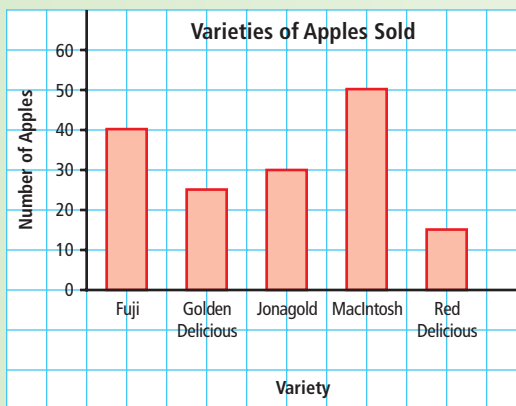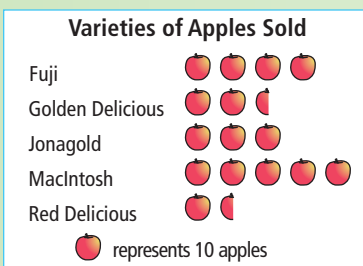
For example, the circle graph shows that 20% of the 125 pizzas were ordered on the Internet. You can find the number of pizzas by calculating 20% of the total number of pizzas.

Since $20\% = 0.2$, then $0.2 \times 125 = 25$ pizzas.

d) A line graph would not be useful since the data do not show changes over time. You need to use a graph that compares data in different categories.

e) A bar graph could also have been used to compare data about pizza orders.

Show You Know

The graphs show the number of each variety of apple sold in a fruit stand.

Varieties of Apples Sold

Fuji
Golden Delicious
Jonagold
MacIntosh
Red Delicious

🍎 represents 10 apples

Varieties of Apples Sold

Number of Apples / Variety

Variety	Number of Apples
Fuji	40
Golden Delicious	25
Jonagold	30
MacIntosh	50
Red Delicious	15

a) In your opinion which graph is easier to read? Justify your choice.

b) Would a line graph be a useful way to display the data? Explain why or why not.

c) What other type of graph could be used to display the data?

Example 2: Representing Data

During the 2005–2006 hockey season, the Edmonton Oilers advanced to the Stanley Cup finals. In regular season play, two of their top three players were Shawn Horcoff (born in Trail, BC) and Jarret Stoll (born in Melville, SK). Here are the statistics for their previous three regular seasons with the Oilers.

Horcoff (Centre)

Season	Games Played	Goals	Assists	Total Points
1	78	12	21	33
2	80	15	25	40
3	79	22	51	73

Stoll (Centre)

| Season	Games Played	Goals	Assists	Total Points
1	4	0	1	1
2	68	10	11	21
3	82	22	46	68

a) Use a double bar graph to display the data.

b) Which player shows the most improvement in total points?

c) Total points are used to assess a player's worth. Take a look at the number of games Horcoff and Stoll played. Is this a fair way to assess a player's worth?

d) Would two circle graphs be effective to display the data? Explain.

Solution

a)

Total Points in Three NHL Regular Seasons
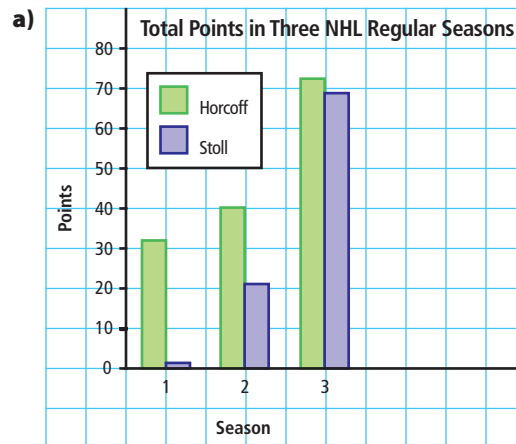
b) Stoll shows the most improvement in total points over three seasons.

c) Total points are not a fair way to assess a player's worth. The graph does not take into account the number of games that each centre played during the regular season. The number of games that Stoll played increased over the three seasons, whereas the number of games that Horcoff played stayed approximately the same each season.

d) No, two circle graphs are less effective. Each circle graph shows the percent of points scored in each season compared with the total number of points scored over three seasons. It is difficult to compare the total points of the two players.

Horcoff's Total Points in Three NHL Regular Seasons (146 points)

Season 1 22%
Season 2 29%
Season 3 49%
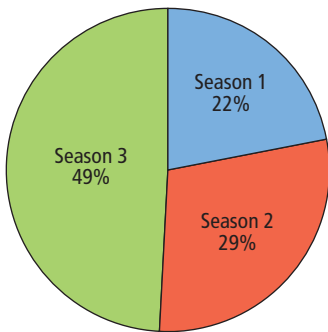
Stoll's Total Points in Three NHL Regular Seasons (90 points)

Season 1 1%
Season 2 23%
Season 3 76%
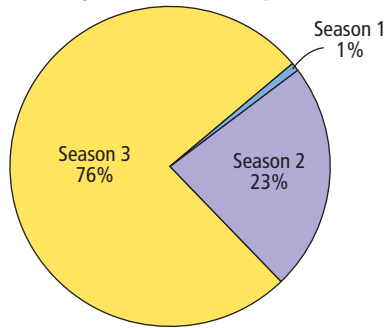
Show You Know

Jenna surveyed students in grade 8 in her school to determine their favourite team sports.

a) Choose one type of graph to display the data.

b) Graph the data.

c) Give one advantage of using your choice of graph.

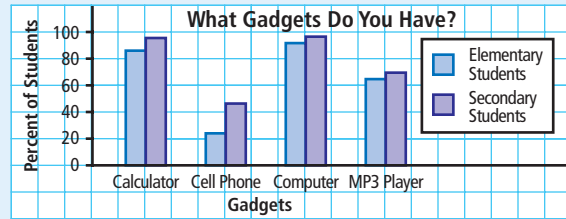| Sports	Frequency
Basketball	24
Volleyball	20
Soccer	45
Baseball	25
Hockey	32
Other	4
Total	150

Key Ideas

- Data can be presented using bar graphs, double bar graphs, circle graphs, line graphs, and pictographs.
- Different graphs may provide different information and display certain types of data better.

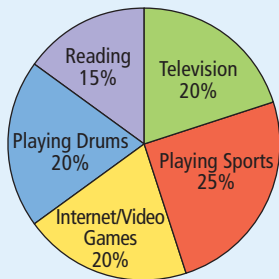 - Bar graphs are best for comparing data across categories.

    Gadgets Owned by a Grade 8 Class
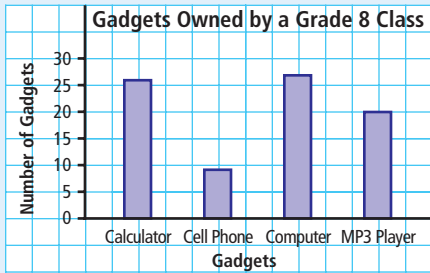
  - Double bar graphs are best for comparing two sets of data across categories.

    What Gadgets Do You Have?

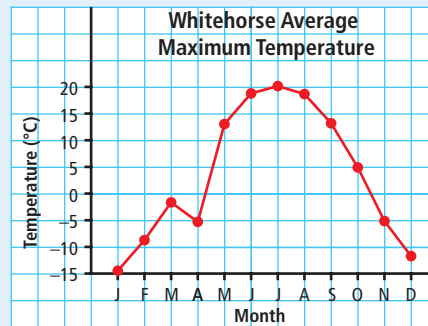   Elementary Students
    Secondary Students

  - Circle graphs are best for comparing categories to the whole using percents. The sum of the percents in a circle graph is 100%.

    Andre's Weekly Activities (25 h)

    Reading 15%
    Television 20%
    Playing Drums 20%
    Playing Sports 25%
    Internet/Video Games 20%

  - Line graphs are best for showing changes in data over time.

    Whitehorse Average Maximum Temperature

  - Pictographs are best for comparing data that can be easily counted and represented using symbols.

    T-Shirt Sales

    Monday
    Tuesday
    Wednesday
    Thursday
    Friday

    represents 10 T-shirts

1. Flora wants to use a graph to summarize movie ticket sales for two movies, and make a prediction for future sales. Which graph should she use—the double line graph or the double bar graph? Explain why.
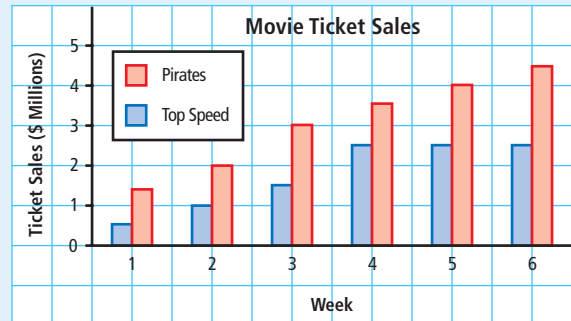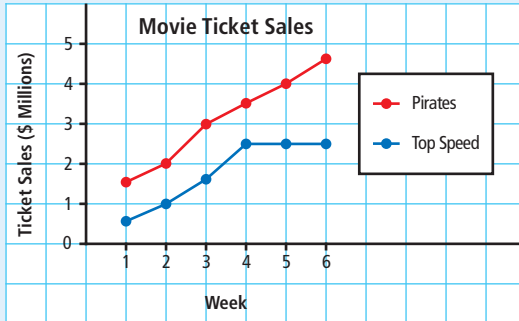
2. Wes surveyed 60 students to determine which type of computer game is the most popular. Wes decided to display the data in a bar graph. Bonnie suggested that a circle graph would be more useful for displaying the data. Who made a better choice? Explain.

Type of Game	Votes
Quest	15
Role-play	20
Simulation	9
Strategy	16
Total	60

3. How are a bar graph and a pictograph similar? How are they different? What type of data is each useful for displaying? Share your answer with a classmate.

Check Your Understanding

Practise

For help with #4 to #6, refer to Example 1 on pages 8–9.

4. Ravi recorded his spending for one month. He displayed the data in a circle graph and a pictograph.

a) How much more does Ravi spend on food than on movies? Which graph shows this more clearly? Explain.

b) Ravi spends half of his money on food and clothing. Which graph shows this more clearly? Explain.

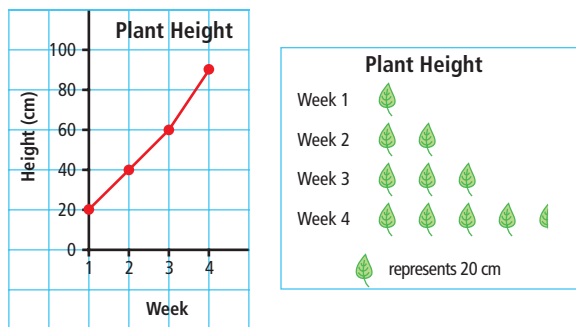**c)** Describe one advantage and one disadvantage of using each graph.

Ravi's Monthly Spending ($200)

Ravi's Monthly Spending
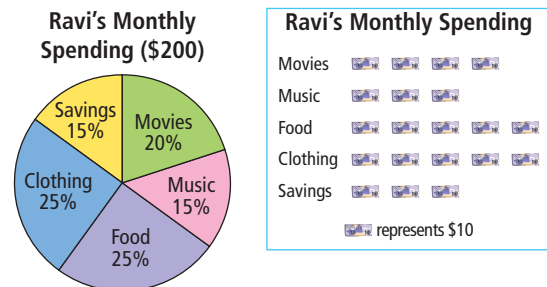
5. The piano that Sara, Ann, and Min use is available for 40 h of practice every week. The graphs show how they divide the practice time.

Piano Practice Per Week (40 h)

Piano Practice Per Week
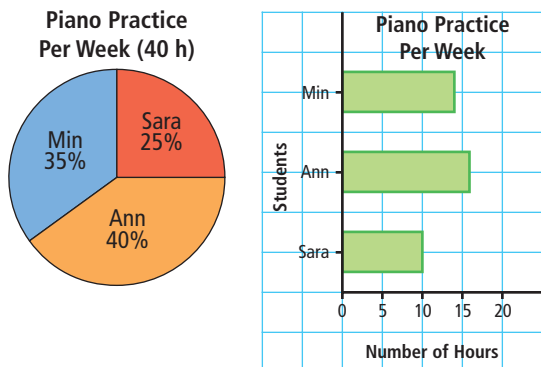
a) What information does each graph provide?

b) Write and answer one question about the data that can be answered from the circle graph.

c) Write and answer one question about the data that can be answered from the bar graph.

6. For a science fair experiment, Mitchell measured the height of a plant every Monday for four weeks. He displayed the data in a line graph and a pictograph.

Week	1	2	3	4
Plant Height (cm)	20	40	60	90

Plant Height

Plant Height

Week 1
Week 2
Week 3
Week 4

🌿 represents 20 cm

a) What information does each graph provide?

b) Between which two weeks did the plant grow at the same rate?

c) Between which two weeks did the plant change the most in height? Which graph shows this more clearly?

d) Describe one advantage and one disadvantage of using each graph.

For help with #7 and #8, refer to Example 2 on pages 10–11.

7. The table shows the heights of two friends measured over time.

Lewis

Age	Height (cm)
2	40
4	60
6	70
8	100
10	120
12	145
14	165
16	175

Andrea

Age	Height (cm)
2	40
4	60
6	80
8	110
10	130
12	150
14	160
16	160

a) Use a double bar graph and a double line graph to display the data.

b) How are the trends for Andrea and Lewis similar? How are they different?

c) Which graph do you think more clearly shows each student's height trend? Explain your choice.

d) Would two circle graphs be effective for displaying the data? Explain why or why not.

Literacy ε Link

A *trend* is the general direction that a line graph is going.

8. The table shows the decibel levels of different sounds in the environment.

Sound	Level
Leaves rustling	20 dB
Whisper	30 dB
Heavy traffic	78 dB
Lawn mower	90 dB
Hockey game	104 dB
Thunder clap	120 dB
Stock car races	130 dB
Balloon pop	157 dB

a) Use a bar graph to display the data. What is one advantage of using a bar graph?

b) Could you use a line graph to display the data? Explain.

c) Could you use a circle graph to display the data? Explain.

d) Would a pictograph be an effective way to display the data? Explain why or why not.
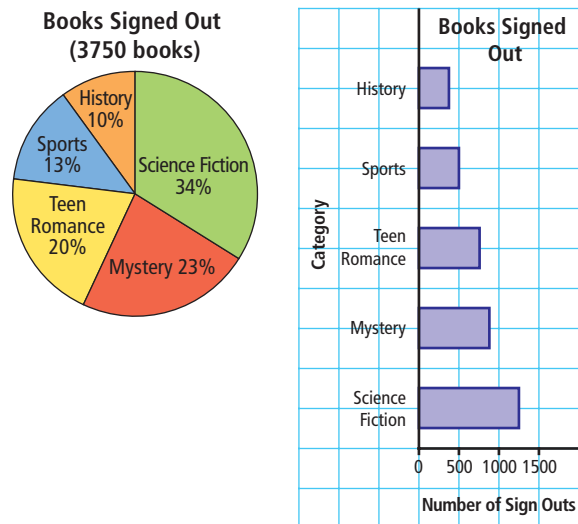
Literacy ⊜ Link

A *decibel* is a measure of the intensity of a sound. The abbreviation is dB.

Did You Know?

Exposure to sounds above 85 dB for a long time can lead to hearing loss.

Apply

9. The graphs show the categories of books that were signed out from a library over a year.

Books Signed Out (3750 books)

a) Estimate how many times more popular science fiction books are than history books.

b) Which graph helped you answer part a)? Why did you choose this graph?

c) Which category of book has approximately the same number of sign outs as history and sports books together? Show your thinking.

d) Which graph helped you answer part c)? Why did you choose this graph?

e) The library has $12 000 to spend on books based on their popularity. How much money should be spent for each category? Show your work.

f) Which graph did you use to answer part e)? Why did you choose this graph?

10. The pictograph shows the results of the election for the grade 8 representative on the students' council.

Grade 8 Representative

Ari ▦▦▦▤

Bai ▦▦▦▦▦▤

Niki ▦▦▦▤

Tuong ▦▦▦▦▦▦

▦ represents 10 votes
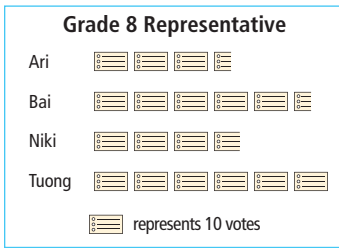
a) Draw a bar graph to show the data in the pictograph.

b) Does the pictograph or the bar graph more clearly show how students voted in this election? Explain your reasoning.

c) Would you recommend using a line graph to show the data? Explain.

d) Identify one advantage and one disadvantage of using a circle graph to show the data.

11. A store manager tracks jewellery sales for one month.

Week	Items Sold
1	14
2	25
3	39
4	65
Total	143

a) Use two different graphs to represent the data.

b) Compare the two graphs. Is one graph more effective in representing the data? Explain your reasoning.

c) Should the store continue to sell this jewellery? Explain your thinking.

12. A grade 8 class recorded the following percent scores on a Math test:

78 65 49 72 89 73 68 70 78 85
44 51 75 95 88 63 58 67 90 48
56 77 98 40 63 89 91 82 76 59

a) Organize the data into groups and develop a frequency table.

b) List the different graphs that could be used to display the data.

c) Which graph would most effectively display the test scores? Explain your choice.

13. A radio station was designing a web site for teen listeners. It surveyed 50 students from each of two schools to find out which features most interested students. Each student voted for the two features they most wanted to see on the web site.

| School	Entertainment News	Music Downloads	Contests	Message Boards
Queen Elizabeth	40	45	5	10
Hillside	20	35	25	20

a) Choose one type of graph to represent the data. Explain your choice.

b) What two categories are the most important for students from Queen Elizabeth?

14. Janice surveyed ten friends about their favourite colour of Freezie™ to stock in the school store. She used this line graph to show the data.
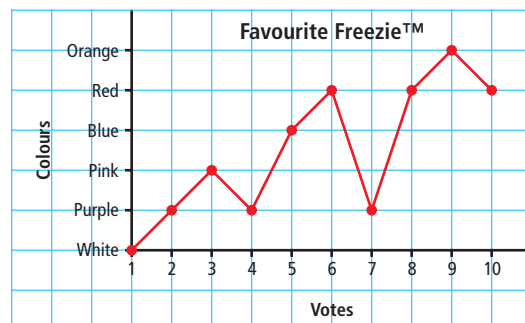
a) How could you improve this graph?

b) Why is using a line graph not a good choice in this case? Explain your reasoning.

15. Search various media, such as magazines, newspapers, and the Internet, for information about music or sports that has been represented in a graph. Print or cut out the graph. Glue or tape it into your notebook.

a) Write and answer two questions about the data in the graph.

b) Represent the data using a different kind of graph.

c) Write and answer two questions about the data that can be answered by your new graph. Your questions should be different from the ones you wrote in part a).

d) Compare the two graphs. Describe an advantage and a disadvantage of using each graph.

16. Here is an incomplete line graph.
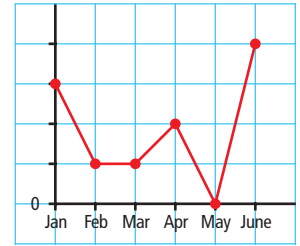
a) Describe a scenario to represent the data on this graph. Then, complete the graph.

b) Draw another graph to show the data.

c) State one disadvantage of using each graph to show the data.

17. Prepare a survey question that would give you data that are appropriate to display in a circle graph.

a) How many different options does your question have? Is your question likely to have a different number of people responding to each option?

b) Explain why the circle graph is preferable to other graphs for displaying this data.

c) Prepare another survey question that would give you data that are appropriate to display in a different graph of your choice.

MATH LINK

Survey the students in your class about their favourite type of music from a list of five or six different types. Consider including the following choice on the survey: None of the above.

a) Record the data in a tally chart and create a frequency table.

b) Draw a graph of your data.

c) Explain an advantage and a disadvantage of using your graph format to display the data.

Misrepresenting Data

Kevin likes to stand in front of the fun house mirrors when he visits the World of Science. Someone looking at an image of Kevin in a curved mirror would know that it was distorted. How can you tell by looking at a graph if it has been distorted?
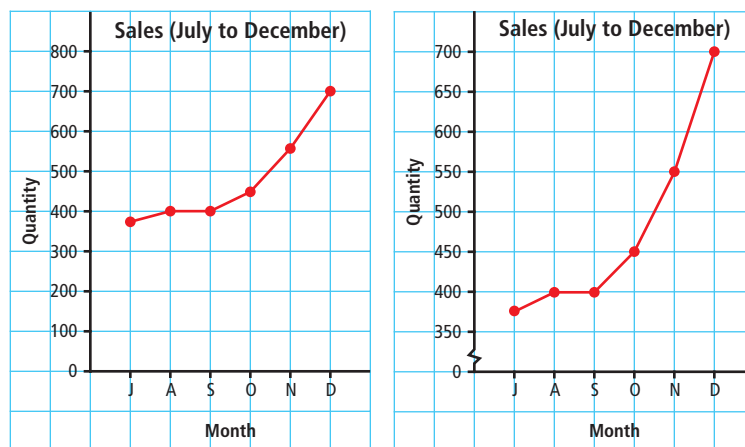
Literacy Link

Distort means to change the appearance or twist the meaning of something in a way that is misleading.

Explore the Math

What are some ways to misrepresent data?

These two graphs display the same data in different ways.

Sales (July to December)

Graph A

Sales (July to December)

Graph B

1. How are the graphs the same?

2. How are the graphs different?

3. Which graph gives a more accurate representation of the sales trend? Explain.

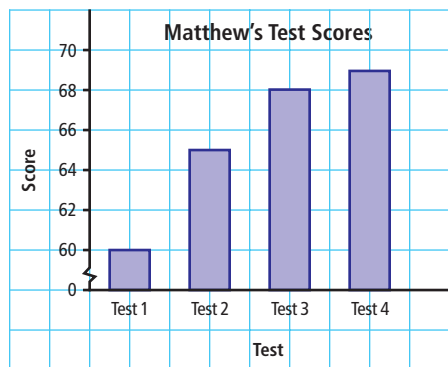4. Change the scale of Graph B to go from 0 to 2000. Draw the new graph.
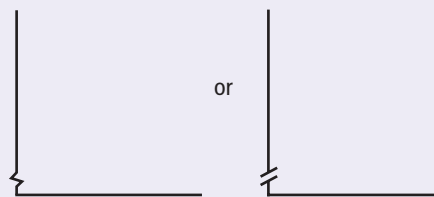
Reflect on Your Findings

5. How can the scale on a graph affect the conclusions someone might make about the data?

Example 1: Distorting the Scale

Matthew's Math test scores are displayed on the bar graph.

a) According to the graph, what did Matthew receive on each test?

b) From the graph, what appears to be true about Matthew's improvement over the four test scores? What part of the graph has been distorted to create this impression?

c) How should the graph be drawn to represent Matthew's progress more accurately?

d) What would be a more accurate conclusion about his improvement?

Solution

a) He received scores of 60, 65, 68, and 69.

b) The graph suggests that Matthew's test scores have improved significantly over the four tests. The break in the scale on the vertical axis creates this misleading impression.

c) The graph should be redrawn with a continuous scale that starts at zero. This would show that Matthew's test scores have improved, but not by as much as the first graph suggests.

Matthew's Test Scores
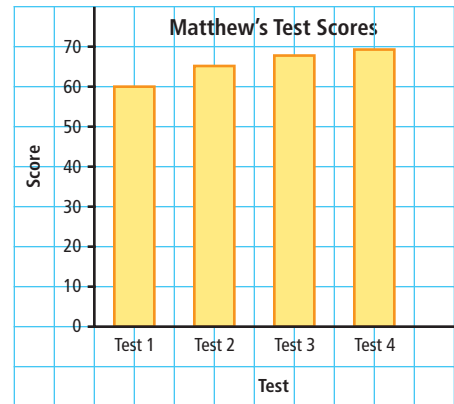
d) Matthew's test scores have improved a small amount over the last four tests. The greatest increase was from Test 1 to Test 2.
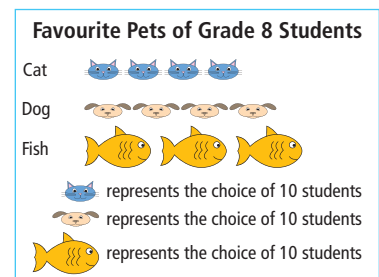
Show You Know

a) Explain how this graph could be misleading.

b) What conclusion does the graph suggest about the price of gas at the end of the day compared with the price at the beginning of the day?

c) Describe how to redraw the graph to represent the data more accurately.

Gas Prices on Monday
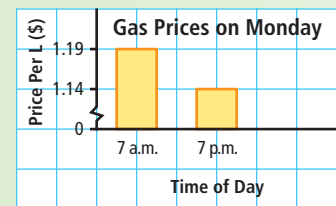
Example 2: Distorting the Visuals

a) From the pictograph, which pet seems to be the favourite? Explain.

b) From the pictograph, does it seem that more students like cats or dogs? Explain.

c) How should the pictograph be redrawn to represent the data more accurately?
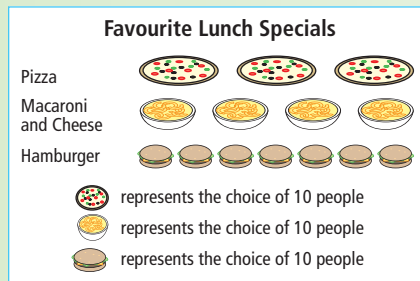
Favourite Pets of Grade 8 Students

Cat

Dog

Fish

represents the choice of 10 students
represents the choice of 10 students
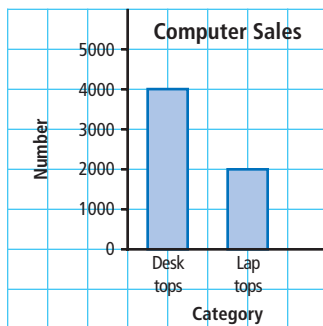represents the choice of 10 students

Solution

a) Fish appear to be the favourite pets because the line for fish is the longest one and the symbol for fish is much larger.

b) It seems as if more students like dogs than cats because the line for dogs is longer than the one for cats.

c) The pictograph should be redrawn so that each symbol is the same size, since each symbol represents the choice of ten students. Also, the symbols need to be spaced the same distance apart.
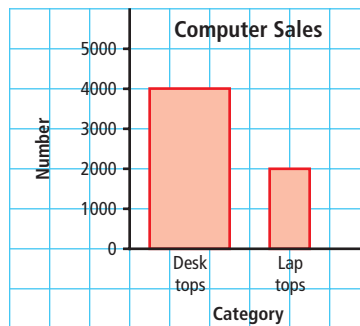
Show You Know

a) Explain how this graph could be misleading.

b) What conclusion does the graph suggest about favourite lunch specials?

c) How could you redraw the graph to represent the data more accurately?

Favourite Lunch Specials

Pizza

Macaroni and Cheese

Hamburger

🍕 represents the choice of 10 people

🍲 represents the choice of 10 people

🍔 represents the choice of 10 people

Example 3: Distorting the Size of Bars

Graph A

Graph B

a) From Graph A, how many times more sales are there of desktops than laptops? Is this an accurate representation? Explain.

b) From Graph B, how many times more sales are there of desktops than laptops? How could Graph B be misleading?

Solution

a) Graph A shows sales of 4000 desktops and 2000 laptops. This is twice as many sales of desktops as laptops. The graph is an accurate representation of the data. The bar for desktops is twice as high as the bar for laptops.

b) Graph B shows sales of 4000 desktops and 2000 laptops. This is twice as many sales of desktops as laptops. The bar for desktops is twice as wide as the bar for laptops. Even though Graph B displays the same data as Graph A, the greater area of the first bar in Graph B suggests that the sales were much higher. The size of the first bar produces a misleading graph.

> Recall that Area = $l \times w$. In Graph B, the area of the desktops bar is four times as great as the laptops bar. This could suggest that desktop sales are four times as great as laptop sales.

Show You Know

a) Explain how this graph could be misleading.

b) What conclusion does the graph suggest about the annual cost in 1997 compared with the annual cost in 2007?

c) Describe how to redraw the graph to represent the data more accurately.
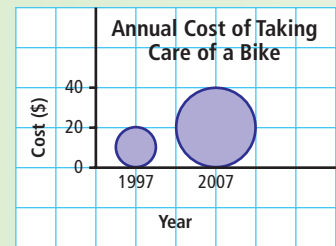
Key Ideas

- Misleading graphs can cause people to misinterpret the data and draw false conclusions.
- The format of a graph can be misleading. Misleading features include
  - distorting the scale
 - distorting the information by using visuals of different sizes
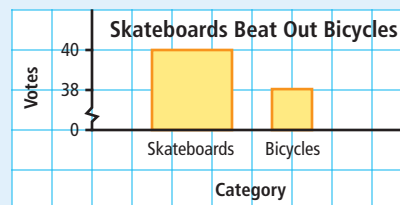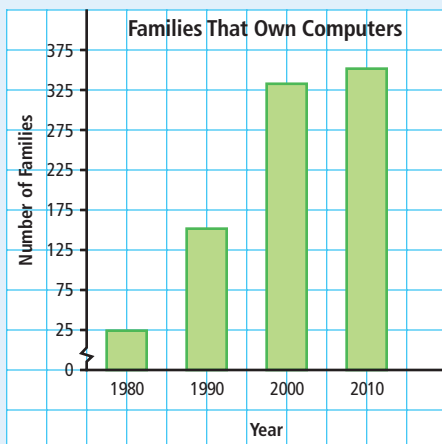
Communicate the Ideas

1. Travis recorded the following data about how he spends his day.

a) How would you make a bar graph to help argue that Travis spends most of his time sleeping or going to school?

b) How would you make a bar graph that Travis could use to argue that he spends almost as much time on homework as he does at school?

Activity	Time (h)
Chores	1
Eating	2.5
Homework	2.5
School	6.5
Sleep	7
Sports	2.5
TV	2
Total	24

2. a) Sophie surveyed her friends about their favourite flavour of ice cream. What information is missing on the graph?

b) How could you present this data more accurately?

3. When might it be to someone's advantage to present distorted data? Share your answer with a partner.

**Favourite Ice Cream**
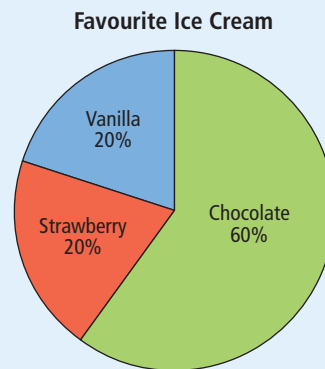
Check Your Understanding

Practise

For help with #4 and #5, refer to Example 1 on pages 19–20.

4. Samantha recorded the temperature on a hot day. She displayed the data in a line graph.

a) Explain how this graph could be misleading.

b) What conclusion does the graph suggest about the changes in temperature?

c) How should the graph be redrawn to make the data clearer?
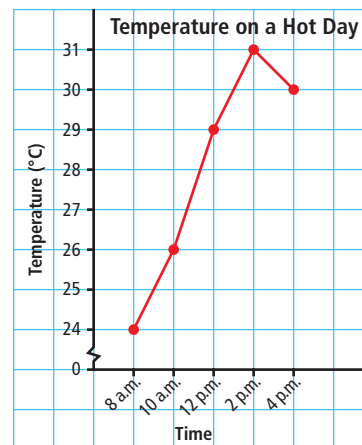
5. The election results for student council president were displayed in a bar graph.


B Wins Majority Vote
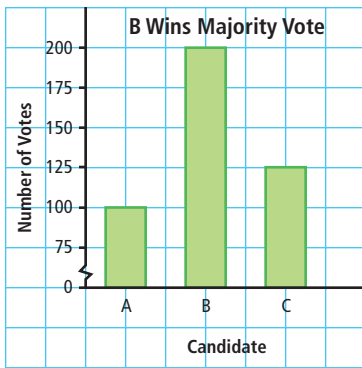
a) How many times taller does the bar for B appear than the bar for A?

b) How many times as great are the votes for B than the votes for A?

c) What conclusion does the graph suggest about the election results?

d) How could the graph be redrawn to make the data clearer?

Literacy 🔗 Link

Majority means more than 50%.

6. a) From the pictograph, which fruit seems to sell the best? Explain.
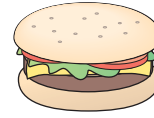

Fruit Sales in One Week
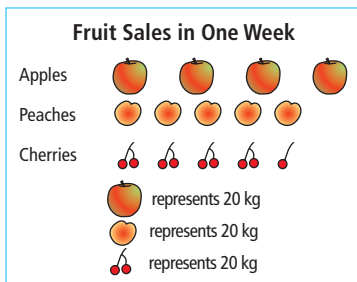
b) Does it seem that more cherries were sold or more peaches? Explain.

c) How should the pictograph be redrawn to represent the data more accurately?

7. The graph in this advertisement shows the results of a taste test.

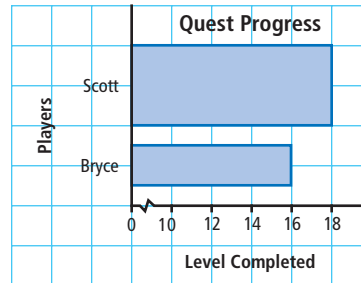Move over Bonzo, The Big Cheese is in town!
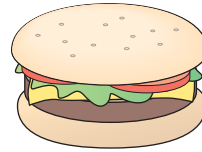
The Big Cheese
56%

Bonzo Burger
44%

a) Which burger seems to be the favourite? Explain.

b) How is the graph misleading?

c) How should the graph be redrawn to represent the data more accurately?

8. The graph shows the progress of friends who are playing a video game.

Quest Progress

a) Explain how this graph could be misleading.

b) What conclusion does the graph suggest about Scott's progress compared with Bryce's progress?

c) Describe how to redraw the graph to represent the data more accurately.

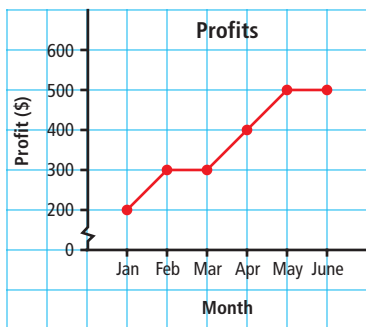**9.** The two graphs show the number of health bars sold by two students.
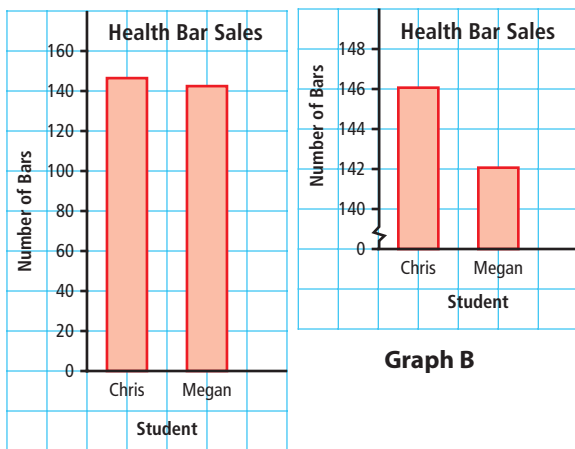
Graph A

Graph B

a) How are the two graphs different?

b) For each graph, what conclusion would you make about health bar sales?

c) Which graph gives a more accurate comparison of sales? Explain.

Apply

**10. a)** Explain how this graph is misleading.

b) From the graph, what conclusion can you make about the profits from January to June?

c) Draw a new graph using a vertical scale from 0 to 600. What conclusion can you now make about the profits from January to June?

11. Charles kept a record of his Math quiz scores for this term.

| Quiz	1	2	3	4	5	6	7	8
Score (%)	65	66	69	70	75	72	77	80

a) He wants to make a distorted graph that will show a great improvement in his quiz scores. Draw such a graph.

b) Draw a new graph that displays the data more accurately.

c) How are the two graphs different?

12. a) Explain how this graph is misleading.
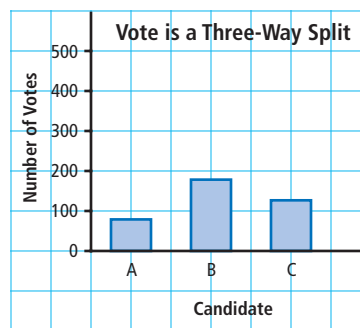
b) Based on the graph, what can you conclude about the outcome of the voting?

c) Does the data support the claim made in the title? If not, reword it to correct the misinformation.
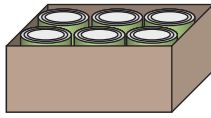
13. a) The two circle graphs are meant to represent the same information. Does it appear that way? Explain.

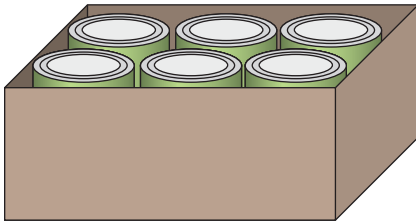**Graph A**   **Graph B**
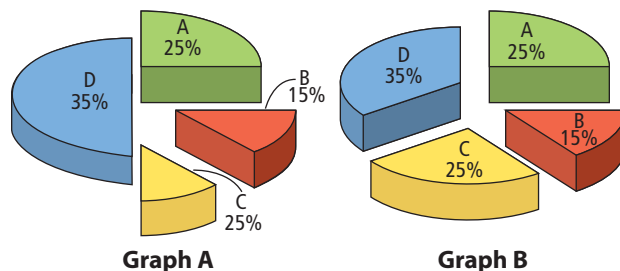
b) Identify the errors in Graph A.

14. Two grade 8 classes collected cans for the food drive. Ms. Chan's class brought in 100 cans. Mr. Rajwani's class brought in 200 cans. Luke made this graph to display the results.
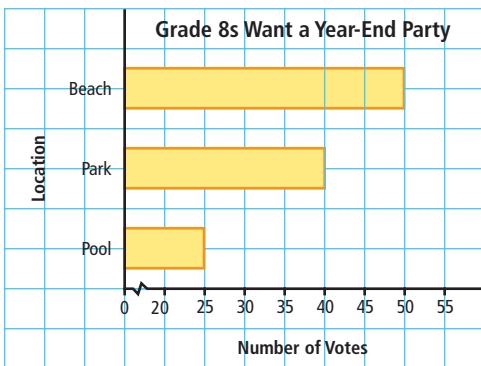

Ms. Chan's class

Mr. Rajwani's class

a) How is this graph misleading?

b) Based on the graph, what can you conclude about the canned food drive?

c) Draw a different graph that is not misleading.

15. The grade 8 students voted on where to hold their year-end party. The results of the vote were presented in this graph.

a) Based on the graph, how many times more popular was the beach than the pool?

b) Leah concluded that the majority of the students want to go to the beach. Is she correct? Explain.

c) Draw a new graph to represent the data more accurately.

16. An ice cream store developed the following graph to advertise its ice cream.

Cool Flavours
$4.5 million

Dairy Tasty
$4.3 million

a) What ice cream store do you believe developed this graph? Explain.

b) How is the graph misleading?

17. A small town recorded crime statistics over the last six years.

Year	1	2	3	4	5	6
Number of Crimes	3	6	6	2	3	4

a) Make a bar graph to display the data.

b) Total the number of crimes for every two years. Make a new bar graph to display these data.

c) What can you conclude from the second bar graph? Do the data in the table support your statement? Explain.

d) How is the second graph misleading?

18. Grade 8 students were surveyed about their weekly use of a computer.

Time	Daily	2 to 6 days	Less than 2 days
Frequency	12	20	8

Draw a diagram to support an argument that Grade 8 students are not using the computer too often.

19. a) Which category on the graph does the government want the public to notice the most?

Provincial Budget 2008-2009

Energy 24%
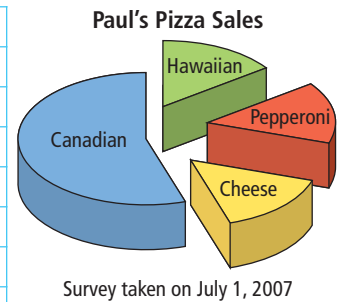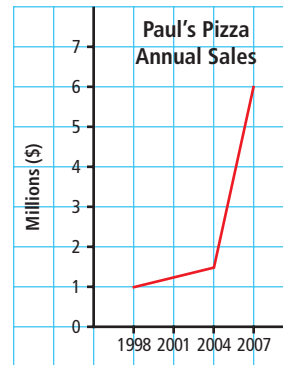Housing 13%
Education 24%
Others 4%
Health 27%
Transportation 8%
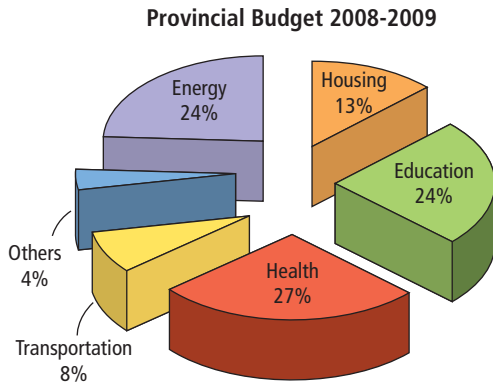
b) Explain how this graph could mislead people.

c) Draw a new graph to represent the data more accurately.

Extend

20. Prepare a survey question that requires making a choice from a list of several options.

a) Survey the students in your class. Record the data in a chart.

b) Make a graph that distorts the data.

c) Explain how your graph is misleading.

21. Paul's Pizza is a franchise that is starting a campaign to recapture pizza sales. The following graphs will be used to advertise their food products.

Paul's Pizza Annual Sales
Millions ($)
7
6
5
4
3
2
1
0
1998 2001 2004 2007

Paul's Pizza Sales
Hawaiian
Pepperoni
Canadian
Cheese
Survey taken on July 1, 2007

a) How might these graphs mislead people? List as many misleading features as you can.

b) Suggest ways to improve the graphs so that they are not misleading.

22. Search various media, such as magazines, newspapers, and the Internet, for an example of a graph that misleads people about a scientific topic. Print or cut out the graph. Glue or tape it into your notebook.

a) Draw a new graph to represent the data accurately.

b) Does your graph support the statement made in the original graph? Explain.

MATH LINK

Search the Internet, magazines, or newspapers for data about music sales for different artists. Choose an argument to make about the music sales.

a) Draw a graph that supports your argument about which artists are selling more than others.

b) How would you change your graph to support the opposite of your argument?

Critiquing Data Presentation

Focus on...

After this lesson, you will be able to...

❑ **explain how a graph is used to represent the data from a given situation**

Did You Know?

A *run* refers to a group of salmon that were hatched in the same place. During the salmon run, the fish swim back up rivers to their birthplace to spawn.

Literacy Link

A *stacked bar graph* has bars stacked instead of side-by-side.

THE DAILY NEWS

Sept 24 2007

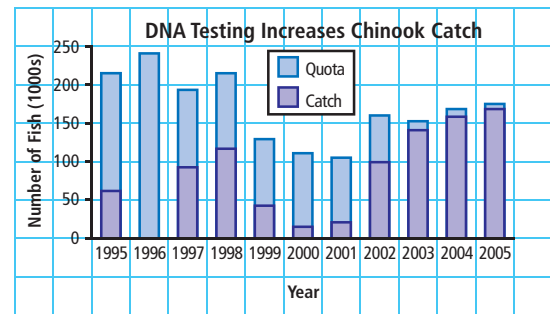### DNA Testing Helps Commercial Fishers

Thanks to DNA testing, B.C.'s commercial fishers can expect to catch as much as 90% of their quota of chinook salmon this year.

Since 2002, scientists have been using DNA testing to determine accurately where fish are originally from. As a result, fishery officials can better manage the fish stocks by setting specific harvest targets to protect the weaker stocks and allow more fishing of the stronger ones.

Between 1995 and 2001, fisheries used coded-wire tags inserted into salmon to estimate the populations of different runs of salmon. They used this information to limit the catch and the areas open to fishing for the following year. Using this method, only about 15% of the available quota was harvested in 2001.

Tyler is presenting his current events report to his grade 8 Social Studies class. His report includes a newspaper article about chinook salmon and the bar graph shown. Does the bar graph support the story?

DNA Testing Increases Chinook Catch

(bar graph with vertical axis "Number of Fish (1000s)" from 0 to 250, horizontal axis "Year" from 1995 to 2005, legend: Quota, Catch)

Explore the Math

Does the graph represent what it says it does?

1. Examine the graph about the chinook salmon catch. Why do you think the author used a stacked bar graph? Is it effective?

2. Decide if the graph is misleading.
   a) Examine the scales on the vertical and horizontal axes. What do you notice?
   b) How could you make the graph easier to understand?

3. The genetic testing of salmon began in 2002. The graph shows the quotas and catches since 1995. Use the graph and the information in the article to help answer the following questions.

a) What support is there for the idea that relying on coded-wire tags limited the catch of salmon?

b) What support is there for the idea that DNA testing has increased the chinook catch?

Reflect on Your Findings

4. What factors should you consider when you critique a graph for whether it represents a situation accurately?

Example: Critiquing a Graph

Bindi recorded the scores for two grade 8 classes that wrote the same test.
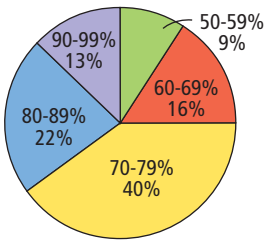
Class A (32 students)

Score (%)	Frequency
50–59	3
60–69	5
70–79	13
80–89	7
90–99	4

Class B (27 students)

Score (%)	Frequency
50–59	2
60–69	3
70–79	8
80–89	13
90–99	1

She decided to display the data on two circle graphs.

Class A Test Scores (32 students)

- 50-59% 9%
- 60-69% 16%
- 70-79% 40%
- 80-89% 22%
- 90-99% 13%

Class B Test Scores (27 students)

- 50-59% 7%
- 60-69% 11%
- 70-79% 30%
- 80-89% 48%
- 90-99% 4%
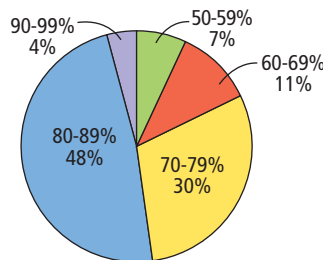
a) Why do you think Bindi used two circle graphs to display the data?

b) Are the graphs misleading? Explain.

c) State two conclusions that you can make based on the graphs.

d) Draw a double bar graph to display the data.

e) List the advantages and disadvantages of using a double bar graph to display the data.

Solution

a) There are more students in Class A than in Class B. By making circle graphs, Bindi can compare the percent of students who scored in each category. It would be less meaningful to compare the number of students who scored in each category.

b) The circle graphs are not misleading. Each sector of the graph is labelled with the category and percent, and the title includes the number of students in each class.

c) Two possible conclusions are:
- The majority of the students in both classes scored between 70% and 89%. A greater number of students in Class B scored between 70% and 89% than students in Class A.
- A total of 35% (11 students) in Class A scored over 80%. A total of 52% (14 students) in Class B scored over 80%. Therefore, a greater percent of students in Class B scored over 80% than students in Class A.

d)
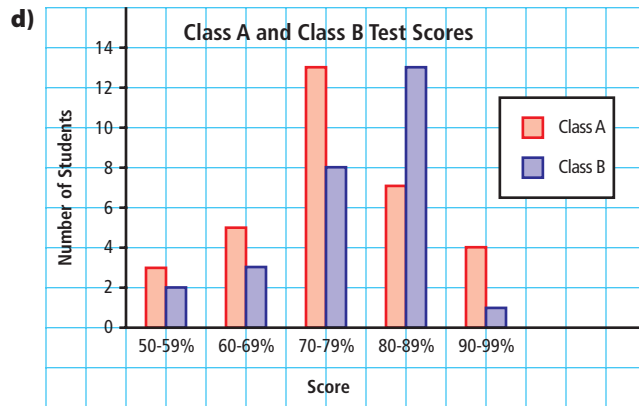
e) A double bar graph lets you compare the number of students who scored in each interval. It does not let you compare the percent of students who scored in each interval. Comparing the number of students in each interval is less meaningful in this case because the class sizes are not the same.
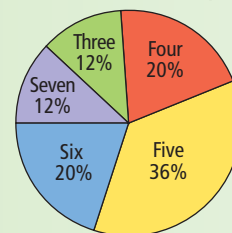
Show You Know

A group of teens picked pears during the pear harvest. The number of teens that picked each number of baskets is shown in the table.

The circle graph shows the percent of teens that picked each number of baskets.

Number of Baskets	Tally	Frequency
Three	|||	3
Four	⊬⊬⊬	5
Five	⊬⊬⊬ ||||	9
Six	⊬⊬⊬	5
Seven	|||	3

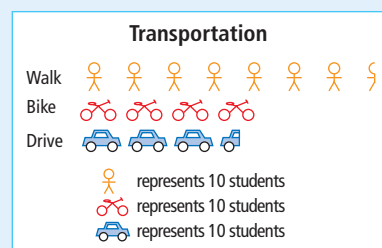**Baskets of Pears Picked (25 teens)**

a) What is an advantage of displaying the data on a circle graph?

b) Is the graph misleading? Explain.

c) State two conclusions that you can make based on the graph.

- When critiquing a graph, it is important to consider several factors:
  - Graph type: Is the graph the best choice for displaying the data?
  - Graph format: Is the graph designed in a way that represents the data accurately?
  - Graph usefulness: Is the graph informative? Does the graph support a claim or an argument?
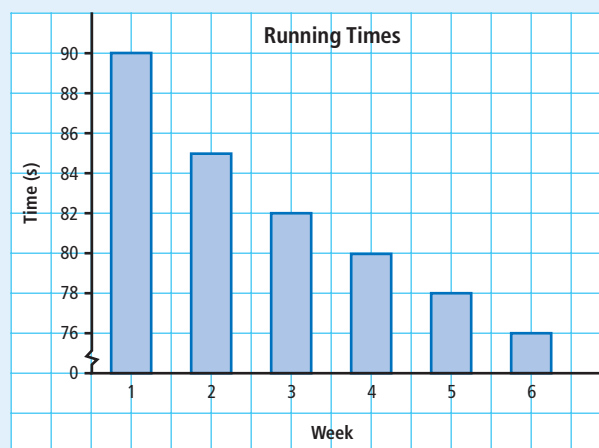
Communicate the Ideas

1. a) Is the pictograph an effective way to display the data about how students get to school? Explain.

   b) Is the graph misleading? Explain.

   c) How informative is the graph? How could it be made even more informative?

   d) Suggest another type of graph to display the data. Give an advantage and a disadvantage of using this graph.

Transportation

Walk	𝑥 𝑥 𝑥 𝑥 𝑥 𝑥 𝑥 𝑥
Bike	🚲 🚲 🚲 🚲
Drive	🚗 🚗 🚗 🚗

𝑥 represents 10 students
🚲 represents 10 students
🚗 represents 10 students

2. Danny made a graph to record his running times over a six-week period.

   a) What can you conclude about Danny's performance from this graph?

   b) How might this graph be misleading? How would you improve this graph?

Running Times

Time (s) vs Week bar graph: Week 1: 90, Week 2: 85, Week 3: 82, Week 4: 80, Week 5: 78, Week 6: 76

3. Your friend missed the lesson on critiquing graphs. Write her an explanation of how to critique graphs and why it is important to do so.

Check Your Understanding

Practise

For help with #4 to #6, refer to the Example on pages 29–30.

4. Madison surveyed grade 8 students about which method they use most often to communicate with friends.

Means of Communication	Girls	Boys
Internet chat	13	11
In person	9	11
Telephone (land line)	7	5
Cell phone	1	3
Text messaging	2	2
E-mail	1	1
Total	33	33

She decided to make a double bar graph to display the data.

Communicating With Friends
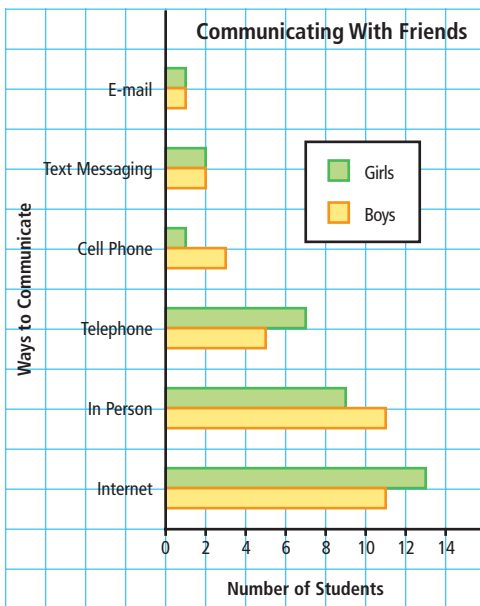
a) Why did Madison choose a double bar graph to display the data?

b) Is this graph misleading? Explain.

c) State two conclusions that you can make from this graph.

**d)** Why would you not represent the data in a double line graph?

5. a) Identify two conclusions you can make based on this double bar graph.

Time Spent on Internet
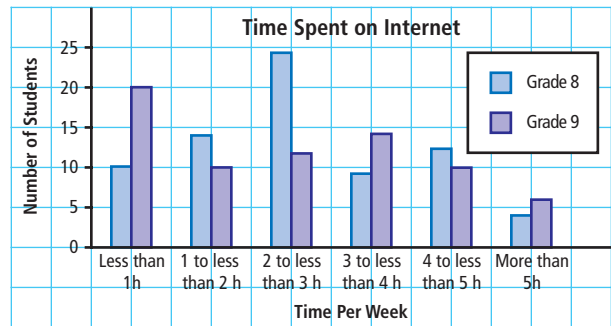
b) Is the graph misleading? Explain.

c) What improvements would you recommend for this graph?

d) What is one advantage of using a double bar graph to display the data?

e) Would another type of graph be more informative? Explain your reasoning.

6. a) What are two conclusions you can make based on this circle graph?


Cars in Parking Lot (50 cars)
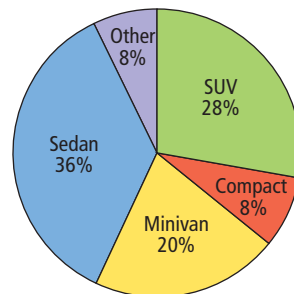
b) Is the graph misleading? Explain.

c) What is one advantage of using a circle graph to display the data?

d) Would another type of graph be more informative? Explain your reasoning.

Apply

7. The school web site posted a survey about the type of organization that grade 8 students would support if they had $1000 to donate. Each student was allowed to vote once. Colin made two graphs to display the data.
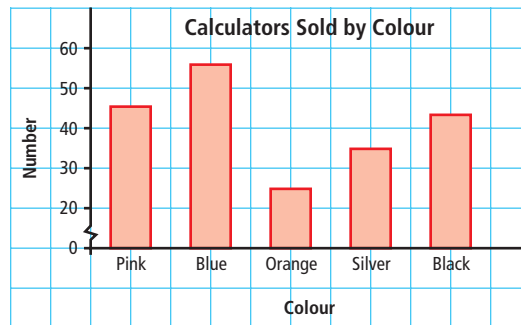
Favourite Foundations (85 votes)
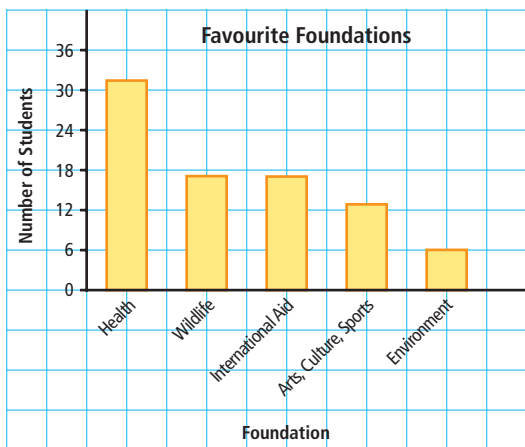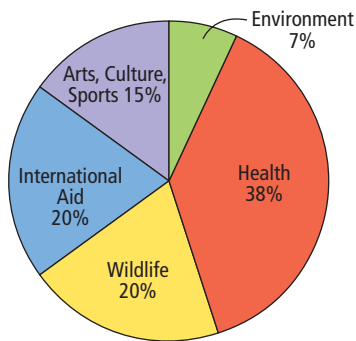
Imagine that you are a spokesperson for a youth health foundation. Which graph would you use to encourage people to donate to your foundation? Explain why.

8. Truong recorded the sales of different colours of graphing calculators during the last month.

Colour	Number
Pink	45
Blue	56
Orange	25
Silver	35
Black	44
Total	205

a) Why might Truong claim that blue calculators are about three times as popular as orange calculators? Is he correct? Explain.

b) Redraw the graph so it is more accurate. What conclusions can you make from the graph you drew?

c) Draw a circle graph to display the data.

d) Give an advantage of using a circle graph.

9. The director of a ski school tracked the snowboard rentals for one week.

| Snowboard Type	Number
Freestyle	59
Freerider	138
Freecarve	49
Alpine	41
Total	287

a) Create a graph to display the data.

b) What conclusions can you make based on your graph?

c) Give an advantage of using the type of graph you made.

d) Exchange graphs with a classmate and critique each other's graph. What improvements can you make to your graph?

10. Chloe recorded the number of hours she spent on homework over the past six days.

She displayed the data in a circle graph.

Day	Hours
Monday	2
Tuesday	1
Wednesday	2.5
Thursday	1.5
Friday	0.5
Saturday	6
Total	13.5

Time Spent on Homework (13.5 h)
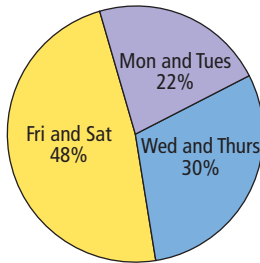
a) Chloe feels that the time she spends on homework has been increasing over the last six days. Why might she think so? Is she correct? Explain your reasoning.

b) Is Chloe's graph misleading? If yes, redraw the graph so it is more accurate.

c) What conclusions can you make based on the new graph?

d) Display the data in a bar graph.

e) What conclusions can you make based on the bar graph?

f) Is a bar graph a better way to display the data than a circle graph? Explain.

Extend

11. The two graphs show the same data about Manitoba's minimum wage.
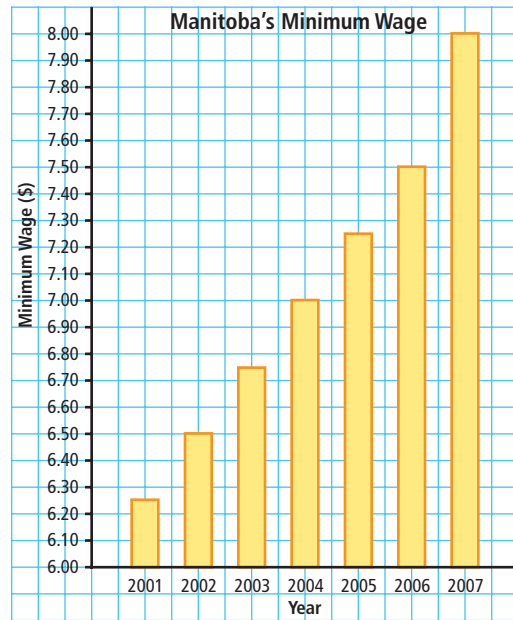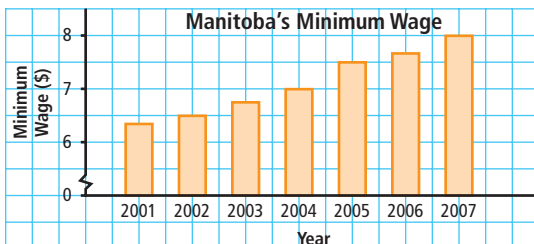

Graph A

Graph B

a) Describe how each of the graphs is misleading.

b) Which graph would support a claim that wages have not increased much over time? Write a statement to support such a claim using the data.

c) Who would use Graph B to support a claim to the government about changing the minimum wage—an employer or an employee? Explain.

12. The graphs show the following sales for the first six months of the year for two car dealerships.
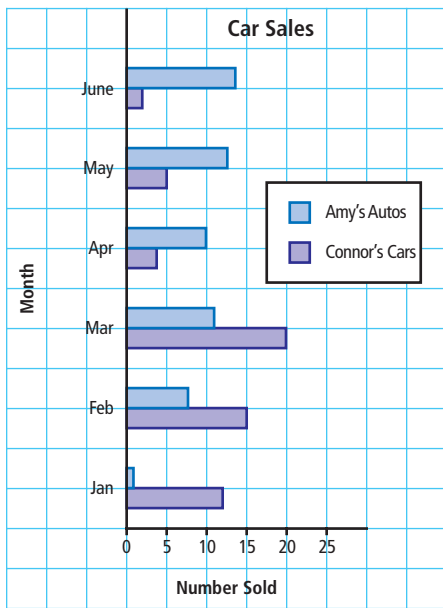
Month	Connor's Cars	Amy's Autos
January	12	1
February	15	8
March	20	11
April	3	10
May	5	13
June	2	14

Car Sales

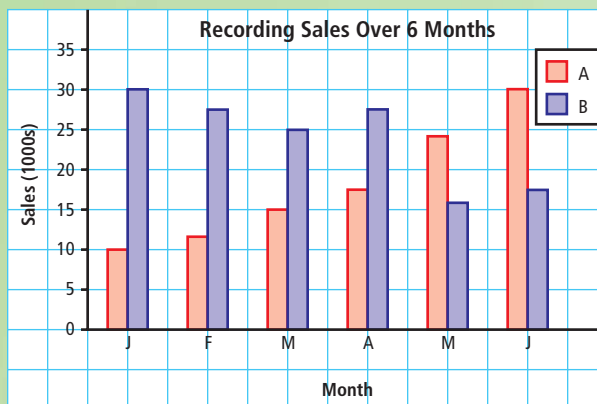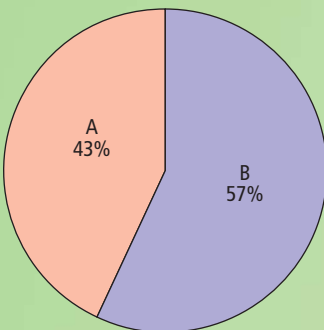**Graph A**

Car Sales

Graph B

a) Which graph did the manager of Connor's Cars likely develop? Explain.

b) What conclusions can you make based on the line graph?

MATH LINK

The organizers of a music concert are deciding between two performers as their headline attraction for a concert in December. The organizers want to use recording sales data to help make their decision. Consider the following graphs.

Recording Sales Over 6 Months

Recording Sales Over 6 Months

a) What information does each graph provide? Explain.

b) The organizers know they must attract a large crowd to cover expenses. Which performer would you select? Justify your answer.
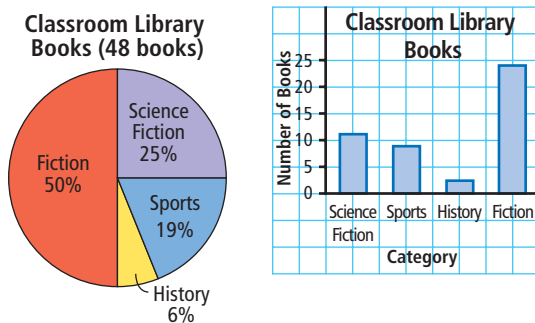
Key Words

For #1 to #5, choose the letter that best matches each description.

1. best for comparing categories using percents

2. compares one set of data using horizontal or vertical bars

3. uses symbols to represent large quantities of data

4. shows changes in data over time

5. compares two sets of data across categories

A bar graph

B double bar graph

C line graph

D interval

E circle graph

F pictograph

1.1 Advantages and Disadvantages of Different Graphs, pages 6–17

6. The number of books in a classroom library is shown on these graphs.

Classroom Library Books (48 books)

Fiction 50%
Science Fiction 25%
Sports 19%
History 6%

Classroom Library Books

Number of Books vs Category (Science Fiction, Sports, History, Fiction)

a) Which graph helps you decide how many more sports books than history books there are? Explain. Could the other graph help you answer the question? Explain.

b) Which graph would most help you decide how to spend $1000 on new books based on what the class has? How much money should be spent on each category? Show your work.

7. Michelle recorded data about how she spends time on a typical Saturday.
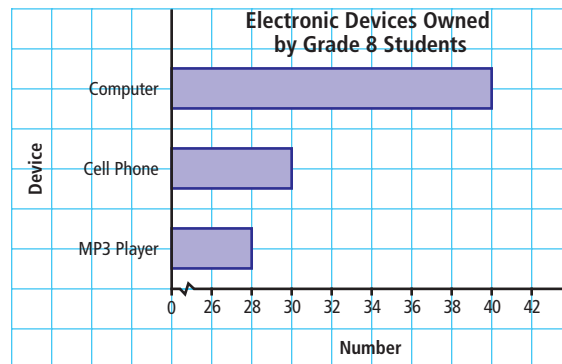
Activity	Time (h)
Chores	1.5
Eating	2
Homework	2.5
Sleep	9
Friends	3
Sports	4
TV	2
Total	24

a) List as many different ways to display the data appropriately as you can.

b) Choose and draw one type of graph to show the data.

c) State an advantage of the graph that you chose. State a disadvantage of one type of graph that you did not choose.

8. Describe a situation in which you would use each of the following to display data:

a) bar graph

b) double bar graph

c) circle graph

d) line graph

1.2 Misrepresenting Data, pages 18–27

9. The graph shows the number of electronic devices that grade 8 students own.

Electronic Devices Owned by Grade 8 Students

Device (Computer, Cell Phone, MP3 Player) vs Number (0, 26, 28, 30, 32, 34, 36, 38, 40, 42)

a) The graph shows that there are more computers than MP3 players and cell phones added together. Is this true? Describe how the graph is misleading.

b) Draw an accurate graph.

c) What conclusions can you make from your new graph?

10. The results of a pizza taste test showed that Mega Pizza was the favourite.
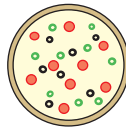
**Mega Pizza
60%**

**Mr. Pizza
40%**

a) How is this graph misleading?

b) Draw a new graph to represent the data more accurately.

11. Greg's company makes 2500 school lockers each day. Some lockers are rejected if they do not meet standards. The table shows the number of rejected lockers.

Day	Number Rejected
Monday	45
Tuesday	40
Wednesday	25
Thursday	30
Friday	35
Total	175

a) Greg wants to exaggerate the number of lockers rejected on Monday. Draw a graph to create this impression.

b) Make a new graph to represent the data accurately.

c) Explain how the two graphs are different.

1.3 Critiquing Data Presentation, pages 28–35

12. The graph represents data about which hand grade 8 students use to write.

Right-Handed, Left-Handed, or Ambidextrous? (58 students)

Left-Handed 9% Ambidextrous 11%

Right-Handed 80%
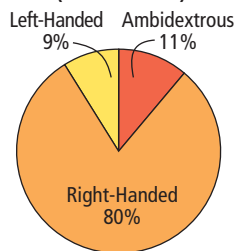
a) What conclusions can you make from this graph?

b) Is the circle graph an appropriate way to present the data? Explain.

c) What other way might you display the data? List an advantage of the graph you chose.

Literacy Link

Someone who is *ambidextrous* is able to use both hands equally well.

13. Two television comedy shows are competing for sponsorship from an advertiser. The ratings for four seasons are shown in the table. The ratings are a percent of the total viewing audience.

Show	% Ratings			
	Season 1	Season 2	Season 3	Season 4
Laughing Out Loud	21	16	18	17
Open Mike Comics	12	13	14	15
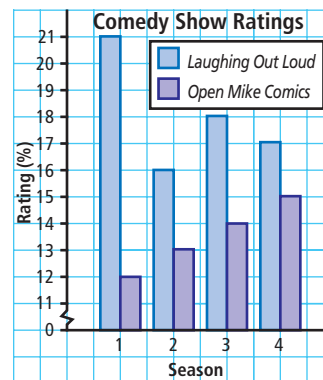
Graph A
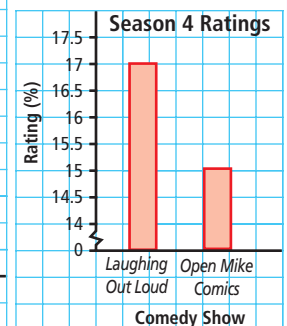
Graph B

a) What rating information does each graph provide?

b) Suggest a catchy new title for each graph. Explain why you recommend each title.

c) Which graph do you think was created by the producer of *Open Mike Comics*? Explain.

d) Which graph do you think was created by the producer of *Laughing Out Loud*? Explain.

Practice Test

1

For #1 to #3, select the best answer.

1. Which type of graph is best used for comparing each category of data with the whole?

   A bar graph   **B** circle graph

   C line graph   **D** pictograph

2. Which type of graph is best used to compare the number of boys and girls born in each month of the year?

   A double bar graph

   B double line graph

   C two circle graphs

   D two pictographs

3. Energy bars cost 25¢ in 1985, 50¢ in 1995, and 75¢ in 2005. How is this graph misleading?
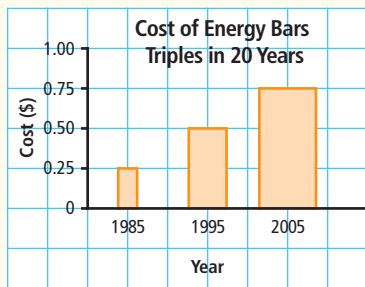
   A The intervals on the vertical scale are not equal.

   B The 2005 bar is three times taller than the 1985 bar.

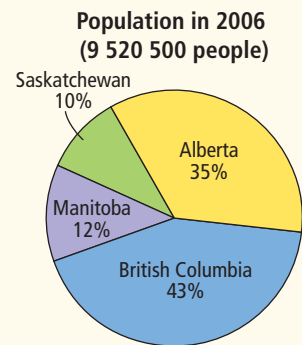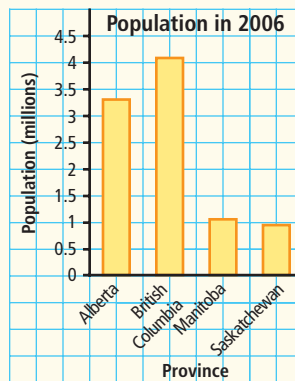   **C** The width of the bars varies.

   D The scale starts at 0.

Complete the statements in #4 and #5.

4. Symbols are used to represent data on a ▬▬▬▬ .

5. Zach wants to draw a graph to show changes over time. He should use a ▬▬▬▬ graph.

Short Answer

6. The graphs display population data of selected provinces.

   a) Do both graphs provide the same information? Explain.

   b) Which graph best shows that Alberta's population is almost three times as great as the population of Manitoba? Explain.

7. Brenden recorded the results of a survey of grade 8s to determine their favourite choice of activity for the year-end field trip. His results are shown.

Activity	Votes
Bowling	17
Beach picnic	32
Inline skating	15
Movie	10
Total	74

   a) Display the data using a bar graph.

   b) Display the data using a circle graph.

   c) Which graph best displays the data? Explain.

8. One hundred grade 8 students were surveyed about their favourite ways to spend spare time.

Favourite Ways to Spend Time

Horizontal bar graph. Axis labels: y-axis "Activity", x-axis "Number of Students" (0, 5, 10, 15, 20, 25, 30). Activities from top: Other, Reading, Internet, Video or Computer Games, Sports, Television.
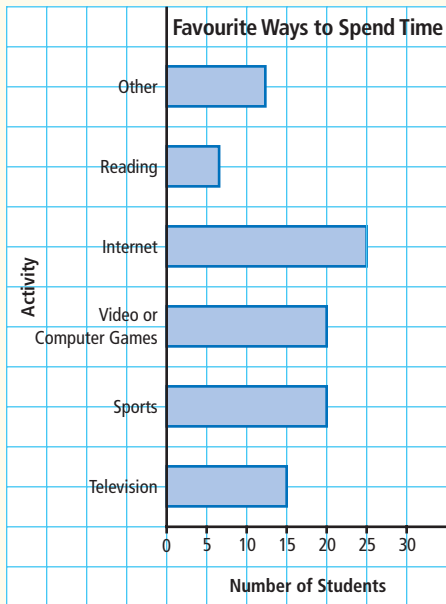
a) State two conclusions you can make based on the graph. Write a more descriptive title.

b) Is the graph misleading? Explain.

c) Display the data using another graph of your choice.

d) Give an advantage or a disadvantage of representing the data on the new graph.

Extended Response

9. Use the data about ticket sales for a basketball game to create a bar graph. Use the same data to create another graph that is misleading. Explain how it is misleading.

Game	Ticket Sales
1	125
2	150
3	250
4	350
5	300

10. The following graph is partially completed.
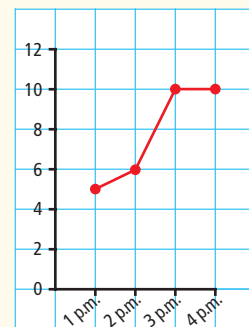
a) Describe a scenario to represent the data on this graph. Then, complete the graph.

b) Draw another graph to show the data.

c) Does each graph provide the same information? Explain.

d) Which graph best represents the information from the scenario that you created? Explain.

Line graph with y-axis (0, 2, 4, 6, 8, 10, 12) and x-axis (1 p.m., 2 p.m., 3 p.m., 4 p.m.).

WRAP IT UP!

Suppose you are a reporter for the school's newspaper. Search the Internet, magazines, or newspapers for data about a topic related to the music industry. For example, you might want to use data about sales, favourite artists, attendance at tours, or popularity of different types of music.

a) Make a table that displays your data.

b) Decide on two different ways to represent the data by drawing one graph that represents the data accurately and another graph that misrepresents the data.

c) You have been asked to write articles that relate to each of your graphs. What will the headlines of your articles be? Explain your thinking.
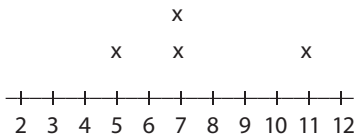
Math Games

The Plot Thickens

1. Play The Plot Thickens with a partner. These are the rules:
   • Each player rolls one die to decide who will play first. If there is a tie, roll again.
   • For each turn, roll the two dice and add the values.
   • Record your total from each turn.

> In my first four turns, I rolled totals of 7, 5, 11, and 7.
>
> ```
>                  x
>          x   x           x
>   +---+---+---+---+---+---+---+---+---+---+---+
>   2   3   4   5   6   7   8   9  10  11  12
> ```

> The total that I rolled five times was 6, so I scored six points for the round.

   • The first player to roll the same total five times wins the round.
   • The winner of the round scores the total that he/she rolled five times.
   • The player who loses a round plays first in the next round.
   • The first player to reach 20 points wins the game.

2. a) Suggest other ways of recording and displaying the data from The Plot Thickens.

   b) Play the game again. Record and display the data in a way you suggested.

3. Play modified versions of the game by using different numbers of dice or by determining products instead of sums.
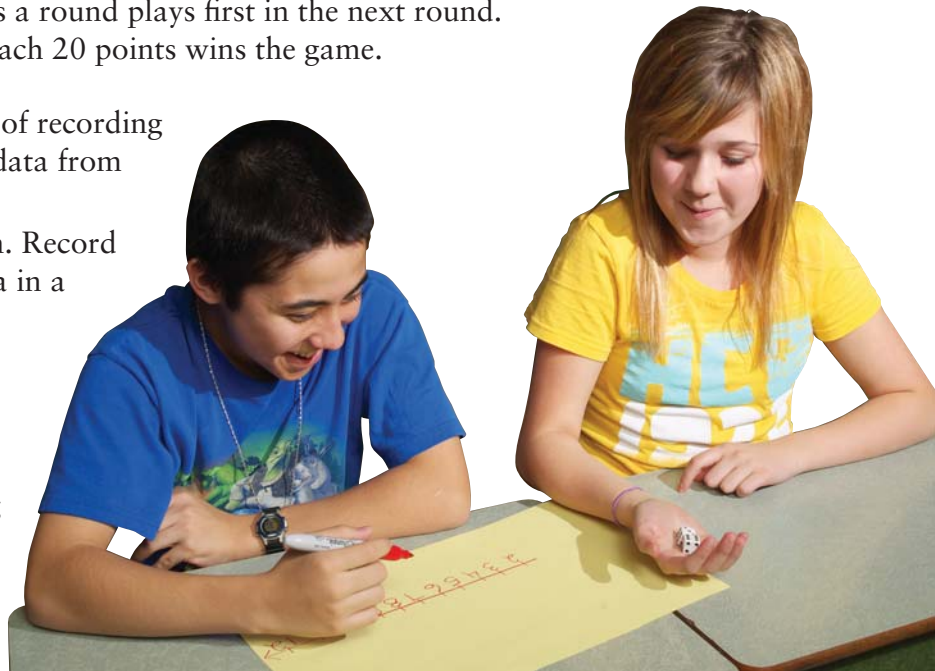
Challenge in Real Life

Keep Your Community Green

Communities across Canada are concerned about the volume of waste they produce. As a result, many cities and towns have recycling programs. How well does your community do?

You be the researcher. Research data related to recycling in your community. Then, choose another Canadian community. Obtain recycling data from it too.

1. Compare the two sets of data and then represent the data in the following two different ways.

    a) Make one graph that misrepresents the data. For example, it could make it appear that your community is better at recycling when the other community is actually better.

    b) Make a second graph that accurately represents the data.

2. Write a brief news article for your community paper using the graphs that showcase your community.