

1.1

Advantages and Disadvantages of Different Graphs

Focus on...

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

- compare information from different graphs
- identify the advantages and disadvantages of different types of 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

Materials

- metre stick
- chalk or masking tape
- ruler
- grid paper (optional)
- coloured pencils

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.

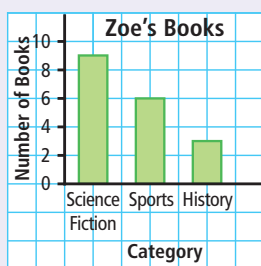
Reflect on Your Findings

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

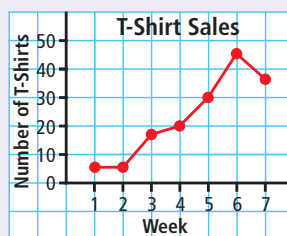
Literacy Link

Types of Graphs

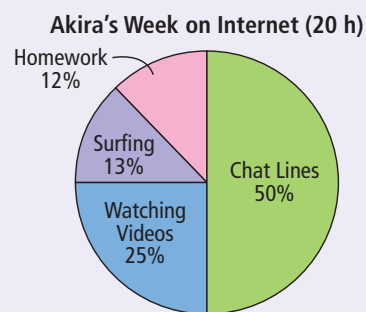
Bar Graph



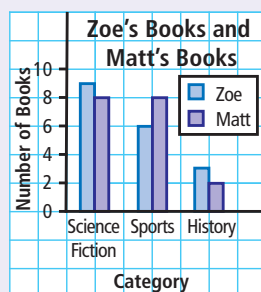
Line Graph



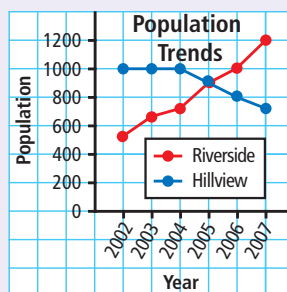
Circle Graph



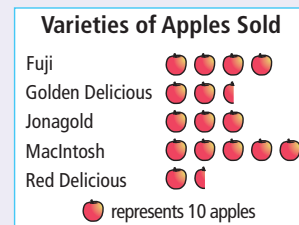
Double Bar Graph



Double Line Graph



Pictograph



Did You Know?

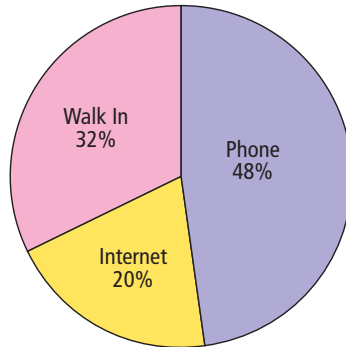
Many cultures have their own version of pizza with unique toppings. For example, Canadian pizza toppings may include bacon, pepperoni, and mushrooms. In India, pizza toppings include ginger, paneer, which is a form of cottage cheese, and chicken tikka.

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)



- How many more pizzas were ordered by phone than on the Internet? Which graph shows this more clearly? Explain.
- Almost half of the total number of orders came by phone. Which graph shows this more clearly? Explain.
- Which graph better shows the number of pizzas ordered by Internet? Justify your choice.
- Would a line graph be a useful way to display the data? Explain why or why not.
- What other type of graph could be used to display the data?

Solution

- 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.
- 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.

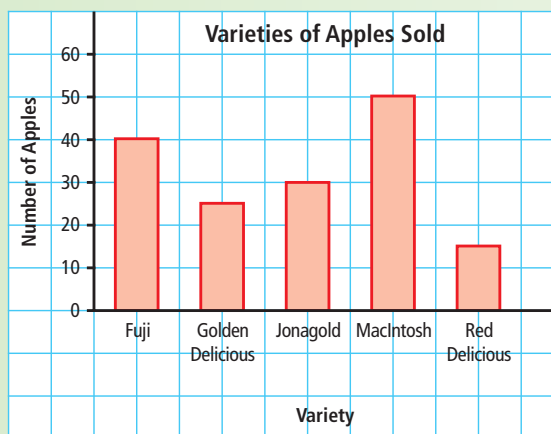
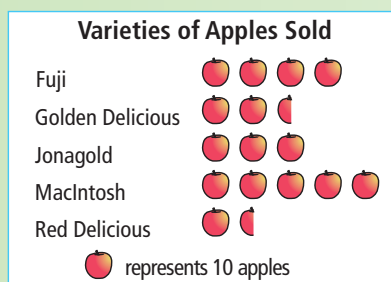
For example, the circle graph shows that 20% of the 125 pizzas were ordered on the Internet. You can find the number of pizzas by calculating 20% of the total number of pizzas.

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.



- 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?

History Link

The Stanley Cup was originally called the Dominion Hockey Challenge Cup. It was donated by Lord Stanley of Preston, a Governor General of Canada, and was first awarded in 1893 to Montréal.

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)

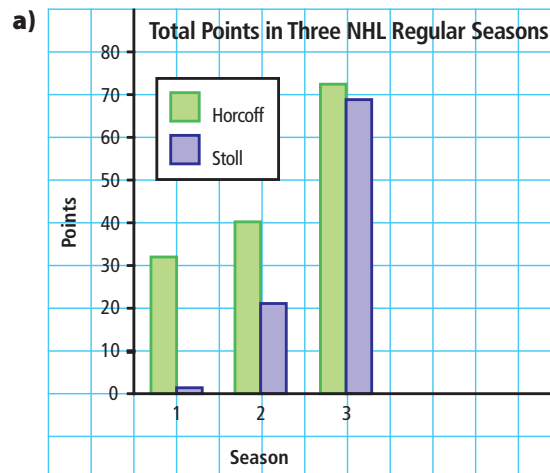
| Season | Games Played | Goals | Assists | Total Points |
|--------|--------------|-------|---------|--------------|
| 1 | 78 | 12 | 21 | 33 |
| 2 | 80 | 15 | 25 | 40 |
| 3 | 79 | 22 | 51 | 73 |

Stoll (Centre)

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

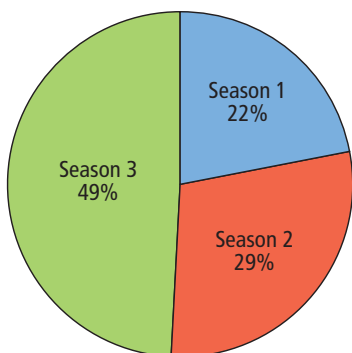
- Use a double bar graph to display the data.
- Which player shows the most improvement in total points?
- Total points are used to assess a player's worth. Take a look at the number of games Horcoff and Stoll played. Is this a fair way to assess a player's worth?
- Would two circle graphs be effective to display the data? Explain.

Solution

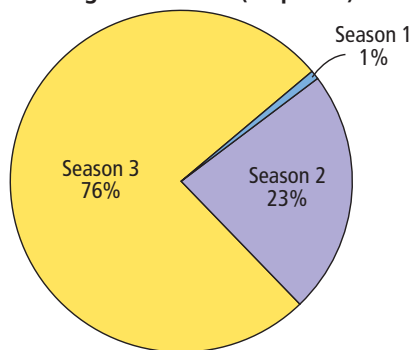


- b) Stoll shows the most improvement in total points over three seasons.
- c) Total points are not a fair way to assess a player's worth. The graph does not take into account the number of games that each centre played during the regular season. The number of games that Stoll played increased over the 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)



Stoll's Total Points in Three NHL Regular Seasons (90 points)



Show You Know

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

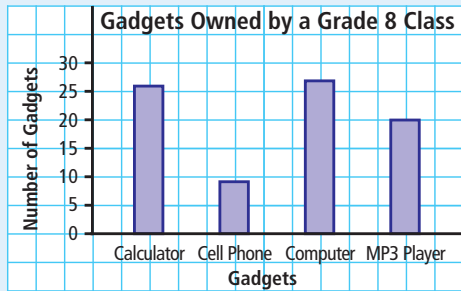
- Choose one type of graph to display the data.
- Graph the data.
- Give one advantage of using your choice of graph.

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

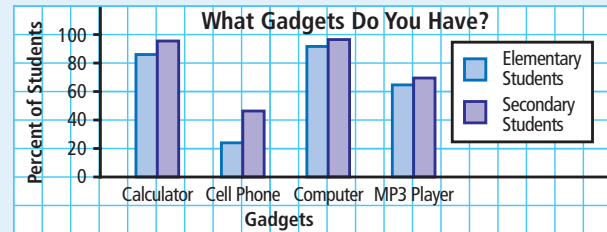
Key Ideas

- 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.

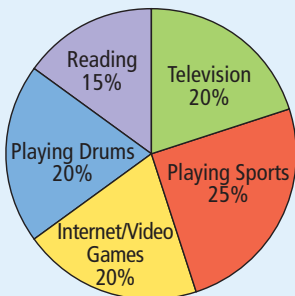


- Double bar graphs are best for comparing two sets of data across categories.

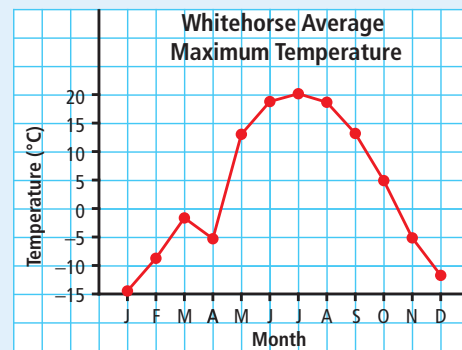


- Circle graphs are best for comparing categories to the whole using percents. The sum of the percents in a circle graph is 100%.

Andre's Weekly Activities (25 h)



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

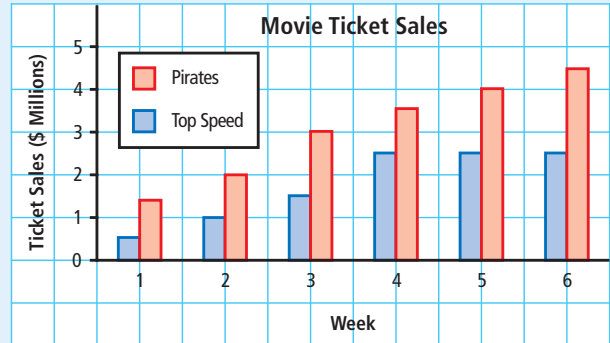
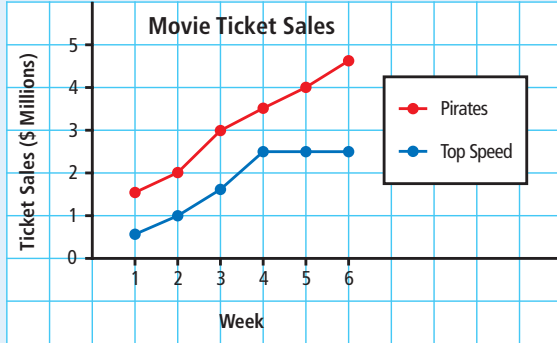


- Pictographs are best for comparing data that can be easily counted and represented using symbols.



Communicate the Ideas

- 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.



- 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 |

- 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.

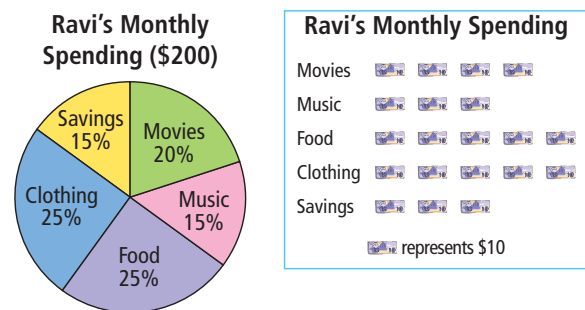
Check Your Understanding

Practise

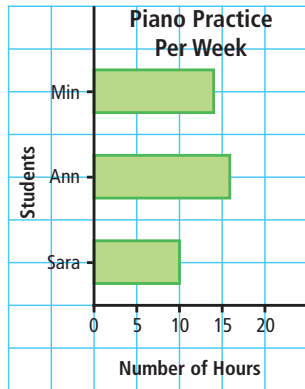
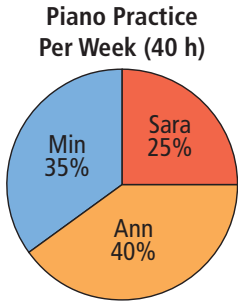
For help with #4 to #6, refer to Example 1 on pages 8–9.

- Ravi recorded his spending for one month. He displayed the data in a circle graph and a pictograph.
 - How much more does Ravi spend on food than on movies? Which graph shows this more clearly? Explain.
 - Ravi spends half of his money on food and clothing. Which graph shows this more clearly? Explain.

- Describe one advantage and one disadvantage of using each graph.

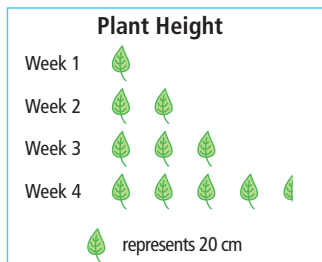
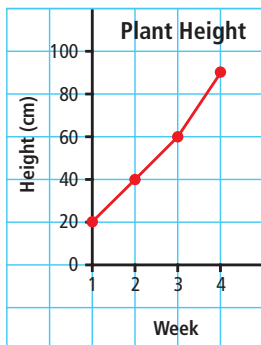


5. The piano that Sara, Ann, and Min use is available for 40 h of practice every week. The graphs show how they divide the practice time.



- 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 |



- 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 | | Andrea | |
|-------|-------------|--------|-------------|
| Age | Height (cm) | Age | Height (cm) |
| 2 | 40 | 2 | 40 |
| 4 | 60 | 4 | 60 |
| 6 | 70 | 6 | 80 |
| 8 | 100 | 8 | 110 |
| 10 | 120 | 10 | 130 |
| 12 | 145 | 12 | 150 |
| 14 | 165 | 14 | 160 |
| 16 | 175 | 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 Link

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

Tech Link

You can use the spreadsheet software available on your computer to create graphs.

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 |

- Use a bar graph to display the data. What is one advantage of using a bar graph?
- Could you use a line graph to display the data? Explain.
- Could you use a circle graph to display the data? Explain.
- Would a pictograph be an effective way to display the data? Explain why or why not.

Literacy Link

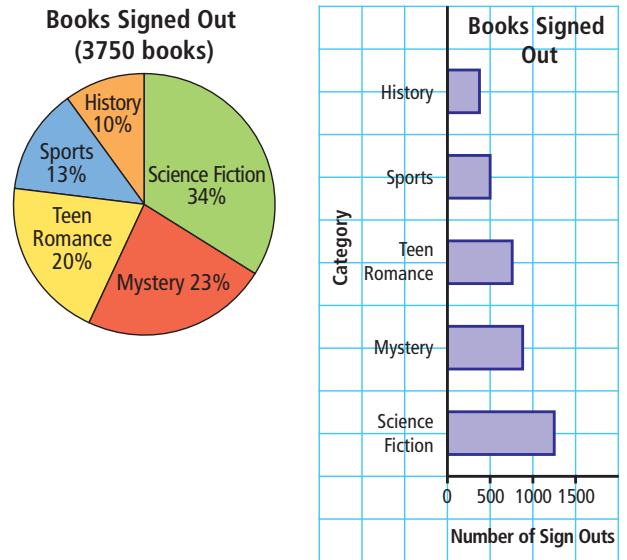
A *decibel* is a measure of the intensity of a sound. The abbreviation is dB.

Did You Know?

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

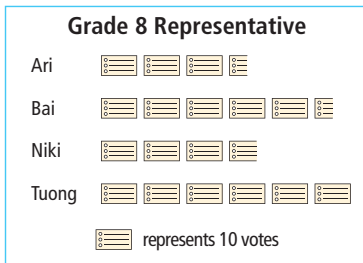
Apply

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



- Estimate how many times more popular science fiction books are than history books.
- Which graph helped you answer part a)? Why did you choose this graph?
- Which category of book has approximately the same number of sign outs as history and sports books together? Show your thinking.
- Which graph helped you answer part c)? Why did you choose this graph?
- 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.
- 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.



- Draw a bar graph to show the data in the pictograph.
 - Does the pictograph or the bar graph more clearly show how students voted in this election? Explain your reasoning.
 - Would you recommend using a line graph to show the data? Explain.
 - 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 |

- Use two different graphs to represent the data.
- Compare the two graphs. Is one graph more effective in representing the data? Explain your reasoning.
- Should the store continue to sell this jewellery? Explain your thinking.

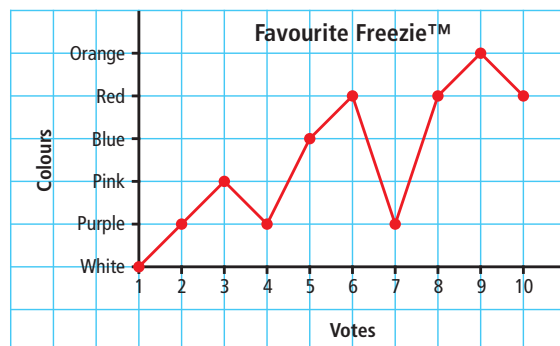
12. A grade 8 class recorded the following percent scores on a Math test:

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

- Organize the data into groups and develop a frequency table.
 - List the different graphs that could be used to display the data.
 - 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 |

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



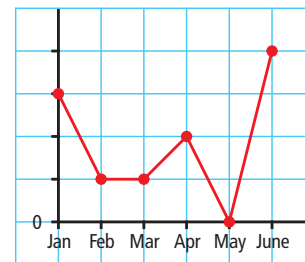
- a) How could you improve this graph?
- b) Why is using a line graph not a good choice in this case? Explain your reasoning.

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.

Extend

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.



1.2

Misrepresenting Data



Focus on...

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

- explain how the size of the intervals on a graph could be misleading
- explain how the visual representation of a graph could misrepresent data
- explain how the size of bars on a graph could be misleading
- identify conclusions that do not agree with a given data set or graph and explain the misinterpretation

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?

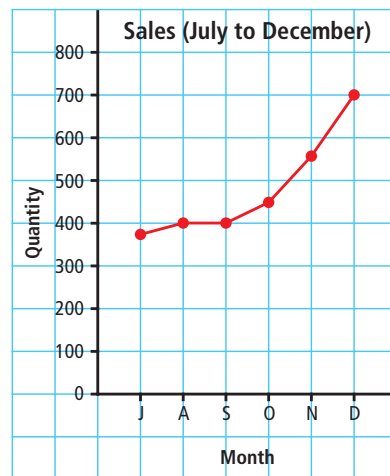
Literacy Link

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

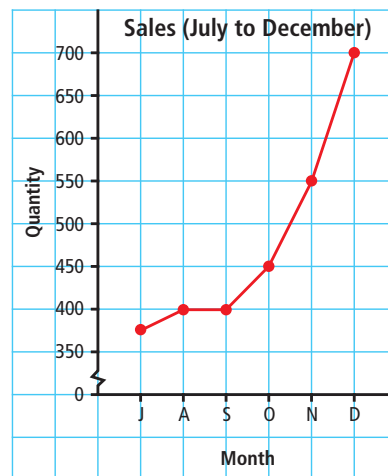
Explore the Math

What are some ways to misrepresent data?

These two graphs display the same data in different ways.



Graph A



Graph B

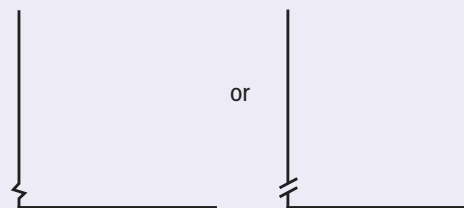
Materials

- grid paper (optional)
- ruler
- coloured pencil

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.

Literacy Link

A break in the y-axis of a graph means the length of the axis has been shortened. The break can be shown as

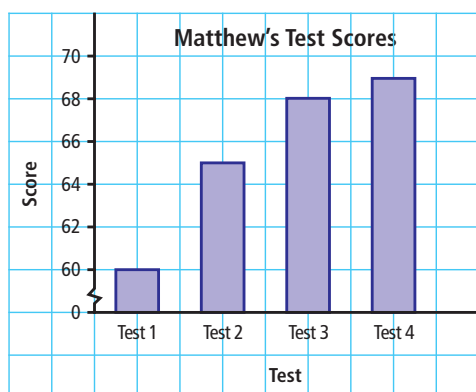


Reflect on Your Findings

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.

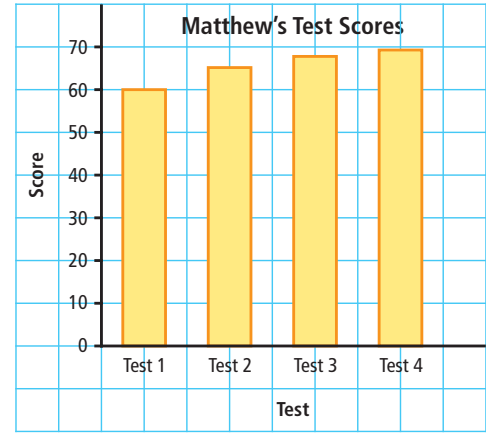


- a) According to the graph, what did Matthew receive on each test?
- b) From the graph, what appears to be true about Matthew's improvement over the four test scores? What part of the graph has been distorted to create this impression?
- c) How should the graph be drawn to represent Matthew's progress 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.

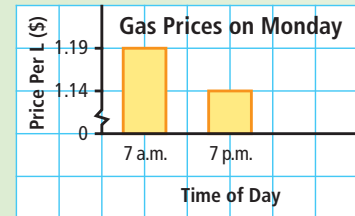
- c) The graph should be redrawn with a continuous scale that starts at zero. This would show that Matthew's test scores have improved, but not by as much as the first graph suggests.



- 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.

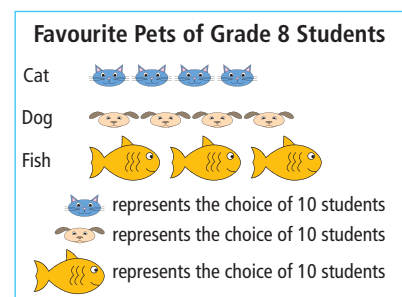
Show You Know

- 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.



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?

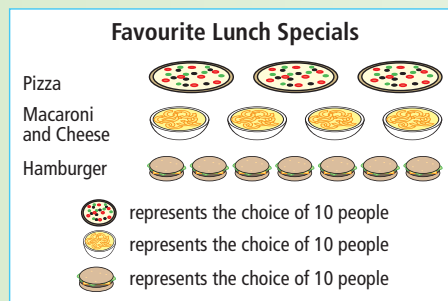


Solution

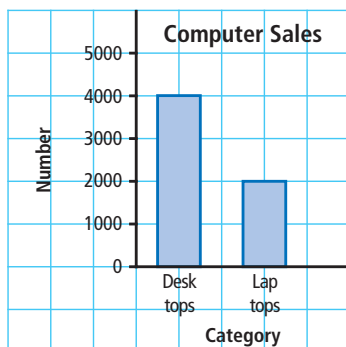
- a) Fish appear to be the favourite pets because the line for fish is the longest one and the symbol for fish is much larger.
- b) It seems as if more students like dogs than cats because the line for dogs is longer than the one for cats.
- c) The pictograph should be redrawn so that each symbol is 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

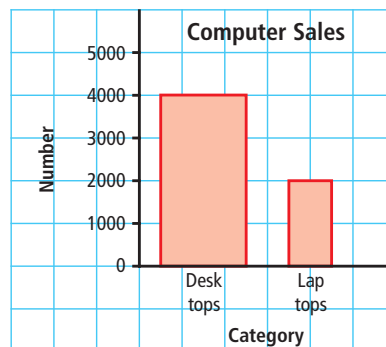
- a) Explain how this graph could be misleading.
- b) What conclusion does the graph suggest about favourite lunch specials?
- c) How could you redraw the graph to represent the data more accurately?



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?

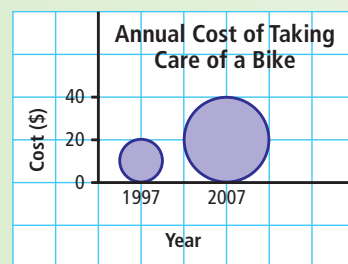
Solution

- 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 $\text{Area} = l \times w$. 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.

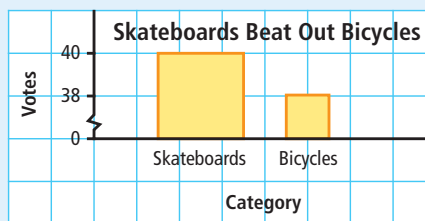
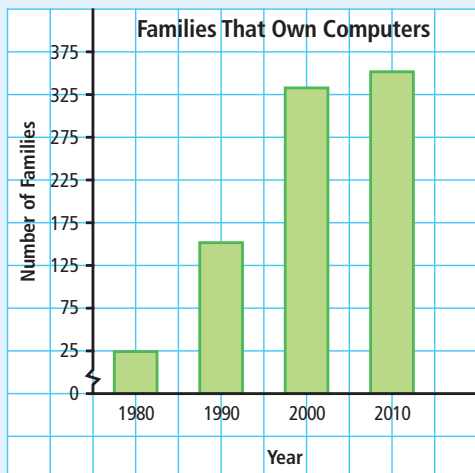
Show You Know

- 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

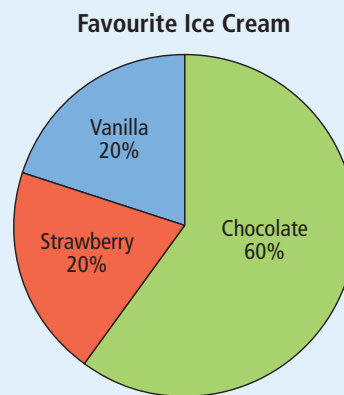


Communicate the Ideas

- Travis recorded the following data about how he spends his day.
 - How would you make a bar graph to help argue that Travis spends most of his time sleeping or going to school?
 - 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 |

- Sophie surveyed her friends about their favourite flavour of ice cream. What information is missing on the graph?
 - How could you present this data more accurately?
- When might it be to someone's advantage to present distorted data? Share your answer with a partner.

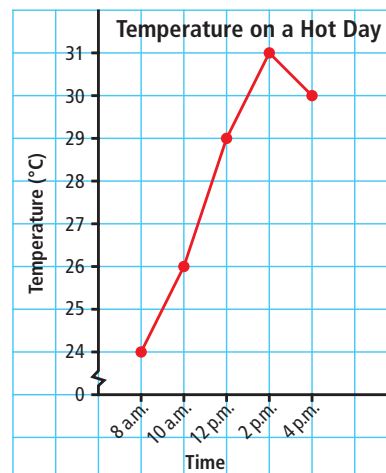


Check Your Understanding

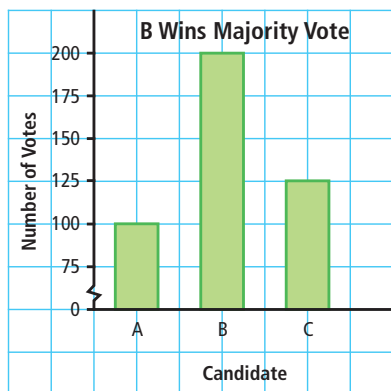
Practise

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

- Samantha recorded the temperature on a hot day. She displayed the data in a line graph.
 - Explain how this graph could be misleading.
 - What conclusion does the graph suggest about the changes in temperature?
 - 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.



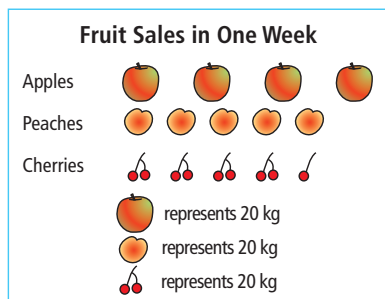
- How many times taller does the bar for B appear than the bar for A?
- How many times as great are the votes for B than the votes for A?
- What conclusion does the graph suggest about the election results?
- How could the graph be redrawn to make the data clearer?

Literacy Link

Majority means more than 50%.

For help with #6 and #7, refer to Example 2 on pages 20–21.

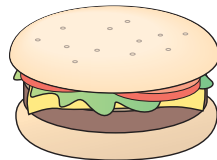
6. a) From the pictograph, which fruit seems to sell the best? Explain.



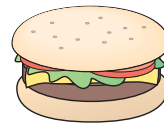
- Does it seem that more cherries were sold or more peaches? Explain.
- How should the pictograph be redrawn to represent the data more accurately?

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%

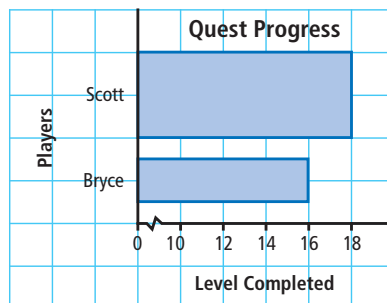


Bonzo Burger
44%

- Which burger seems to be the favourite? Explain.
- How is the graph misleading?
- How should the graph be redrawn to represent the data more accurately?

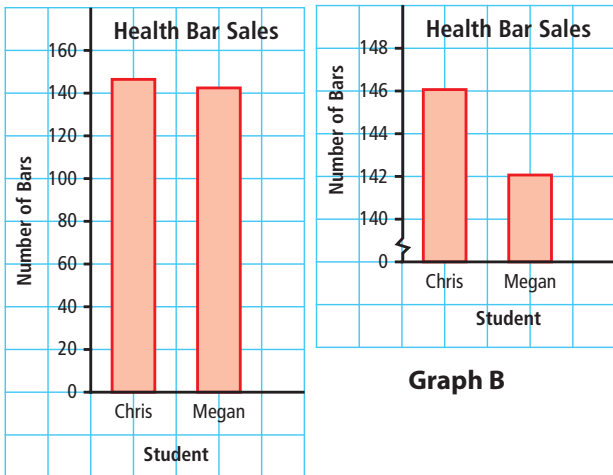
For help with #8 and #9, refer to Example 3 on pages 21–22.

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



- Explain how this graph could be misleading.
- What conclusion does the graph suggest about Scott's progress compared with Bryce's progress?
- 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.



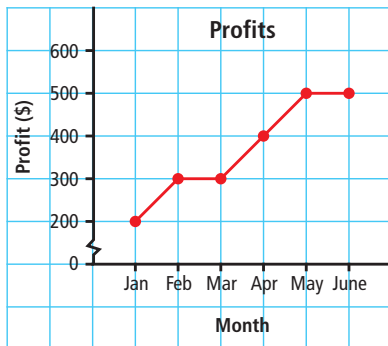
Graph A

Graph B

- How are the two graphs different?
- For each graph, what conclusion would you make about health bar sales?
- Which graph gives a more accurate comparison of sales? Explain.

Apply

10. a) Explain how this graph is misleading.

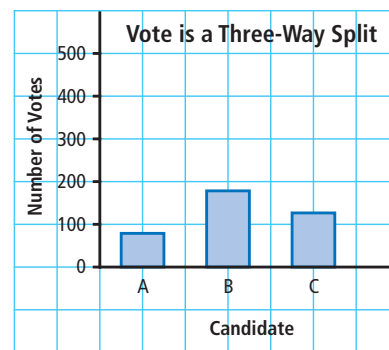


- From the graph, what conclusion can you make about the profits from January to June?
- Draw a new graph using a vertical scale from 0 to 600. What conclusion can you now make about the profits from January to June?

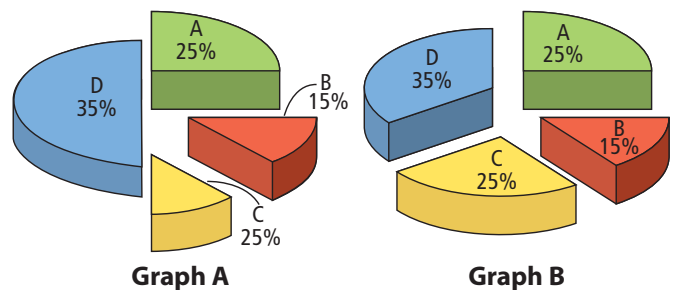
11. Charles kept a record of his Math quiz scores for this term.

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

- He wants to make a distorted graph that will show a great improvement in his quiz scores. Draw such a graph.
 - Draw a new graph that displays the data more accurately.
 - How are the two graphs different?
12. a) Explain how this graph is misleading.

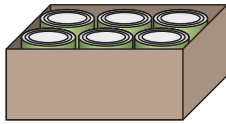


- Based on the graph, what can you conclude about the outcome of the voting?
 - Does the data support the claim made in the title? If not, reword it to correct the misinformation.
13. a) The two circle graphs are meant to represent the same information. Does it appear that way? Explain.

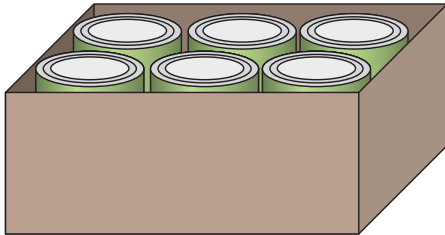


- b) Identify the errors in Graph A.

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.

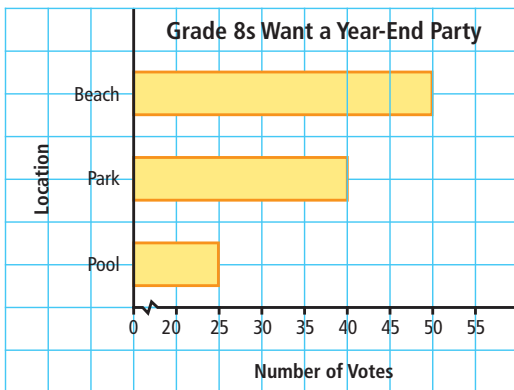


Ms. Chan's class



Mr. Rajwani's class

- How is this graph misleading?
 - Based on the graph, what can you conclude about the canned food drive?
 - 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.



- Based on the graph, how many times more popular was the beach than the pool?
- Leah concluded that the majority of the students want to go to the beach. Is she correct? Explain.

- Draw a new graph to represent the data more accurately.

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



- What ice cream store do you believe developed this graph? Explain.
 - 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 |

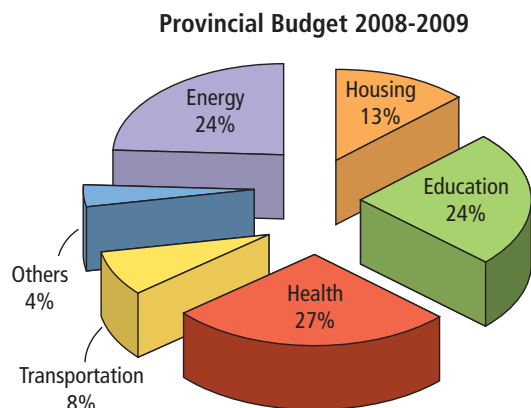
- Make a bar graph to display the data.
- Total the number of crimes for every two years. Make a new bar graph to display these data.
- What can you conclude from the second bar graph? Do the data in the table support your statement? Explain.
- How is the second graph misleading?

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?

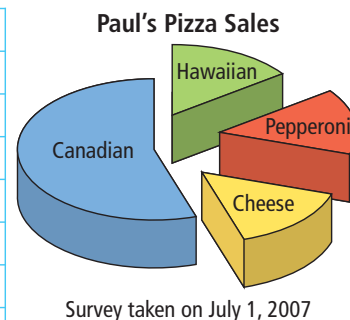
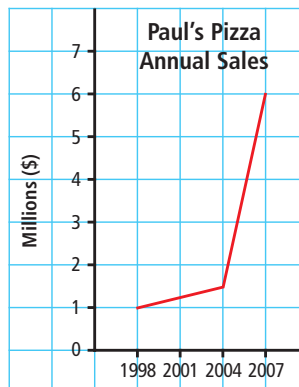


- b) Explain how this graph could mislead people.
 c) Draw a new graph to represent the data more accurately.

Extend

20. Prepare a survey question that requires making a choice from a list of several options.
- Survey the students in your class. Record the data in a chart.
 - Make a graph that distorts the data.
 - 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.



- How might these graphs mislead people? List as many misleading features as you can.
 - 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.
- Draw a new graph to represent the data accurately.
 - 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.

- Draw a graph that supports your argument about which artists are selling more than others.
- How would you change your graph to support the opposite of your argument?

WWW Web Link

For information about music sales, go to www.mathlinks8.ca and follow the links.

1.3

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

THE DAILY NEWS

Sept 24 2007

DNA Testing Helps Commercial Fishers

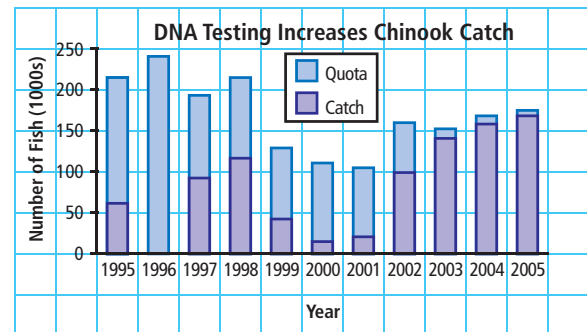
Thanks to DNA testing, B.C.'s commercial fishers can expect to catch as much as 90% of their quota of chinook salmon this year.

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?



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.

Explore the Math

Literacy Link

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

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)

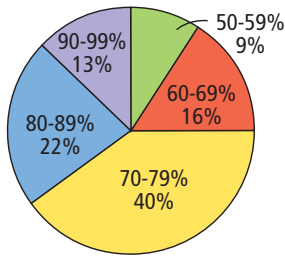
| Score (%) | Frequency |
|-----------|-----------|
| 50–59 | 3 |
| 60–69 | 5 |
| 70–79 | 13 |
| 80–89 | 7 |
| 90–99 | 4 |

Class B (27 students)

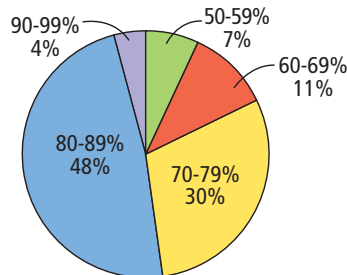
| Score (%) | Frequency |
|-----------|-----------|
| 50–59 | 2 |
| 60–69 | 3 |
| 70–79 | 8 |
| 80–89 | 13 |
| 90–99 | 1 |

She decided to display the data on two circle graphs.

Class A Test Scores (32 students)



Class B Test Scores (27 students)

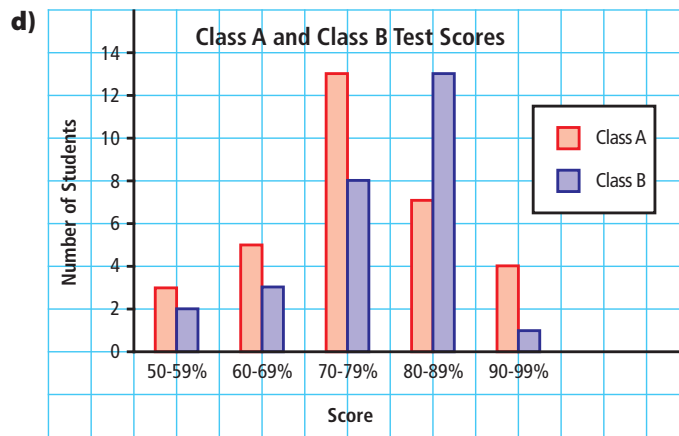


- a) Why do you think Bindi used two circle graphs to display the data?
- b) Are the graphs misleading? Explain.
- c) State two conclusions that you can make based on the graphs.
- d) Draw a double bar graph to display the data.
- e) List the advantages and disadvantages of using a double bar graph to 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.



- 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.

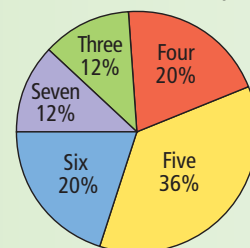
Show You Know

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)



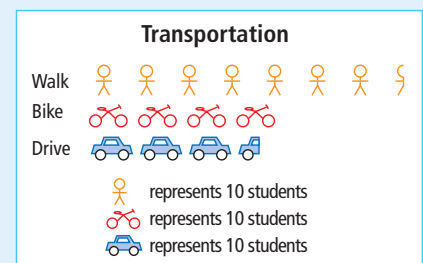
- a) What is an advantage of displaying the data on a circle graph?
- b) Is the graph misleading? Explain.
- c) State two conclusions that you can make based on the graph.

Key Ideas

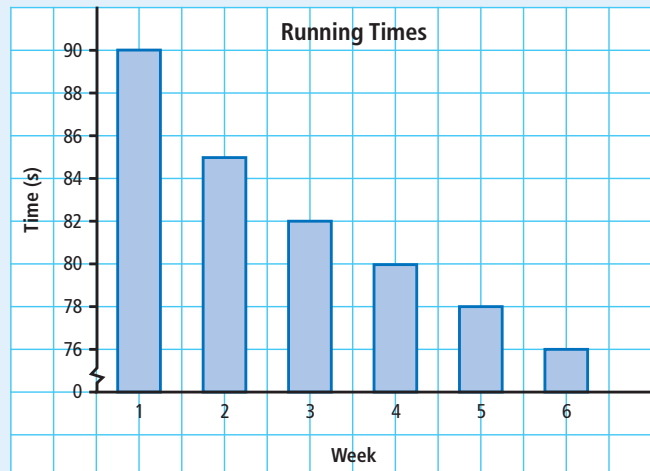
- When critiquing a graph, it is important to consider several factors:
 - Graph type: Is the graph the best choice for displaying the data?
 - Graph format: Is the graph designed in a way that represents the data accurately?
 - Graph usefulness: Is the graph informative? Does the graph support a claim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

Communicate the Ideas

- 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.



- 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?



- a) 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

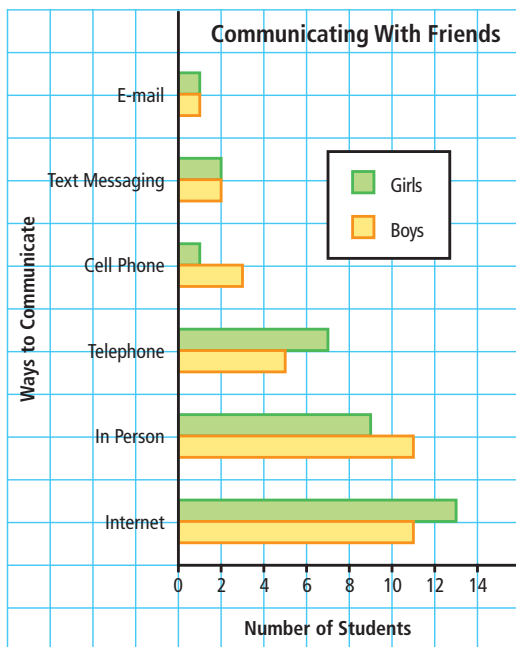
Practise

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 |

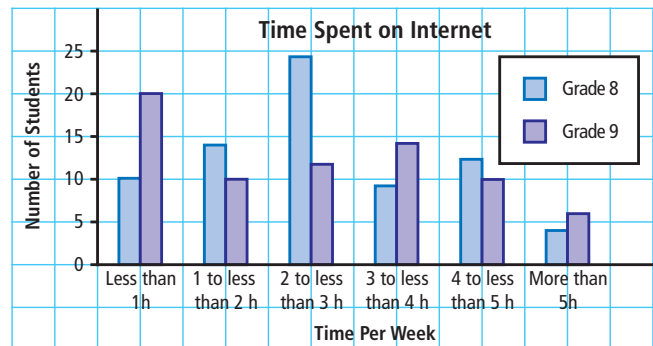
She decided to make a double bar graph to display the data.



- 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?

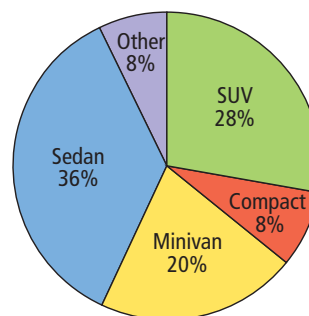
5. a) Identify two conclusions you can make based on this double bar graph.



- 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)

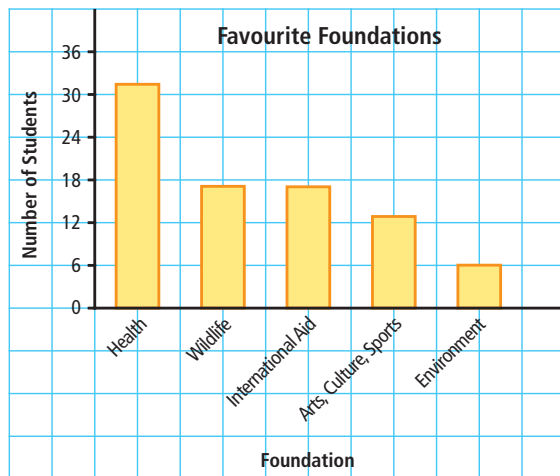
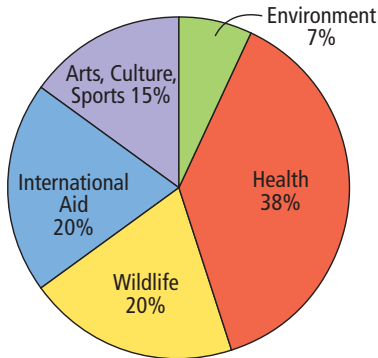


- b) Is the graph misleading? Explain.
 c) What is one advantage of using a circle graph to display the data?
 d) Would another type of graph be more informative? Explain your reasoning.

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)

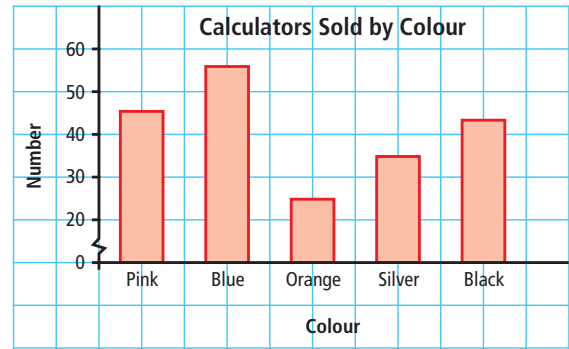


Imagine that you are a spokesperson for a youth health foundation. Which graph would you use to encourage people to donate to your foundation? Explain why.

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 |

He displayed the data in a bar graph.



- Why might Truong claim that blue calculators are about three times as popular as orange calculators? Is he correct? Explain.
 - Redraw the graph so it is more accurate. What conclusions can you make from the graph you drew?
 - Draw a circle graph to display the data.
 - Give an advantage of using a circle graph.
9. The director of a ski school tracked the snowboard rentals for one week.

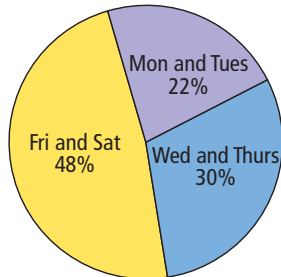
| Snowboard Type | Number |
|----------------|--------|
| Freestyle | 59 |
| Freerider | 138 |
| Freecarve | 49 |
| Alpine | 41 |
| Total | 287 |

- Create a graph to display the data.
- What conclusions can you make based on your graph?
- Give an advantage of using the type of graph you made.
- 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 |

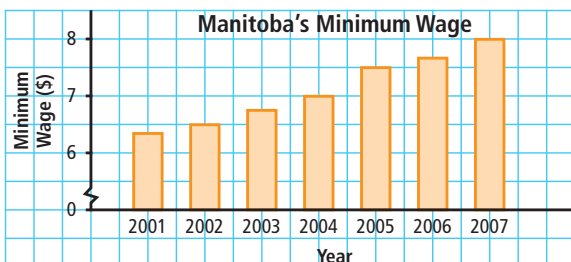
Time Spent on Homework (13.5 h)



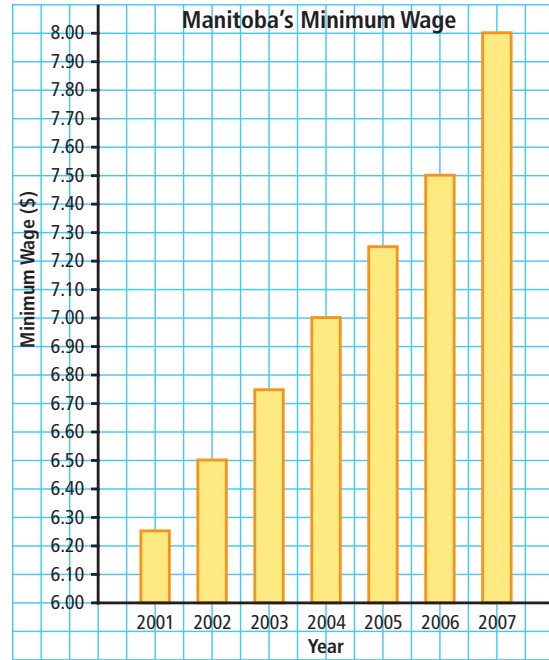
- Chloe feels that the time she spends on homework has been increasing over the last six days. Why might she think so? Is she correct? Explain your reasoning.
- Is Chloe's graph misleading? If yes, redraw the graph so it is more accurate.
- What conclusions can you make based on the new graph?
- Display the data in a bar graph.
- What conclusions can you make based on the bar graph?
- 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.



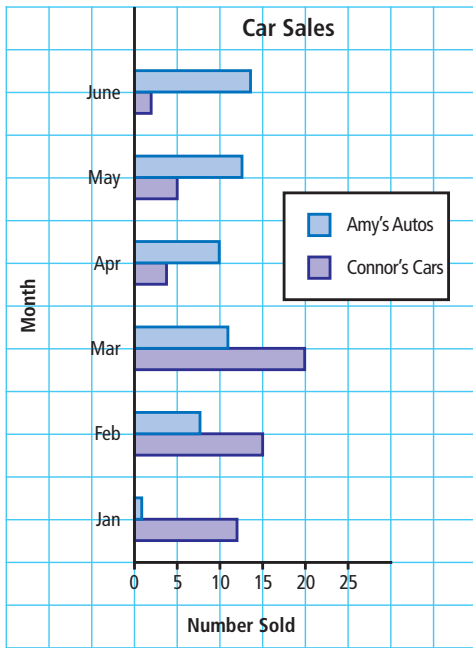
Graph A



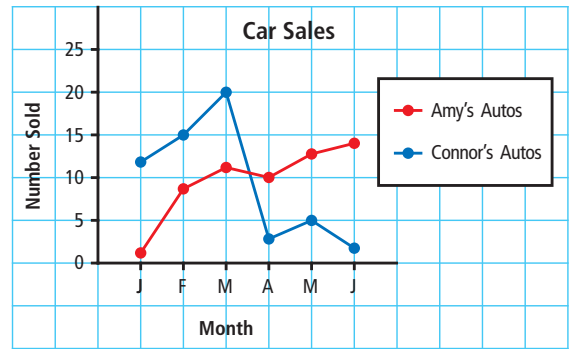
Graph B

- Describe how each of the graphs is misleading.
 - 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.
 - 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 |



Graph A



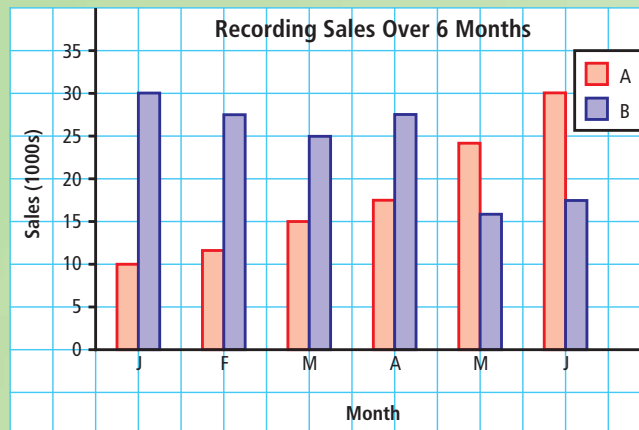
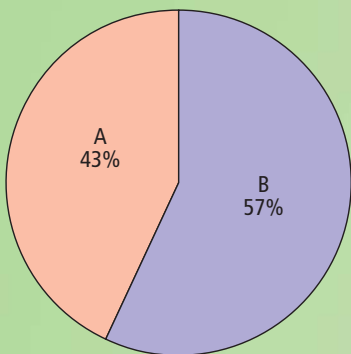
Graph B

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



- What information does each graph provide? Explain.
- The organizers know they must attract a large crowd to cover expenses. Which performer would you select? Justify your answer.