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

Materials

- grid paper (optional)
- ruler
- coloured pencil

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?
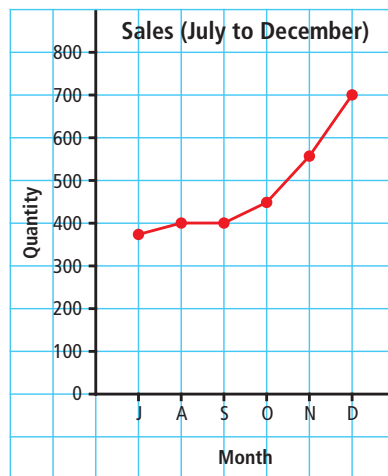
Literacy Link

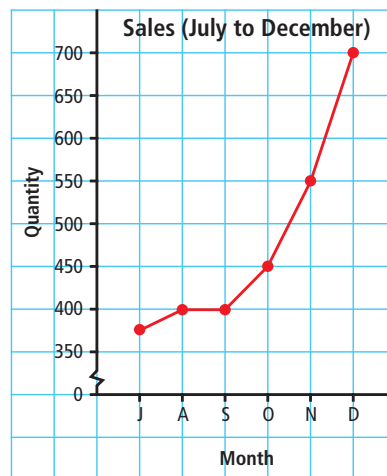*Distort* means to change the appearance or twist the meaning of something in a way that is misleading.

Explore the Math

What are some ways to misrepresent data?

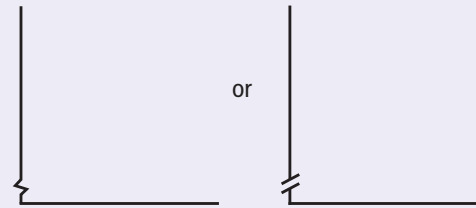These two graphs display the same data in different ways.

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.
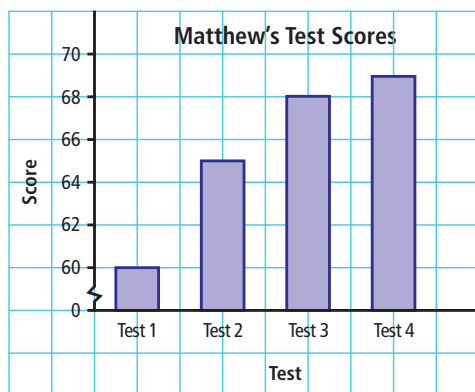
Reflect on Your Findings

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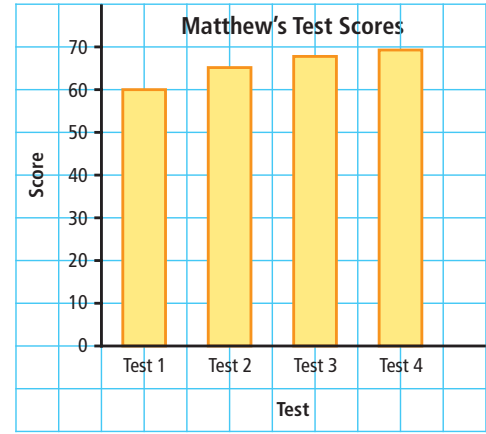
d) Matthew's test scores have improved a small amount over the last four tests. The greatest increase was from Test 1 to Test 2.
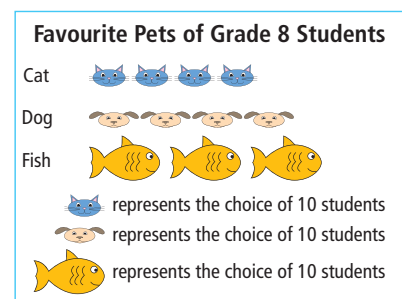
Show You Know

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
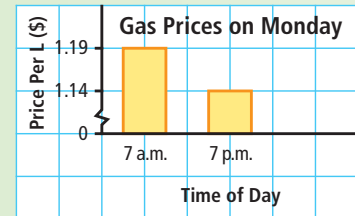
Example 2: Distorting the Visuals

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.

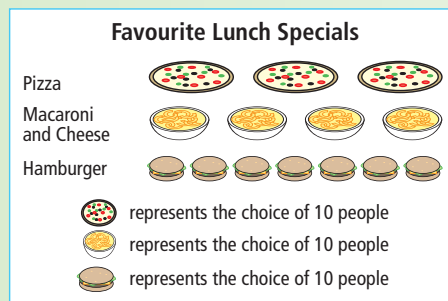**c)** How should the pictograph be redrawn to represent the data more accurately?

Favourite Pets of Grade 8 Students

Cat

Dog

Fish

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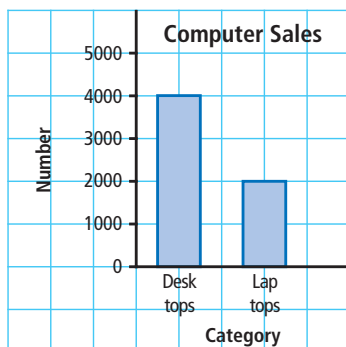represents the choice of 10 students

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.
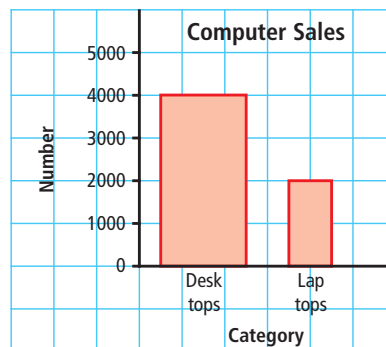
Show You Know

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* × *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.
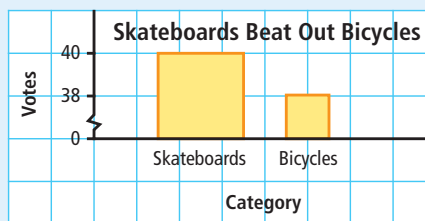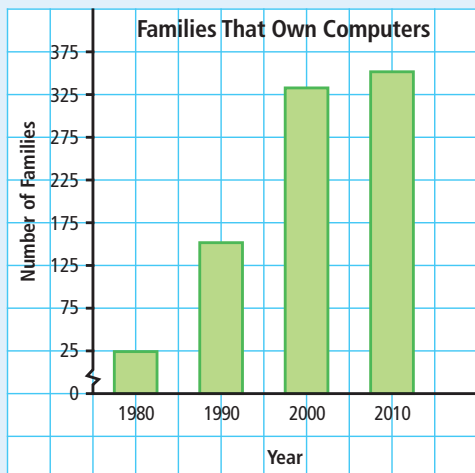
Show You Know

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.

Annual Cost of Taking Care of a Bike

(graph with Cost ($) axis: 0, 20, 40; Year axis: 1997, 2007)
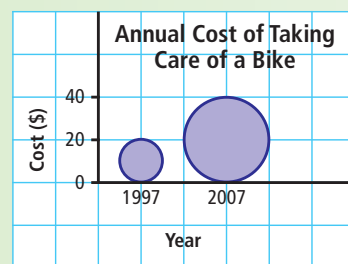
Key Ideas

- 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

    Families That Own Computers

    (graph with Number of Families axis: 0, 25, 75, 125, 175, 225, 275, 325, 375; Year axis: 1980, 1990, 2000, 2010)

  - distorting the information by using visuals of different sizes

    Skateboards Beat Out Bicycles

    (graph with Votes axis: 0, 38, 40; Category axis: Skateboards, Bicycles)

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

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

   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?

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.
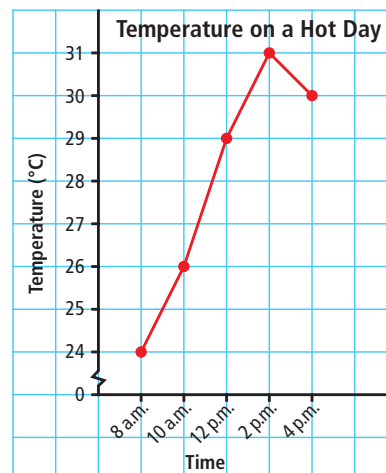
Favourite Ice Cream
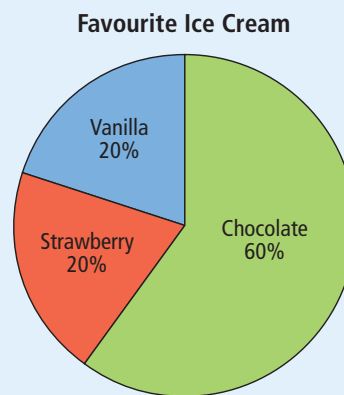

Check Your Understanding

Practise

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.
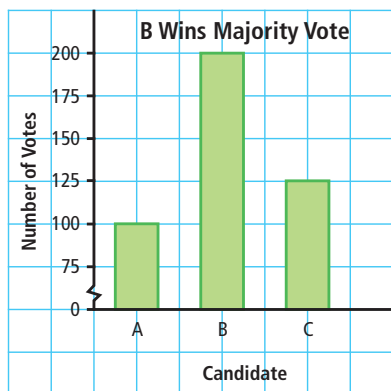
a) How many times taller does the bar for B appear than the bar for A?

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%.

For help with #6 and #7, refer to Example 2 on pages 20–21.
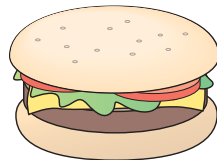
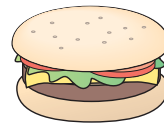**6. a)** From the pictograph, which fruit seems to sell the best? Explain.
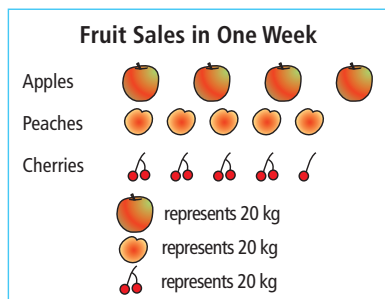
b) Does it seem that more cherries were sold or more peaches? Explain.

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.

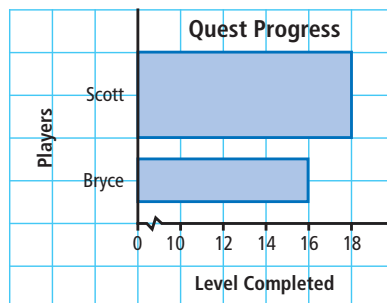Move over Bonzo, The Big Cheese is in town!

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?

**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.

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.

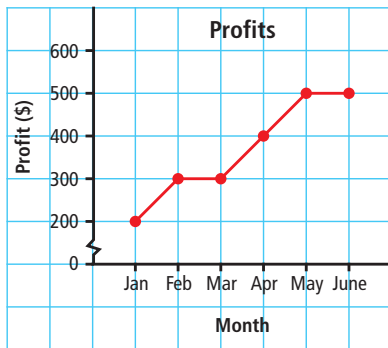**9.** The two graphs show the number of health bars sold by two students.
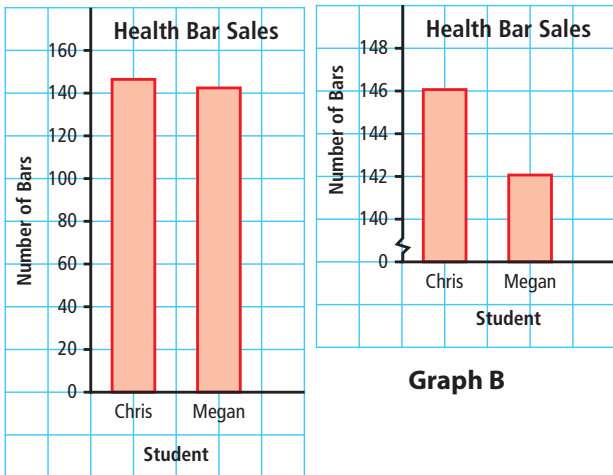
Graph A

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.
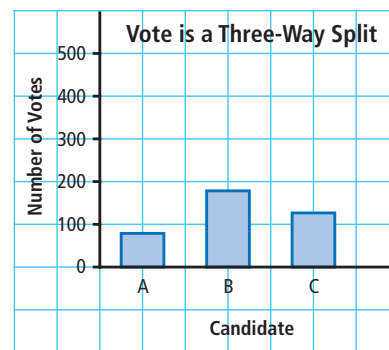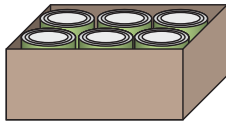

b) Based on the graph, what can you conclude about the outcome of the voting?

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.

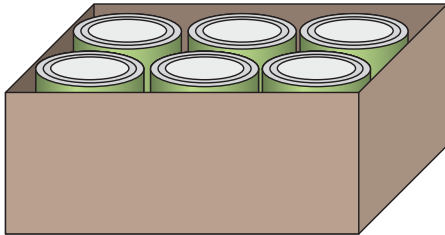**Graph A**   **Graph B**
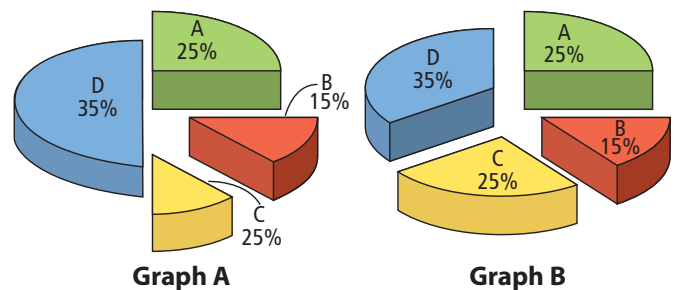
b) Identify the errors in Graph A.

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.
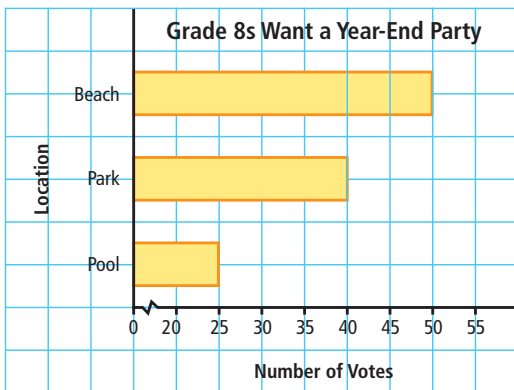

Ms. Chan's class

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

Dairy Tasty

$4.5 million $4.3 million

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

b) How is the graph misleading?

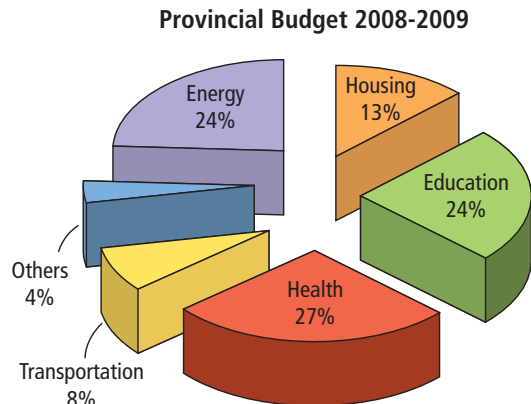**17.** A small town recorded crime statistics over the last six years.

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?
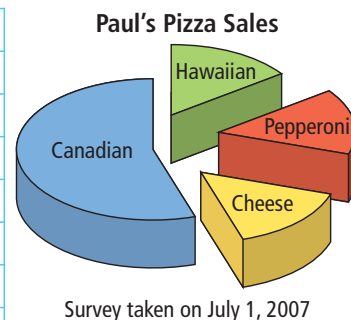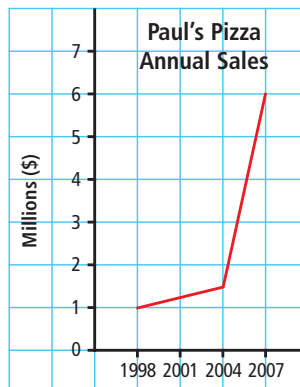
Provincial Budget 2008-2009

- 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 ($)

1998 2001 2004 2007

Paul's Pizza Sales

- Canadian
- Hawaiian
- Pepperoni
- 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?

WWW Web Link

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