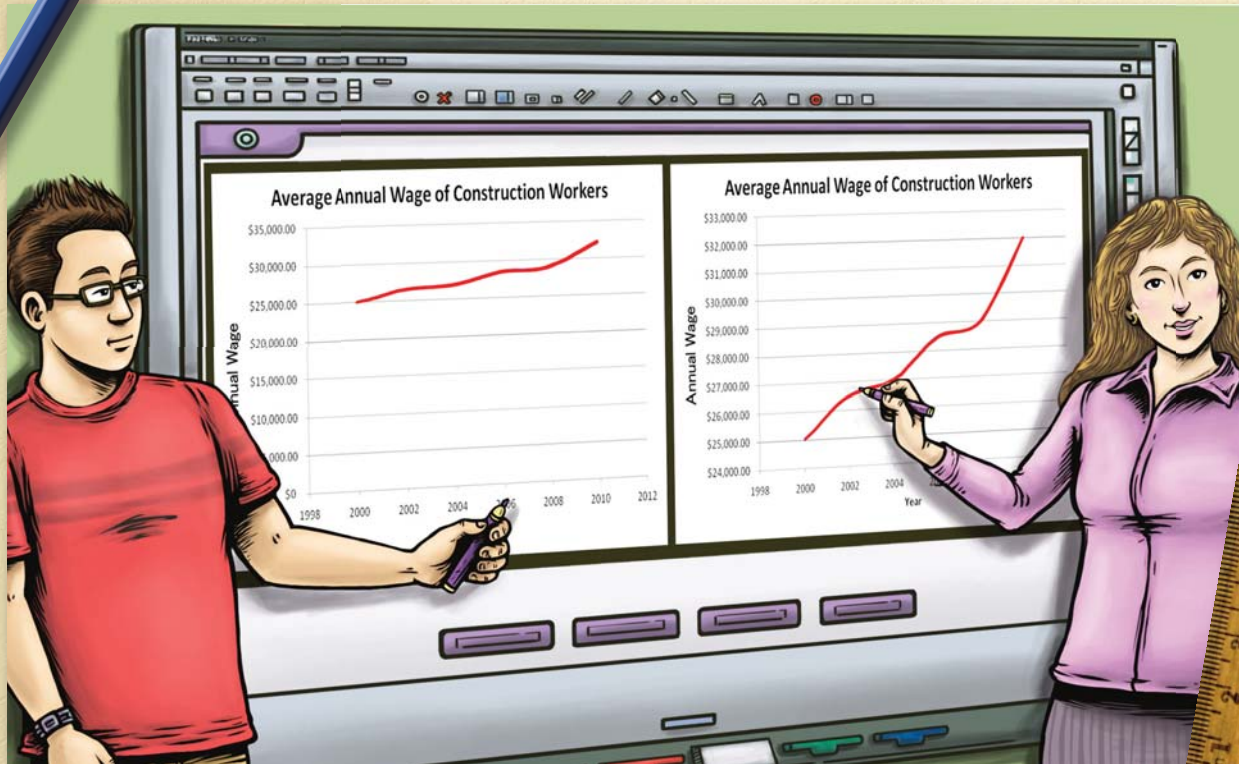# Math at Work 11: Chapter 4

February 20, 2012, 16:09

Interpreting Graphs

Chuck's graph shows that there has been a small, steady increase in the average annual wage of construction workers over a 10-year period. Melissa's graph shows that there has been a large, steady increase in average annual wages.

1. Do both graphs represent the same data?

2. Why do they look different?

3. Why might Chuck want his graph to give the impression of a small increase?

4. Why might Melissa want her graph to give a different impression?

Key Words

discrete
histogram
continuous
trend
interpolate
extrapolate

Career Link

Jocelyn is a local union representative. Her job is to help get the best wages, working conditions, and benefits for the members she represents. To stay organized, she must research information and represent it in tables and in graphs.
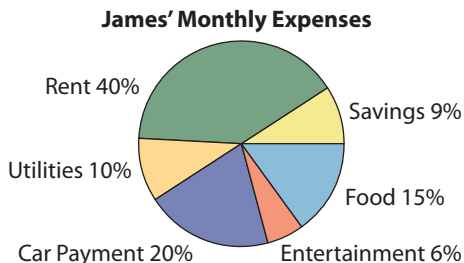
Percent

1. Show each fraction as a percent. Round your answer to the nearest whole percent.

a) $\frac{7}{8}$ **b)** $\frac{9}{10}$ **c)** $\frac{24}{25}$

d) $\frac{7}{16}$ **e)** $\frac{5}{6}$ **f)** $\frac{17}{20}$

2. Estimate.

a) 90% of 110 **b)** 15% of 255

c) 55% of 427 **d)** 2% of 68

e) 68% of 96 **f)** 42% of 75

3. Calculate each value in #2. How close were your estimates?

Circle Graphs

4. James organizes his monthly income of $2500 in a circle graph.

James' Monthly Expenses

- Rent 40%
- Savings 9%
- Utilities 10%
- Food 15%
- Car Payment 20%
- Entertainment 6%

a) What percent of his monthly income does James spend on rent?

b) How much does he spend on rent?

c) How much does he spend on food?

d) James decides to save 5% of his monthly budget and increase his entertainment budget by 4%. What is the new amount James spends on entertainment?

5. A survey asked students about the activities they do in their free time. Thirty students responded.

Activity	# of Students
Playing sports	3
Watching TV	6
Playing video games	6
Surfing the Internet	10
Reading	1
Other	4

a) What percent of the 30 students chose each activity?

b) Represent the data using a circle graph.

Bar Graphs

6. The bar graph below shows the hourly wages of five jobs.

Hourly Wages of Different Jobs
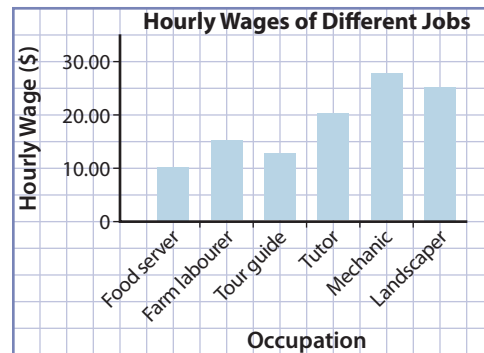
a) List the occupations in ascending order by hourly pay.

b) The hourly wage of a food server is half the wage of which occupation?

**c)** The hourly wage of a landscaper is twice the wage of which occupation?

7. The data below show the average rent for a two-bedroom apartment in various cities.

City	Monthly Rent ($)
Edmonton, AB	1200
Fredericton, NB	800
Montreal, QC	1300
St. John's, NL	700
Vancouver, BC	1800
Winnipeg, MB	900

Draw a bar graph to represent the data.

Line Graphs

8. The double line graph shows new car sales in Newfoundland and Labrador from 2006 to 2010.
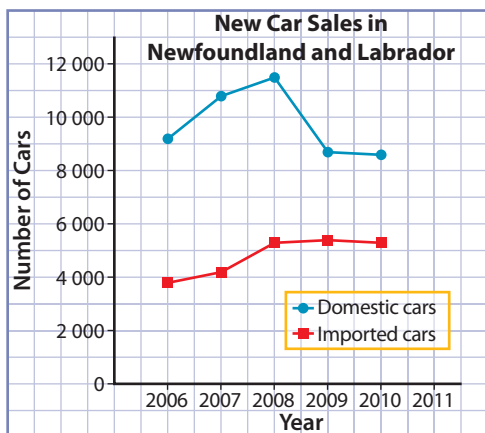
a) In what year were the most domestic cars sold?

b) In 2010, what type of car sold the most?

c) Overall, how do the sales of domestic cars compare to the sales of imported cars?

9. The data below show the gross sales of Java John's Coffee Shop for 2007–2012.

Year	Gross Sales ($)
2007	38 000
2008	29 500
2009	40 000
2010	35 000
2011	22 500
2012	46 000

Draw a line graph to represent the data in the table.

Puzzler

a) Complete the equations.

$2 \ \blacksquare \ 5 = 7$

$2 \ \blacksquare \ 5 = 10$

$3 \ \blacksquare \ 3 = 6$

$6 \ \blacksquare \ 6 = 12$

$1 \ \blacksquare \ 6 \ \blacksquare \ 12 = 19$

b) Find the pattern in the columns of the tables. Write the patterns. Then, copy and complete the tables.

1	4	7	6	12	8	
3	3	4	2	4		7
4	7	11			16	20
3	12	28				

1	4	6	8	12		
2	8	12			18	
4	16	24				20
7	28	42				

4.1

Choosing a Graph

- creating graphs
- choosing possible graphs to represent a given data set
- explaining the advantages and disadvantages of each type of graph
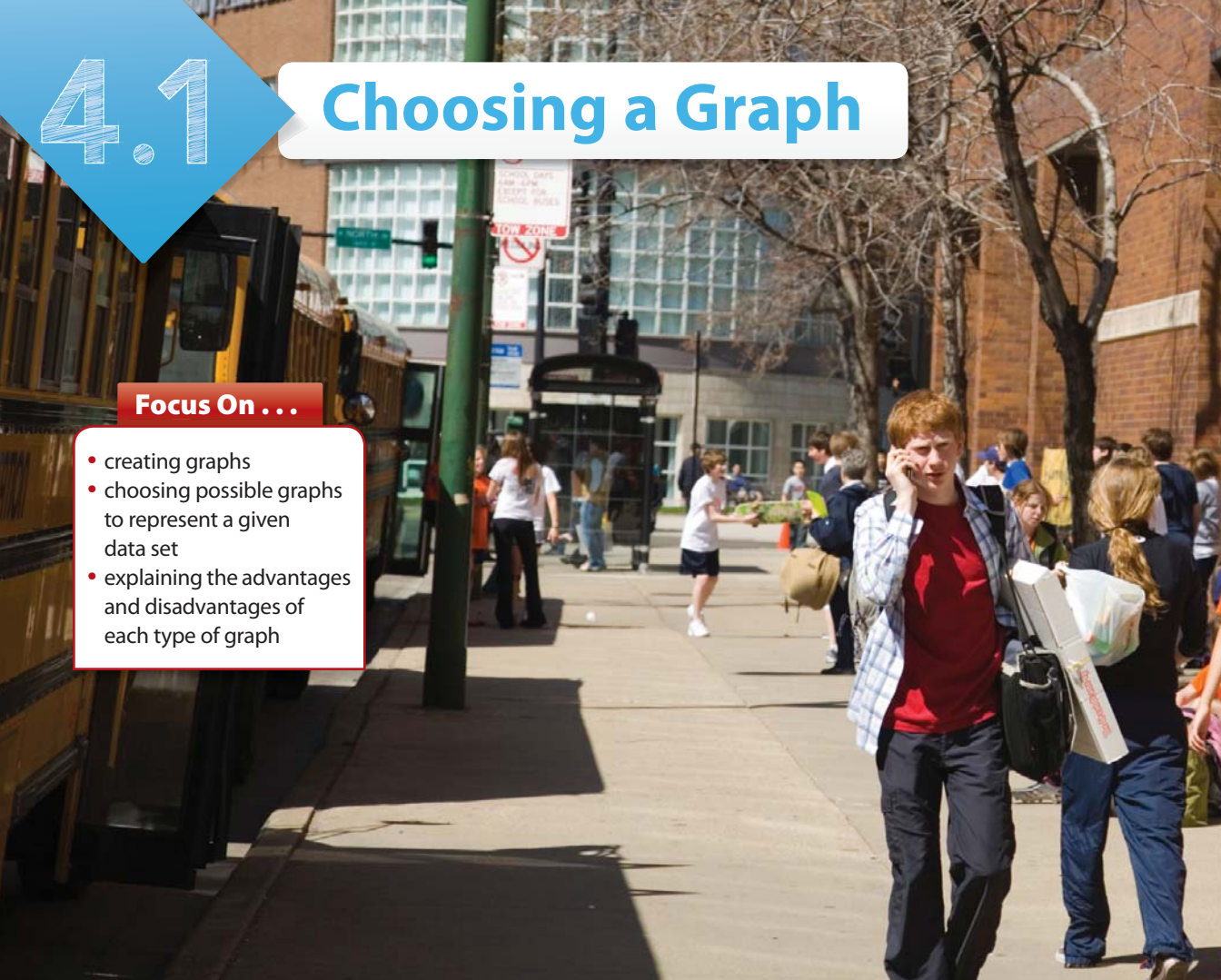
Students travel different distances to get to school. Organizing this information lets schools know how many parking spaces and bicycle racks to provide. Cities can also use this information to plan bus routes and other forms of transportation.

Materials

- grid paper
- ruler
- graphing technology

Explore Graphs for Specific Situations

1. Survey the students in your class with this question: How far do you travel from home to school?

2. Record the data in a table similar to the one below.

Distance Travelled (km)	Tally	Frequency
0.0–2.0		
2.1–4.0		
4.1–6.0		
6.1–8.0		
8.1–10.0		
10.1–12.0		

3. Choose a type of graph to represent the data you collected. Create the graph.

   a) What type of graph did you choose?

   b) Why did you choose this type of graph?

4. Compare your graph to the graphs drawn by your classmates.

   a) What types of graphs were used?

   b) Why were different types of graphs chosen?

   c) Do the data appear to be the same on different types of graphs? Explain.

5. Reflect Copy the chart below into your notebook. In the chart, list two advantages and two disadvantages of the type of graph you chose. Then, list two advantages and two disadvantages of another type of graph used in the class.

Type of Graph	Advantages	Disadvantages

6. Extend Your Understanding

   a) Graph the data using a type of graph different from the graphs in your chart.

   b) What are some advantages and disadvantages to using this type of graph?

On the Job 1

Represent Data Using Various Graphs

Martha works as a fundraising coordinator for a charity that distributes books and toys to children's hospitals. For her year-end presentation, she wants to represent the charity's different sources of funding on a graph.

Source	Total Amount ($)
Individual donations	39 600
Business donations	130 300
Annual fundraising dinner	28 330
Government grants	70 820
Other	10 450

a) Represent the data using two different types of graphs.

b) Give at least one advantage and one disadvantage of each type of graph.

c) Which category is the charity's largest source of funds? smallest source of funds?

d) Which graph do you think people watching Martha's presentation would use to answer part c)? Why?

Solution

a) *Method 1: Create a Circle Graph using Microsoft® Excel*

- Enter the data in Martha's table into a spreadsheet

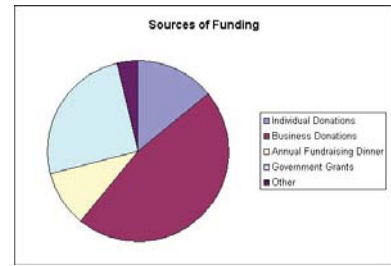|	A	B
1	Source of Funding	Total Amount ($)
2	Individual Donations	39600
3	Business Donations	130300
4	Annual Fundraising Dinner	28330
5	Government Grants	70820
6	Other	10450

- Highlight the data.

- Go to **Insert**, and then select **Chart**

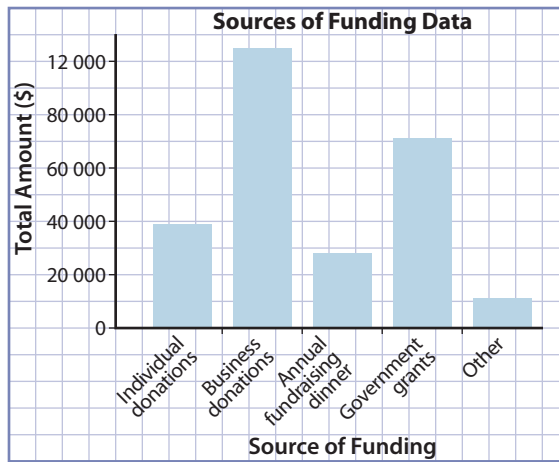- Select **Pie Chart**, and then select **Next**. Click on **Next** again.
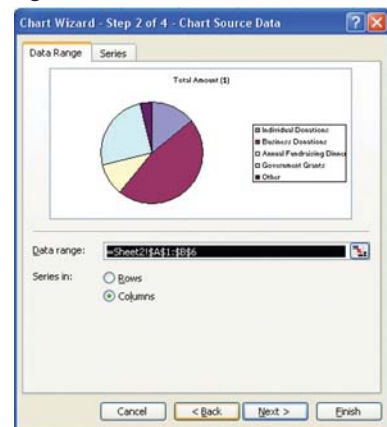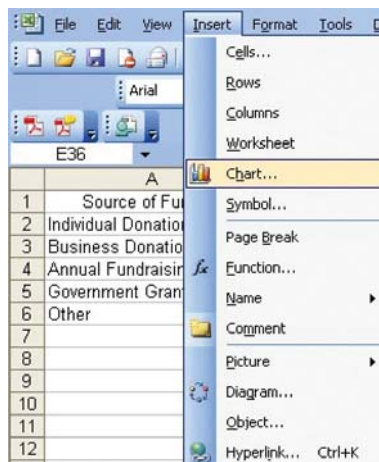
- Enter a title for the graph, and then select **Finish**.

Method 2: Create a Bar Graph by Hand

- Scale the vertical axis by units of $20 000.
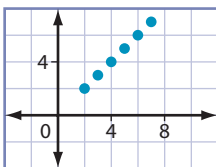- Scale the horizontal axis by type of source.

b) Use a plus/minus chart.

Type of Graph	+	−
Circle	• Represents **discrete** data • Can be used to compare amounts • Shows each amount as a percent of the total	• Can be difficult to draw accurately • Can be time-consuming to create by hand
Bar	• Used for discrete data that have categories • Shows the dollar amount from each source of funding	• Can be difficult to read accurately because some bars do not end on a grid line

c) Largest source of funding: Business donations
Smallest source of funding: Annual fundraising dinner

d)
I like to use a circle graph to show parts of a whole. I can easily compare the size of each sector.

discrete

- data values that are distinct and can be counted
- data values that fall into categories

Your Turn

Luca collected the following data about the number of people employed in various types of jobs in PEI.

a) What type of graph would be the best to use to represent these data?

b) Why did you choose that type of graph?

c) Create your chosen type of graph to represent the data.

| Type of Job	# of People
Construction	4 300
Education	5 000
Food and hospitality	5 100
Health care	8 000
Manufacturing	6 600
Public administration	6 900
Trades	10 900

Check Your Understanding

Try It

1. Conrad recorded the weather conditions each day for the month of April.

   a) Represent the data using a bar graph.

   b) Represent the data using a circle graph.

Type of Weather	Number of Days
Cloudy	6
Sunny	9
Rain	10
Snow	2
Combination	3

2. Kara is a wildlife officer near the George River in Labrador. She helps researchers study the population of woodland caribou in the region. The data are displayed in two graphs.

George River Woodland Caribou Population
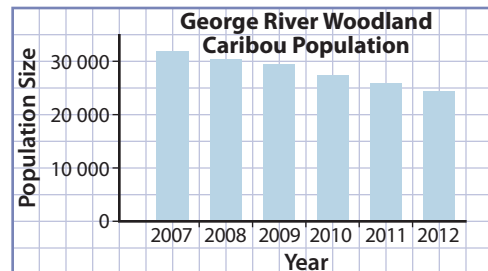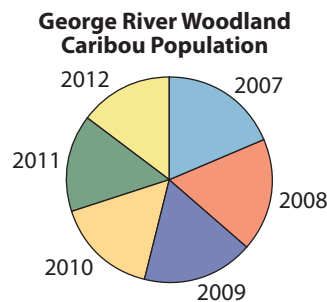
Which graph is most appropriate to represent the data? Why?

3. Radio staff track the number of weekly listeners of their online radio station. What type of graph would best represent the percent of listeners that visit the site each week? Create the graph.

| Week	Number of Visitors
1	7502
2	6205
3	4150
4	6974
5	7810

Apply It

4. A disc jockey surveyed 50 students to determine what type of music to play most often during a school dance.

Music Type	# of Students
Top 40	13
Hip-hop	12
Rap	9
Country	3
Techno	4
Rock	9

a) What type of graph would best show that half the students would like top 40 or hip-hop music to be played most often at the dance?

b) Represent the survey results in a graph.

c) Does your graph allow you to easily determine how many students voted for each type of music? Explain why or why not.

d) Describe one advantage and one disadvantage of your graph.

5. Peter manages an online movie rental service. He keeps track of the categories of movies that were rented over one year.

Movie Rentals

Movie Rentals (3750 rentals)
Action 20%, Mystery 13%, Drama 10%, Comedy 34%, Romance 23%
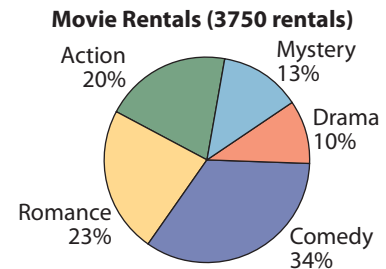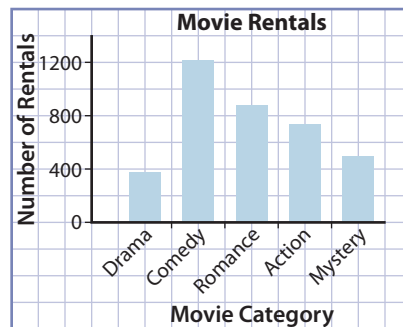
a) Estimate how many times more popular comedies are than dramas.

b) Which graph did you use to answer part a)? Why?

c) Which two movie categories were rented about the same number of times?

d) Which graph did you use to answer part c)? Why?

e) Each year, Peter uses $15 000 to purchase new movies. How should Peter decide what categories of movies to buy?

f) How much of his $15 000 should Peter spend on each category?

Create and Interpret Histograms

The Canada Winter Games is a nationwide event held every two years to celebrate young Canadian athletes. Each province and territory sends a team of its best athletes to compete. Athletes on the Newfoundland and Labrador men's hockey team provided their age, height, and hometown for the Canada Winter Games web site. Deanne is responsible for creating the visuals on the web site.
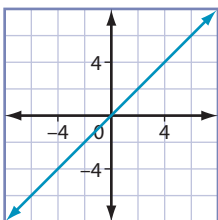
Jersey Number	Age (years)	Hometown	Height (cm)
01	16	St. John's, NL	183
02	15	Conception Bay South, NL	175
03	16	Wabush, NL	178
04	17	St. John's, NL	185
05	14	Kelligrews, NL	180
06	15	St. John's, NL	183
07	15	St. John's, NL	178
08	15	Conception Bay South, NL	175
09	14	Ferryland, NL	178
10	16	Ferryland, NL	182
11	14	Corner Brook, NL	177
12	16	Mount Pearl, NL	175
13	15	St. John's, NL	183
14	15	Baie Verte, NL	173
15	16	Conception Bay South, NL	174
20	16	St. John's, NL	182
31	14	Conception Bay South, NL	171
80	16	Hodges Cove, NL	185

a) Represent the height data using a **histogram**.

b) What observations can Deanne make from the histogram?

c) Why is a histogram a good choice for this type of data?

Solution

a) *Method 1: Create a Histogram by Hand*

Deanne notices that the data is **continuous** data. The shortest player on the team is 171 cm and the tallest is 185 cm. All the other players have heights somewhere in between these two measurements.

histogram

- type of bar graph
- shows the number of times data appear within a certain interval, such as the number of players between 170.5 and 173.5 cm in height
- uses vertical bars without any gaps between them

continuous

- data values on a graph that are connected

Deanne divides the heights of the players into intervals that span a range from 170.5 cm to 185.5 cm. Intervals of 3 cm are convenient for this data. She uses a frequency table to record how many players there are in each data interval.

| Height Data Range (cm)	Tally	Frequency
170.5–173.5	||	2
173.5–176.5	||||	4
176.5–179.5	||||	4
179.5–182.5	|||	3
182.5–185.5	||||	5

Deanne graphs the frequency of each interval on a histogram. In a histogram, the bars touch, because the data is continuous.
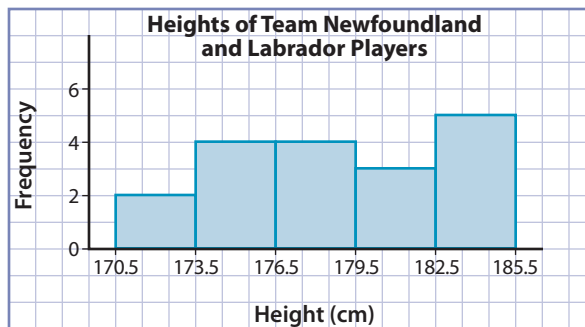
Method 2: Create a Histogram Using a TI-83 Plus™ Graphing Calculator

Using a TI-83™ Plus graphing calculator, Deanne creates a histogram.

- Turn on your calculator. Press [2nd] [=] 4 [Enter] to clear the list memory.
- Press [STAT] 1 to enter the list editor. In list L1, enter the heights of the hockey players.
- Press [2nd] [Y=] to enter the **STATPLOT** editor.
- On the second line, turn the plot **ON**. Select the third plot option, histogram.
- Set **XList** to L1 and **Freq** to 1. Press [WINDOW].
- Set **Xmin** to 170.5, **Xmax** to 186.5, **Xscl** to 3, **Ymin** to 0, **Ymax** to 6, **Yscl** to 1, and **Xres** to 1.
- Press [GRAPH].
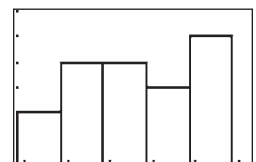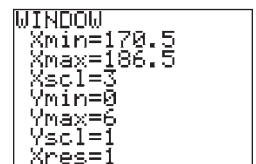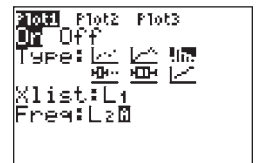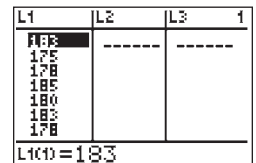
b) From the histogram, Deanne can see the frequency of each height interval. The majority of players on the team are shorter than 182.5 cm. The largest group of players (5) fall into the interval of 182.5–185.5 cm.

c) Continuous data that change over time are best shown on a line graph. Continuous data that have frequencies are best shown on a histogram.

Your Turn

Recreational cod fishing in Trinity Bay, NL, is Alan and Matthew's favourite summer pastime. To make sure there are enough cod for future generations, they release any cod they catch that is 55 cm or smaller. Over the three-week fishing season, Alan and Matthew measure the length of each fish they catch.

Fish Length (cm)
57
48
34
66
71
30
62
41
59
29
60
62

a) What would be an appropriate graph to represent the data? Explain your choice.

b) Graph the data using the type of graph you chose in part a).

c) How many fish did Alan and Matthew catch that were large enough to keep?

d) What observations can you make from their data?

Try It

1. Is the type of graph used to display the data in each scenario appropriate? Why or why not?

   a) Olivia tracks the height of a plant for four weeks. She represents the data using a line graph.

   b) Alan creates a histogram to represent the amount of money he earned in the last year at his job.

   c) Patrick records the heart rate of 50 people after they ran for five minutes. He represents the data using a histogram.

2. Students in Stuart's math class received the following marks out of 100 on the last test.

   71, 54, 64, 81, 77, 75, 63, 74, 54, 79, 83, 92, 83, 65, 37, 48, 36, 85, 88

   a) Copy and complete the table in your notebook.

Score Interval	Tally	Frequency
35.5–45.5		
45.5–55.5		
55.5–65.5		
65.5–75.5		
75.5–85.5		
85.5–95.5		

   b) Create a histogram to display the data.

   c) What score interval had the greatest frequency?

3. Elizabeth sells portraits to raise money for charity. She tracks her monthly sales for six months.

Month	Sales ($)
January	452
February	500
March	321
April	279
May	524
June	389

   a) What type of data are shown in the table?

   b) Represent the data using a line graph.

4. Morgan is looking for an automobile insurance policy. He researches annual insurance premiums from many companies for cars similar to the one he drives. Morgan receives the following quotes.

$705, $720, $711, $710, $735, $713, $714, $708, $728, $731, $713, $722

a) Represent the data using a histogram.

b) What is the range Morgan should expect to pay for his annual insurance premium? Why?

c) What other types of graphs could Morgan use to represent his data?

Apply It

5. Statistics Canada records data about people and events in Canada. The high school dropout rate for the country between 1990 and 2010 is represented in the graph.

Canadian High School Dropout Rates, 1990–2010
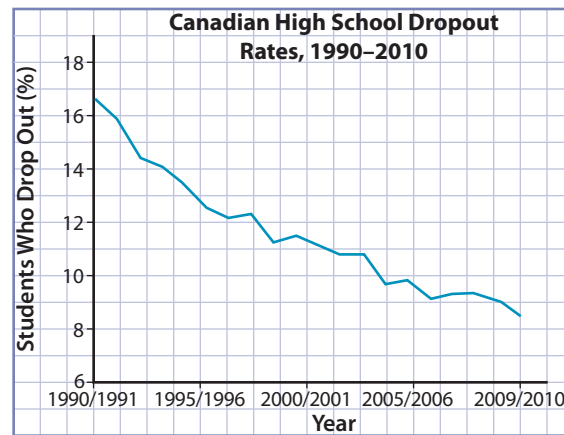
a) Do you think this is an appropriate type of graph to represent the data? Why or why not?

b) What was the dropout rate in the 2000–2001 school year?

c) About how much larger was the dropout rate in the 1990–1991 school year than the dropout rate in the 2009–2010 school year?

6. Madison works as an educational assistant. Her class is learning about temperature. The students record the temperature each day for 16 days.

Temperature (°C)	Tally	Frequency
18.5–20.5	||	
20.5–22.5	⊬⊬ ||||	
22.5–24.5	||||	
24.5–26.5	|	

a) Draw an appropriate graph to represent the data.

b) Explain why you chose the type of graph that you used in part a).

c) A student wants to know what percent of the days had a temperature higher than 22°C. How should Madison respond?

d) Would another type of graph be suitable to represent the data to answer the student's question? Why or why not?

7. The following table shows information about household yearly food budgets, by province, for three years.

Province	Household Average Yearly Food Budget		
	Year 1 ($)	Year 2 ($)	Year 3 ($)
Alberta	7491	7713	7778
British Columbia	7745	7938	7570
Manitoba	6518	6493	6520
New Brunswick	6602	6548	6691
Newfoundland and Labrador	6463	6740	6496
Nova Scotia	6640	6827	6682
Ontario	7383	7523	7284
Prince Edward Island	6629	6738	6720
Quebec	7321	7396	7215
Saskatchewan	6073	6301	6344

a) Create a graph that compares the household food budgets, by province, for year 2.

b) Create a different type of graph that shows the average household food budget for your province or territory for the three years.

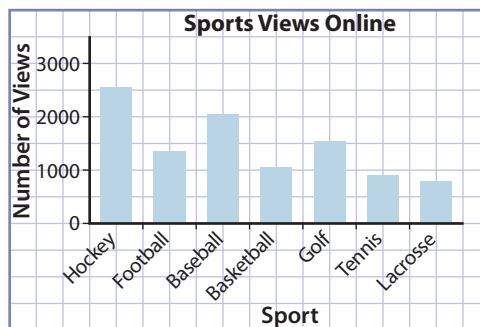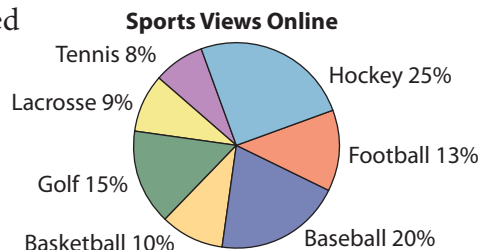**c)** Give an advantage of using each type of graph you made.

Work With It

1. The following table shows the percent of volunteers that are teenagers in different types of organizations.

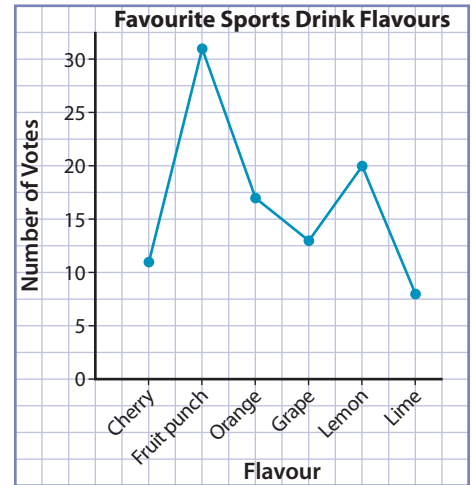| Organization Type	% of Volunteers
Education and research	28
Environment	3
Health	7
Housing	6
Social services	15
Sports	15
Religion	11

a) Represent the data using an appropriate type of graph.

b) Give one advantage and one disadvantage of the type of graph you chose.

c) If 440 students in a school are volunteers, how many do you predict volunteer for sports organizations?

2. A sports news web site tracked how many times each sport was viewed in one month. The data are represented in two graphs.

Sports Views Online

Tennis 8%
Lacrosse 9%
Golf 15%
Basketball 10%
Hockey 25%
Football 13%
Baseball 20%

a) The web site manager wants to know how many more times hockey was viewed than baseball. Which graph should she use to find this information?

Sports Views Online

(bar graph: Number of Views vs Sport — Hockey, Football, Baseball, Basketball, Golf, Tennis, Lacrosse)

b) It costs time and money to follow sports and post news on the web site. It may not be in the best interest of the web site to continue to post information about unpopular sports. The manager wants to know the number of views for lacrosse each day for the month. Can she use these graphs to determine the information? Why or why not?

3. Sean is a marketing representative for a beverage company. He surveys 100 people on their favourite flavour of sports drink. He uses this graph to represent the survey data.

Favourite Sports Drink Flavours

Number of Votes (y-axis) vs Flavour (x-axis): Cherry, Fruit punch, Orange, Grape, Lemon, Lime

a) Are the survey data continuous or discrete? How do you know?

b) Is a line graph the best choice to represent Sean's data? If not, represent the data using a more appropriate type of graph.


Discuss It

4. Robert is the manager of the movie theatre in Mount Pearl, NL. Determine what type of graph would be best to use to display each set of data. Explain your choice.

a) Robert wants to determine if he needs to hire more ticket collectors. He finds out the daily attendance at the theatre for the past month.

b) Robert wants to determine the most popular type of snack sold at the concession stand. He will make sure that he has more of the most popular snack to sell.

c) Robert wants to make sure he is correctly budgeting for staff, rent, and other expenses. He calculates his total profit each day for three months.
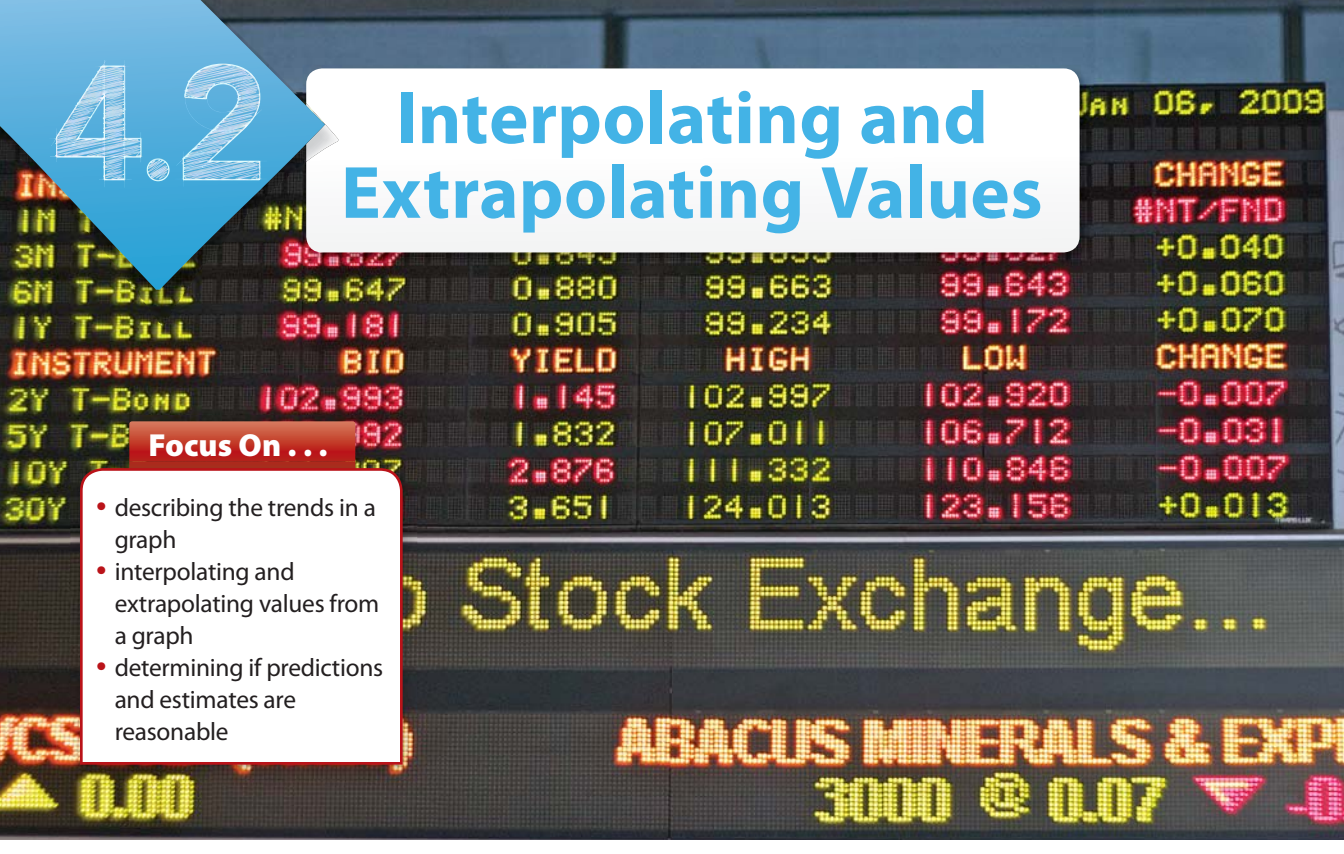
5. The graph is partially completed.

Graph with values 0, 4, 8, 12 on y-axis and 1 p.m., 2 p.m., 3 p.m., 4 p.m. on x-axis
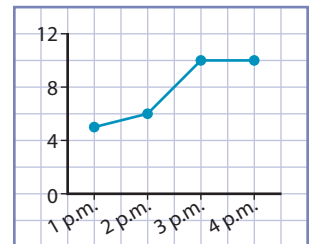
a) Describe a scenario to represent the data on the graph. Then, complete the graph in your notebook.

b) What other types of graphs could you use to display the data?

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

JAN 06, 2009

Focus On . . .

- describing the trends in a graph
- interpolating and extrapolating values from a graph
- determining if predictions and estimates are reasonable

Stock exchanges allow people to buy and sell stocks. A stock index allows investors to track a particular sector of the stock market, such as precious metals or large industrial companies. Changes in the Consumer Price Index can affect the price of stocks, and vice versa.
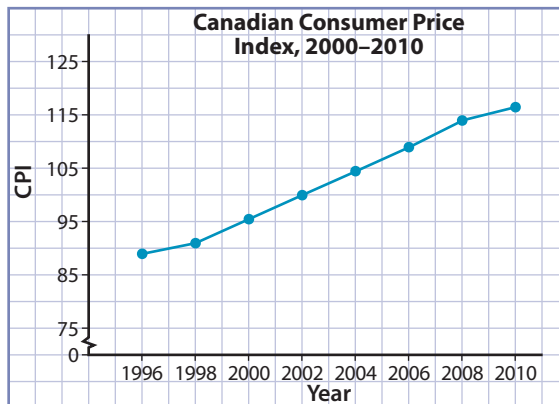
### Materials
- ruler

Explore the Trends in a Set of Data

The Canadian Consumer Price Index (CPI) measures the changes in the prices of consumer goods, such as food, shelter, and transportation, over time.

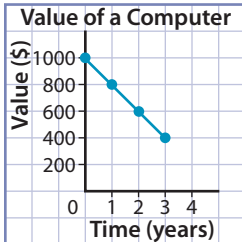| Year	Annual Average CPI
2010	116.5
2008	114.1
2006	109.1
2004	104.7
2002	100.0
2000	95.4
1998	91.3
1996	88.9

Canadian Consumer Price Index, 2000–2010

trend

- the general direction in which values in a data set tend to move
- trends are either upward or downward
- upward (or positive) trend:
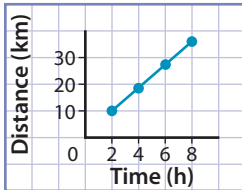
- downward (or negative) trend:

Value of a Computer

F.Y.I.

The CPI was developed in the early 1900s and used the prices of 29 items. Now, the CPI uses the prices of 600 items.

Web Link

You can look up the Canadian CPI on the Internet. Go to www.mcgrawhill.ca/school/learningcentres and follow the links.

1. Look at the data in both the table and the graph. What **trend**(s) do you see as you move from 1996 to 2010?

2. **a)** Use a ruler or your finger to extend the line of the graph to predict the CPI for 2012 and 2016.

   b) Predict the CPI for 1990.

3. Locate the position on the horizontal axis that represents the year 2003. Using a ruler or your finger, extend up from that position until you reach the line of the graph. Then, move horizontally to the vertical axis. Predict what you think the 2003 CPI might have been.

4. The CPI for the following years are not listed. Estimate what you think they might have been.

   a) 2007

   b) 1997

5. **Reflect** Why is the graph that represents the CPI not a straight line?

6. **Extend Your Understanding**

   a) Research on the Internet or in books to find the CPI for 1997, 2003, and 2007.

   b) How close to the real CPI values were your predictions?

   c) Do you think that the trend in this graph will continue? Why or why not?

On the Job 1

Interpolate and Extrapolate Values on a Graph

Charlottetown Horticulture Centre and Nursery grows and sells plants, trees, and flowers. Lynne works as a grower there. For the winter holidays, Lynne is responsible for growing the amaryllis plants for a special display. Three weeks before the busy holiday season, she tracks the growth of one of the plants.

Date	Height (cm)
Nov 15	6
Nov 18	23
Nov 19	27
Nov 22	37
Nov 23	39
Nov 25	45
Dec 1	52
Dec 3	58
Dec 4	60
Dec 6	67
Dec 7	70

a) To visualize the data easily, Lynne wants to represent them using a graph. Create a line graph of Lynne's data.

b) One of the other growers at the greenhouse keeps similar records of his amaryllis plants. He wants to know how tall Lynne's plant was on November 28 and December 5. **Interpolate** to estimate the plant's height on November 28 and December 5.

c) To determine which plants to place in the display, the nursery supervisor wants to know how tall the plant may be on December 13 and December 25. **Extrapolate** to predict the plant's height on December 13 and December 25.

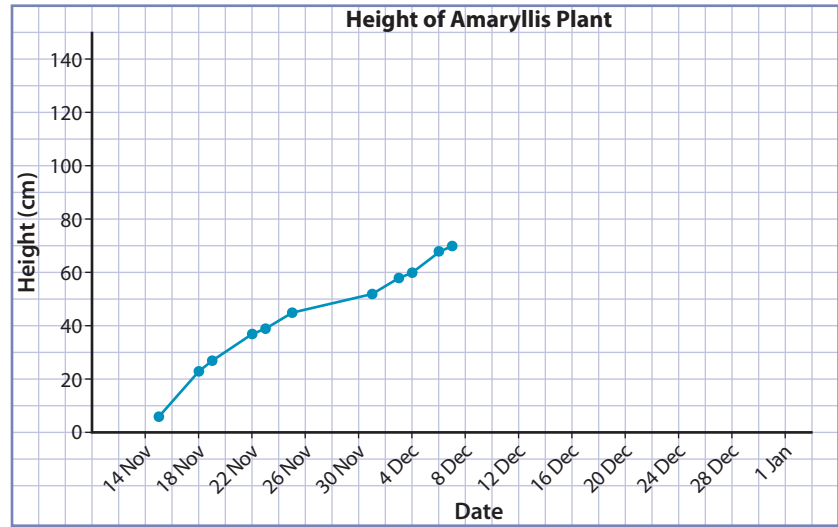**d)** Explain why the height you determined for December 25 may not be accurate.

interpolate
• estimate a value that falls within a known range or graph of values

extrapolate
• estimate a value that falls outside a known range or graph of values
• for example, if the trend continues, what will the next values on the graph likely be?

Solution

a) Lynne creates a line graph of the plant's growth.

b) Lynne did not measure her plant's height on November 28 or December 5. She needs to interpolate between her recorded values to estimate what the height likely was on those two dates.

To interpolate, Lynne
- locates the position on the horizontal axis that represents November 28
- extends up from that position until she reaches the line of the graph
- moves horizontally to the vertical axis
- reads the height from the axis

The height of the plant on November 28 was likely about 50 cm.

Lynne follows the same procedure to estimate the height of the plant on December 5.

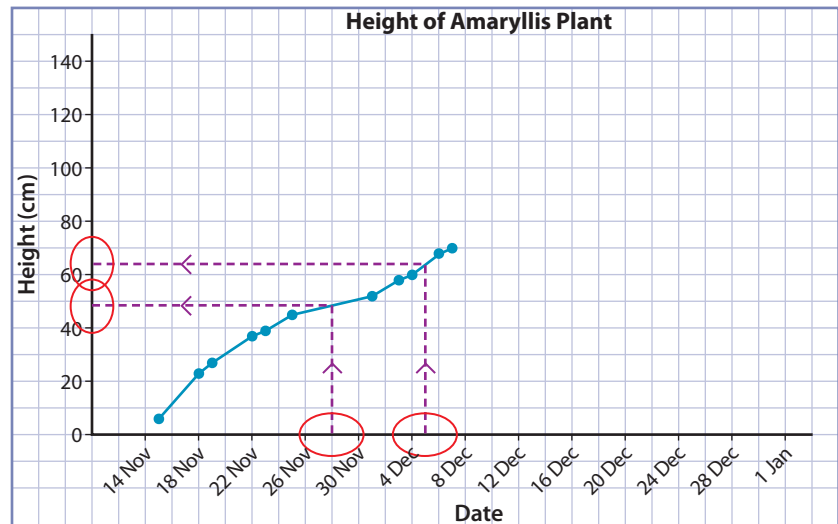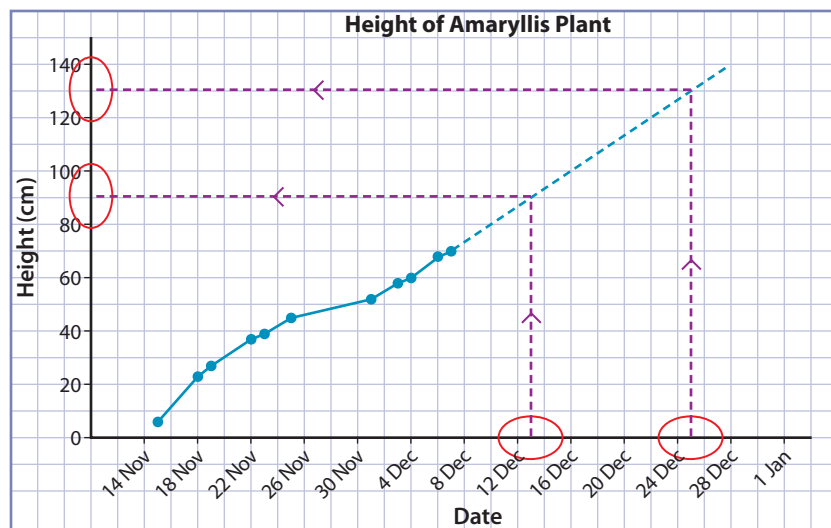The height of the plant on December 5 was likely about 64 cm.

<div>

Strategy

Develop a Strategy

Extrapolated values are estimates. How could you use the horizontal and vertical axes to come up with reasonably close estimates for the given dates?
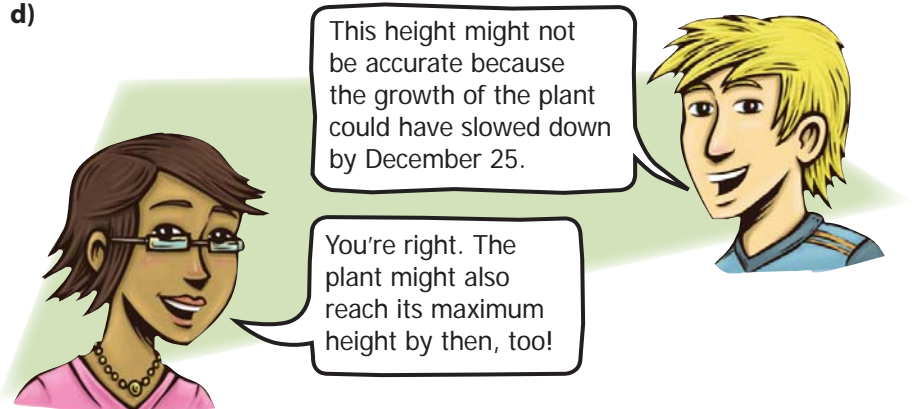
</div>

c) Lynne cannot have measurements for future dates. She must extrapolate to predict the plant's height on December 13 and on December 25. She

- locates December 13 on the graph
- extends up from that position until she reaches the extended line of the graph
- moves horizontally to the vertical axis
- reads the height from the axis

The height of the plant on December 13 will likely be about 90 cm.

Lynne follows the same procedure to predict the likely height of the plant on December 25.

The height of the plant on December 25 will likely be about 130 cm.

d)

This height might not be accurate because the growth of the plant could have slowed down by December 25.

You're right. The plant might also reach its maximum height by then, too!

Your Turn

Cory plays baseball frequently. His coach records the speed of each of his outfield throws and the distance the ball travels.

Speed (km/h)	Distance (m)
70	39
72	40
75	44
80	49
83	54
85	57

a) Represent the data using an appropriate type of graph.

b) Extrapolate to predict how far the ball would likely travel if Cory threw at a speed of 87 km/h.

c) Interpolate to determine how far the ball might travel if Cory threw at a speed of 77 km/h.

**d)** What might affect your answers to parts b) and c)?

Try It

1. Travis works as a catering manager for a local golf and country club. He has gathered data on how many kilograms of roasted meat are needed for catered dinners of certain sizes, which he represents using a line graph.

Roasted Meat Needed for Catering

Amount of Roasted Meat (kg) vs Number of People
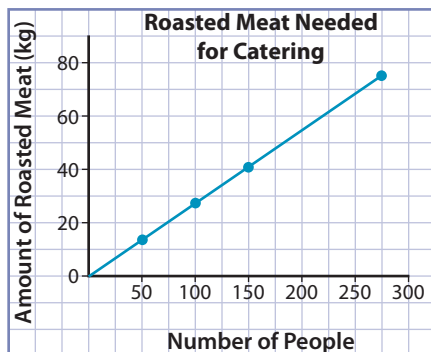
Determine approximately how much meat is needed for each size of dinner.

a) for 40 people

b) for 175 people

c) for 225 people

d) for 241 people

2. Danny owns a small business that runs whale-watching tours off Conception Bay. The graph shows the round-trip distance of each tour, and the length of time it takes to complete it.

Distance-Time Graph for Tour Boat

Distance (km) vs Time (h)
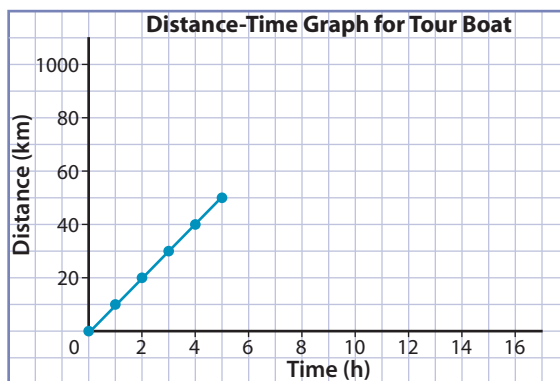
a) Approximately how long would a 20-km tour take?

b) Approximately how long would a 45-km tour take?

c) A customer wants to charter Danny's boat for a 65-km tour. Approximately how long will the tour take?

d) If a tour takes 8 hours to complete, approximately what distance did the boat travel?

Apply It

3. The Torngat Mountain Climbers Club is planning a charity mountain climb. Air gets colder as altitude increases. To help climbers pack for the climb, the club provides them with a graph of air temperature at different altitudes.

Air Temperature at Different Altitudes
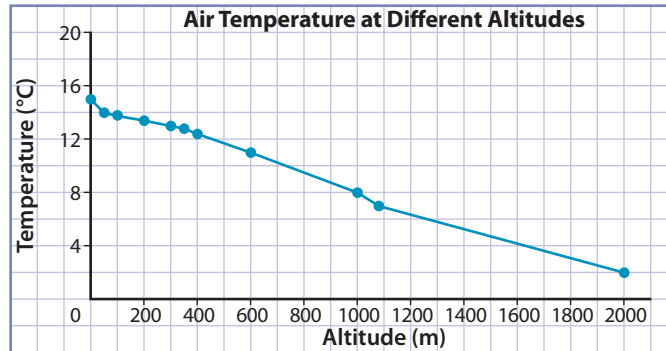
a) The average altitude of the Torngat Mountains is 350 m. The average temperature at sea level the week of the climb is 15 °C. What temperature should the climbers expect during the climb?

b) Margo is planning to participate in the charity climb. She plans to climb the highest peak of the mountains, which is 1652 m in altitude. On the day she leaves, it is 15 °C at sea level. What temperature should she expect at the peak of the mountain?

c) Should Margo plan to bring clothing for anything other than very cold temperatures? Explain why or why not.

4. The table below shows the minimum stopping distance of a car on a dry, level road for different speeds. This distance includes the reaction time the driver takes to apply the brakes.

Speed (km/h)	Stopping Distance (m)
20	10
40	18
60	32
80	55

a) Create a graph to represent the data.

b) Determine the likely stopping distance at speeds of 10 km/h and at 70 km/h.

c) A football field for the Canadian Football League is 101 m long. How fast would a car be travelling if it took the length of the football field to stop?

d) What factors do you think affect stopping distance?

On the Job 2

Describe Trends in Graphs

Chelsea is a data analyst for a provincial health centre. She gathers the following information about the life expectancy of 65-year-old males in Newfoundland and Labrador since 2000. These data will help doctors develop a healthy living campaign for seniors.

Year	Remaining Life Expectancy (years)
2000	15.0
2001	15.2
2002	15.4
2003	15.6
2004	15.8
2005	15.8
2006	16.0
2007	16.2
2008	16.5

a) Represent Chelsea's data with an appropriate graph.

b) What trend(s) do you notice in the graph?

c) Could this trend continue indefinitely? Why or why not?

Solution

a) Chelsea's information shows the changes to 65-year-old life expectancy over time. Continuous data like these are best shown in a line graph.

- Scale the vertical axis by units of 0.2 years.
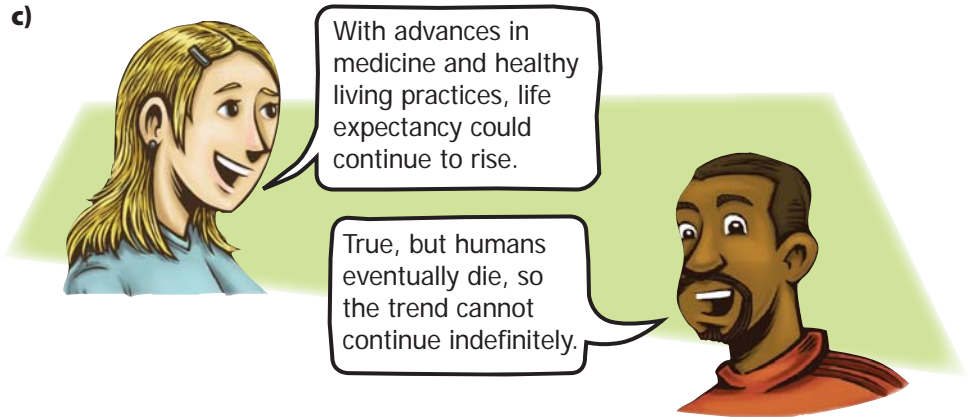- Scale the horizontal axis by units of 1 year.
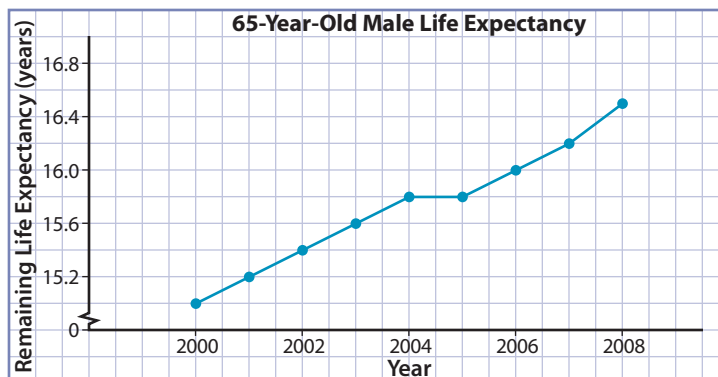
65-Year-Old Male Life Expectancy

b) The graph shows an upward trend. The life expectancy for 65-year-old males in Newfoundland and Labrador has been steadily increasing.

c)

With advances in medicine and healthy living practices, life expectancy could continue to rise.

True, but humans eventually die, so the trend cannot continue indefinitely.

Your Turn

The table shows the number of female athletes in the Summer Olympic Games for the years 1980 to 2008.

| Year	# of Female Athletes
1980	1115
1984	1566
1988	2194
1992	2704
1996	3512
2000	4069
2004	4329
2008	4746

a) Create a graph to represent the data appropriately.

b) What trend is evident from the graph?

c) Give a possible reason for this trend.

**d)** Do you think this trend can continue indefinitely? Why or why not?

Try It

1. Gina and Phillip are twins. The graph shows each twin's height, from the age of 2 to the age of 20.

Twins' Heights from 2 to 20 Years

(graph: Height (cm) vs Age (years), lines for Phillip and Gina)
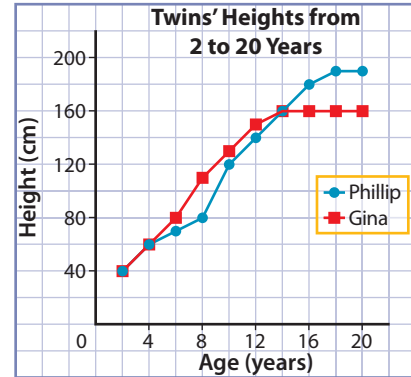
a) Describe the trend in Phillip's height.

b) Describe the trend in Gina's height.

c) Compare and contrast the trends. Explain possible reasons for the similarities and differences.

2. This graph shows temperatures for different times during one day in January.

Temperature on January 5

(graph: Temperature (°C) vs Time)
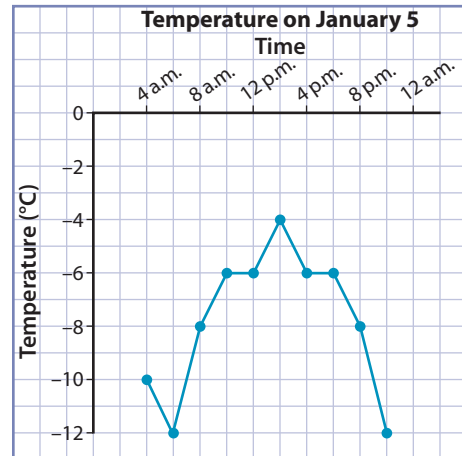
a) Describe the change in temperature throughout the day. Is this typical for a January day where you live? Explain.

b) Would a bar graph accurately represent the data? Why or why not?

3. The table shows the percent of students, by age, who have part-time jobs.

Age	Percent With Part-Time Jobs
14	5
15	8
16	19
17	38
18	45
19	70

a) Draw an appropriate graph to represent the data.

b) What trend is evident in the age of students and the percent of students who have part-time jobs?

c) Would another type of graph show the same trend? If so, what type? Explain.

Apply It

4. Helen works as a program coordinator for a local sports and recreation club. Each program receives funding for staff and equipment based on the number of people registered in the program. Helen is trying to determine if the swimming program needs increased funding over the next five years. She gathers information about the number of people registered in the swimming program for the last five years.

Year	# of Registrants
2006	420
2007	560
2008	623
2009	681
2010	690

a) With or without technology, create an appropriate graph to represent the data.

b) Describe the trend in the graph.

c) Would you recommend that the swimming program receive more funding over the next five years? Explain.

5. Here is an incomplete table of data.

Year	_____
1970	48
1980	55
1990	62
2000	65
2010	44

a) Graph the data using an appropriate graph.

b) Describe a scenario that could represent these data. Give the graph an appropriate title and labels to fit your scenario.
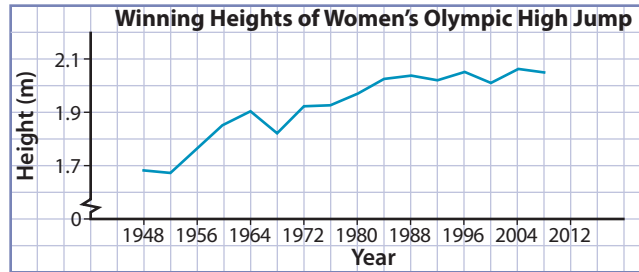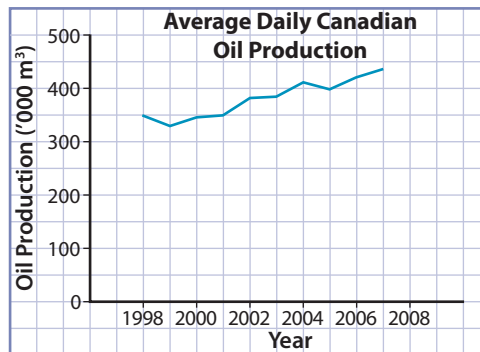
1. The graph below shows the winning heights for women's high jump for the Summer Olympic Games from 1948 to 2008.

Winning Heights of Women's Olympic High Jump

(line graph: Height (m) on vertical axis marked 0, 1.7, 1.9, 2.1; Year on horizontal axis marked 1948, 1956, 1964, 1972, 1980, 1988, 1996, 2004, 2012)

a) What trend can you see in the graph? Is it possible for this trend to continue indefinitely? Explain.

b) There were no Olympic games in 1944. Extrapolate to find what the winning height might have been in 1944.

c) In what years did the winning heights not follow the trend? Give a possible reason for this.

d) Extrapolate to predict the winning height for the 2012 Olympics.

e) Research to find the winning height for the 2012 Olympics. Was your prediction correct? Suggest reasons why or why not.

2. The line graph below shows Canada's average daily oil production from 1998 to 2007.

Average Daily Canadian Oil Production

(line graph: Oil Production ('000 m³) on vertical axis marked 0, 100, 200, 300, 400, 500; Year on horizontal axis marked 1998, 2000, 2002, 2004, 2006, 2008)

a) What trend do you see in the graph?

b) Explain whether this trend is likely to continue indefinitely.

c) In which year was the production the highest? Estimate the amount produced.

d) Extrapolate to determine the oil production in 2010.

e) Interpolate to determine the oil production in 2000.

3. Marty and Leo are examining the graph that represents bacterial growth in a scientific sample. They use the graph to predict the number of bacteria in the sample after 180 minutes have passed.

Bacterial Colony Growth

I think there will be about 300 bacteria after 180 minutes have passed.

I think there will be about 400 bacteria.

Marty   Leo
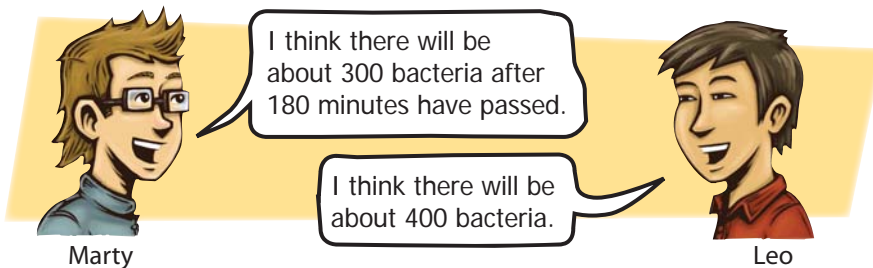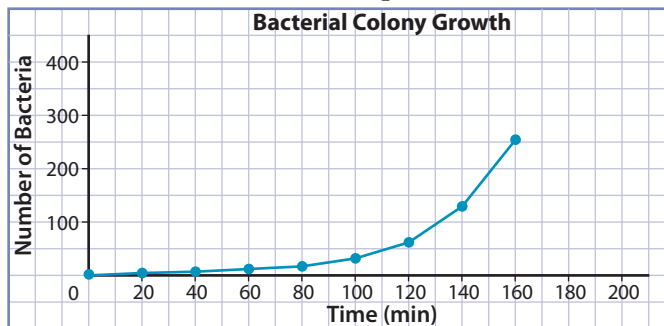
a) Describe the trend in the data.

b) Whose conclusion do you agree with? Why? Discuss your thoughts with a partner.

c) Describe the method you think Marty may have used to determine his prediction. Would you use this method?

4. Marlene lives in Abbotsford, BC, and Tori lives in Fredericton, NB. They start a 4-H project on Canada comparing the population of their provinces, using data from the Canadian census.

Year	New Brunswick Population	British Columbia Population
1991	723 900	3 282 061
1996	738 133	3 724 500
2001	729 498	3 907 738
2006	729 997	4 113 487

a) Graph the data for each province. Predict the populations for these two provinces for 2011, 2016, and 2026, to the nearest 10 000 people.

b) Research online to check the accuracy of your predictions for the year 2011. Why do you think your predictions were or were not accurate?

c) Do you think your predictions for 2016 and 2026 will be accurate? Explain two reasons why or why not.

4.3

Graphic Representations

Focus On . . .

- determining if a graph accurately represents data
- explaining how the same graph can show more than one conclusion
- explaining how a graph can be misrepresented to emphasize a point of view

Recycling is a big business. Governments support recycling because it is good for the environment, and they often offer incentives for households and companies who recycle. Anna and Yuri are researching waste management strategies in Newfoundland and Labrador.

Explore Using Graphs to Accurately Represent Data

Materials

- grid paper
- ruler
- graphing technology

Anna and Yuri work with the same data from the Internet. They each represent the data with a different graph.
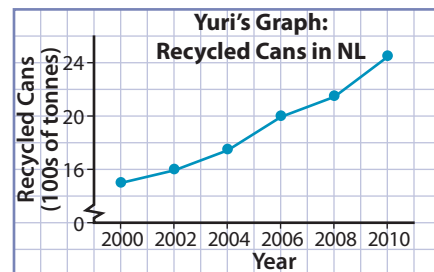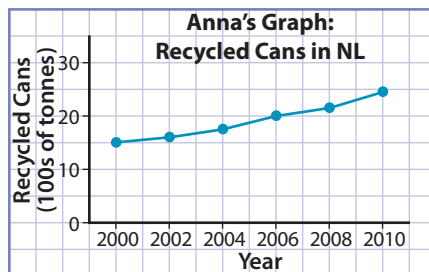
1. How are the graphs the same?

2. How are the graphs different?

3. Which graph gives a better representation of the recycling trend? Explain.

4. Anna and Yuri each draw a new graph, showing more recycling information.
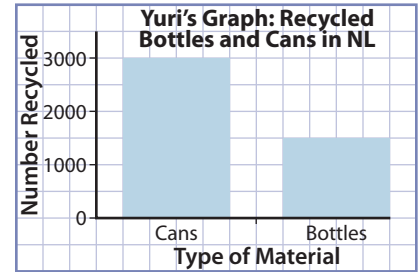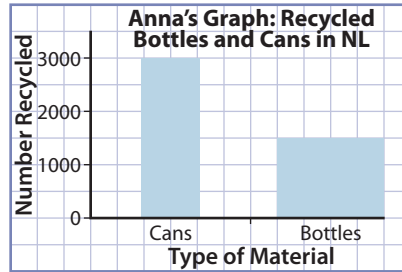
a) How are their graphs similar? How are they different?

b) Explain how Anna's graph could appear misleading.

5. Reflect Anna decides that she might need to redraw her first graph. She decides to change the scale of her vertical axis to 0–50 tonnes, in units of 10 tonnes. Predict how the look of Anna's graph will change.

6. How can the scale on a graph affect the observations someone might make about the data?

7. Extend Your Understanding Explain how the following statements could be supported with one of the graphs.

a) Recycling of cans has levelled off for the ten-year period, so the government should provide more incentives for people to recycle.

b) Recycling of cans has drastically increased, so more recycling locations should be built.

c) Recycling of bottles is not significant, so a higher deposit should be placed on bottles.

8. How could a business or organization use these graphs to promote its views on recycling? Give two examples.
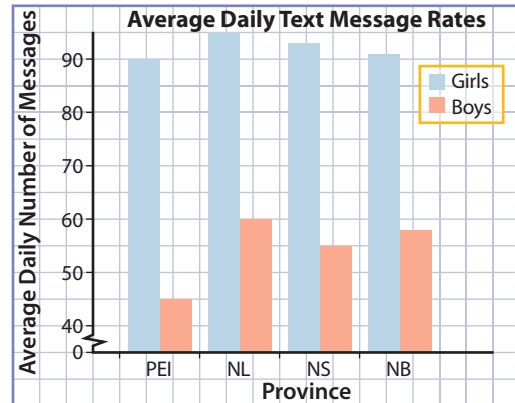
On the Job 1

Use Graphs to Draw Conclusions

Telecommunications companies often conduct customer surveys to see if they should offer a new package. Atlantic TeleWave surveys boys and girls in the Atlantic Provinces about how often they send text messages. The company will use this to see if they should offer a special discount package.

Average Daily Text Message Rates

(Bar graph: y-axis "Average Daily Number of Messages" marked at 0, 40, 50, 60, 70, 80, 90; x-axis "Province" with PEI, NL, NS, NB. Legend: Girls, Boys.)

PEI: Girls 90, Boys 45
NL: Girls ~95, Boys 60
NS: Girls ~93, Boys 55
NB: Girls ~91, Boys 58

a) What two observations could Atlantic TeleWave make about the average number of text messages sent by teenagers in Prince Edward Island, based on the graph? What conclusion might they draw from these observations?

b) According to the graph, how many text messages on average did girls and boys send per day in each province?

c) Are the observations for part a) supported by your solution for part b)? Why or why not?

d) Recreate the graph to better represent the survey results. How might the new graph affect the conclusions Atlantic TeleWave could make about the average number of text messages sent by teenagers in Prince Edward Island?

Solution

a)

Get Email   Reply Reply All Forward   New Message

From: Tom
Subject: Text Messages

MEMO: Teenagers in Prince Edward Island send fewer text messages on average than teenagers in other provinces. Teenage boys in Prince Edward Island send a lot fewer text messages than boys in other provinces. A special discount package is not needed for the province.

b) Using the graph, determine the number of messages for girls and for boys in each province.

Province	Average Number of Text Messages Per Day	
	Girls	**Boys**
PEI	90	45
NL	95	60
NS	93	55
NB	91	58

c) The observations for part a) are not supported by part b). Teenage girls in Prince Edward Island send one fewer text message on average than girls in New Brunswick.

Teenage boys in Prince Edward Island send on average 45 text messages per day, only 10 fewer on average than boys in Nova Scotia. The scale on the vertical axis has a break at 40, which makes the graph misleading.

d) Atlantic TeleWave can now see that girls have higher average rates than boys. Prince Edward Island rates are lower, but not by that much. The company could develop one special discount package for all provinces.
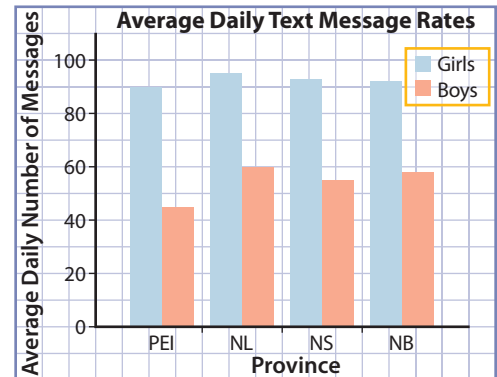
Your Turn

The marketing department of a local newspaper creates a graph showing where the paper gets its money. The department presents the graph at a staff meeting.
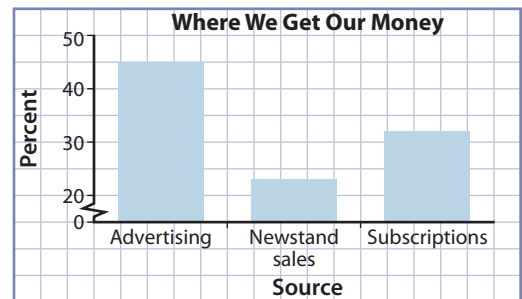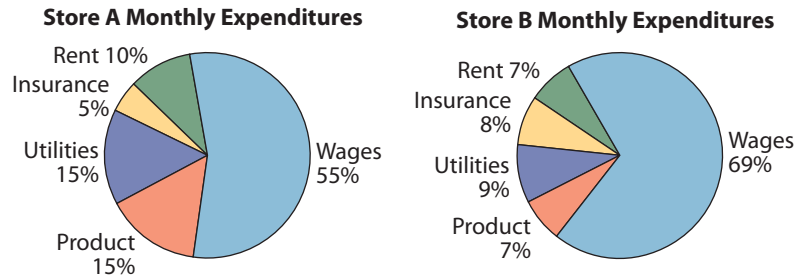

a) What observations might the staff make from the graph?

b) What percent of the newspaper's money comes from each source?

c) Does the graph accurately represent the money the newspaper makes from each source? Why or why not?

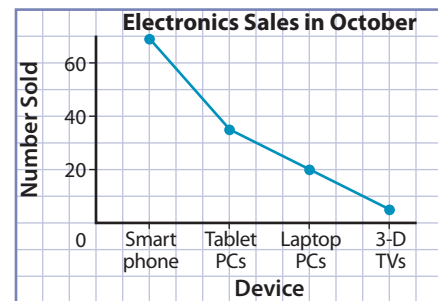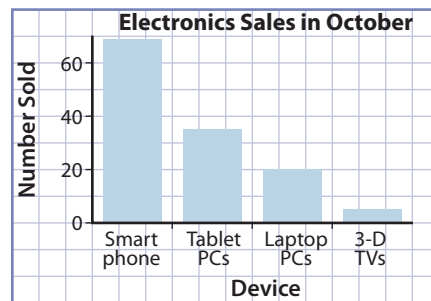**d)** How could you represent the data differently? Draw a new graph.

Try It

1. Antonia owns two sandwich shop franchises. At the end of the month, her accountant presents her with graphs of the monthly expenditures of each store location.

Store A Monthly Expenditures

Rent 10%
Insurance 5%
Utilities 15%
Wages 55%
Product 15%

Store B Monthly Expenditures

Rent 7%
Insurance 8%
Utilities 9%
Wages 69%
Product 7%

a) Using the graphs, Antonia determines that Store B is spending more money than Store A on wages. Is this true? Explain.

b) Referring to her financial records, Antonia discovers that Store A has total monthly expenditures of $45 000 and Store B has total monthly expenditures of $30 000. Determine how much each store spends on wages each month.

c) Does your answer for part b) confirm your answer for part a)? If not, how could Antonia better represent her data using a graph?

2. The bookkeeper of an electronics store prepared the two graphs below to represent sales in October.

Electronics Sales in October

Number Sold (y-axis): 0, 20, 40, 60
Device (x-axis): Smart phone, Tablet PCs, Laptop PCs, 3-D TVs

Electronics Sales in October

Number Sold (y-axis): 0, 20, 40, 60
Device (x-axis): Smart phone, Tablet PCs, Laptop PCs, 3-D TVs

a) State two observations that could be made about sales of electronics in October.

b) Which graph best represents data of this type? Explain.

3. The graph represents the type of transportation that students use to get to school.

Student Transportation Methods

a) State two observations that you could make from this graph.

b) Would knowing the total number of students surveyed in each class affect the observations that you made in part a)? Explain.
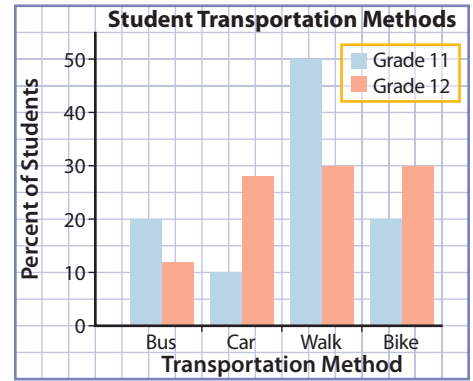
Apply It

4. Jaslin sells frozen cookie dough to her family and friends. She tracks her monthly sales and displays them in a graph.
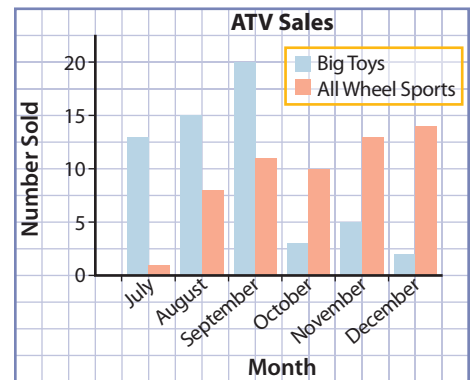
Frozen Cookie Dough Sales

a) Jaslin says that her sales have increased dramatically since July. Do you agree with her statement? Why or why not?
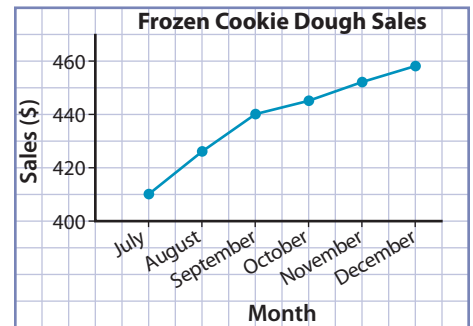
b) How could you represent the data more accurately? Draw a new graph.

5. The graph represents the number of ATV vehicles sold each month from July to December for two ATV dealers, Big Toys and All Wheel Sports.

ATV Sales

a) Represent the data in two other ways.

b) What observations can you make from each representation of the data? Organize your thoughts in a table.

c) How do the three different representations of the data alter the observations you make about the data?

Use Graphs to Emphasize a Point of View

During a high school job fair, Bradley visits booths for companies offering boilermaker jobs. A large industrial firm that employs boilermakers hands out brochures showing the salary increases that one of their boilermakers can expect over six years.
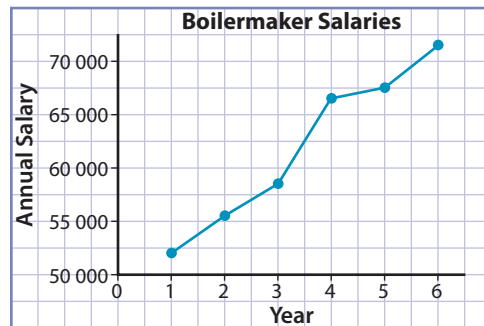
Boilermaker Salaries

Tools of the Trade

Boilermakers construct steel machinery using gas torches and arc welders. Their work includes building steam boilers for large buildings and ships. To learn more about boilermakers, go to www.mcgrawhill. ca/school/learningcentres and follow the links.

a) Bradley looks at the brochure quickly. At first glance, he thinks that the salary in year 6 is about three times the salary in year 1. Is this observation accurate?

b) Why might the graph be drawn this way?

c) How could Bradley recreate the graph to make it more accurately reflect the data?

Solution

a) Bradley finds that the salary in year 1 is $52 000. To find out if his conclusion from the graph is correct, he calculates three times the salary of year 1.

$$\text{Estimated salary in year 6} = \text{salary in year 1} \times 3$$
$$= 52\ 000 \times 3$$
$$= 156\ 000$$

Bradley calculates that if the salary in year 6 is three times the salary of year one, the salary in year 6 should be $156 000. The salary in year 6 is about $72 000. So, Bradley's observation is not consistent with the data on the graph.

> The scale on the vertical axis of the graph does not start at 0. The conclusion that the salary in year 6 is three times greater than the salary in year 1 is not correct.

b) During the job fair, people may not look closely at the graph in the brochure. The company might want to make people think that they offer better salary increases than other companies by making the line of the graph appear steeper. A steeper line implies that a boilermaker would earn more money quickly.

c) The vertical axis of the graph does not start at 0. This makes the trend appear that the salaries increase by a large amount over six years. To recreate the graph, Bradley could start the vertical axis at 0.

Your Turn

Jeanette wants to buy a used car. She notices the following ad in the automotive section of the newspaper.
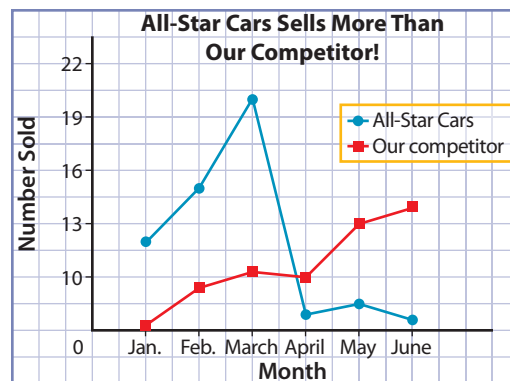

a) Why do you think All-Star used this graph in their ad?

b) What is the difference between All-Star's total sales and the competitor's total sales?

c) Explain how to create a graph to accurately represent the sales data for both dealerships.

Try It

1. The GetGas Fuel Company releases this graph to its customers showing the average price of gas during the week and on weekends at its gas stations.

GetGas Prices
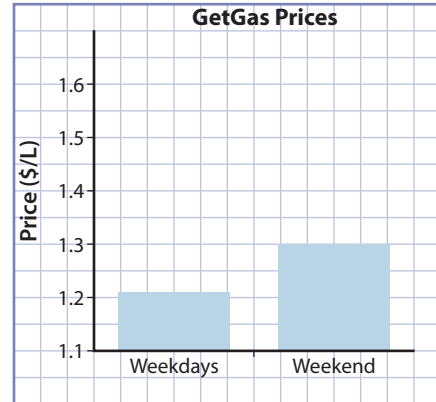
a) Explain how the graph could appear misleading.

b) What conclusions would most customers make about the price of gas on weekends compared to the price on weekdays?

c) Create a new graph that represents the average price of gas more accurately.

2. The two graphs below represent data about the average number of rainy or snowy days per year in six Canadian cities.
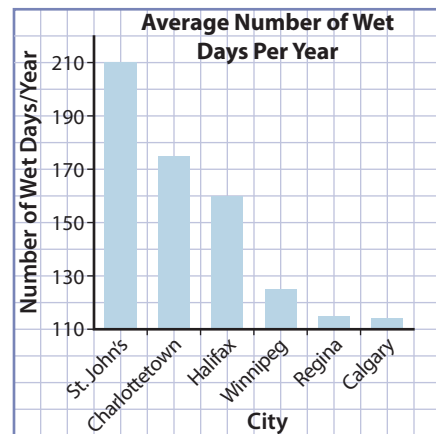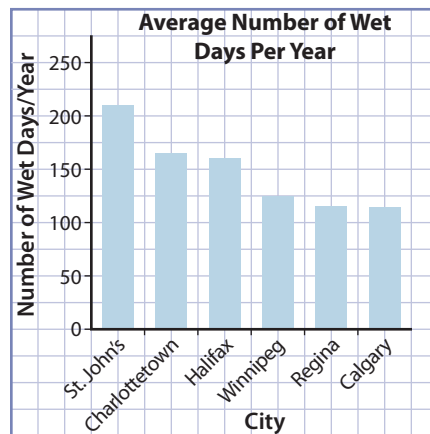
a) What is the same about the graphs?

b) What is different about the graphs?

c) Which graph would be used by the following organizations?
- a tourist company encouraging people in Atlantic Canada to spend their vacation in Calgary
- a company hired to convince people of the beautiful weather in Eastern Canada
- a clothing company that wants to invite investors to fund a store selling waterproof clothing in Newfoundland and Labrador
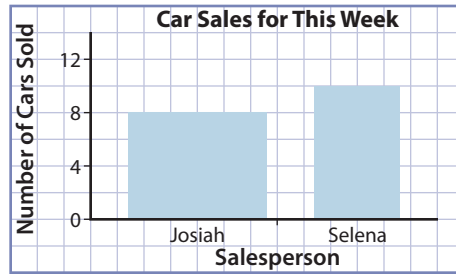
Strategy

Develop Alternative Approaches

Why would different companies develop different graphs?

3. Josiah and Selena sell used cars. At the end of each week, their manager chooses an employee to be Salesperson of the Week. The manager receives this graph in his inbox at the end of the week.


Car Sales for This Week

a) Who do you think developed this graph? Why?

b) Who sold more cars this week?

c) Create a new graph that accurately represents the car sales of Josiah and Selena for this week.

d) Who should be Salesperson of the Week? Why?

Apply It

4. A market research company tells a political party that many people would like to see more money budgeted for green energy research. The party releases its proposed budget.

a) Based on the graph, rank the five categories from highest budget to lowest. Estimate what percent of the budget each category receives.

Proposed Provincial Budget
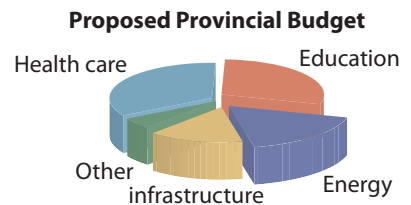
b) The proposed budget is released in table form a few weeks later. What percent of the budget does energy actually receive?

Budget Category	Budget ($ billion)
Health care	2.04
Education	1.74
Energy	1.02
Infrastructure	1.02
Other	0.30

c) Is your estimate from part a) close to your answer for part b)? Why or why not?

d) Explain why you think the party would prefer to use the graph rather than the table during the election.
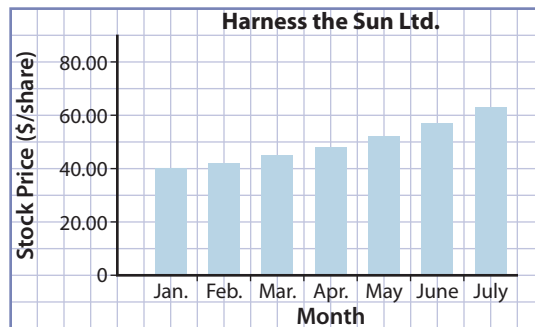
5. The median annual income of families in Canada was collected in a 2009 survey. Create a graph that would best represent each point of view below. Then, explain your choice.

Province or Territory	Median Family Income
Newfoundland and Labrador	60 290
Prince Edward Island	62 110
Nova Scotia	62 550
New Brunswick	60 670
Quebec	64 420
Ontario	69 790
Manitoba	65 550
Saskatchewan	70 790
Alberta	83 560
British Columbia	66 700
Yukon	84 640
Northwest Territories	98 300
Nunavut	60 160

a) An organization that runs youth centres in the Northwest Territories wants the median income in their territory to look low compared to the income in other provinces. They want to secure additional funding from the government to build more centres.

b) A market research organization wants the income for families in all provinces to appear very close to being the same. They want to win a bid for a national advertising campaign to sell frozen family-sized meals.

c) The federal government wants to represent the data in the most accurate way possible.

6. These two graphs display the same data regarding Larry's boat sales in different ways.
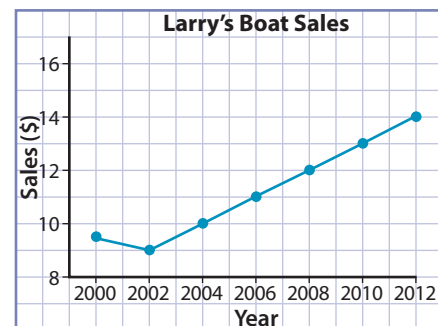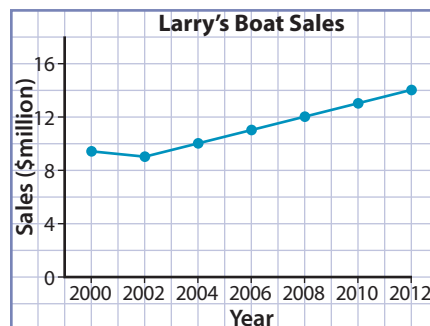
a) How are the graphs the same?

b) How are the graphs different?

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

7. Timothy works as a financial advisor. Part of his job is to provide his clients with accurate information about different companies that they can invest in. Companies with increasing stock prices have the potential to make the most money for investors. One group of clients wants to invest in a solar energy company. Timothy prepares the following graphs for his clients.

Solar Energy Co.

Stock Price ($/share) vs Month (Jan., Feb., Mar., Apr., May, June, July)

Harness the Sun Ltd.

Stock Price ($/share) vs Month (Jan., Feb., Mar., Apr., May, June, July)
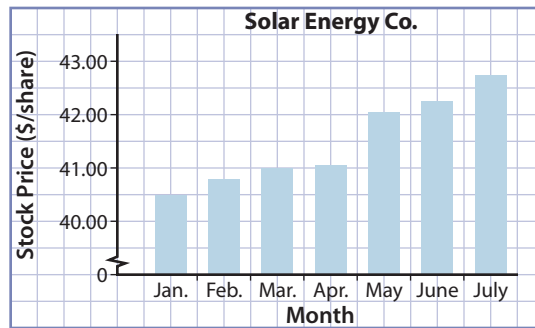
a) Which company's stock appears to be increasing more quickly?

b) By how much has Solar Energy Co.'s stock increased since January?

c) By how much has Harness the Sun Ltd.'s stock increased since January?

d) Are the graphs misleading? Explain.

e) Has Timothy provided his clients with accurate information? Explain.

Work With It

1. The table below shows average annual earnings of males with different levels of education.

Level of Education	Average Annual Earnings ($)
Less than grade 9	40 400
Some secondary school	43 600
High school graduate	50 300
Some post-secondary	51 500
Post-secondary diploma	57 700
University degree	91 800

a) Draw a bar graph to represent the data.

b) State two conclusions that can be made from the graph.

c) Redraw the graph so it appears that a male with a university degree can make 5 times the amount of a male high school graduate.

d) What kind of organization might use the second graph? Why would they choose it?

2. The table shows the NHL's top point scorers for the 2010–2011 hockey season.

Player	Team	Score
Daniel Sedin	Vancouver	104
Martin St. Louis	Tampa Bay	99
Corey Perry	Anaheim	98
Henrik Sedin	Vancouver	94
Steven Stamkos	Tampa Bay	91
Jarome Iginla	Calgary	86
Alex Ovechkin	Washington	85
Teemu Selanne	Anaheim	80
Henrik Zetterberg	Detroit	80
Brad Richards	Dallas	77

a) Create a graph that Daniel Sedin's agent might use to negotiate a new contract. Explain why you drew the graph you did.

b) Create a graph that the Tampa Bay Lightning might use to negotiate a new contract for the player Martin St. Louis. Explain why you drew the graph you did.

3. Search various media sources, such as magazines, newspapers, and the Internet, for an example of a graph that could be misleading. Print, copy, or cut out the graph.

a) What is the purpose of the graph?

b) How is the graph misleading?

c) Why would an organization want to misrepresent a data set?

d) How could the graph be redrawn to represent the data more accurately?
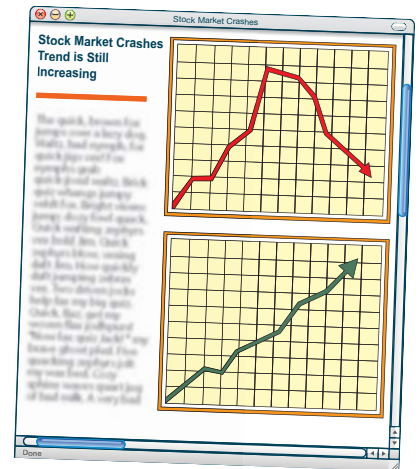
4. A local retailer sells $5000 of garden items each month from April to June. In July and August, sales fall to $4000 each month.

a) Give an example of how the retailer could present inaccurate data in an ad.

b) Give an example of how the retailer could present misleading data in an ad.

c) Why might the retailer want to present misleading data in an ad?

What You Need to Know

Section	After this section, I know how to . . .
4.1	■ **draw bar, line, and circle graphs and histograms, with and without technology** ■ **determine the type of graph that best represents given data** ■ **state advantages and disadvantages of different types of graphs**
4.2	■ **describe data trends on a given graph** ■ **interpolate and extrapolate data on a given graph** ■ **determine if my estimates and predictions are reasonable**
4.3	■ **determine if a graph accurately represents data** ■ **explain how a graph can represent more than one conclusion** ■ **determine how different groups of people may represent their points of view using a graph**

If you are unsure about any of these questions, review the appropriate section or sections of this chapter.

4.1 **Choosing a Graph, pages 154–167**

1. The manager of Pizzarillo's kept track of the methods customers used to place their orders for one week. The findings are displayed in the table below.

Method of Ordering	# of Orders
Walk-in	38
Cell phone app	20
Telephone	60
Internet	42

a) Draw two appropriate graphs to represent the data.

b) State at least one advantage and one disadvantage of each type of graph.

c) Which type(s) of graph would not be appropriate to represent the data set? Explain.

2. An oceanographer collected ocean temperature information for different latitudes in Canada. The information is displayed in a table.

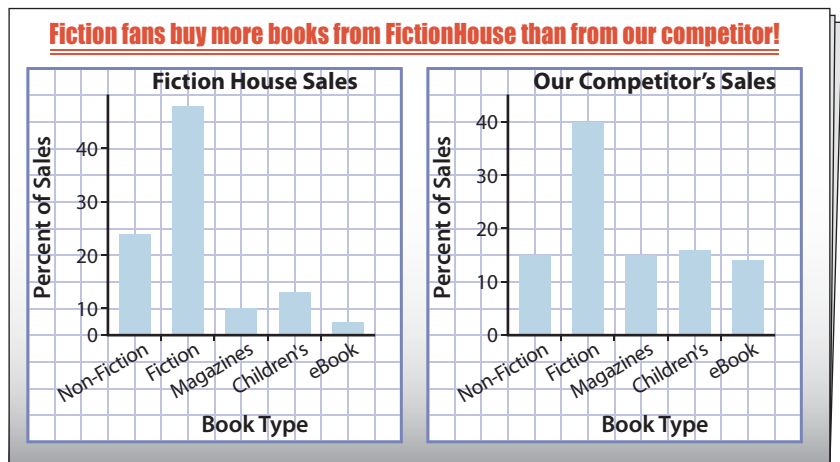| Latitude (°N)	Temperature (°F)
10	80
20	79
30	76
40	69
50	56
60	48
70	42

F.Y.I.

Latitude is the distance of a location north or south of the equator, measured in °N or °S.

a) Represent the data with an appropriate graph.

b) What trend do you observe in the graph?

c) Interpolate to find the average ocean temperature in Cape Breton, NS, which is located at 46° N.

d) The northernmost point in Canada is Cape Columbia on Ellesmere Island, NU, at 83° N. Extrapolate to estimate the ocean temperature in Cape Columbia.

3. The Fiction House online bookstore releases an ad comparing their sales of fiction books to those of their competitor.

a) Do you agree with the ad's statement? Why or why not?

b) Create a graph that more accurately represents the FictionHouse data.

c) To find out which store sold more fiction books, what information do you need to know?

Fiction fans buy more books from FictionHouse than from our competitor!

Fiction House Sales

Percent of Sales

Non-Fiction, Fiction, Magazines, Children's, eBook

Book Type

Our Competitor's Sales

Percent of Sales

Non-Fiction, Fiction, Magazines, Children's, eBook

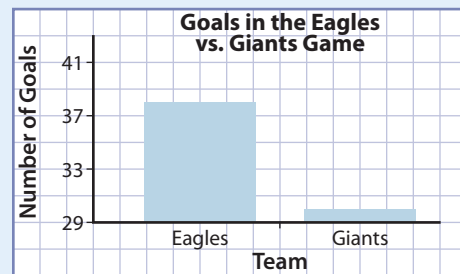Book Type

For #1 to #5, select the best answer.

1. Which type of graph best shows a trend over time?

   A bar   **B** circle   **C** histogram   **D** line

2. Which type of graph best shows discrete data in categories?

   A bar   **B** circle   **C** histogram   **D** line

Use the graph to answer #3 and #4.

3. Who may have drawn the graph?

   A The coach of the Eagles team. He is trying to motivate his team to score more goals.

   B The agent of the Giants leading scorer. The agent is trying to negotiate more money for his client.

   C The owner of the Eagles team. He is trying to sell his team and wants to show how good it is.

   D A fan. She is trying to convince her friends that the Giants are the best hockey team.

Goals in the Eagles vs. Giants Game

4. How is the graph misleading?

   A The intervals on the vertical scale are not equal.

   B The vertical scale does not start at zero.

   C The bar representing the Eagles is shown first.

   D The bars are drawn inaccurately.

5. Eighty grade 11 students were surveyed to determine their favourite brand of jeans. The results are shown in the table. Which type of graph would best show that GLG and Shawn's jeans are favoured by 50% of the students?

   **A** bar   **B** circle

   C double line   **D** line

Brand of Jeans	# of Students
GLG	32
Shawn's	8
Tori	14
Blue Republic	21
Other	5

6. The table shows sales of two smart phone apps for a period of six months.

Month	App A	App B
March	$118 000	$122 000
April	$117 000	$124 000
May	$121 000	$124 000
June	$119 000	$126 000
July	$124 000	$127 000
August	$127 000	$128 000

a) Which type of graph would be most appropriate to compare the sales of the apps? Draw the graph. State two observations you can make from the graph.

b) Draw a graph to make App B's sales appear to be increasing faster than App A's. Explain how your graph represents this point of view.

c) Draw a graph to make App A's August sales appear greater than App B's sales for August. Explain how your graph represents this point of view.

7. A new union representative created these two graphs to show his members how much their wages per hour have increased since he took over the position in 2008.
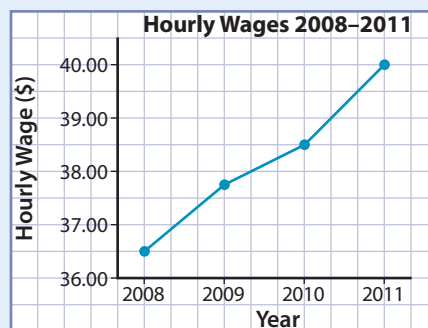
a) What observations can you make from the graph for 2004–2007? the graph for 2008–2011?

b) How could the graphs be changed to represent the data more accurately? Redraw the graphs.

c) State an observation based on your new graphs.

8. a) Describe the trend in domestic and imported car sales.

b) Extrapolate to predict the sales for domestic cars in 2011 and 2013.

c) Do you think this trend will continue? Explain.

Chapter Project
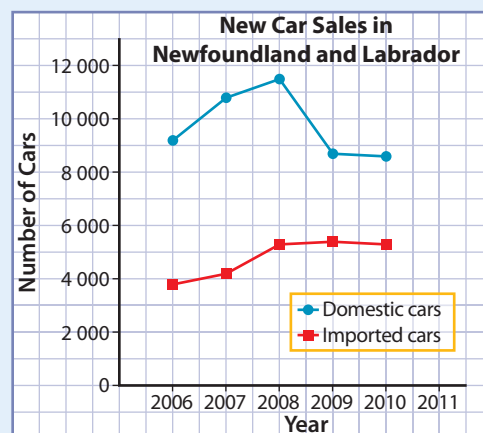
Advertise Your Product

Project

Companies advertise to increase sales. They often want to create the impression that they have sold a lot of their product. This encourages customers to buy their product.

1. You have started a company that sells a product to consumers. Decide on a company name and product.

2. You want to prepare advertising to promote your product. Advertising for your product will be placed in media sources, such as newspapers, magazines, television, billboards, and online.

3. Create a table of data representing your product's sales.

4. Create two graphs to represent the data.
   - One graph is either misleading or does not accurately represent the data.
   - One graph accurately represents the data.

5. Choose one of the graphs to appear in your advertising. Explain why you chose that graph.

6. Create the advertisement, including the graph. You may also wish to include the following:
   ✔ company name and logo
   ✔ company slogan
   ✔ picture(s) of the product
   ✔ use of the product
   ✔ cost of the product
   ✔ reasons why customers should buy the product

4 GAMES AND PUZZLES

Square It

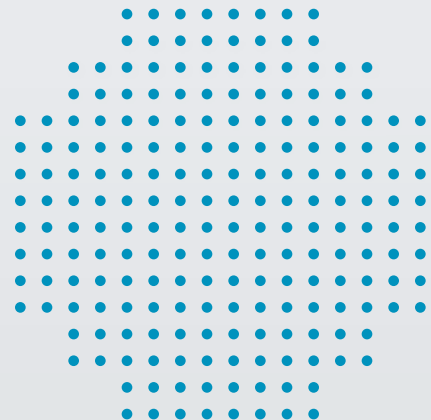Play this game with a partner. Each player uses a different colour of pen.

1. Draw the 5-by-5 grid below in your notebook, using a third colour of pen or a pencil.

2. Take turns drawing a single vertical or horizontal line segment to connect two dots. The player who completes the fourth side of a 1-by-1 box writes their initials in the box and takes another turn drawing a line segment.
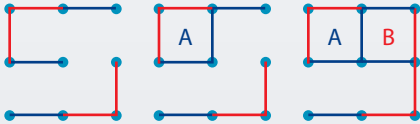
3. The game ends when no more line segments can be drawn. The player with the most initialled boxes on the game grid wins.

4. With your partner, discuss strategies you can use to help you win the game.

5. Try this game with other grids.
   ✔ a larger grid, such as a 9-by-9 grid
   ✔ a Chakana or Inca Cross grid, like the one shown here
   ✔ a grid of your own design