

2.2

Bar Graphs

NEW SKILLS: WORKING WITH BAR GRAPHS

discrete data: data made up of distinct values, where intermediate values are not possible

A bar graph is another way to visually represent data. A bar graph is used to plot **discrete data** using rectangular bars, the lengths of which are proportional to the values represented. Discrete data is data that can only have certain distinct values; an example is the number of students in your class: the answer must be a whole number since you cannot have half a student in your class.

The bars on a bar graph can be either vertical or horizontal, and have spaces between them. Set the scale, label the axes, and give the graph a title the same way you would for a broken line graph.

As with broken line graphs, the scale and the starting point on the axes affect the way a graph is interpreted. By increasing or decreasing the scale, or by changing the starting point on an axis, you can make the viewer see the data a certain way.

For more details, see page 74 of *MathWorks 11*.

Example 1

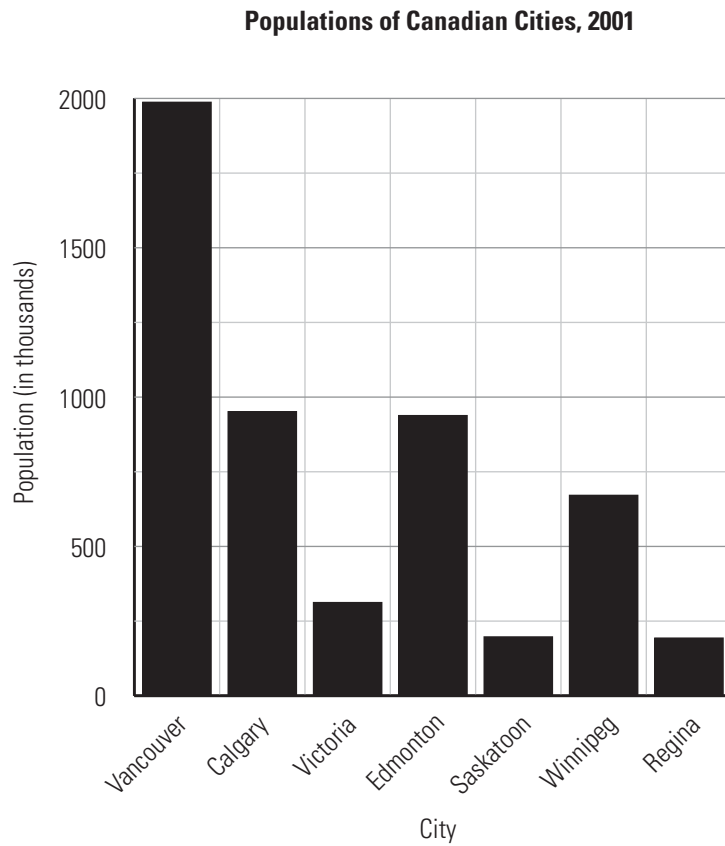
The 2001 Canadian census data listed the following approximate populations of various cities, to the nearest thousand.

POPULATION OF CANADIAN CITIES, 2001							
City	Vancouver	Calgary	Victoria	Edmonton	Saskatoon	Winnipeg	Regina
Population (in thousands)	1987	951	312	938	197	671	193

Display the data on a bar graph.

SOLUTION

The data ranges from just under 200 to almost 2000, so increments of 100 would be appropriate for the vertical axis. Draw a bar with a height corresponding to the population.



You may want to arrange the bars according to height, because this gives a more visual representation of the ranking of the populations.

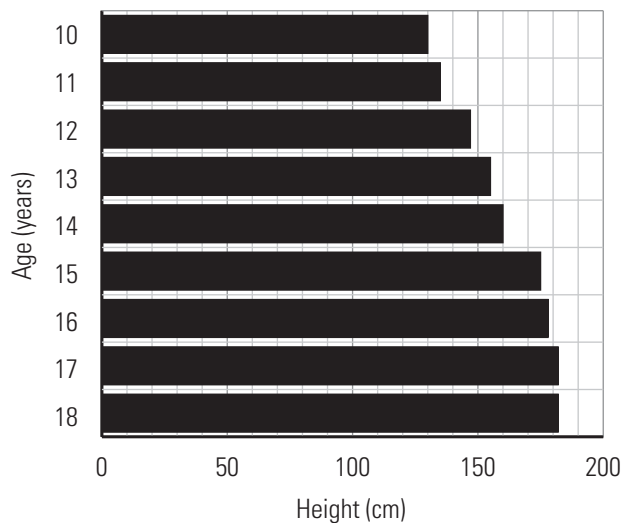
BUILD YOUR SKILLS

1. A company tracked how new software was obtained and installed on their computers. The results are given in the table below. Draw a bar graph to represent the data.

SOFTWARE INSTALLATIONS	
<i>How software was obtained and installed</i>	<i>Percentage of total software installations</i>
In-house IT department	58
In-house IT with help from provider	16
Outsourced to service provider	10
Outsourced to development partner	12
Other	4

2. The following graph shows Jamie's height from age 10 to age 18.

Jamie's Height



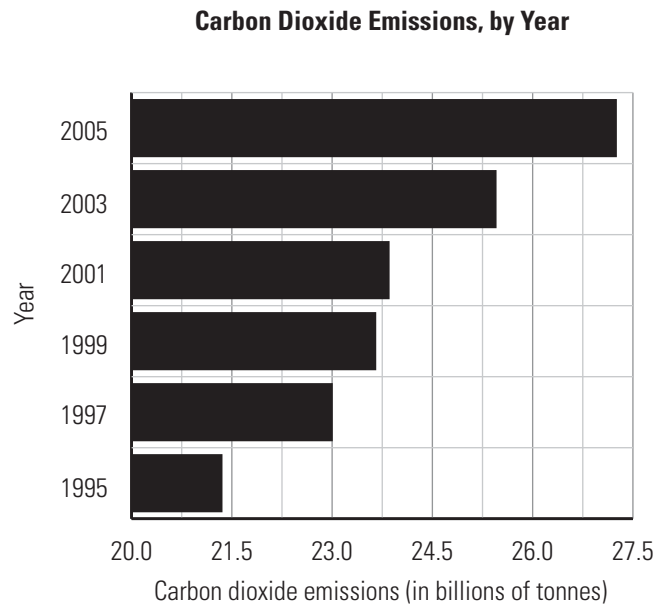
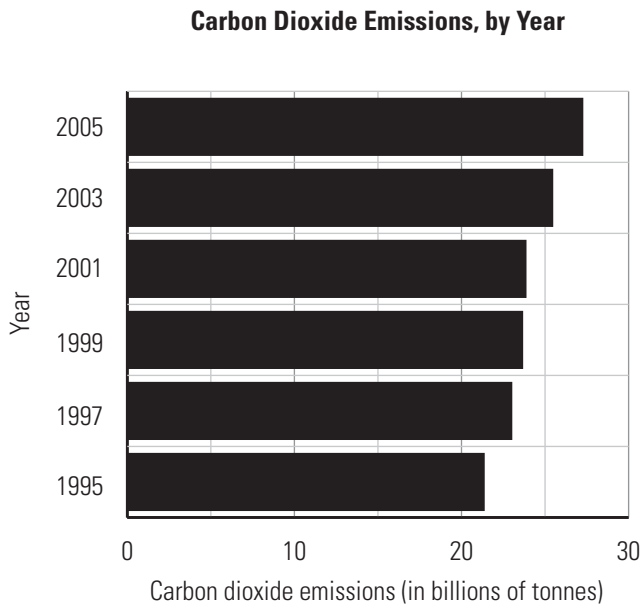
a) Suggest two ways to improve the way the data is presented.

b) Redraw the graph in a way that better represents the data.

3. Sabine is a staff supervisor at city fairgrounds. She made the graph below to show the number of employees working at the fair each month. Give two reasons why the graph may be misread.



4. Carbon dioxide (CO_2) emissions contribute to climate change, and so they are closely monitored by governments and environmental groups. The following two graphs represent CO_2 emissions worldwide from 1995 to 2005.



- a) Which graph is a better representation of worldwide CO_2 emissions? Why?
- b) What were the emissions in 1999?
- c) What were they in 2005?
- d) Why might the more misleading graph be used to represent the data?

NEW SKILLS: WORKING WITH DIFFERENT REPRESENTATIONS OF DATA

Some data that can be represented using either a vertical bar graph or a horizontal bar graph can also be shown on a broken line graph. Each type of graph has its advantages for displaying certain kinds of data.

Example 2

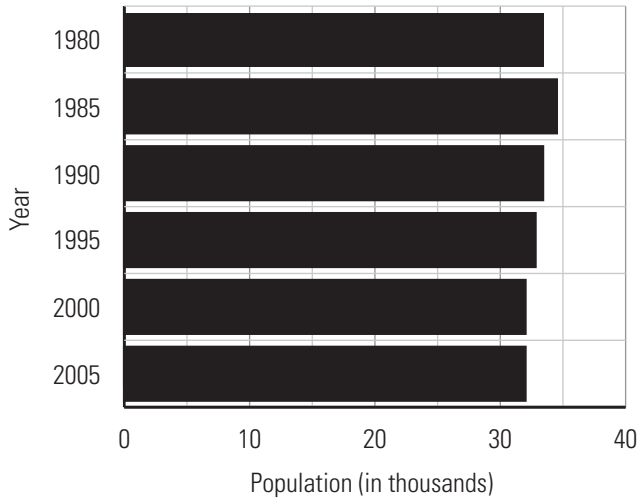
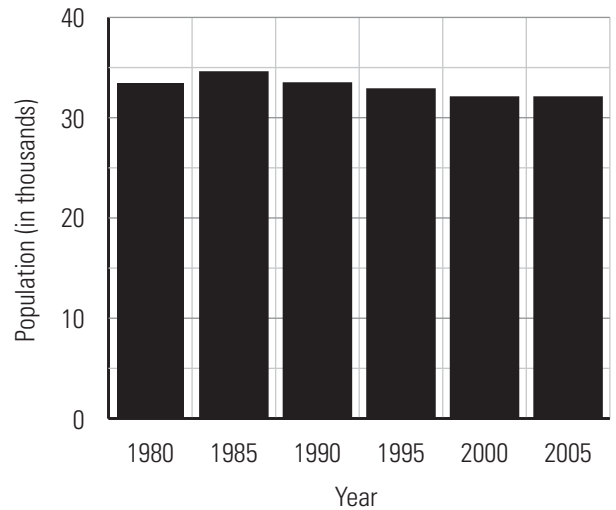
The following table shows the approximate population of Moose Jaw, Saskatchewan, from 1980 to 2005.

POPULATION OF MOOSE JAW, SASKATCHEWAN, 1980–2005						
Year	1980	1985	1990	1995	2000	2005
Population (in thousands)	33.5	34.3	33.4	32.8	32.0	32.0

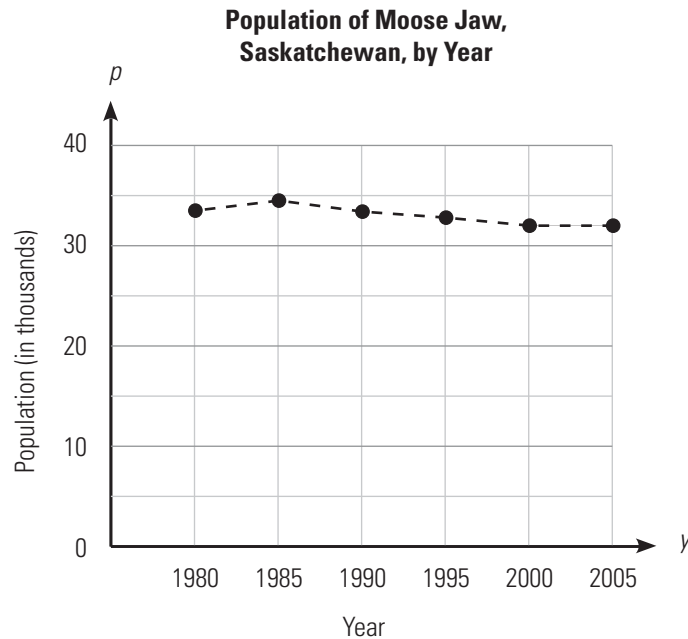
- Display the data on both a horizontal and a vertical bar graph.
- Which graph is a better representation of the data? Why?
- What is the trend in population size in Moose Jaw?
- Draw a broken line graph of the data. Is the vertical bar graph or the broken line graph a better representation of the data?
- Draw a broken line graph of the data so that the graph is misleading, making it appear that the population has declined significantly.
- Draw a vertical bar graph using the same scales and starting points on the axes. Is it similarly misleading? Why or why not?



Mac the Moose is a fibreglass moose that stands next to the visitors' centre in Moose Jaw, SK. Mac is claimed to be the world's largest moose, at about 9.8 m tall.

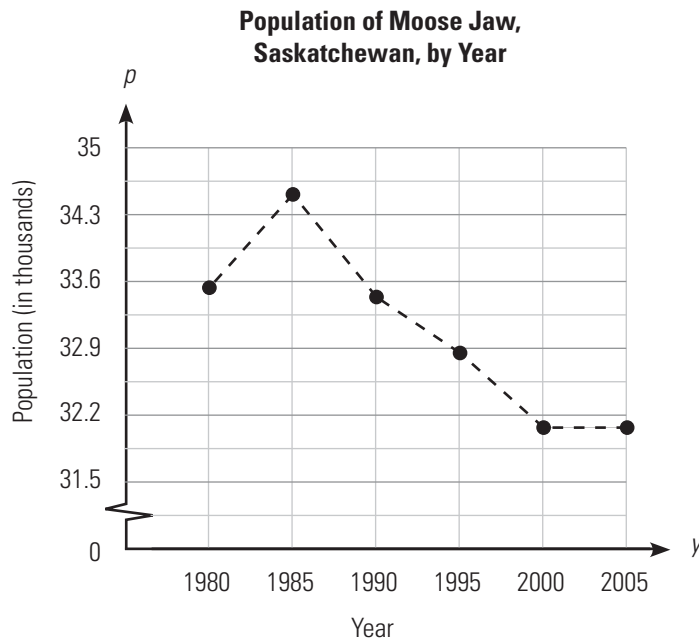
SOLUTIONa) **Population of Moose Jaw, Saskatchewan, by Year****Population of Moose Jaw, Saskatchewan, by Year**

- b) The vertical bar graph seems to be a better representation of the data because you can see the population trend more clearly as you read the graph from left to right.
- c) The population trend shows a slight decline in population over the years.
- d)

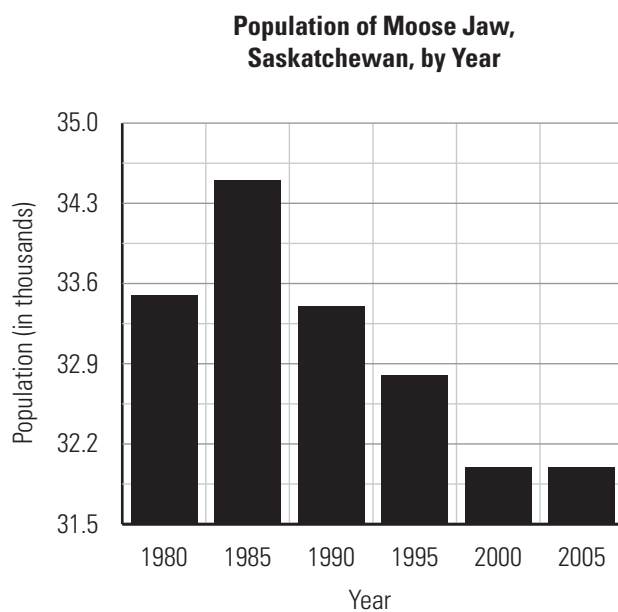


Both the broken line graph and the vertical bar graph are good representations of the data, but the broken line graph is better for showing a trend in the data.

e)



f)



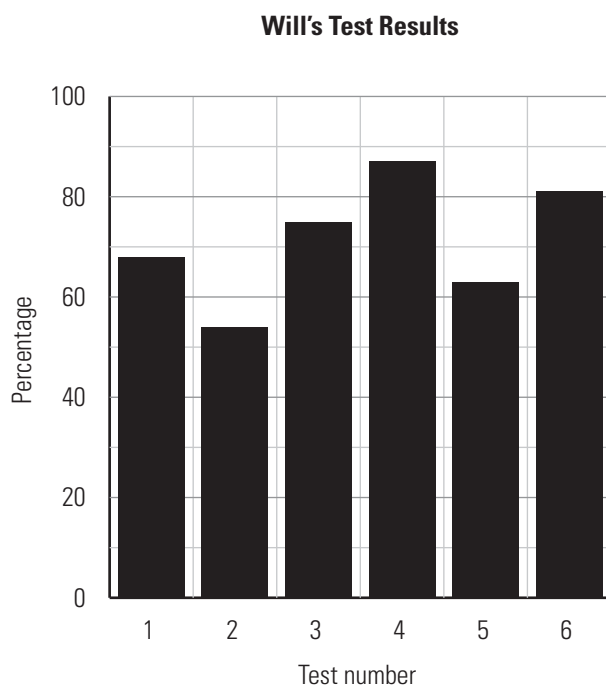
The bar graph does not seem to be quite as misleading as the broken line graph, because some of the difference appears to be absorbed in the width of the bars.



Canadian Forces 431 Air Demonstration Squadron, known as the Snowbirds, are Canada's flight demonstration team. The team is based out of Canadian Forces Base Moose Jaw, and performs at airshows worldwide.

BUILD YOUR SKILLS

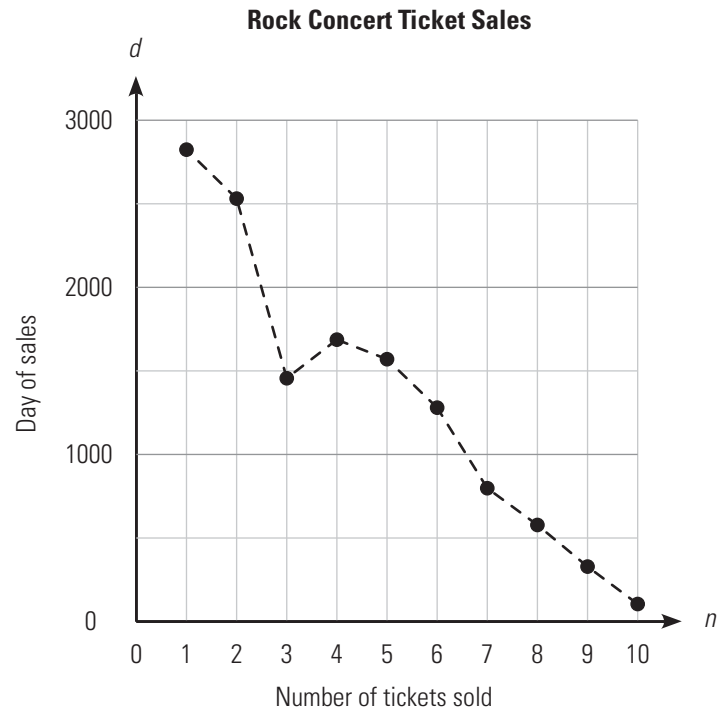
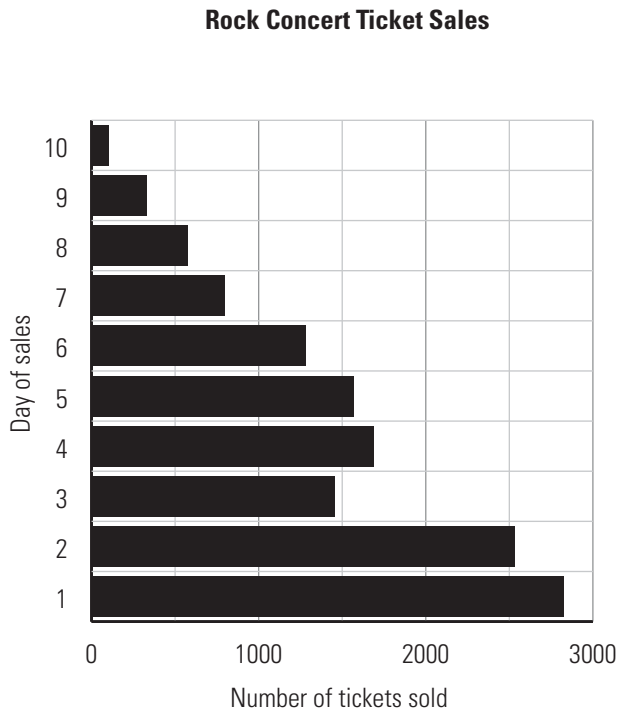
5. Given the vertical bar graph below, draw a broken line graph depicting the same data. Which graph seems to be the better representation of the data? Why?



6. The table below shows the number of tickets sold per day until a rock concert is sold out.

NUMBER OF ROCK CONCERT TICKETS SOLD PER DAY										
Day	1	2	3	4	5	6	7	8	9	10
No. of tickets	2824	2531	1456	1687	1570	1280	796	578	329	105

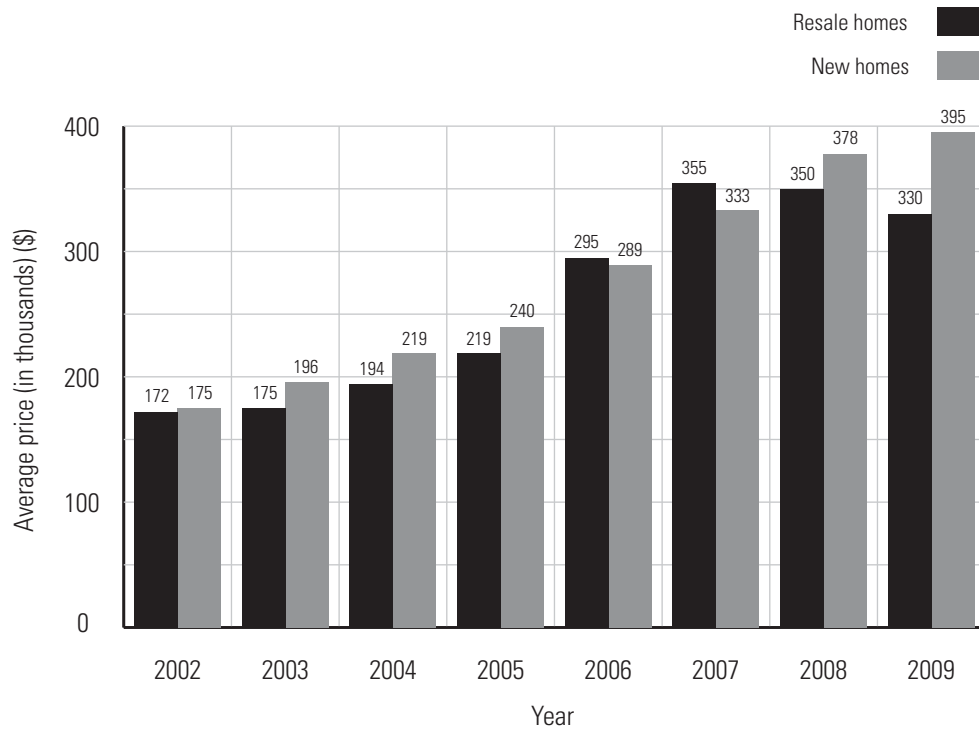
- a) What is the general trend in sales over the 10-day period?
- b) Darlene used a graphing tool to draw a horizontal bar graph and a broken line graph of the data. Which graph is a better representation and why?



Example 3

Roger is a real estate agent in Red Deer, Alberta. The graph below compares the average house prices of new single-family homes and resale (not new) single-family homes.

Single-family House Prices in Red Deer, Alberta, 2002–2009



- What was the average price of a new single-family home in 2005?
- Between what years was there a drop in the price of resale single-family homes?
- What is the general trend in the differences in prices (which cost more/less) of the two types of units? In which years was this not so?

SOLUTION

- The cost was approximately \$240 000.00.
- Since the bar is lower in 2008 than in 2007, there was a drop in the prices.
- Generally, new single-family homes sold for more than resale homes. In 2006 and 2007, resale homes sold for more than new homes.

BUILD YOUR SKILLS

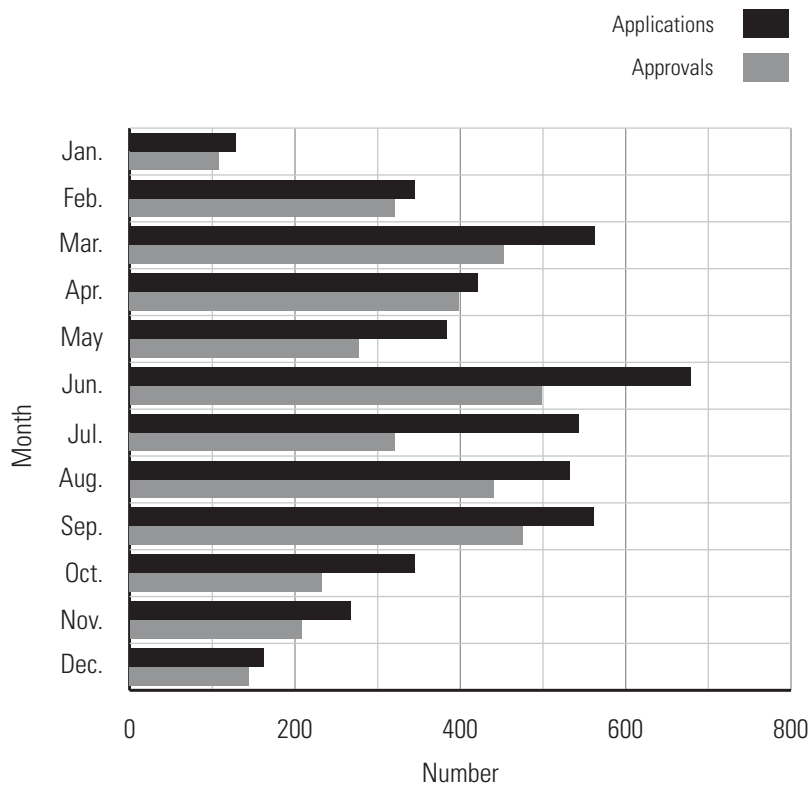
7. The following table shows average weekly household expenses of all Canadian households with children compared to the expenses of households in the lowest income range in the country.

AVERAGE WEEKLY HOUSEHOLD EXPENSES, CANADA									
<i>Item</i>	<i>Food & drink</i>	<i>Clothing</i>	<i>Heat & electricity</i>	<i>Health</i>	<i>Transportation</i>	<i>Communication</i>	<i>Recreation & culture</i>	<i>Education</i>	<i>Eating out</i>
Lowest income households	104	44	124	2	70	22	78	6	56
All households with children	140	62	130	4	176	26	160	30	104

- a) Draw a double bar graph to represent the data.
- b) Explain the trends in spending of the lowest income families compared to all families.

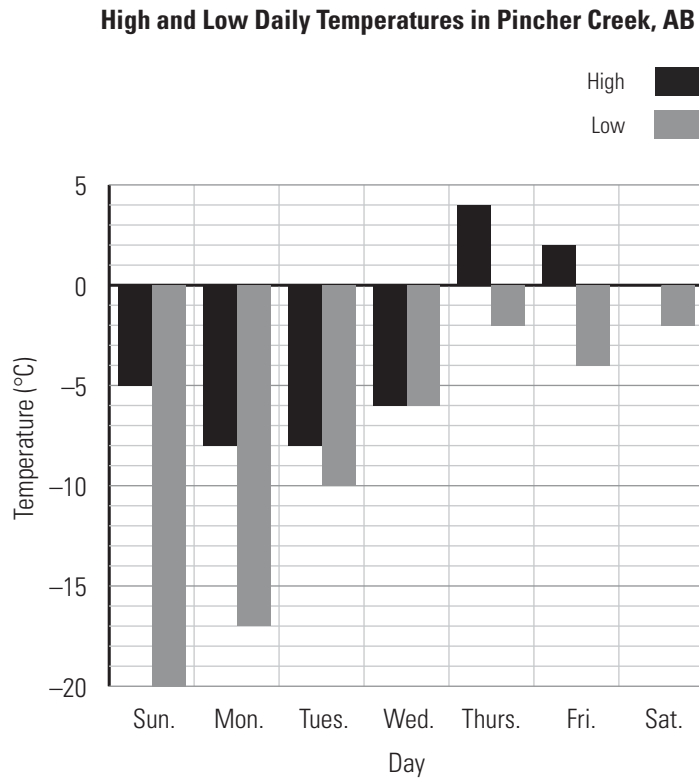
8. In order for citizens of other countries to travel to Canada, they may be required to get a visa, which is a document that shows the person is authorized to enter the country. Sally works at Citizenship and Immigration Canada, and has gathered information on the number of visas applied for and the number approved over the course of one year.

Visa Applications and Approvals



- a) In which month was the most applications for visas received? How many visa applications were received that month? In which month were the fewest applications received? How many were received that month?
- b) In which month was the greatest difference between the number of applications and the number of approvals? What was the approximate difference?

9. The following graph shows the high and low daily temperatures for one week in November in Pincher Creek, Alberta.



Pincher Creek, AB, is called the wind capital of Canada. Because of the strong winds that blow in the area, wind turbines have been installed to generate electricity.

- Why are most of the bars going downward?
- Why is there no black bar on Saturday?
- What is significant about Wednesday's temperature?
- What was the general trend in temperature during the week?

NEW SKILLS: WORKING WITH STACKED BAR GRAPHS

When comparing data, you can sometimes use a stacked bar graph. In this style of graph, each type of item is represented by a different colour, but instead of being drawn side by side, the bars are stacked on top of each other. It is important that the bars are stacked in the same order.

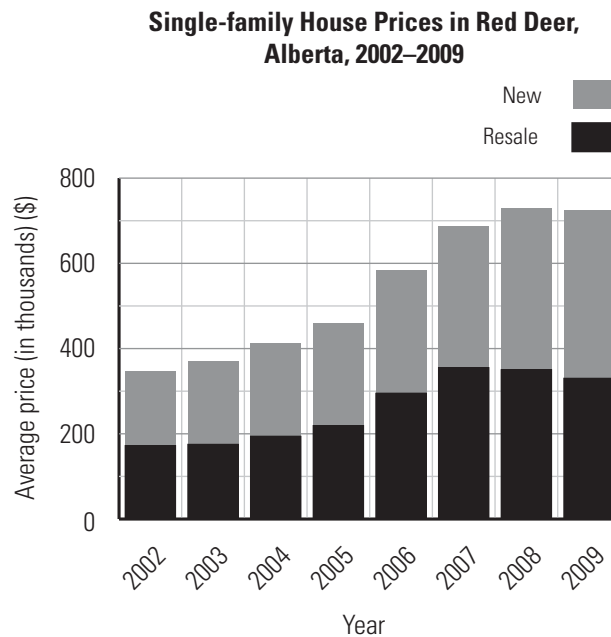
Example 4

For this example, use the data from Example 3 about Roger, the real estate agent from Red Deer, AB.

- Draw a stacked bar graph showing the total sales of single-family houses in Red Deer from 2002 to 2009.
- What is less obvious on the stacked graph than on the double bar graph?

SOLUTION

a)



- The trend in the value of new properties is less obvious on the stacked bar graph.

ALTERNATIVE SOLUTION

The graph could also have been drawn with the new sales on the bottom, and the resale houses stacked on top.

BUILD YOUR SKILLS

10. Trina did a survey of her school to find out students' favourite sports to watch on TV. The results are summarized below.

SURVEY RESULTS: FAVOURITE SPORT TO WATCH ON TV					
<i>Sport</i>	<i>Football</i>	<i>Hockey</i>	<i>Basketball</i>	<i>Baseball</i>	<i>Golf</i>
Boys	135	243	101	79	18
Girls	121	265	75	15	2

- a) Draw a double vertical bar graph and a stacked vertical bar graph to represent the data.
- b) How many people took the survey?
- c) What is the most popular sport to watch on TV?
- d) What is easier to see on the double bar graph than the stacked bar graph? When might the stacked bar graph be useful?

11. Consider the three multiple bar graphs in Build Your Skills questions 7, 8, and 9 above:

- Question #7: Average Weekly Household Expenses, Canada
- Question #8: Visa Applications and Approvals
- Question #9: High and Low Daily Temperatures in Pincher Creek, Alberta

Which of the three graphs is the most suitable for a stacked bar graph? Explain your answer.

PRACTISE YOUR NEW SKILLS

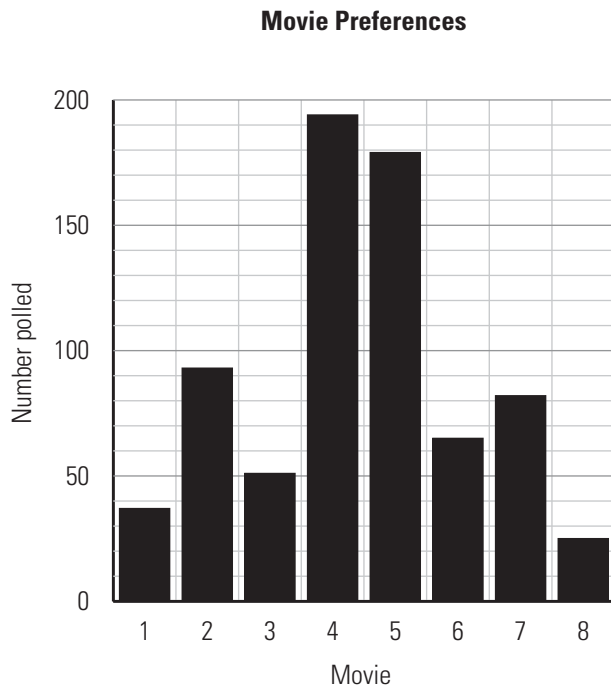


Indoor fitness equipment allows people to exercise even during wet and cold weather.

1. Petro is a trainer at the local gym. He recorded the following information about the number of people who used the equipment during the day. Graph the data on a horizontal bar graph.

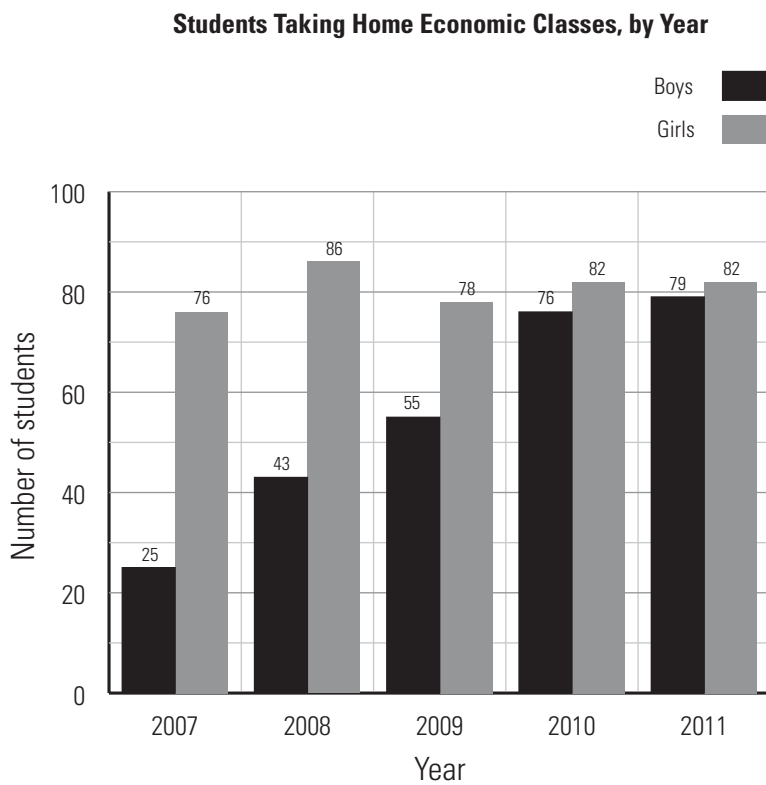
NUMBER OF USERS OF FITNESS EQUIPMENT PER DAY				
<i>Equipment</i>	<i>Stationary bike</i>	<i>Treadmill</i>	<i>Elliptical cross-trainer</i>	<i>Stairclimber</i>
Number	142	167	85	149

2. A multiplex theatre has eight different-sized theatres. In order to determine which movie should be shown in which theatre, Mollie polled people on the street as to which movie they would attend. Her results are displayed in the graph below.

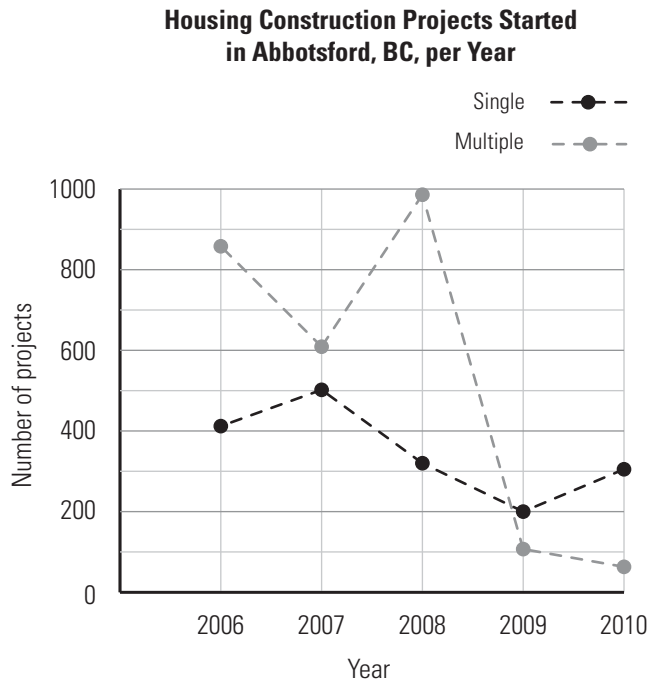


- a) Which are the two most popular movies?
- b) Which is least popular?

3. Use the graph below to discuss the general trend of students taking home economics classes at a high school in Brandon, MB, over a period of five years.



4. A real estate agent wants to compare the number of single-detached house and multiple-unit construction projects started in Abbotsford, BC, over a period of five years.



- a) Use the graph to explain trends in housing projects in Abbotsford.
- b) Use the data from the graph to draw a double bar graph comparing the number of housing projects. Which graph do you prefer for presenting the data? Why?