



graphs, tables AND CHARTS

12

Putting toast to the test

Over 1000 students in the United Kingdom recently collected data to find out whether toast falling off a plate usually falls butter side down.

The students found that 'butter-side up' toast dropped from table height landed butter-side down 62% of the time. They then did a similar experiment to see whether the butter was causing this, by writing 'B' on one side of unbuttered toast. The toast ended up 'B'-side down almost as often as butter-side down in the previous experiment. This indicated that it wasn't the butter that was causing the toast to tend to land the way that it did. So what's going on here?

A third experiment involved dropping buttered toast from a height of 2.5 metres rather than table height. Surprisingly, the toast only landed butter-side down 47% of the time. This indicates that it's not the butter that counts but the height from which toast is dropped and how many flips it can do before it hits the ground.

outcomes

After completing this chapter you will be able to:

- construct frequency tables
- draw, read and interpret line graphs, sector graphs, divided bar graphs, scatter diagrams, travel graphs, step and conversion graphs, dot plots and stem-and-leaf plots.



Prepare for this chapter by attempting the following questions. If you have difficulty with a question, click on the Replay Worksheet icon on your *eMaths Zone* CD or ask your teacher for the Replay Worksheet.

e Worksheet R12.1

- 1 (a) List the numbers you get if you count by fives from 0 to 30.
 (b) List the numbers you get if you count by twos from 16 to 28.
 (c) List the numbers you get if you count by hundreds from 1300 to 1700.
 (d) List the numbers you get if you count by twenties from 60 to 200.

e Worksheet R12.2

- 2 (a) List the multiples of 50 from 50 to 250.
 (b) List the multiples of 25 from 100 to 200.
 (c) List the multiples of 200 from 1400 to 2000.

e Worksheet R12.3

- 3 Order the listed numbers from smallest to largest.
 (a) 12, 22, 14, 20, 10, 16, 24, 6
 (b) 15, 0, 50, 20, 55, 100, 25, 5
 (c) $5, 1\frac{1}{2}, 6\frac{1}{2}, 1, \frac{1}{2}, 0, 3\frac{1}{2}, 5\frac{1}{2}, 2, 3, 2\frac{1}{2}, 4$

e Worksheet R12.4

- 4 Copy and complete the pattern by adding the same number each time.
 (a) 12, ____, ____, 21, ____, 27
 (b) 120, ____, ____, ____, ____, 220
 (c) 225, ____, ____, 300, ____, 350

e Worksheet R12.5

- 5 Draw a set of axes and plot the following points.
 (a) $A(2, 4)$ (b) $B(0, 2)$ (c) $C(5, 0)$ (d) $D(4, 1)$

KEY WORDS

census
 column graph
 conversion graph
 data
 divided bar graph

dot plot
 frequency table
 graph
 line graph
 pie graph

population
 scatter diagram
 sector graph
 stem-and-leaf plot
 step graph

survey
 travel graph

12.1 Surveys and frequency tables

In this topic we talk a lot about **data**. Data is simply information that has been collected in some way.

One of the easiest ways to *collect* data is to conduct a **survey**. In a survey only a fraction of the total **population** is questioned or observed as opposed to a **census** which involves all of the population.

Having collected the data we must then present it in some way. A **frequency table** is often used for this.

worked example 1

A Year 7 class of 25 students has been surveyed about the number of brothers and sisters they have. The results are:

2, 3, 5, 0, 1, 1, 2, 0, 3, 1, 4, 0, 7, 1, 3, 2, 2, 2, 1, 1, 0, 1, 1, 2, 4

Draw up a frequency table for this survey.

Steps

1. Draw up a table with three columns. The first column shows what is being surveyed.
2. Use the tally column to help count the number of times each category occurs. In using a tally column you should go through the data list only once. Notice **++++** is used to represent 5.
3. Write these tallies as numbers and enter them in the third column. Add up the numbers in the third column to check that you have tallied correctly.

Solution

Frequency table

Number of brothers and sisters	Tally	Frequency
0		4
1	++++	8
2	++++	6
3		3
4		2
5		1
6		0
7		1
		25

Sometimes the data we collect is so spread out that we need to group the results so that we don't have too many rows in our frequency table. We like to have between five and ten rows in our frequency table, so this helps us decide how to group the data.

worked example 2

The Exceptional Felines basketball team keeps track of the points they score on the way to the State championship. The point totals were:

73, 84, 68, 45, 52, 44, 45, 52, 66, 42, 43, 40, 53, 47, 82, 76, 42, 57, 65, 81, 80, 40, 56, 72, 74, 83, 41, 66, 76, 75, 68, 81, 82, 79, 58, 81, 78, 80, 78, 76

Draw up a frequency table for these results.

Steps

1. Decide on how to group the data. The smallest score is 40 and the highest is 84, which is a difference of 44.
 $44 \div 5 = 8.8$, so group in 5s.
2. Draw up a table with three columns. Write the grouped values in the first column. Be careful with your groupings. 40–44 includes the numbers 40, 41, 42, 43, 44, i.e. 5 values.

Notice we don't make the intervals 40–45, 45–50 because this puts the number 45 into two groups.



Solution

Group in 5s; this will give 9 groups.

Number of points scored	Tally	Frequency
40–44	++++	7
45–49		3
50–54		3
55–59		3
60–64		0
65–69	++++	5
70–74		3
75–79	++++	7
80–84	++++	9
		40

3. Use the tally column to help with the count. Remember, go through the data list only once.
4. Write the tallies as numbers and enter them in the third column. Add up the numbers in the third column to check that you have tallied correctly.

exercise 12.1 Surveys and frequency tables

P Preparation: Prep Zone Q1–4

Core

- 1** A Year 7 class was surveyed about how many pets they owned.

The results were:

0, 0, 2, 1, 1, 1, 0, 6, 9, 4, 3, 0, 1, 3, 2, 1, 1, 4, 5, 4, 3, 2, 1, 4, 7

Draw up a frequency table showing this information.

- 2** A Year 7 class was surveyed about how many hours of television they watched on a normal week night. The results were:

3, 2, $1\frac{1}{2}$, $\frac{1}{2}$, 1, $2\frac{1}{2}$, 1, 0, $4\frac{1}{2}$, $2\frac{1}{2}$, 2, $2\frac{1}{2}$, 2, 0, 4, 2, $1\frac{1}{2}$, $2\frac{1}{2}$, 3, $\frac{1}{2}$,

0, $\frac{1}{2}$, 1, $2\frac{1}{2}$, 2, 2, $\frac{1}{2}$

Draw up a frequency table showing this information.

- 3** 7C was surveyed about their favourite

takeaway food. The results were:

Sarah—pizza, Brent—fish & chips, Whitney—hamburgers, Ruby—pizza, Morgan—Chinese, Romano—fish & chips, Kimiko—pizza, Gareth—chicken, Liam—hamburgers, Fleur—never has takeaway, Anne—chicken, Jonty—pizza, David—not allowed to have takeaway, Carol—Chinese, Malcolm—pizza, Tracy—hamburgers, Gary—hamburgers, Maryse—pizza, Dieter—chicken, Douglas—pizza

Copy and complete the following frequency table showing this information.



Type of takeaway	Tally	Frequency
Pizza		
Fish & chips		
?		
?		
?		
None		

- 4** A Year 7 class was surveyed about how much money they had in their pocket at that time. The results were:

\$1.20 \$0.75 \$1.00 \$2.55 \$1.50 \$4.00 \$0.00 \$0.00 \$0.80

\$2.40 \$1.25 \$0.00 \$3.60 \$4.40 \$4.30 \$2.90 \$1.80 \$2.35

\$2.20 \$0.00 \$0.50 \$0.40 \$2.50 \$1.50 \$1.75

Draw up a frequency table showing this information. You will need to group the results. Use \$0.00–\$0.49, \$0.50–\$0.99, \$1.00–\$1.49, etc.

e hi.com.au

e Worksheet C12.1

e Animation

e Hint

5 The numbers of calls per day to the emergency help department of the automobile association were recorded for the month of June. The results were:

120	100	75	60	66	100
110	197	55	80	155	179
154	43	75	98	172	130
25	55	110	99	72	90
113	65	87	94	112	18

Draw up a frequency table showing this information. You will need to group the results. Use 0–19, 20–39, 40–59, etc.



Extension

Questions 6–10 can be done by the class as a whole with results being recorded on the blackboard.



- 6** Find out how many pets each of the students in your class owns by surveying your class. Draw up a frequency table of your results.
- How many members of your class have no pets?
 - How many members of your class have exactly one pet?
 - What number of pets do the majority of the members of your class have?
- 7** Find out how many hours of television each of the students in your class watches on a normal week night by surveying your class. Draw up a frequency table of your results. Round your answers to the nearest half hour.
- How many of your class members watch no television on a normal week night?
 - How many of your class members watch less than 1 hour of television on a normal week night?
 - How many of your class members watch 3 or more hours of television on a normal week night?
 - How much television do the majority of the members of your class watch on a normal week night?
 - Do you watch more or less television than the majority of the members in your class? Or do you watch about the same amount as the majority of the members?
- 8** Find out the favourite type of takeaway of each of the students in your class by surveying your class. Draw up a frequency table of your results.
- Did you need to add any categories that didn't appear in Question 3? If so, what were they?
 - What is the favourite takeaway of the members of your class?
 - What is the second favourite takeaway of the members of your class?

- (d) Are there any takeaways which none of your class members said was their favourite? If so, what were they?
- (e) How many students had no favourite takeaway?
- 9 Find out the favourite school subject of each of the students in your class by surveying your class. Draw up a frequency table of your results.
- (a) What is the favourite subject of the members of your class?
- (b) What is the second favourite subject of the members of your class?
- (c) How many students had no favourite subjects?
- 10 Find out the hair colour of each of the students in your class by surveying your class. Draw up a frequency table of your results.
- (a) What are your categories?
- (b) What difficulties are there with this survey compared to the others?
- (c) What was the most common hair colour?
- (d) What was the second most common hair colour?

12.2 Column graphs

Another way of looking at statistics is to draw a **graph**.

There are many types of statistical graphs. We will begin by looking at **column graphs**.

Column graphs can be drawn with their columns vertical  or horizontal .

Reading column graphs

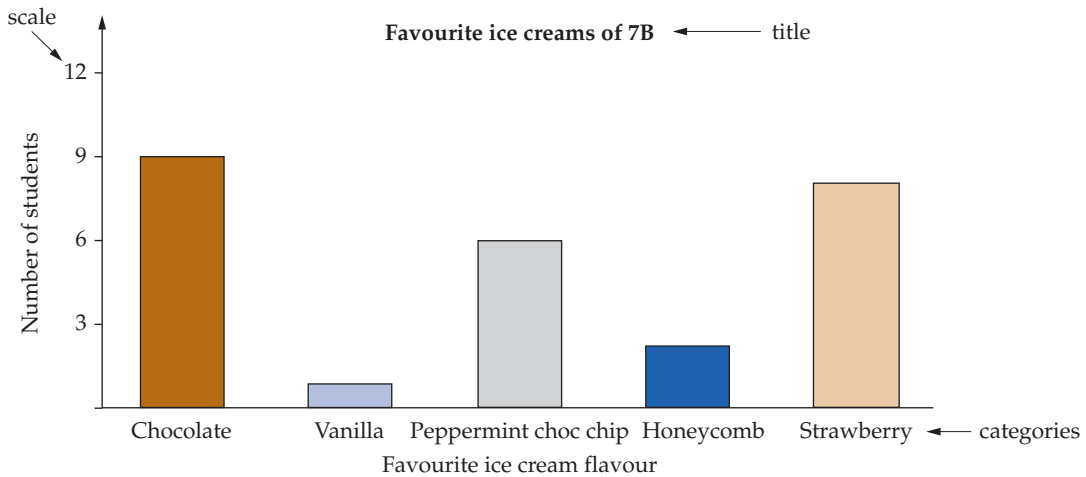
To read a column graph you simply look at the required column and read off the value.

Drawing column graphs

Although there are slightly different ways to draw column graphs, the basic column graph should have the following:

1. a title
2. a scale which shows numbers in some form, and which explains what the numbers stand for
3. a clear list of the categories that are being looked at.

An example of a column graph appears on the following page.



e Tutorial

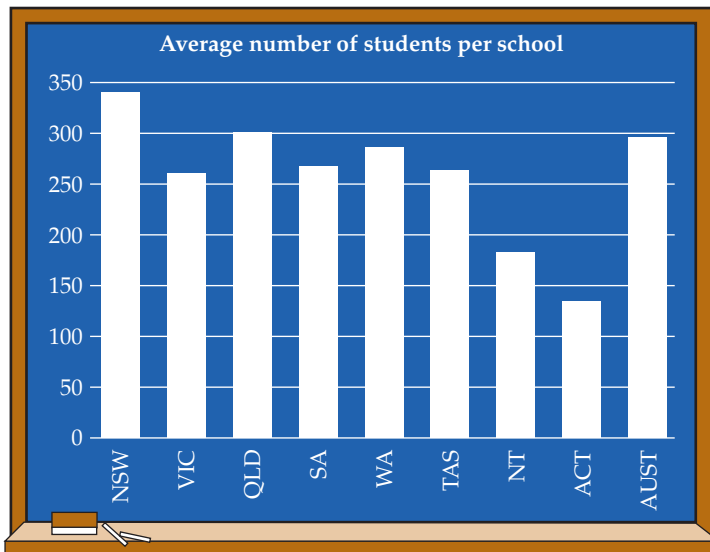
exercise 12.2 Column graphs

p Preparation: Ex 12.1

core

e Worksheet C12.2

1 New South Wales' schools: how they compare

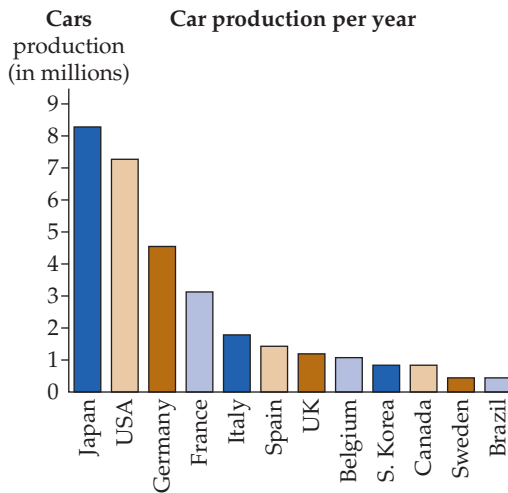


- Which Australian State or Territory has the highest average number of students per school?
- Which Australian State or Territory has the lowest average number of students per school?
- About how many students do Queensland schools have on average?
- About how many students do New South Wales schools have on average?

e Hint

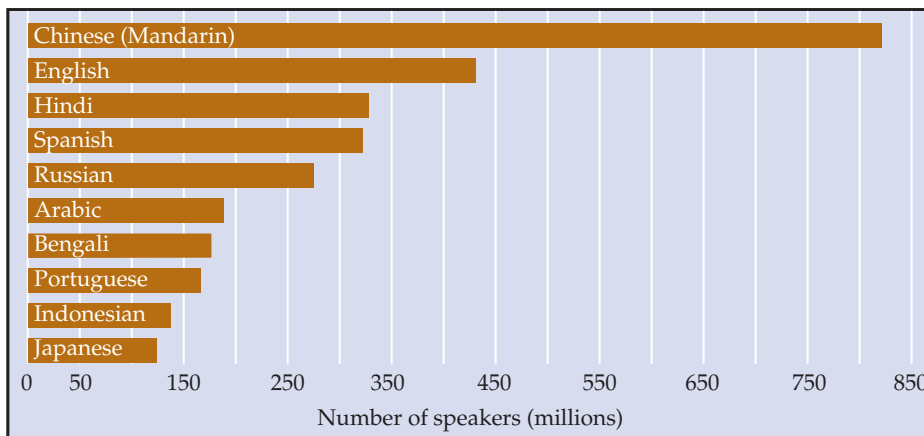
- (e) Is the average number of students in New South Wales schools more or less than the Australian average?
- (f) What is the title of the graph?
- (g) Is the picture actually part of the graph?
- (h) Look at the scale on the left of the graph. By what multiple is it increasing?
- (i) Why is it difficult to read the exact figures of the average numbers of students?
- (j) Is your school above or below the average for your State?

2 The following column graph shows the numbers of cars produced in a year by the world's major car producing countries. Choose the correct answer.



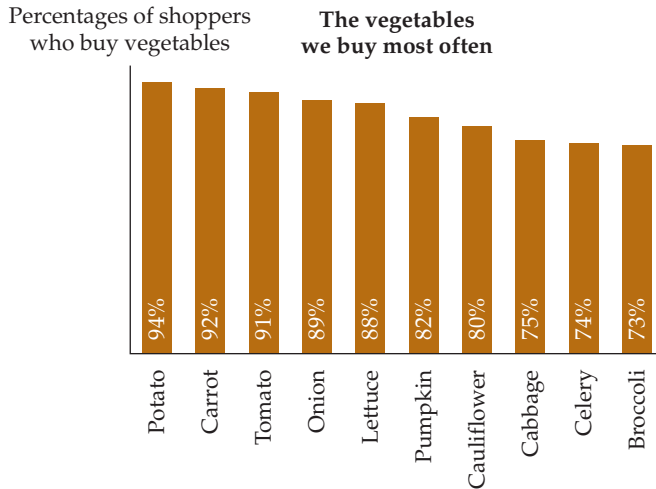
- (a) Which country produces the most cars?
 - A USA
 - B Japan
 - C Brazil
 - D It's impossible to tell from the graph.
- (b) Which countries shown produce the fewest cars?
 - A Japan and USA
 - B France and Germany
 - C Brazil and Sweden
 - D It's impossible to tell from the graph.
- (c) The number of cars produced by Germany is:
 - A 4.5
 - B 45 000 000
 - C 4 500 000
 - D 450 000
- (d) The number of cars produced by Canada is:
 - A 8000
 - B 800 000
 - C 0.8
 - D 8 000 000

3 The 10 most widely spoken languages in the world



- (a) What are the differences between this and a vertical column graph?
- (b) Approximately how many people in the world speak Mandarin?
- (c) Approximately how many people in the world speak English?
- (d) What is the fourth most-spoken language in the world?
- (e) What do you notice is unusual about the scale at the bottom of the graph?
- (f) Could this have been drawn as a vertical column graph?

4 Look at the following column graph.



- (a) Is it a vertical or horizontal column graph?
- (b) What are the three most-often-bought vegetables?
- (c) What percentage of shoppers buy cabbage?
- (d) What is missing on this graph that has appeared on all the others? Why isn't it needed?

Extension

5 Look at this table of information.

- (a) What percentage of cancers of lung, lip and throat were caused by smoking?
- (b) (i) Which disease had the highest percentage caused by smoking?
- (ii) What percentage was this?

<i>Percentages of diseases caused by smoking</i>	
<i>Disease</i>	<i>Percentage</i>
Heart diseases	30%
Strokes	32%
Chronic bronchitis	65%
Cancers of lung, lip, throat	75%
Narrowing of leg arteries	90%

Source: Quit

- (c) What does the scale on a column graph of this information need to go up to?
- (d) If you wanted to write only 10 numbers on the scale, what multiple would you go up by?
- (e) Draw a column graph of the information which has ten numbers on the scale.

6 Look at the following table of information.

<i>Circumstance of accidental drownings, 1992–1998</i>	
<i>Circumstance</i>	<i>Number</i>
Falling or wandering into water	748
Swimming, paddling or wading	600
Surfboard riding	20
Swept off rocks, breakwater	91
Diving, spear fishing	83
Drowning in a bathtub	131
Attempting rescue	41
Watercraft accidents	343

Source: Australian Bureau of Statistics

- (a) Of the circumstances mentioned, which is the least common cause of drowning?
 - (b)
 - (i) What is the total number of drownings that occurred in this time period?
 - (ii) Given that 1758 of the drowning victims were male, how many females drowned between 1992 and 1998?
 - (c) If you choose your scale to go up in multiples of 100, what is the highest number you need to show?
 - (d) Using a scale that goes up in multiples of 100, draw a column graph of the information.
- 7 Draw a column graph of the following table of information which shows the numbers of settlers who arrived in Australia from different countries in 2001–2002. You will need to round off these numbers before trying to draw the graph.

<i>Where migrants come from</i>	
<i>The top 10 source countries by country of birth of settler 2001–2002</i>	
<i>Country</i>	<i>Number of immigrants</i>
New Zealand	15 663
United Kingdom	8 749
China	6 708
South Africa	5 714
India	5 091
Indonesia	4 221
Philippines	2 837
Federal Republic of Yugoslavia	2 082
Sri Lanka	2 011
Malaysia	1 939

Source: Department of Immigration and Multicultural Affairs

 eQuestions

 Homework 12.1

12.3 Line graphs

A **line graph** can be made up of a series of straight line segments or it can be made up of a curved line.

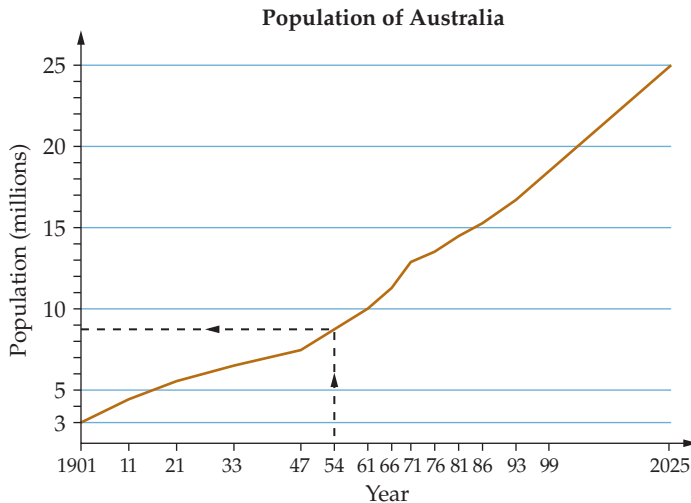


dangerzone

Line graphs should only be used for data that can be measured over some period of time. This is because the connected line indicates that values can occur between the given markings on the axis.

Reading line graphs

To read a line graph we look for the appropriate value on one axis and read across, or up, to the graph and then read down, or across, to find a value on the other axis. For example, if we were given the graph shown we could find the population of Australia in, say, 1954 by drawing a line from 1954 up to the graph line and then drawing a line across to the population axis. This is shown in the diagram. We would say the population of Australia in 1954 was approximately 9 million people.

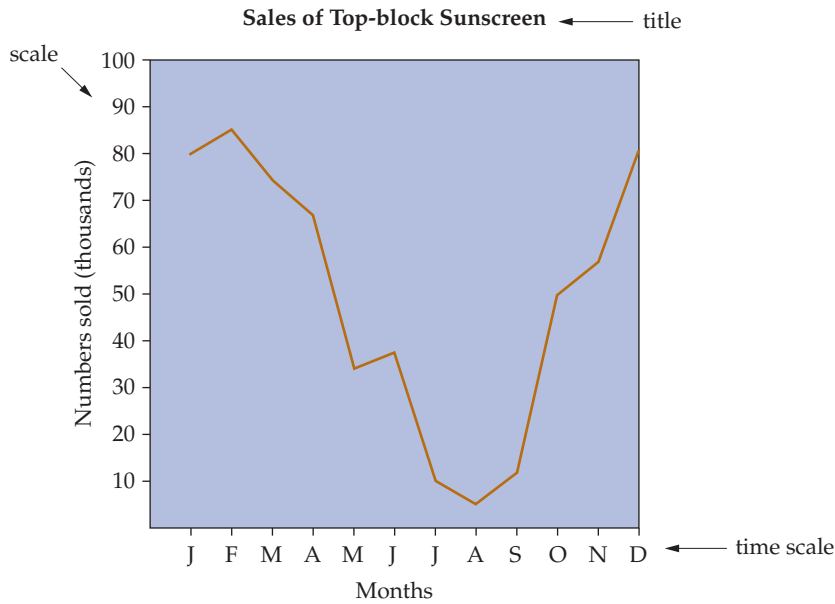


Drawing line graphs

Although there are slightly different ways to draw line graphs, the basic line graph should have the following:

1. a title
2. a scale across the bottom (the horizontal axis) which usually measures time in some way, and which is clearly labelled

3. a scale on the left-hand side (the vertical axis) which is also clearly labelled.



exercise 12.3 Line graphs

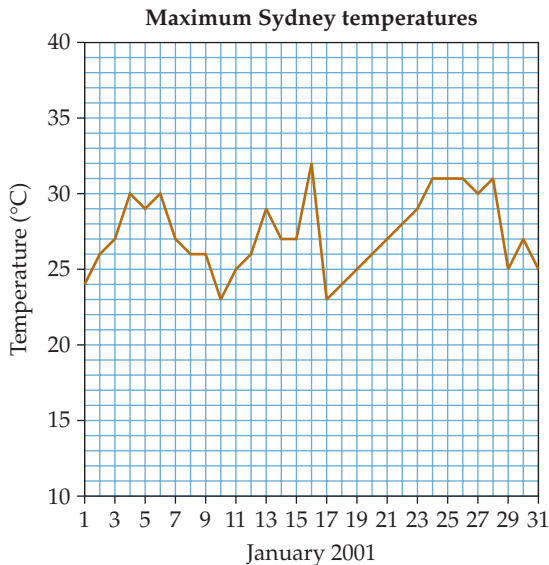
p Preparation: Prep Zone Q1 and 2

Core

- 1** The line graph below shows the maximum temperatures in Sydney for January 2001.

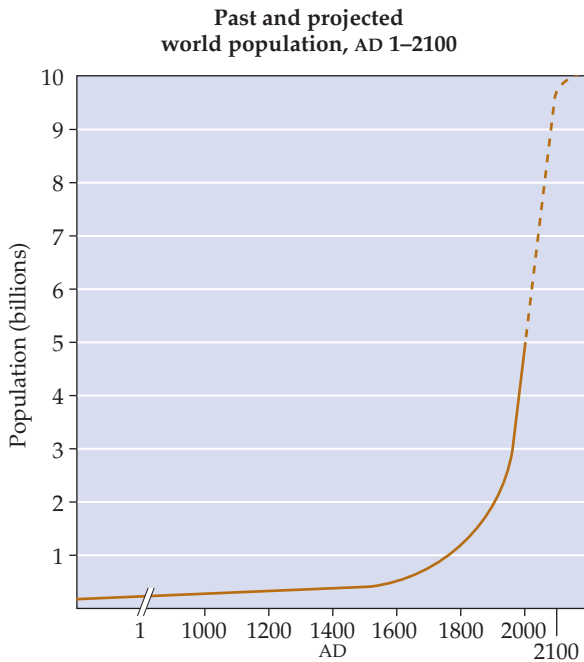
e Worksheet C12.4

e Hint



- (a) (i) What was the highest maximum temperature reached?
(ii) On which date was this temperature reached?
- (b) (i) What was the lowest maximum temperature reached?
(ii) On which date(s) was this temperature reached?
- (c) Up until 16 January, the maximum temperature was always roughly between which two values?
- (d) Describe the temperature pattern between 17 January and 24 January.

2 Look at the following line graph.



- (a) Has there ever been a time when the world's population has decreased?
- (b) Approximately when did the world's population reach one billion?
- (c) What was the approximate world population in 1900?
- (d) During which century has there been the biggest population growth?
- (e) (i) What do you think the two sloping lines (\neq) on the bottom scale indicate?
(ii) Why do you think the sloping lines have been used?
- (f) Why do you think the graph becomes broken towards the right-hand end?

Notice how all of these line graphs represent data collected over time.

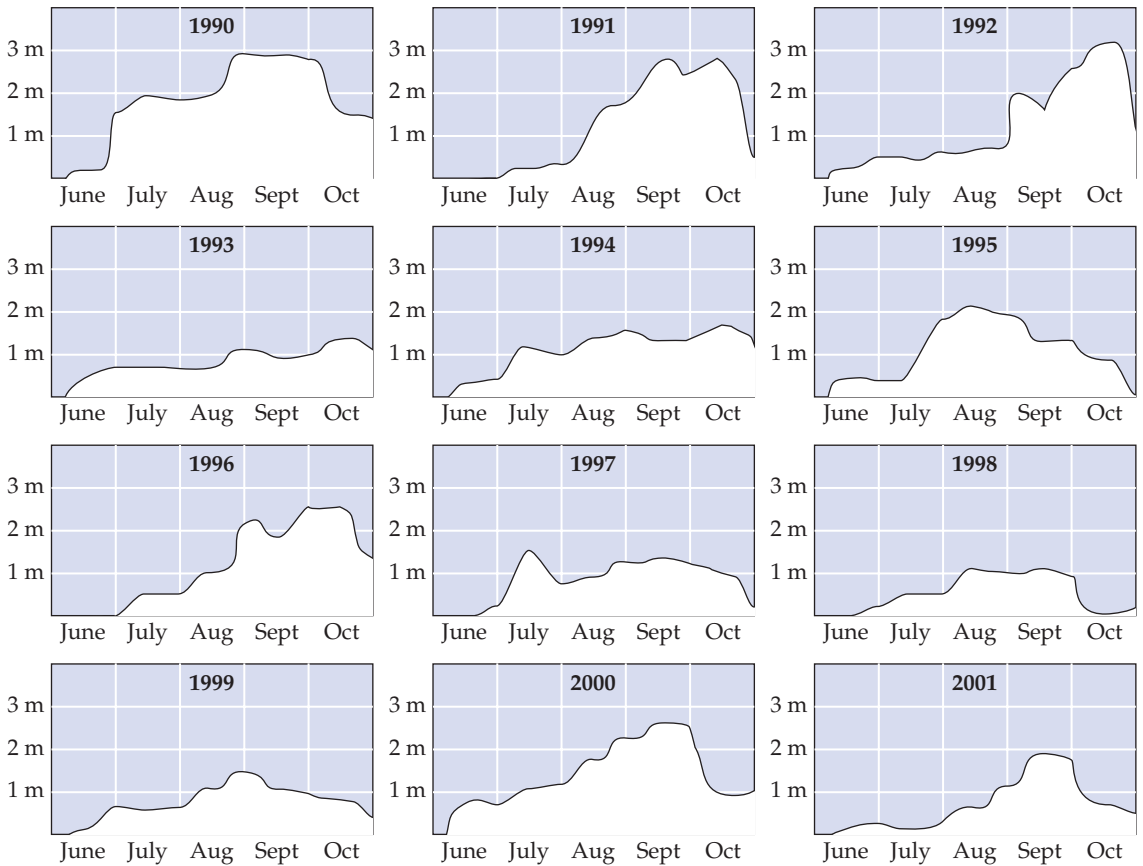


e Animation

3 Look at the following line graphs which show the average snow depths (in metres) at Spencer's Creek, Mt Kosciuszko, from 1990 to 2001.

e Hint

Spencer's Creek snow depths



- Did the snow depth reach 3 metres at any time during the twelve years?
- What was the greatest snow depth reached in October 1995?
- What was the greatest snow depth reached in 2000?
- Which year had the least snow in July?
- Which year had the most snow through the whole of July?
- Which year had the worst October skiing?
- Which year had the best October skiing?
- Which year would have probably had the best November skiing?
- Which year had the worst skiing overall?
- Which month usually has the best skiing?
- Which month usually is the second best skiing month?
- It has been claimed that New South Wales' overall temperature has been getting higher due to the greenhouse effect. Is there any evidence in these graphs to back this up?



- (m) Why would it not work very well if you tried to draw the information about snow depth as a bar graph?

Extension

- 4 The following shows the average maximum temperatures ($^{\circ}\text{C}$) in Adelaide.

J	F	M	A	M	J	J	A	S	O	N	D
23	23	21	18	14	12	11	12	14	17	19	22

- (a) Draw a line graph showing this information. Use multiples of 3°C on the vertical axis.
 (b) Which are the three hottest months?
 (c) What is the highest average maximum temperature?
 (d) What is the lowest average maximum temperature?

e Hint

- 5 The following shows the average maximum temperatures ($^{\circ}\text{C}$) in New York.

J	F	M	A	M	J	J	A	S	O	N	D
0	0	5	11	16	22	25	24	20	15	8	2

- (a) Draw a line graph showing this information.
 (b) Why does the line graph for New York have a different basic shape from the line graph for Adelaide?
 (c) What is the highest average maximum temperature in New York?
 (d) What is the lowest average maximum temperature in New York?
 (e) Which is generally colder, Adelaide or New York?
 (f) Which of the two cities has the most extremes in temperature?
- 6 The following table of information shows the number of people at the Water World Swimming Complex at various times on two particular days.

Time	Day 1	Day 2
6.00 a.m.	2	25
8.00 a.m.	12	12
10.00 a.m.	28	20
noon	79	26
2.00 p.m.	145	24
4.00 p.m.	122	78
6.00 p.m.	84	73
8.00 p.m.	31	91
10.00 p.m.	4	56

- (a) Draw a line graph for day 1.
 (b) When did attendances peak on day 1?
 (c) Do you think day 1 is a weekday or a weekend? Give reasons for your answer.
 (d) Draw a line graph for day 2 on the same axes.
 (e) When did attendances peak on day 2?
 (f) Do you think day 2 is a weekday or a weekend? Give reasons for your answer.

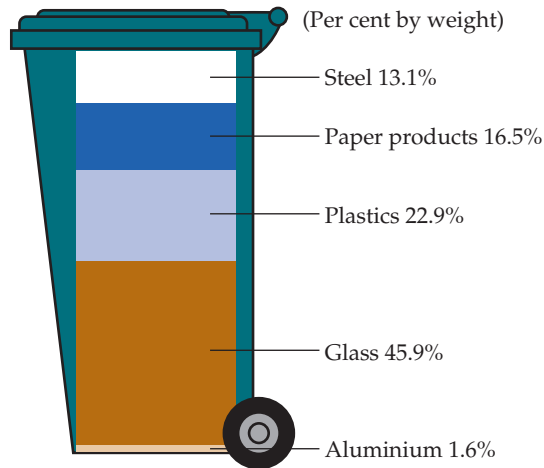
12.4 Divided bar and sector graphs

We look now at **divided bar graphs** and **sector graphs**.

Both of these break a shape into various pieces. For a sector (or **pie**) graph this is always a circle. For divided bar graphs it is usually a rectangle but can be any convenient shape. To read a divided bar or sector graph we simply need to look carefully at the given graph. For example, if we were given the graph shown we might be asked for the most common type of domestic garbage packing material. To answer this we simply look at the graph and find the highest percentage value which, in this case, is glass which makes up 45.9% of the total.

We would not normally use a divided bar graph or sector graph if there were too many pieces. The graph would become very messy and difficult to read.

Packaging content of domestic garbage
Glass, bottles, jars, cans, cardboard, paper and plastic makes up 34%, or about one third by weight of all Sydney's garbage.



Drawing sector graphs

worked example 3

The table shows the number of certain makes of car which passed a school in a fixed time. Draw a sector graph from this data.

Make	Number observed
Holden	78
Ford	65
Toyota	39
Mitsubishi	26
Other	52

Steps

1. Add up the total number of cars observed.
2. Work out the fraction of the whole circle for each make by using $\frac{\text{number of cars for the make}}{\text{total number of cars}}$

e.g. Holden = $\frac{78}{260}$

3. Multiply the fraction from step 2 by 360° to find the sector angle (use a calculator), e.g.

$$\text{Holden} = \frac{78}{260} \times \frac{360}{1} = 108^\circ$$

and, if necessary, round off your answer to the nearest whole number. (Make sure that your sector angles add up to 360° . It is possible that this may not be exact if you round off.)

4. Draw the sector graph using your protractor to measure the sector angles.

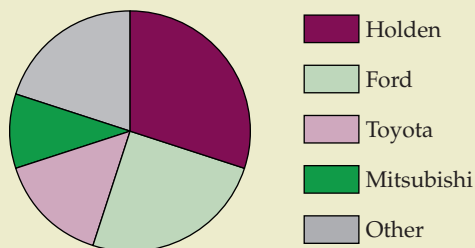
Solution

260

Make	Number observed	Fraction of whole circle
Holden	78	$\frac{78}{260}$
Ford	65	$\frac{65}{260}$
Toyota	39	$\frac{39}{260}$
Mitsubishi	26	$\frac{26}{260}$
Other	52	$\frac{52}{260}$
Total	260	1

Make	Number observed	Fraction of whole circle	Sector angle
Holden	78	$\frac{78}{260}$	108°
Ford	65	$\frac{65}{260}$	90°
Toyota	39	$\frac{39}{260}$	54°
Mitsubishi	26	$\frac{26}{260}$	36°
Other	52	$\frac{52}{260}$	72°
Total	260	1	360°

Cars travelling past school



exercise 12.4 *Divided bar and sector graphs*

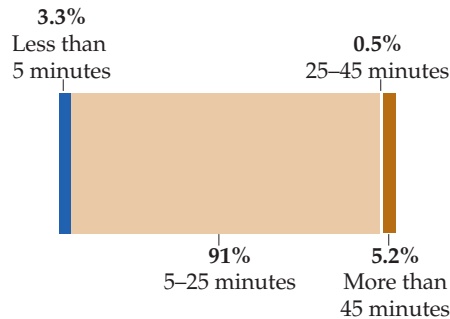
p Preparation: Prep Zone Q1 and 2

Core

1 The following graph shows how long people take when they visit a doctor.

- What percentage of people spend less than five minutes when they visit a doctor?
- What percentage of people spend more than forty-five minutes when they visit a doctor?
- How long do the majority of people take when they visit the doctor?
- What percentage of people spend less than 25 minutes when they visit the doctor?

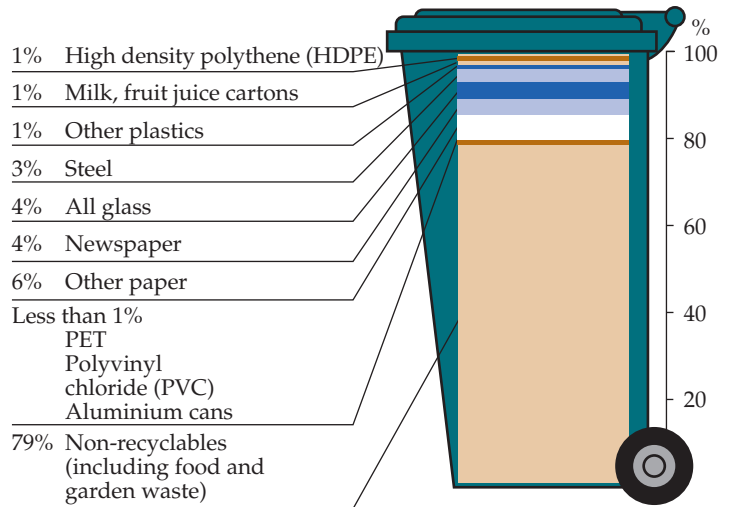
How long it takes when people visit a doctor



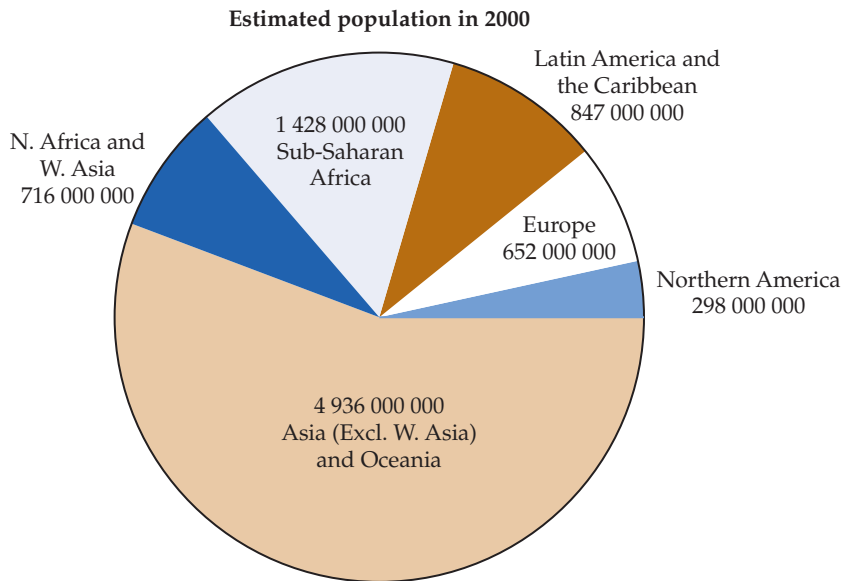
2 Look at the following divided bar graph which shows how much of different types of rubbish we throw out.

- What percentage of our rubbish is all glass?
- What percentage of our rubbish is milk and fruit juice cartons?
- What percentage of our rubbish is newspaper?
- What is the largest category of rubbish?
 - What percentage of rubbish is in this category?
- What do we throw out more of when it comes to rubbish, high density polythene or paper?
- What do we throw out more of when it comes to rubbish, steel or glass?
- Is the picture of the rubbish bin actually part of the graph?
- What does this divided bar graph have that the divided bar graph in Question 1 didn't have?

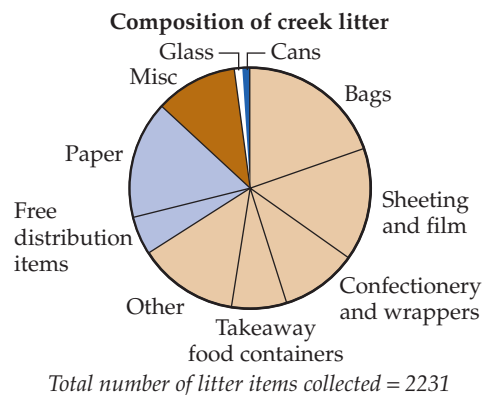
Household rubbish



- 3 The following sector graph shows the estimated populations of different world regions for the year 2000.



- Which region has the largest estimated population?
 - Which region has the smallest estimated population?
 - Which has a larger estimated population, Europe or Latin America and the Caribbean?
 - Which has a larger estimated population, Sub-Saharan Africa or Europe?
 - Which region is Australia a part of?
 - Why is this also called a pie graph?
- 4 Look at the following sector graph showing the type of litter in a particular creek in Sydney.
- What was the most common type of litter?
 - What was there more of, cans or sheeting and film?
 - What was there more of, takeaway food containers or confectionery and wrappers?
 - When you compare this sector graph with the one in Question 3, what is missing?
 - Misc stands for miscellaneous. What do you think this means?
 - We are told how many litter items were collected in the survey. Is this important? Why or why not?
 - Why are sector graphs like divided bar graphs?



Extension

- 5 Copy and complete the tables on the following page, finding the sector angles and rounding off to the nearest whole number. Draw the sector graph as accurately as possible.

- (a) Fifty vegetables were picked from Belinda's garden.

<i>Vegetable</i>	<i>Number of vegetables picked</i>	<i>Fraction of whole circle</i>	<i>Sector angle</i>
Potatoes	20	$\frac{20}{50}$	
Carrots	12		
Turnips	8		
Cabbage	10		
Total	50		



e Hint

- (b) At a multicultural festival a number of people were asked their native language.

<i>Language</i>	<i>Number of people who speak the language</i>	<i>Fraction of whole circle</i>	<i>Sector angle</i>
Italian	22		
French	18		
Japanese	12		
Indonesian	8		
Total			

- (c) The number of pizzas purchased one evening at Abracadabra Pizza Parlour.

<i>Pizza</i>	<i>Number of pizzas ordered</i>	<i>Fraction of whole circle</i>	<i>Sector angle</i>
Super Supreme	6		
Capricciosa	8		
Hawaiian	4		
Italiana	3		
Australiana	2		
Total			



- (d) The number of cars in the staff car park at a small high school.

<i>Car make</i>	<i>Number of cars in the staff car park</i>	<i>Fraction of whole circle</i>	<i>Sector angle</i>
Ford	4		
Holden	5		
Mazda	4		
Toyota	3		
Mitsubishi	2		
Other	5		
Total			

- 6 Try to generate sector graphs for Question 5 using Chart Wizard in Excel (or similar) if you have access to a computer. Compare your graphs with the computer-generated ones (you could use 3D graphs also) and comment on any differences.



eQuestions

12.5 The best statistical graph

We can't really say that one type of statistical graph is always better than another. It depends on the type of data that needs to be graphed. Sometimes one of them is definitely the best choice. Other times two or three types are equally effective.

The following are good general guidelines:

- Use line graphs if you want to see how something changes over time.
- Use sector graphs or divided bar graphs if you want to compare different parts of a whole and there's no time element involved and there aren't too many pieces.
- Use column graphs if you are *not* looking at changes over time and your categories are *not* parts of a whole.

exercise 12.5 The best statistical graph

P Preparation: Exs 12.2–12.4

Core

- 1 Which statistical graph would be the best one to use for the following data? Do not actually draw the graph.

- (a) Sales figures for Gobbler sweets:

1990	1991	1992	1993	1994	1995	1996	
0.3	0.4	1.2	1.7	2.9	3.2	4.1	(million)

- (b) The different ways the members of 7D at Reed High School get to school:

Bus	Bicycle	Walk	Car	Skateboard	Taxi
11	4	7	2	1	1

- (c) Nathan's height measured every six months from when he was five to when he was ten:

5	$5\frac{1}{2}$	6	$6\frac{1}{2}$	7	$7\frac{1}{2}$	8	$8\frac{1}{2}$	9	$9\frac{1}{2}$	10
98	102	106	110	113	115	122	131	135	138	143 (cm)

- (d) The distances travelled by five friends to get to school:

Jana	Azuma	Cameron	Vivian	Miriam	
920	210	1040	560	1400	(metres)

e Hint



- 2 Which statistical graph would be the best one to use for the following information?
- (a) The number of people in Australia looking for jobs each month in 2001.
 - (b) The favourite television show watched by you and nine of your friends.
 - (c) The attendance at a cinema at certain times on a particular day.
 - (d) The favourite subject of members in your class.
 - (e) The different reasons people give for not doing any exercise.
 - (f) The different religions of people in Australia.

e Hint

Extension

- 3 For each of the four different kinds of graphs, give an example of a type of data that could be represented on that graph.

e Homework 12.2

Working mathematically

Investigation



Surveys

Most common car colour

- 1 Go in a group of 2 or 3 to a large car park or to a busy intersection and survey the different colours of cars you see there. Decide how many cars you will need to include in your survey.
- 2 Decide what your categories will be and how you will fit each colour variation into a category. Then draw up a frequency table.
- 3 Choose the type of statistical graph you want to use. Each member of the group should draw their own graph.



What is the most common letter in the English language?

- 1 Pick out a passage of writing from a book. Decide how long the passage should be.
- 2 Count how often each letter appears in your passage and draw up a frequency table.
- 3 Choose the type of statistical graph you want to use and graph your results.

12.6 Stem-and-leaf and dot plots

A **stem-and-leaf plot** is another way of displaying grouped numerical data. In a stem-and-leaf plot, each piece of data is considered as two parts—a stem, and a leaf. For example, a score of 23 would be written as

$$\begin{array}{c} \text{STEM} \mid \text{LEAF} \\ 2 \mid 3 \end{array}$$

Notice that the tens digit is the *stem* and the units digit is the *leaf*.

Dot plots also display grouped data, but don't show the individual values.

worked example 4

A class obtained the following percentage results in a science test.

69 54 91 42 73 75 81 96 88 76 65 83 74
76 82 61 57 64 58 79 83 90 73 60 51

Draw **(a)** an ordered stem-and-leaf plot and **(b)** a dot plot to display this data.

Steps

- (a)**
- Group the results in intervals of 10, i.e. 40–49, 50–59, 60–69, etc.
 - List the stems down the page in ascending order. The tens digit is the *stem*. (4, 5, 6, 7, 8, 9)
 - Work through the data in the order given. List the leaf of each individual result in the appropriate row. The *leaf* is the units digit.
 - Order the data in the leaf part of the stem-and-leaf plot.

- (b)**
- Draw a horizontal line with the intervals written across the bottom.
 - Work through the data in the order given. Draw a dot for each individual result above the correct interval.

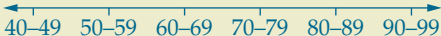
Solutions

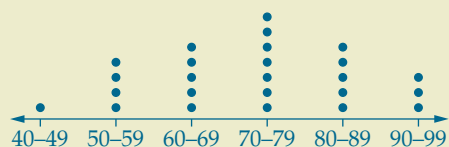
(a) STEM | LEAF

$$\begin{array}{c} 4 \mid 2 \\ 5 \mid 4 \ 7 \ 8 \ 1 \\ 6 \mid 9 \ 5 \ 1 \ 4 \ 0 \\ 7 \mid 3 \ 5 \ 6 \ 4 \ 6 \ 9 \ 3 \\ 8 \mid 1 \ 8 \ 3 \ 2 \ 3 \\ 9 \mid 1 \ 6 \ 0 \end{array}$$

STEM | LEAF

$$\begin{array}{c} 4 \mid 2 \\ 5 \mid 1 \ 4 \ 7 \ 8 \\ 6 \mid 0 \ 1 \ 4 \ 5 \ 9 \\ 7 \mid 3 \ 3 \ 4 \ 5 \ 6 \ 6 \ 9 \\ 8 \mid 1 \ 2 \ 3 \ 3 \ 8 \\ 9 \mid 0 \ 1 \ 6 \end{array}$$

(b) 



exercise 12.6 Stem-and-leaf and dot plots

P Preparation: Prep Zone Q1–3

Core

- 1** Copy and complete the following stem-and-leaf plots for the data given. Then order each stem-and-leaf plot.

- (a) Data: 54, 71, 60, 59, 81, 85, 63, 78, 54, 67

STEM	LEAF
5	4 _____
6	_____ 3 _____
7	_____ _____
8	_____ 5

- (b) Data: 107, 93, 112, 85, 124, 91, 101, 110, 80, 97

STEM	LEAF
8	_____ 0
9	_____ _____ _____
10	7 _____
11	2 _____
12	_____

- (c) Data: 65, 81, 73, 50, 79, 62, 57, 69, 88, 86, 60, 71, 75, 81, 67

STEM	LEAF
5	_____
5	_____
6	_____ 0
6	5 _____ _____
7	_____ 1
7	_____ _____
8	_____ 1
8	8 _____

- 2** Express the following data as ordered stem-and-leaf plots with class intervals of 10.

- (a) 57, 48, 42, 41, 31, 22, 37, 30, 23, 28, 34, 52
 (b) 51, 41, 62, 67, 58, 67, 56, 63, 48, 74, 57, 68, 42
 (c) 96, 63, 55, 49, 38, 76, 87, 90, 72, 61, 64, 75, 79, 72, 61, 88, 82
 (d) 25, 44, 15, 29, 37, 26, 33, 35, 14, 8, 2, 27, 30, 42, 34, 21, 18, 3

- 3** Express the data in Question 2 in dot plots.

- 4** Express the following data as ordered stem-and-leaf plots with class intervals of 5.

- (a) 23, 28, 34, 27, 38, 42, 31, 21, 22, 27, 20
 (b) 48, 57, 56, 53, 68, 64, 47, 58, 52, 51, 61, 42, 47
 (c) 21, 24, 5, 9, 7, 6, 13, 15, 19, 28, 26, 17, 20, 12
 (d) 96, 83, 95, 99, 88, 76, 87, 80, 82, 91, 84, 75, 89, 92, 91

- 5** Express the data in Question 4 in dot plots.

e Worksheet C12.5

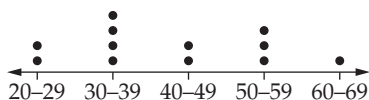
e Hint



e Animation

e Hint

- 6 Make up a possible stem-and-leaf plot for the following dot plot.



- 7 The number of customers being served at a supermarket checkout each half hour over a period of 8 hours is: 6, 15, 17, 11, 5, 6, 2, 13, 21, 16, 13, 6, 9, 5, 17, 15. Using a class interval of 5, produce an ordered stem-and-leaf plot of the data.
- 8 The number of chocolate bars produced at a factory every hour over a 20-hour period is: 146, 128, 133, 138, 140, 125, 142, 129, 136, 130, 133, 142, 126, 129, 150, 134, 126, 121, 128, 143.
- (a) Using class intervals of 5, produce an ordered stem-and-leaf plot of the data.
- (b) Draw an ordered stem-and-leaf plot of the data if it is expressed in intervals of 10.

Extension

- 9 The school populations of 12 schools in a region are: 750, 860, 920, 820, 770, 840, 950, 680, 780, 850, 810, 900.
- (a) Delete the last digit and draw an ordered stem-and-leaf plot in class intervals of 5.
- (b) Using the hundreds column as the stem and the tens and units column as the leaf, draw an ordered stem-and-leaf plot with class intervals of 50.
- (c) Using the hundreds column as the stem and the tens and units column as the leaf, draw an ordered stem-and-leaf plot with class intervals of 100.

Hint

Worksheet C12.6

eQuestions



speedingzone

Do these in your head as quickly as you can and write down the answers.



Time target: 2 minutes

- | | |
|---|------------------------|
| 1 900×12 | 2 $-320 + 170 + (-50)$ |
| 3 $3\frac{4}{5} + 1\frac{2}{5}$ | 4 $6.2 - 8$ |
| 5 0.4×0.09 | 6 $\$3.25 + \9.80 |
| 7 $92 \div 200$ | 8 $27 + 58 + 63$ |
| 9 Find the value of y if $y = 2x - 9$ and $x = 7$. | |
| 10 How many factors does 49 have? | |



The data displays below have many numbers missing. Find the number that each letter represents and then arrange the letters in the order given by the corresponding answers to find the cartoon caption. Show all working in your book.

27, 39, 42, 17, 24, 28, 37, 18, 36, 46, 12, 22, 36, 39, 35, 28, 39, 47, 17, 24

Score	Frequency	STEM LEAF
R-19	4	1 2 7 7 K
20-A	6	2 2 4 4 7 8 8
30-39	U	O T 6 C 7 9 9 9
40-49	3	W Y 6 7
Total	L	

Food	Number	Fraction of whole circle	Sector angle
Pizza	13	$\frac{\mathbf{S}}{40}$	117°
Vegetarian	9	$\frac{\mathbf{B}}{40}$	D °
Mexican	E	$\frac{15}{40}$	I °
Thai	3	$\frac{3}{40}$	M °
Total	H	$\frac{40}{40} = \mathbf{N}$	G °

4	135	20	20	2	3	7	81	3	27	2	27	29	5	40	13
---	-----	----	----	---	---	---	----	---	----	---	----	----	---	----	----

40	3	27	15	4	3	10	8	5	3	1	135	360	40	5	?
----	---	----	----	---	---	----	---	---	---	---	-----	-----	----	---	---

1	3	135	5	4	3	7	20	81	1	5	9	15
---	---	-----	---	---	---	---	----	----	---	---	---	----

10	135	360	40	5
----	-----	-----	----	---

4	15	20	20	2	3	7	6	3	7	20	81	5	10	2
---	----	----	----	---	---	---	---	---	---	----	----	---	----	---

problem solving

Julie's journey

The students in Julie's class were surveyed about the time, in minutes, it takes them to travel to school. The following stem-and-leaf plot shows the data collected. Find which value represents the time it takes Julie to get to school given the following clues:

- No other student in Julie's class takes this amount of time to travel to school.
- Julie is in the half of the class that gets to school more quickly.
- It takes Julie more than 10 minutes to get to school in the morning.

STEM	LEAF
0	5 8 9
1	2 6 6 8 8
2	2 2 3 5 6 9
3	0 2 2 4 8
4	1

Copy out the stem-and-leaf plot and cross out values as you go through the clues.

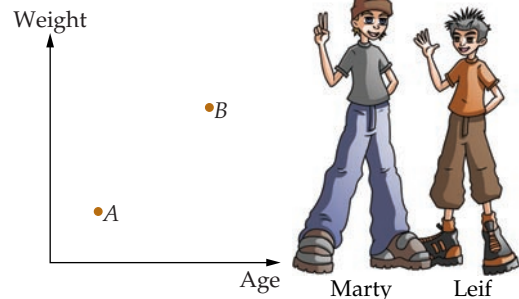


12.7 Scatter diagrams

In the graph opposite, the points labelled *A* and *B* tell us about the ages and weights of Marty and Leif.

Point *A* matches Leif (lower age and lower weight) and point *B* matches Marty (higher age and higher weight). In other words, the graph shows that Marty is older than Leif and that Leif weighs less than Marty.

This type of graph is called a **scatter diagram**.

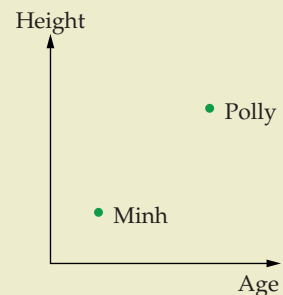


worked example 5

This graph shows the ages and heights of Minh and Polly.

Answer TRUE or FALSE to each of these statements.

- Polly is taller than Minh.
- Minh is older than Polly.
- Polly is younger than Minh.
- Minh is shorter than Polly.



Steps

- (a) Compare heights. Height increases the further you move up the vertical axis. The point for Polly is higher so she is taller than Minh.
- (b) Compare ages. Age increases the further you move to the right. The point for Polly is further to the right so she is older than Minh.
- (c) Compare ages. Polly is older than Minh as the point for Polly is further to the right.
- (d) Compare heights. The point for Minh is lower so she is shorter than Polly.

Solutions

- (a) Polly is taller than Minh. TRUE
- (b) Minh is older than Polly. FALSE
- (c) Polly is younger than Minh. FALSE
- (d) Minh is shorter than Polly. TRUE

exercise 12.7 Scatter diagrams

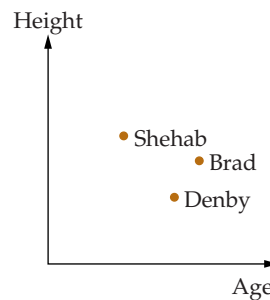
p Preparation: Prep Zone Q5

Core

1 This graph shows the ages and heights of Shehab, Denby and Brad.

Answer TRUE or FALSE to each of these statements.

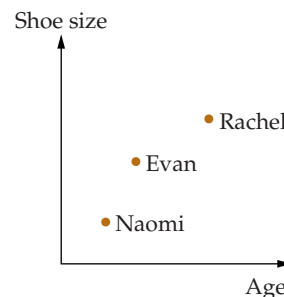
- (a) Brad is taller than Shehab.
- (b) Denby is the shortest.
- (c) Brad is older than Denby.
- (d) Shehab is the youngest.



e Animation

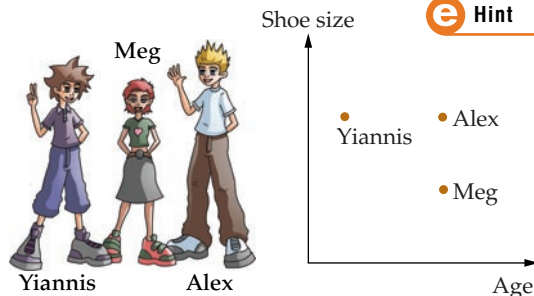
2 (a) What are the two variables shown in the graph?

- (b) Who is the youngest?
- (c) Who takes the largest shoe size?



3 Use the graph opposite to answer the following questions.

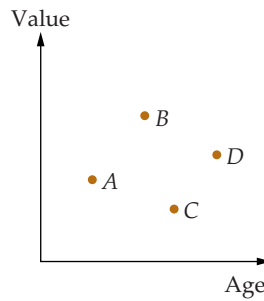
- (a) Who is the youngest?
- (b) Who takes the smallest shoe size?
- (c) What can you say about the shoe sizes of Yiannis and Alex?
- (d) What can you say about the ages of Meg and Alex?



e Hint

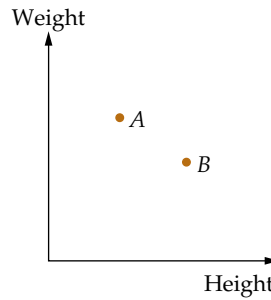
4 Consider this graph showing items of antique furniture.

- (a) Which item has the highest age?
- (b) Which item has the lowest age?
- (c) Which item has the highest value?
- (d) Which item has the lowest value?
- (e) Write the items in ascending order of value (lowest to highest).
- (f) Write the items in descending order of age.



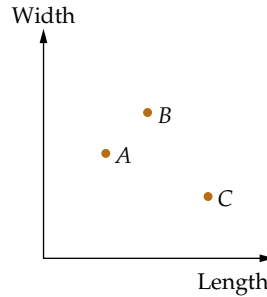
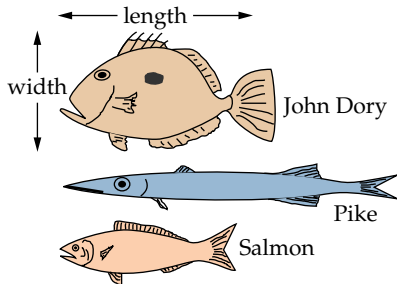
5 Consider this graph showing the weights and heights of an elephant and a giraffe.

- (a) Match each point with the animal it represents.
- (b) Copy this graph and add a point C to represent a kangaroo.
- (c) Add another point D to the graph to represent a blue whale. (Height here means length of the whale.)

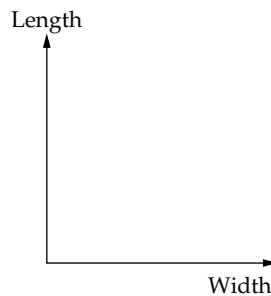


6 Consider this graph showing the widths and lengths of various fish.

e Hint



- (a) Match each point with the fish it represents.
- (b) Copy and complete this graph to show the positions of the points A, B and C for the three fish.



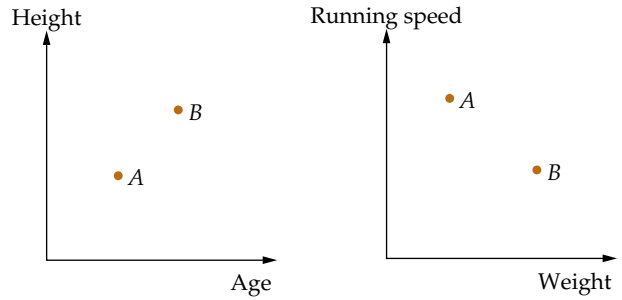
Extension

7 The following graphs describe two students, Amelia and Birute. The point *A* represents Amelia and the point *B* represents Birute.

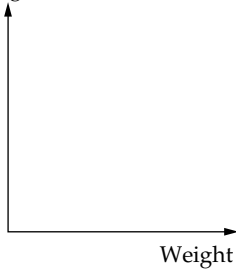
(a) What does the first graph show?
Compare the ages and heights of Amelia and Birute.

(b) What does the second graph show?
Compare the weights and running speeds of Amelia and Birute.

(c) Copy the following graphs and on each show the points *A* and *B*, representing Amelia and Birute.



(i) Height

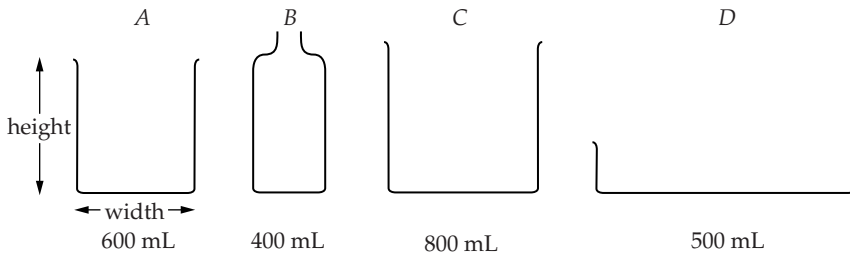


(ii) Running speed



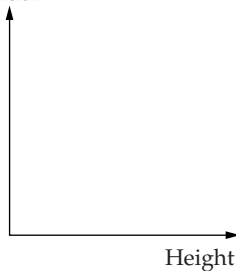
(d) What information is conveyed by the graphs in part (c)?

8

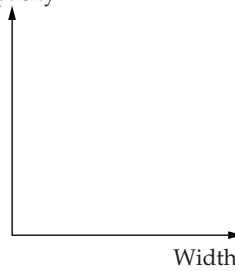


Complete scatter diagrams for the containers *A*, *B*, *C* and *D*.

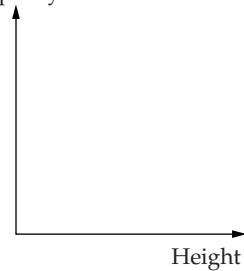
(a) Width



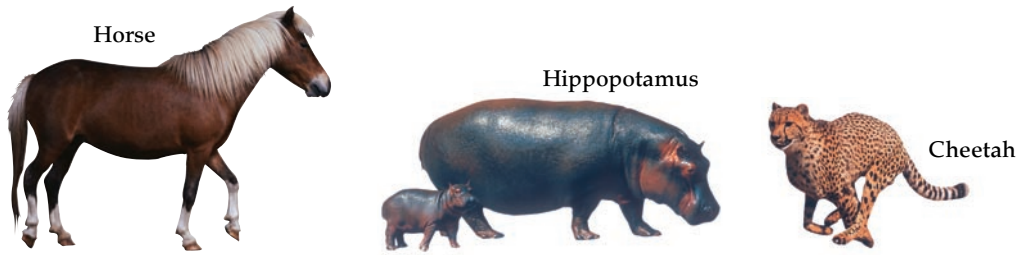
(b) Capacity



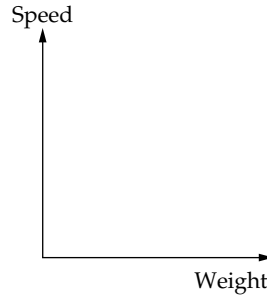
(c) Capacity



9

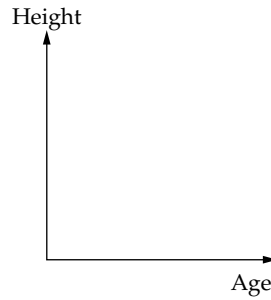
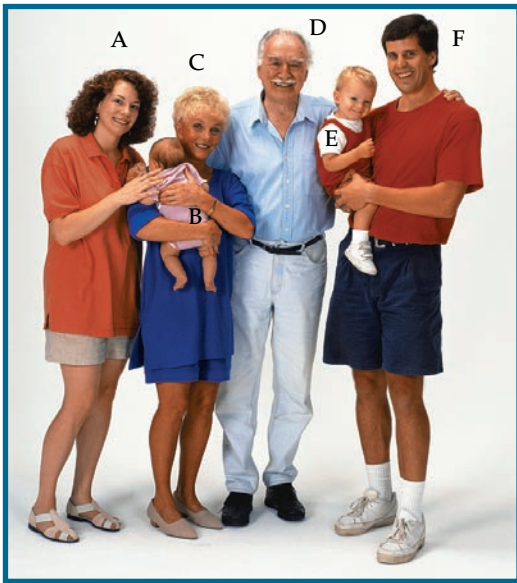


- (a) Copy and complete the scatter diagram for the 3 adult animals shown in the photos above.
- (b) Draw another two different point graphs from the information shown in the photos. (Hint: What other variable could be considered from the photos?)

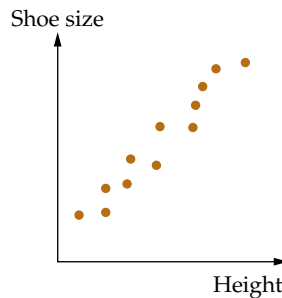


- 10 Copy and complete the scatter diagram for the people shown in the photo below.

e Hint

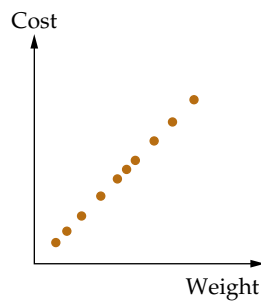


- 11 (a) What are the two variables shown in this graph?
- (b) Is there a general trend or relationship which can be seen between the two variables?
- (c) Describe the relationship between the two variables.



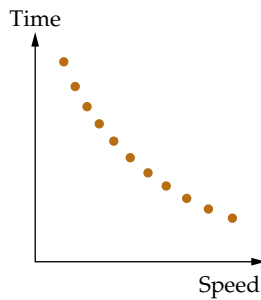
12 This point graph, showing the weight and cost of flour, has many points.

- Does the graph show a connection between the weight of the flour and its cost?
- Describe this relationship.
- Copy the same axes and draw a line which shows the relationship between weight and cost.



13 This point graph shows the connection between the speed of a car and the time it takes to travel 20 km.

- Describe the relationship between the variables.
- Copy the same axes and draw a curved line which shows the relationship between speed and time.



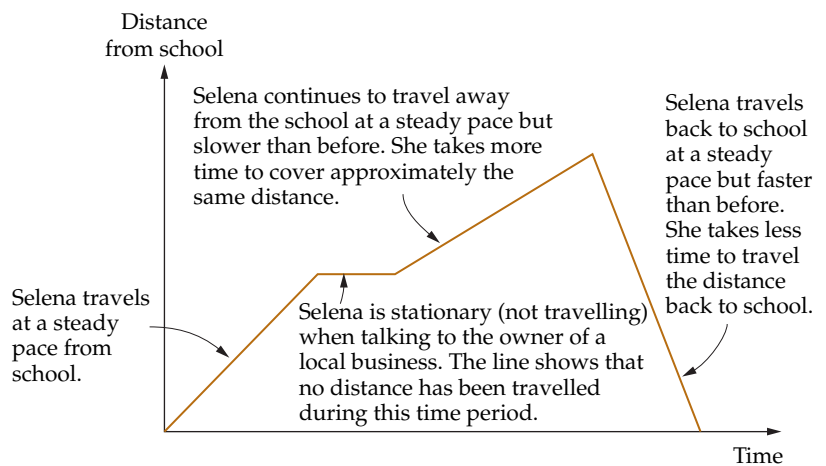
12.8 Travel graphs

Earlier in the chapter you looked at line graphs. One specific type of line graph is a **travel graph**, which compares distance travelled to the time taken.

Consider the following situation:

Selena is travelling from school with her class to collect information for a project. She stops at a local business for a short time to speak with the owner then continues on to another store. This store is closed for the day, so she immediately returns to school.

How can you tell by looking at the line segments in the graph whether Selena is travelling faster or slower than before? Discuss this with another student.



exercise 12.8 *Travel graphs*

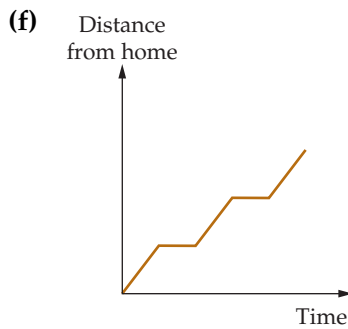
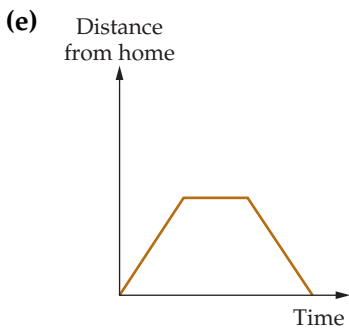
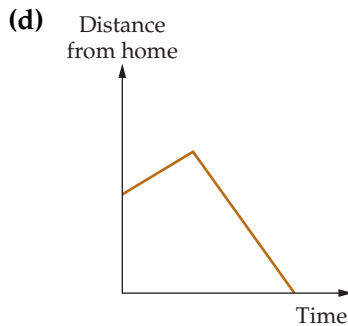
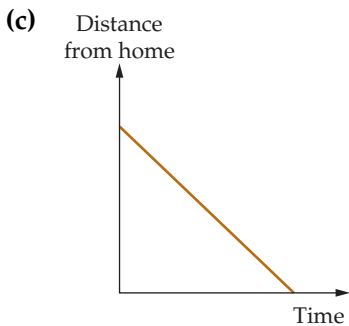
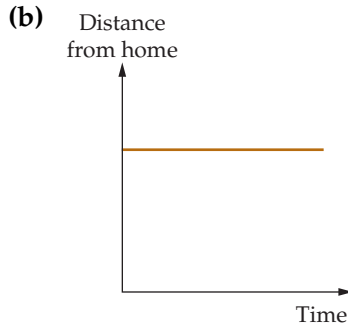
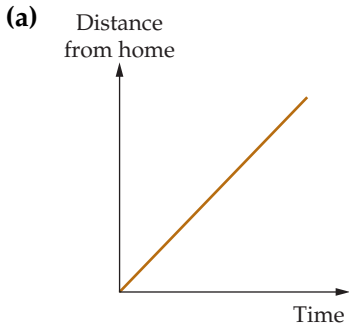
P Preparation: Ex 12.3

Core

e hi.com.au

e Hint

1 The following graphs show the distance Amad is from his home while out walking during different time intervals.

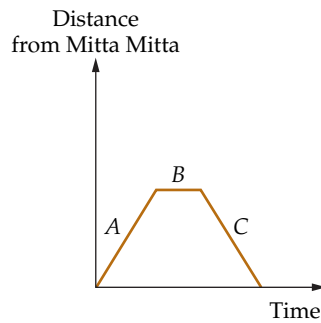


Match each graph **(a)–(f)** with the description of a journey **A–F** given below.

- A** Amad is walking and stopping at equal time intervals.
- B** Amad is walking directly home.
- C** Amad is walking away from his home at first; then he immediately returns home.
- D** Amad is stationary (not walking).
- E** Amad is walking away from his home, stops for a rest, then walks home.
- F** Amad is walking away from his home.

2 A family is travelling in their car.
What information is being shown on the graph in:

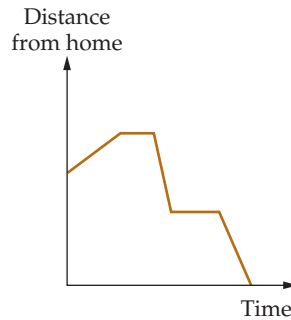
- (a) section A
- (b) section B
- (c) section C?



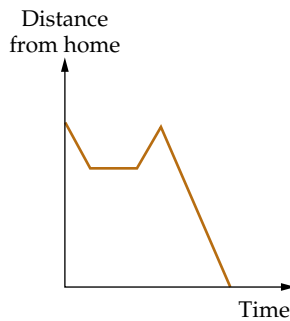
e Hint

3 The graph shows the distance Josie is from home while walking one afternoon.

- (a) Did Josie start her walk from home? Explain.
- (b) Josie walked to the local shop and stopped to buy some milk and bread. She then started to walk back home but stopped at a friend's place. How many times did Josie stop during her journey?
- (c) Did she spend more time at the milkbar or her friend's place?
- (d) Did Josie reach her home at any time on her walk? Explain.



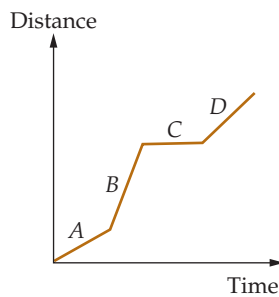
4 Write a story to describe the journey shown in this graph.



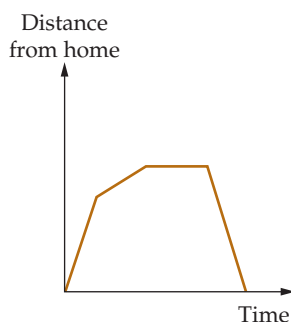
e Hint

5 Rhiannan is riding her mountain bike in the snow.

- (a) In which section of the graph (A, B, C or D) is Rhiannan moving the fastest?
- (b) In which section is she stationary?
- (c) In which section is she moving the slowest?

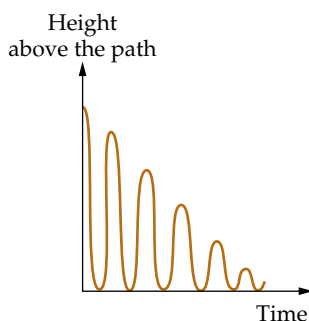


- 6 Write a story to describe the journey shown by this graph. Take into account the speed as well as the direction of travel.



- 7 Chloe drops a rubber ball from the top of a tree she is climbing and it falls straight down to a concrete path below. The graph shows what happens to the ball over a period of time after it is dropped.

- (a) Describe what happens to the ball.
 (b) Over the time period shown, how many times does the ball bounce on the path?



e Hint

Extension

- 8 Draw graphs which describe each of the following situations.
- A person bungee jumping.
 - A train travelling from Gosford station to Woy Woy station stopping at Point Clare and Tascott stations on the way.
 - A person travelling up and down in a lift which stops to let other people on and off at various floors.

Discuss your graphs with another student. Do they seem reasonable?

e eQuestions

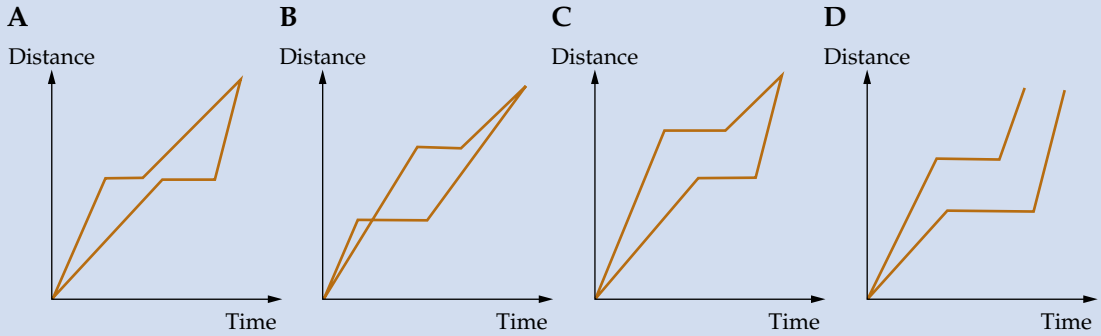
Working mathematically

problem solving

Tricky travelling

Jim and Trinh have completed a homework task. They travelled from Trinh's house to Jim's house separately, stopping on the way for a lunch break. They then drew a travel graph of their journeys and handed it in to the teacher. But Jim and Trinh forgot to write their names on their graph. The teacher has four graphs, shown on the next page, and needs to know which one is Jim and Trinh's. They gave the teacher the following clues so she could work it out. Can you find which graph represents Jim's and Trinh's journeys?

- Jim and Trinh arrived at Jim's house at the same time.
- Jim and Trinh did not stop at the same place for lunch.
- At no stage did either of them overtake the other.



Eliminate a possibility with each clue.

12.9 Conversion and step graphs

A **conversion graph** is a graph that we use to convert between two units. It is often a straight line, depending on the situation it is representing.

A **step graph** shows data that change at different stages or steps. A typical use of a step graph is to show postage charges.

exercise 12.9 Conversion and step graphs



Preparation: Prep Zone Q5

Core

1 The conversion graph shows the relationship between the units miles and kilometres.

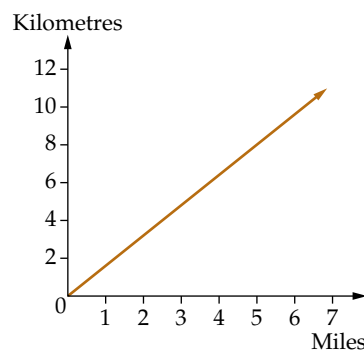
(a) Use the graph to find the approximate value in miles of:

- (i) 1.5 km (ii) 4 km
(iii) 6.5 km

(b) Use the graph to find the approximate value in kilometres of:

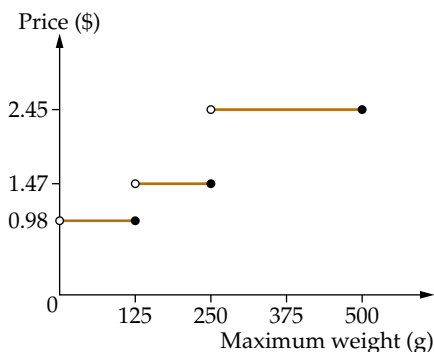
- (i) 1 mile (ii) 4 miles
(iii) 5.5 miles

(c) Is one mile longer or shorter than one kilometre?



e Hint

2 This step graph shows the costs in December 2001 of posting large letters within Australia.



e Hint

(a) Explain why some of the circles at the ends of the lines are filled in and others are empty.

(b) What would it cost to post parcels of the following weights?

(i) 50 g **(ii)** 200 g **(iii)** 500 g

(c) Given that an A4 page weighs approximately 5 g, how much would it cost to post a 40-page document in an envelope weighing 30 g?

Extension

3 Michelle wants to change Australian currency into British pounds (£). The exchange rate offered to her is A\$1 = £0.33.

e Hint

(a) How many pounds would Michelle get in exchange for A\$500?

(b) Draw a set of axes with A\$ on the horizontal axis (up to A\$500) and £ on the vertical axis (up to £200). On the graph plot the points (0, 0) and the point you found in part **(a)**, then join these points with a line.

(c) Why does the graph go through the point (0, 0)?

(d) Use your graph to convert the following into pounds.

(i) A\$80 **(ii)** A\$270 **(iii)** A\$450

(e) Use your graph to convert the following into Australian dollars.

(i) £50 **(ii)** £110 **(iii)** £150

4 The table below shows the cost of hiring a DJ for different lengths of time.

Length of time	Cost (\$)
0–2 hours	150.00
Up to 3 hours	200.00
Up to 4 hours	240.00
Up to 7 hours	300.00

(a) Draw a step graph showing this information.

(b) How much does it cost to hire the DJ for:

(i) 1.5 hours **(ii)** 2 hours **(iii)** 4 hours?

(c) Jake plans to have a party with music at his house starting at 7 p.m. and finishing at midnight. How much will he have to pay for the DJ?

(d) Josh and Annie are responsible for planning the school social and they want to hold it between 6.30 p.m. and 11 p.m. After seeing the DJ costs they decide to start the formal at 7 p.m. instead. What do you think made them change their minds?

Don't forget about the filled and empty circles.



e Homework 12.3

The mystery of the Incas



The ruins of Machu Picchu

How did the ancient Incan city of Machu Picchu remain relatively hidden in the Peruvian jungle for so many centuries? The Spanish conquistadors had destroyed the Incan Empire by 1530, yet it wasn't until 1911 that the ruins of Machu Picchu were made widely known by the American explorer Professor Hiram Bingham. Was it a city at all? In nearly impassable terrain high above the Urubamba River Canyon cloud forest, it could not have had military, commercial or administrative use.

Yet the Incan civilisation has even greater mysteries than Machu Picchu. The Incan Empire owes much of its success to one of the most perplexing mathematical devices, the quipu (pronounced 'kee-poo').

The quipu was a device made of knotted coloured cords which enabled the Incas to keep complex statistical records. Empires require order and organisation and, through the use of quipus, the Incas kept control of the movement of armies, the payment of taxes, the planting of crops, the contents of storage chambers, the output of gold mines and the make-up of workforces. They were the Incan equivalents of graphs, tables and charts. There is evidence that quipus were used to record phases of the moon, musical rhythms and story patterns. The Spanish conquistadors destroyed most of these devices, considering them the work of the devil, and now only around 550 remain.

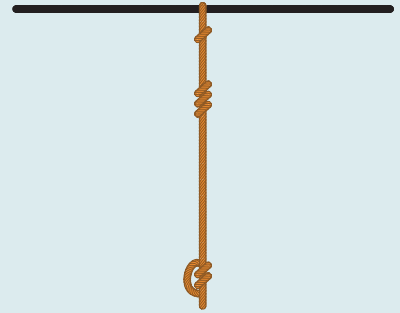


Inca holding a quipu

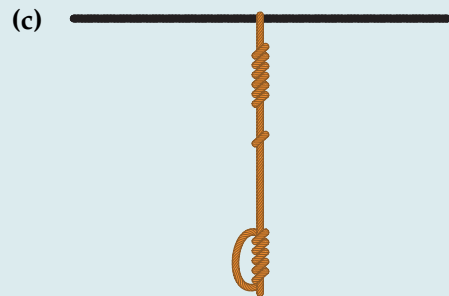
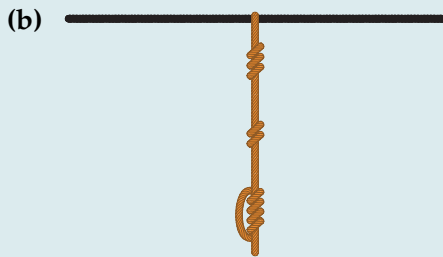
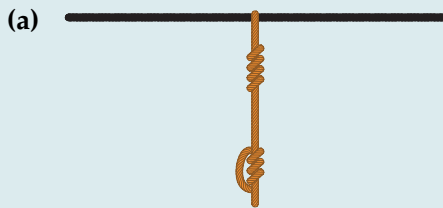
Quipus look like nothing more than a jumble of knots and strings, but there is a complex system of mathematics behind them. The underlying number system is very close to ours—it is a base 10 system, and it uses a zero. The exact knowledge of the code of the quipus has long been lost, but researchers are gradually decoding the patterns that they are finding. In deciphering the quipus, the type of knot and direction of twist are important, as well as the colour. Cords that come off other cords also have certain meanings. Some researchers now believe that the quipus actually recorded a type of language as well as numbers.

Questions

- 1 Name two ways that the number system shown on quipus is like ours.
- 2 Explain how quipus helped the Incas to keep control of their empire. How would the Spanish conquistadors have helped destroy the empire by destroying the quipus?
- 3 The diagram on the right shows the number 1302 on a quipu.

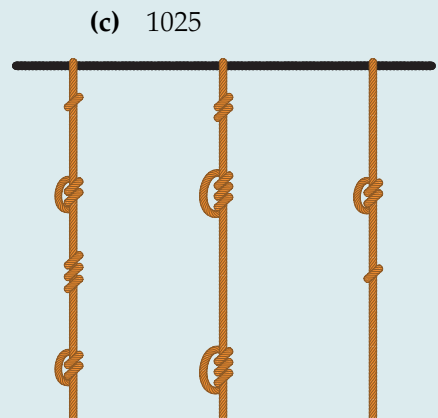


See if you can decode the following quipus.

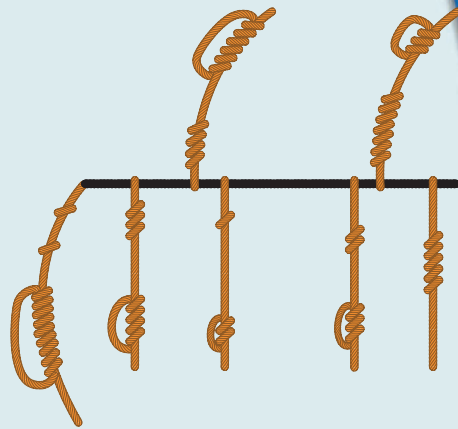


- (d) How do you know which knots show the units in a number?
 - (e) How do you know when there is a zero?
- 4 Draw quipus that show the following numbers.
 - (a) 253
 - (b) 412
 - 5 See if you can break the code of the following quipus.

- (a) There are six numbers shown here. Can you work out what they are?

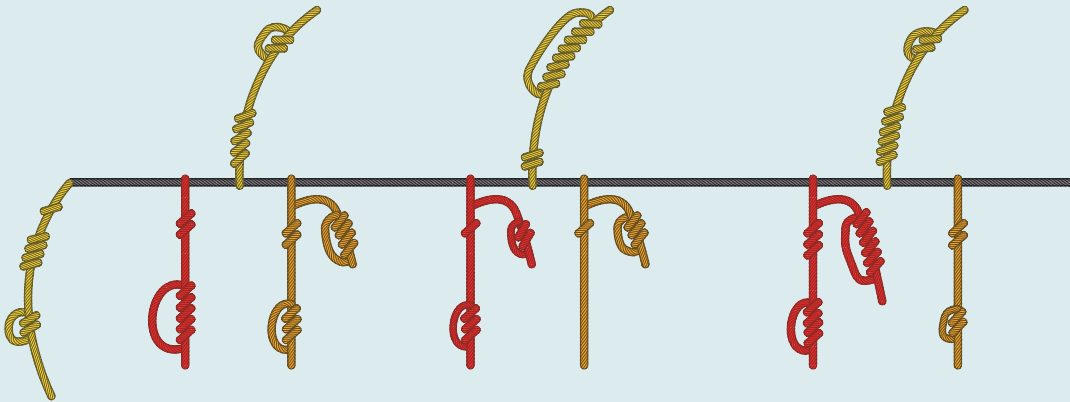


- (b) In the quipu shown here, what pattern do the numbers on the top cords indicate? What does the number on the dangling cord on the left indicate?



- 6 Near the high Andean village of Chinchero, in the year 1453, an Incan camayoc (quipu maker) used a quipu to record the number of adult and baby llamas and alpacas in three herds.

The quipu looked like the one shown here.



- (a) If there are 25 adult llamas in the first herd and 13 in the second, how many adult llamas are there in the third herd?
- (b) If there are two baby llamas in the second herd, then how many are there in the third?
- (c) What does the colour red indicate in this quipu?
- (d) What do you think the colour orange indicates?
- (e) Describe how the number of babies is indicated.
- (f) How many baby llamas are there in the first herd? How do you know?
- (g) How many llamas and alpacas are there altogether in the first herd? Which cord tells you this?
- (h) How many llamas and alpacas are there altogether? Which cord tells you this?

- 7 Draw a quipu that shows the following information (including all the totals) for the three herds of llamas and alpacas tended near the village of Pachama.

	Herd 1	Herd 2	Herd 3	
Adult llamas	12	25	32	
Baby llamas	2	0	0	
Adult alpacas	4	14	20	
Baby alpacas	2	3	0	
Total	20	42	52	= 114

Research

Do a PowerPoint or other electronic presentation about how the ancient Egyptians and other ancient civilisations kept statistical records.





Summary

Copy and complete the following summary of this chapter using the words and phrases from the list. A word or phrase may be used more than once.

- 1 Another name for a pie graph is a _____.
- 2 The graphs in this chapter are all ways of presenting _____.
- 3 A _____ is used to collect information from a group of people whereas a census gets information from a _____.
- 4 To represent data collected over a period of time it is best to use a _____.
- 5 It is not good to use a sector (pie) graph or a _____ _____ if there are many categories.


Key words

census
column graph
conversion graph
data
divided bar graph
dot plot
frequency table
graph
line graph
pie graph
population
scatter diagram
sector graph
stem-and-leaf plot
step graph
survey
travel graph

Questions

- 1 Which would be considered more accurate: a stem-and-leaf plot or a dot plot? Why?
- 2 In relation to circles, what does 'sector' mean?
- 3 A survey is conducted where students are asked to tick one of four boxes describing their attitude to wearing a school uniform. What type of graph would be useful to display the data collected?
- 4 Why don't we call a line graph a line plot, or a sector graph a sector plot?
- 5 Which of the words 'graph', 'table', 'plot' and 'diagram' can also be used as verbs? There may be more than one answer.
- 6 Make as many words, of at least three letters, as you can from the letters in 'population'. Score 1 point for each three-letter word, 2 points for each four-letter word and 3 points for each five-letter word.

 Worksheet L12.1

 Worksheet L12.2

chapter REVIEW

12

FAQS

There are so many different kinds of graphs. How do I know which one is the best? Sometimes there is not just one best graph. Sometimes different graph types are suitable for a set of data. Use the tips in section 12.5 to decide which graph or graphs are most suitable.

Do stem-and-leaf graphs always have to be ordered? I have seen some that aren't. If the question says to order the plot then you must. Otherwise, it is best to order a stem-and-leaf graph. From Year 8 on you will be using stem-and-leaf graphs to analyse data and it is very important that the data is in order.

Do I always have to colour in the sectors in a sector graph?

With any graph you have to make sure it is clear which part is for which group of data. Colouring in makes the data groups very clear, but it is not necessary as long as you label each sector clearly.



Core

- 1** A Year 7 class was surveyed about how many television sets their families had at home. The results were:

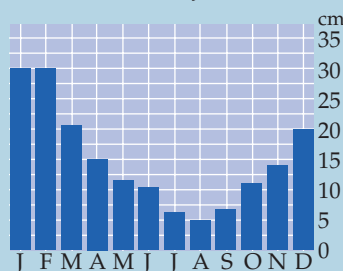
1, 1, 1, 1, 2, 1, 1, 3, 2, 5, 2, 1, 1, 0, 1, 2, 0, 4, 1, 2, 0, 3, 1

Draw up a frequency table for this information.

- 2** Look at the following graph which shows the average amount of rainfall (cm) in the city of Jakarta over one year.

- (a) What type of graph is this?
(b) What is unusual about the position of the vertical scale?
(c) What is Jakarta's second driest month?
(d) What is the highest average monthly rainfall?
(e) Which three months form the rainy season?

Average amount of rainfall in Jakarta



12.1

12.2

- (g) Approximately what percentage of people were unemployed in late 1996 and early 1997?

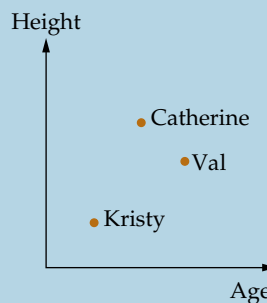


- 5 Draw an ordered stem-and-leaf plot for the following set of data. 12.6
- 43, 37, 28, 15, 39, 32, 41, 25, 29, 11, 45, 27, 35, 39

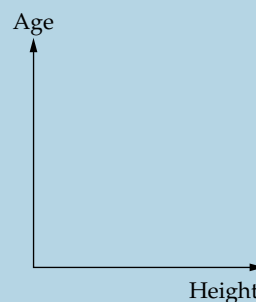
- 6 Draw a dot plot for the following set of data. 12.6
- 89, 92, 76, 51, 72, 78, 82, 85, 93, 87, 84

- 7 This scatter graph shows the ages and heights of three girls. 12.7

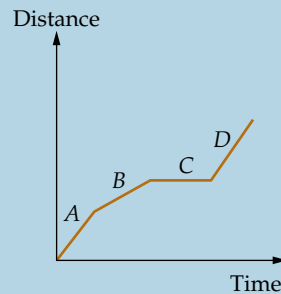
- (a) Who is the youngest?
 (b) Who is the tallest?
 (c) Write the names of the girls in ascending order of height (shortest to tallest).
 (d) Write the names of the girls in descending order of age.



- (e) Copy and complete this scatter graph for the three girls.



- 8 Liam is rollerblading along a path.
- In which section of the graph (A, B, C or D) is Liam moving the fastest?
 - In which section is he stationary?
 - In which section is he moving the slowest?



12.8

Extension

- 9 The following are the sales figures for Beeper computer games from 1995 to 2000.

1995	1996	1997	1998	1999	2000
10 000	25 000	35 000	30 000	40 000	45 000

Draw a line graph for this information.

12.3

- 10 Look at the following information.

12.2, 12.5

<i>How much Australians spend on pets each year (\$ million)</i>				
<i>Expenditure type</i>	<i>Dogs</i>	<i>Cats</i>	<i>Other</i>	<i>Total</i>
Food	560	431	90	1081
Vet charges and prescriptions	230	148	26	404
Pet care products/equipment	153	85	12	250
Pet services	116	35	–	151
Other expenses	109	20	12	141
Total	1168	719	140	2027

Source: BIS Shrapnel

- Draw a column graph showing how much we spend on dogs each year.
- Explain why a column graph is better than a line graph to show this information.



REPLAY

- 1** Calculate:
- (a) $2 + 6 \times 7$ (b) $15 \div 5 \times 2 \times 4$ (c) $7 \times (4 + 14 - 3 + 5)$ **1.6**
- 2** Calculate:
- (a) $-17 + 37$ (b) $-12 - 42$ (c) $53 - 100 + 7$ **2.5**
- 3** Calculate:
- (a) -3×12 (b) -15×-6 (c) $4 \times -3 \times -5$ **2.6**
- 4** List the first five multiples of each of the following numbers. **3.1**
- (a) 10 (b) 6 (c) 12
- 5** Copy and complete the following number patterns. **4.1**
- (a) __, 7, 10, __, 16, __ (b) 5, 1, __, __, -11, __
- 6** (a) What angle is the supplement of 57° ? **5.5, 5.7**
(b) What angle is the complement of 84° ?
(c) What angle is vertically opposite an angle of 38° ?
- 7** Calculate: **6.6, 6.7, 6.8**
- (a) 2.91×7 (b) 0.786×100 (c) 0.73×0.04
- 8** A rectangle has a length of 8 cm and a perimeter of 28 cm. What is its area? **7.6**
- 9** (a) What is the size of each angle in an equilateral triangle?
(b) A parallelogram has one angle that measures 126° . What size is each of the three remaining angles? **8.2, 8.4**
- 10** Calculate: **9.6**
- (a) $\frac{3}{8} \times \frac{10}{21}$ (b) $1\frac{7}{9} \times 3\frac{5}{8}$ (c) $-\frac{1}{7} \times 2\frac{5}{8} \times \frac{4}{27}$
- 11** Simplify the following expressions. **10.3**
- (a) $2a - 3b + 7a$ (b) $7x^2 + 8x - 9x^2 + 2x^2$
(c) $8mn - 3n + 12mn + 9n + 4m$
- 12** What is the volume, in cubic centimetres, of a rectangular prism of breadth 10 cm, length 0.5 m and height 8 cm? **11.2**