Half-time 9

Ex 9.2

1 Find the **(i)** mean (correct to one decimal place) **(ii)** median, **(iii)** mode and **(iv)** range for each of the following sets of test results.

(a) 3, 2, 4, 8, 6, 2, 4, 6, 3, 2, 1 **(b)** 4, 6, 3, 4, 3, 6, 5, 9, 8, 7, 6, 3, 2, 4, 5, 6, 4

Ex 9.4

2

Victoria's greenhouse gas emissions (end use allocation of emissions)	
Residential	17%
Commercial	16%
Manufacturing	32%
Passenger transport	14%
Primary production net	12%
Freight transport	5%
Waste	3%
Other	1%

Using the table given above:

(a) draw a sector graph **(b)** draw a divided bar graph.

Ex 9.1

3 The height of each of the 25 students in a class was recorded.

142	147	151	142	146	151	157	138	141
140	129	135	142	151	150	160	141	152
148	157	130	143	147	149	154		

(a) Why are class intervals of 125–129, 130–134 etc. appropriate?

(b) Using these class intervals, draw a frequency table showing this information.

Ex 9.1

4 The number of students absent from class was recorded for each of the 21 school days in a month.

3	0	1	2	4	1	0	1	0	2	0
1	0	0	2	1	3	0	1	2	0	

Construct a frequency table showing this information.

Ex 9.3

5 Draw a dot plot to illustrate the following data that represents the number of times the students in a class have travelled interstate.

6	4	0	1	2	3	1	2	2	0	0	0
1	2	4	5	3	2	5	3	0	1	1	2

Ex 9.3

6 The number of marks taken by the top 12 players in the AFL after round 15, 2010, are given below.

86 74 76 91 132 84 67 80 82 62 85 90

(a) Draw a stem-and-leaf plot to represent this data.

(b) Find the median for this data set.

(c) Can you identify any possible outliers? Justify your answer.

Technology Exploration Excel

Equipment required: 1 brain, 1 computer with an Excel spreadsheet

Versions of this Exploration are available for other technologies in Pearson Reader.

Finding statistics using technology

When we have a very large data set it is best to use some form of technology to calculate statistics such as mean, mode, median and range. Here, we will use Excel to find some of these statistics.

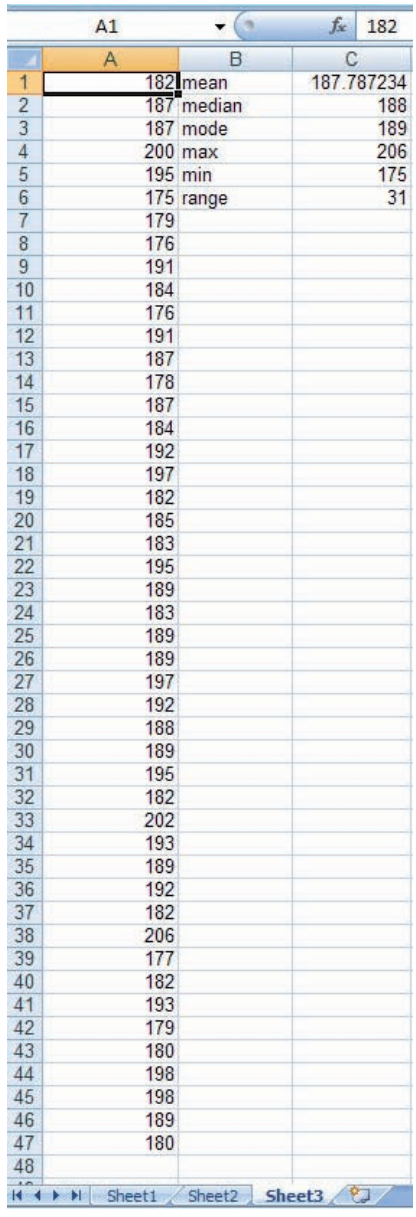
The following table shows the height, in cm, of the 47 players on the list for the Geelong Cats in the AFL for the 2010 playing season. We will use this data to find the mean, median, mode and range using Excel.

Note that Excel uses the word 'Average' to find the mean.

182	187	187	200	195	175	179	176	191	184
176	191	187	178	187	184	192	197	182	185
183	195	189	183	189	189	197	192	188	189
195	182	202	193	189	192	182	206	177	182
193	179	180	198	198	189	180			

1. Open an Excel spreadsheet and enter the data in column A.
2. Enter the names of the statistics to be found in column B, Mean in B1, Median in B2 and Mode in B3.
3. As the range is the difference between the highest (maximum) value and the lowest (minimum) value, Excel is used to find the maximum and the minimum values. Enter Max in B4, Min in B5 and Range in B6.
4. In cell C1, enter the formula = Average (A1:A47) to find the mean.
5. In cell C2, enter the formula to find the median, in cell C3, enter the formula to find the mode, in cell C4, enter the maximum formula and, in cell C5, enter the minimum formula.
6. In cell C6, subtract the minimum value from the maximum value to find the range.

Any of these formulas can be found by selecting Formulas and Insert Function from the toolbar. The fomulas are entered as shown in the screenshot at the bottom right of the page.



	A	B	C
1	182	mean	187.787234
2	187	median	188
3	187	mode	189
4	200	max	206
5	195	min	175
6	175	range	31
7	179		
8	176		
9	191		
10	184		
11	176		
12	191		
13	187		
14	178		
15	187		
16	184		
17	192		
18	197		
19	182		
20	185		
21	183		
22	195		
23	189		
24	183		
25	189		
26	189		
27	197		
28	192		
29	188		
30	189		
31	195		
32	182		
33	202		
34	193		
35	189		
36	192		
37	182		
38	206		
39	177		
40	182		
41	193		
42	179		
43	180		
44	198		
45	198		
46	189		
47	180		
48			

Sheet1 Sheet2 Sheet3

B	C
mean	=AVERAGE(A1:A47)
median	=MEDIAN(A1:A47)
mode	=MODE(A1:A47)
max	=MAX(A1:A47)
min	=MIN(A1:A47)
range	=C4-C5

Taking it further

7. The weights, in kg, of the 47 players on the playing list for the Geelong Cats in the AFL for the 2010 playing season are listed below.

   Use Excel (or another form of technology) to find the mean, median, mode and range of the weights.

88	84	88	102	85	77	88	77
89	72	84	87	82	81	91	85
88	101	83	100	84	95	87	88
85	92	99	87	79	92	99	70
108	102	93	94	86	105	80	73
92	68	80	94	104	88	80	

9.5 Graphing bivariate data

Bivariate data consists of two variables, an independent variable and a dependent variable. The dependent variable changes as the independent variable changes. An example is the distance travelled by a car in a given time period. The time of the journey is the independent variable and the distance travelled is the dependent variable.

Line graphs

A line graph is used when we have data that shows changes over time. Line graphs are useful if we are trying to identify a **trend** in the data. That means we are looking for a general pattern being followed that we could use to predict future values in the data set. Line graphs are used only for continuous data, such as mass, height, profits and temperatures. These are all data that can be measured over time.

Drawing a line graph

All line graphs should include:

1. a title
2. the independent variable always on the horizontal axis
3. a scale across the horizontal axis that uses equally spaced intervals and is clearly labelled, including any relevant unit of measurement
4. a scale on the vertical axis that also uses equally spaced intervals and is clearly labelled, including any relevant unit of measurement.

When drawing line graphs you need to choose a suitable scale. The following data set will be used to illustrate the process.

Worked Example 11 WE11

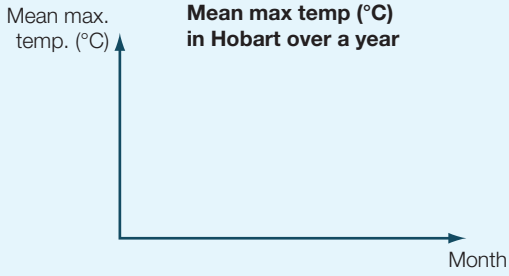
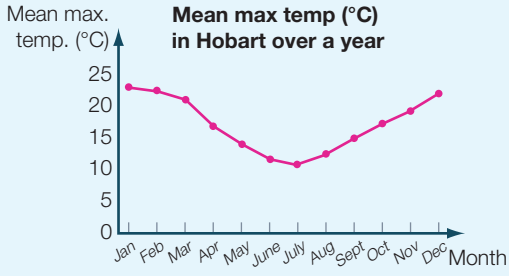
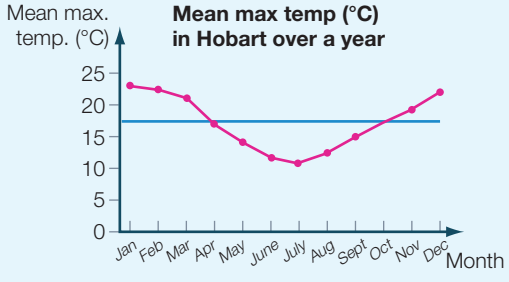
The mean daily maximum temperature (°C) for each month in Hobart (Botanical Gardens) is shown in the table below:

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean max. temp. (°C)	23.1	22.2	20.7	17.0	13.9	11.4	10.5	12.2	14.9	17.4	19.4	21.9

Bureau of Meteorology

(a) Draw a line graph to represent this data.

(b) For which months was the mean maximum temperature below 17°C?

Thinking	Working
(a) 1 Look for the highest value to be graphed.	(a) Highest value = 23.1°
2 Decide how tall you want your graph to be (a vertical height of 10 cm is good) and divide the maximum value by the chosen height to get an idea of the scale required.	Approximate scale $= \frac{23.1}{10} = 2.31$
3 Use this number to choose an appropriate scale.	Scale 1 cm = 2°C
4 Draw the axes, label them and give the graph a title.	
5 Scale both axes and plot the pairs of values. (The first one to plot would be January, 23.1. Choose Jan on the horizontal axis and 23.1 on the vertical axis and plot the point.) Join each point to the next with a straight line.	
(b) 1 Draw a horizontal line across from the vertical axis for the given value (17°).	(b) 
2 Find the points on the line graph under this line and read off the values on the horizontal axis that correspond to these points.	May, June, July, August, September

9.5 Graphing bivariate data

Navigator

Answers page 680

Q1, Q2, Q3, Q4, Q5, Q8, Q9, Q10	Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q9, Q10	Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9, Q10

Fluency

WE11

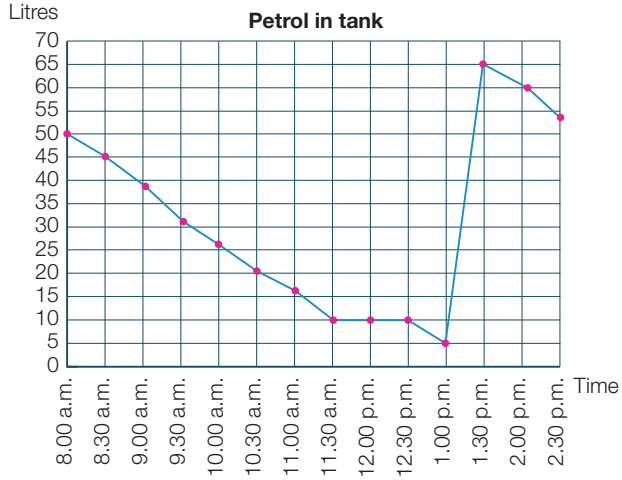
1 At an athletics competition, the wind speed is measured so that new records can be accepted. The following table shows the wind speed (metres per second) at 10-minute intervals for the hour over which the 100 m sprints were run.

Time	1.00 p.m.	1.10 p.m.	1.20 p.m.	1.30 p.m.	1.40 p.m.	1.50 p.m.	2.00 p.m.
Wind speed (metres per second)	0.9	0.95	1.3	1.2	1.15	1.1	0.95

(a) Draw a line graph to represent this data.

(b) When was the wind speed greater than 0.95 metres per second?

2 The graph shows the number of litres of petrol in a car at various times during the day.



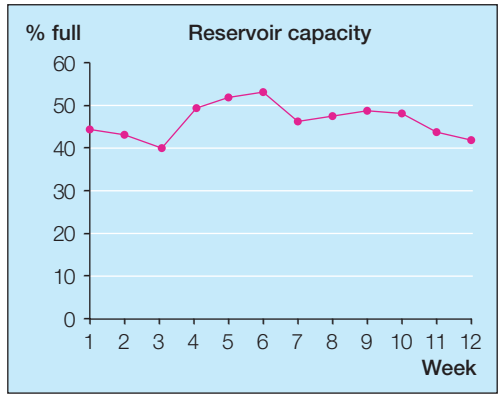
(a) How many litres were in the tank at the start of the day?

(b) When did the driver visit the petrol station?

(c) What was the minimum number of litres of petrol purchased?

(d) Between which times is it likely the driver had lunch?

3 Each week, the amount of water in a reservoir is recorded as a percentage of its maximum capacity. The graph on the right shows the results for a number of weeks.



(a) How full was the reservoir when measured in Week 4?

A 40% **B** 45%

C 50% **D** 55%

(b) There was heavy rain during a particular week. The measurement for which week shows the result of this rain?

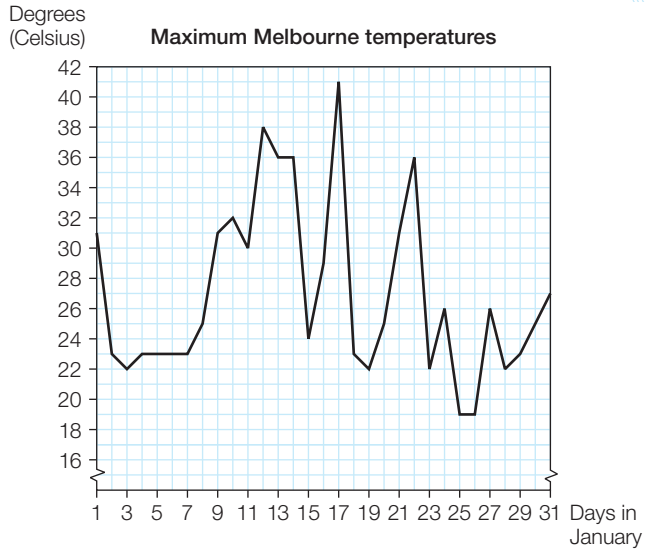
A 2 **B** 4 **C** 5 **D** 6

(c) A large quantity of water was released from the reservoir to flush out the downstream areas. The measurement for which week most likely shows the result of this action?

A 2 **B** 3 **C** 7 **D** 10

Understanding

4 The line graph opposite shows the maximum temperatures in Melbourne for January of a particular year.



(a) **(i)** What was the highest maximum temperature reached?

(ii) On which date was this temperature reached?

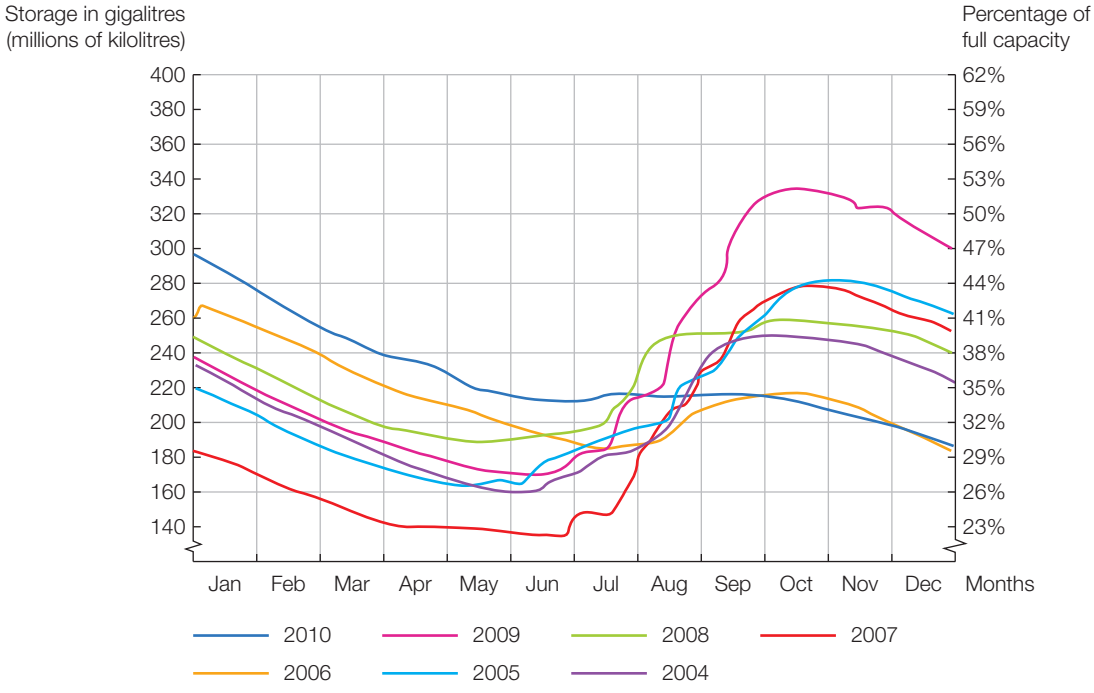
(b) **(i)** What was the lowest maximum temperature reached?

(ii) On which date(s) was this temperature reached?

(c) Up until 15 January, the maximum temperature was always between which two values?

(d) After 23 January, the maximum temperature was always between which two values?

5



Above is a graph of Perth's water storage from 2004 to 2010. Use this graph to answer the following questions.

(a) What was the storage percentage at the start and end of 2008?

(b) In which year was there almost no change in storage levels from the beginning of June to the end of September?

(c) Which 6-month period over the years 2004–2010 had the lowest water storage? What does this tell you about the rainfall in that period?

(d) By what percentage did the water storage levels decrease in December 2009? Check the percentage drop in water storage levels for other years in December. What does this tell you about the rainfall in December in Perth?

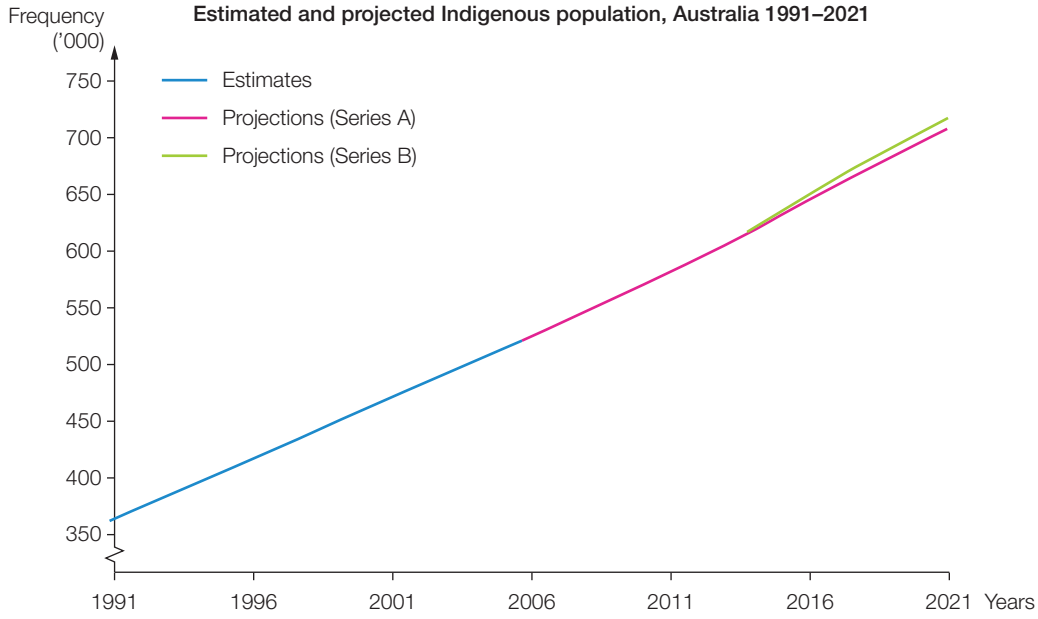
(e) Did the water storage levels increase or decrease over the year 2009? Find the increase or decrease percentage.

(f) From the data shown here, in which month is Perth likely to be the wettest?

(g) From the data shown here, in which month is Perth likely to be the driest?

Reasoning

6 This graph shows the Indigenous population of Australia from 1991 to 2006 and the projected (estimated) population for 2006 to 2021. Different projections are made using different estimation methods for future populations.



(a) What was the estimated Indigenous population of Australia in 1991?

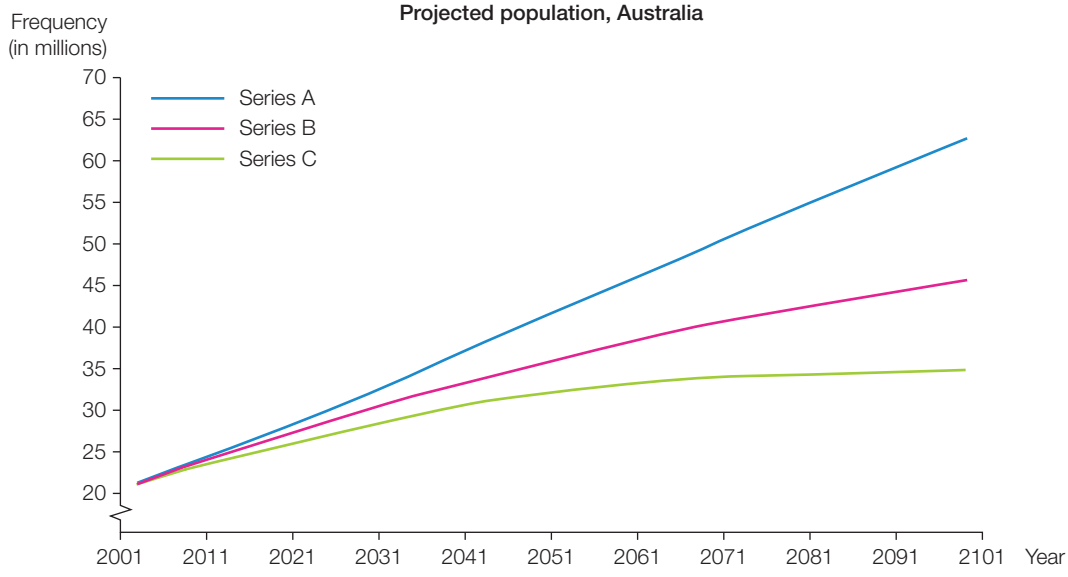
(b) What was the estimated Indigenous population of Australia 15 years later?

(c) Why do you think the graph from 1991 to 2006 is an estimated graph?

(d) What are the two projected values for the Indigenous population in 2021?

(e) Give two reasons why you think the Indigenous population has increased so much in the 30 years from 1991 to 2021.

7 Statisticians use data from the past to predict trends for the future. Below are three graphs that show different ways of predicting (or projecting) the future population of Australia.



(a) Use the graph to find the population of Australia in 2007.

(b) What is the projected population of Australia in 2041 on the Series A graph?

(c) Find the increase in population predicted over the time period shown on the Series A projection.

(d) What are the two main factors that would cause the population to increase according to the Series A projection?

(e) List at least two problems Australia would face if the Series A projection was correct.

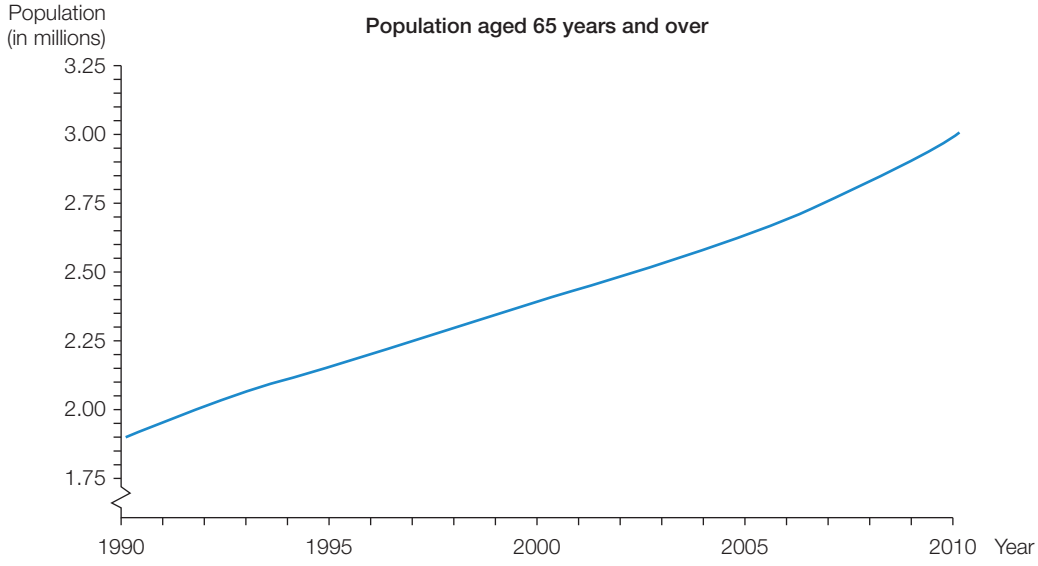
(f) What would be the projected population of Australia in 2061 on the Series B projection?

(g) If the number of births equals the number of deaths in the Series B projection, why would the population continue to grow?

(h) The Series C projection flattens out by 2081. What would be the projected population over the period 2081–2101?

(i) What needs to happen if the population of Australia is to stay stable (the same year after year)?

8



This line graph shows the number of Australians 65 years and older in the time period 1990–2010.

(a) In 2000, approximately how many Australians were 65 years or older?

(b) In which year did the number of Australians 65 years and older reach 2.75 million?

(c) Between which years does the graph follow an almost perfectly straight line? (Use a ruler to help you.)

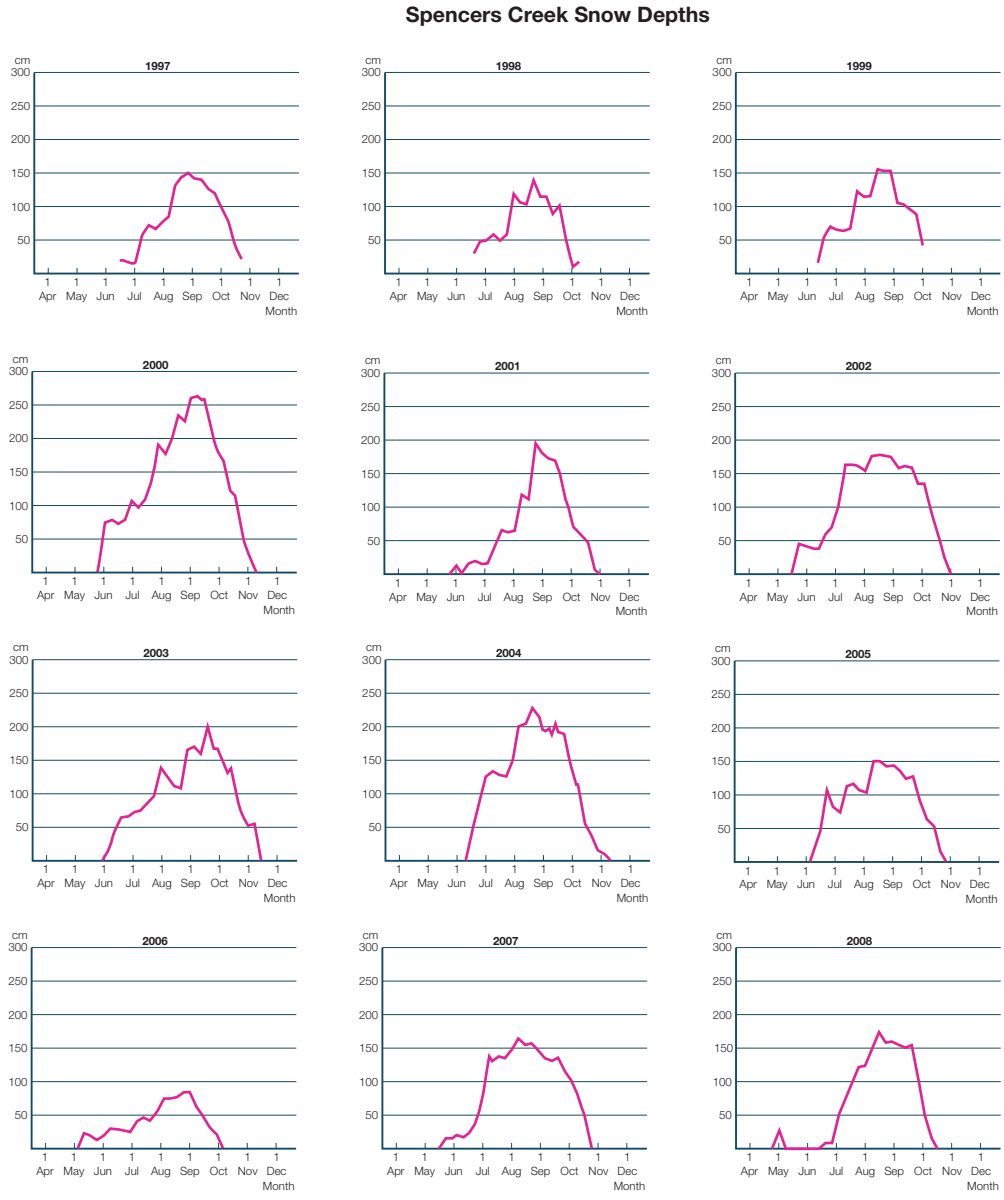
(d) Find the population aged 65 years and over in 2002, 2006 and 2010. Use these findings to describe the shape of the graph in the period 2002–2010.

(e) Use your answers to parts **(c)** and **(d)** to describe the shape of the graph overall.

(f) After World War II ended in 1945, Australia's birth rate increased dramatically. In addition, Australia's immigration policies have changed greatly since then, accepting immigrants from all around the world. Use these facts and your answer to part **(e)** to give two reasons why the shape of the graph has changed.

(g) What do you expect the population aged 65 years and over will be in 2015 if the present trend continues?

9 Look at the following line graphs that show the average snow depths (in centimetres) at Spencers Creek, Mt Kosciuszko, from 1997 to 2008. (The deeper the snow, the better it is for skiing.)



(a) Did the snow depth reach 2.5 metres at any time during the 12 years? If so, which year(s) did this happen?

(b) What was the greatest snow depth reached in 1997?

(c) What was the greatest snow depth reached in 2008?

(d) Which year had the most snow in June?

(e) Which year had the most snow through the whole of July?

(f) Which year had the worst October skiing?

(g) Which year had the best October skiing?

(h) Which year would have probably had the best November skiing?

(i) Which year had the worst skiing overall?

(j) Which month usually has the best skiing?

(k) Which month is usually the second best skiing month?

(l) It has been claimed that New South Wales' overall temperature has been getting higher due to climate change. Is there any evidence in these graphs to back this up?

(m) Why do we use line graphs rather than bar graphs to show this information?

Open-ended

10 When do you think you feel hungriest during the day? Draw a line graph that shows your level of hunger during the day from the time you wake up until the time you go to sleep. Do you think the shape of the graph would be similar for most people? Explain any differences you can think of.

Outside the Square Puzzle

Add it up

A game board consists of the numbers 1, 2 and 3 arranged in a triangle as shown. The first player puts a counter on any of the three numbers and takes that number as their score. The other player then moves the counter to one of the other numbers and takes that as their score. The first player moves the counter and adds the value to their total. Play continues in this way until a player gets a total of 12. If you go over 12 you lose.

Explain the strategy you would follow if you were playing this game. You might like to play the game with a friend to help formulate your strategy.

Now, make up a strategy for the second game board shown. What would be a suitable target number for this board?