2014 Higher School Certificate Specimen Examination
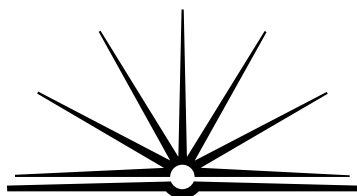
Mathematics General 2

The accompanying specimen examination, together with the mapping grid, worked solutions, sample marking guidelines and performance band descriptions, has been developed for the 2014 Higher School Certificate examination of the Preliminary Mathematics General/HSC Mathematics General 2 pathway. This examination will be titled the 'Mathematics General 2' HSC examination.

The specifications for the Mathematics General 2 HSC examination state that the examination 'will be based mainly on the HSC Mathematics General 2 course and will focus on the course objectives and HSC outcomes. The Preliminary Mathematics General course (including the Focus Studies) will be assumed knowledge for this examination' (see *Assessment and Reporting in the HSC Mathematics General 2 Course*).

Content and Considerations

Coverage of the content of the Preliminary Mathematics General and HSC Mathematics General 2 courses is of prime importance in the preparation of candidates for the Mathematics General 2 HSC examination.

However, it also needs to be noted that the 'Considerations' (the list of important considerations for teaching and learning that accompanies each of the Strand and Focus Study topics) in the syllabus have been taken into account, as appropriate, in the development of the specimen examination, and similarly will be taken into account in the development of the Mathematics General 2 HSC examinations for 2014 and beyond.

2014

HIGHER SCHOOL CERTIFICATE
SPECIMEN EXAMINATION

Mathematics General 2

General Instructions

- Reading time – 5 minutes
- Working time – $2\frac{1}{2}$ hours
- Write using black or blue pen
  Black pen is preferred
- Board-approved calculators may
  be used
- A formulae and data sheet is
  provided at the back of this paper
- In Questions 26–30, show
  relevant mathematical reasoning
  and/or calculations

Total marks – 100

(**Section I**) Pages 2–12

25 marks

- Attempt Questions 1–25
- Allow about 35 minutes for this section

(**Section II**) Pages 13–35

75 marks

- Attempt Questions 26–30
- Allow about 1 hour and 55 minutes for this section
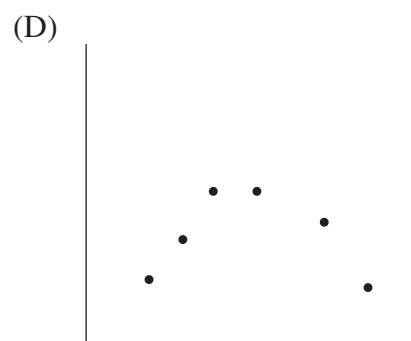
Section I

25 marks
Attempt Questions 1–25
Allow about 35 minutes for this section

Use the multiple-choice answer sheet for Questions 1–25.

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1 Which graph shows data that have a correlation coefficient closest to –0.9?

(A)

(B)

(C)

(D)
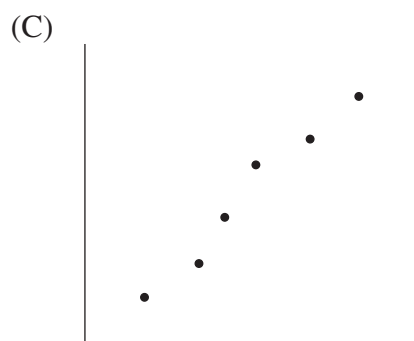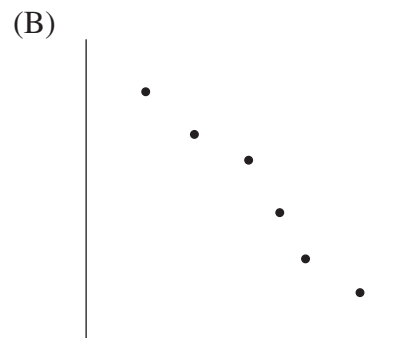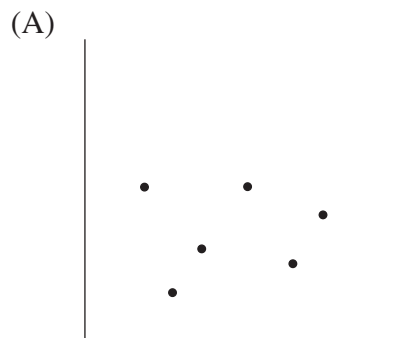
2 For which solid could the volume be calculated using the formula $V = Ah$?
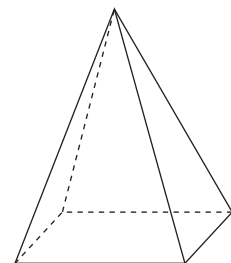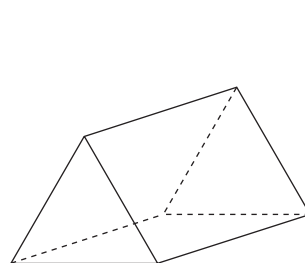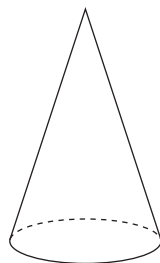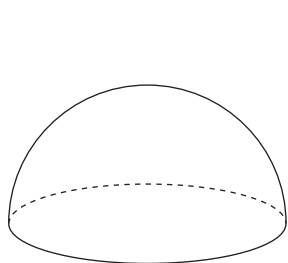
(A)   (B)   (C)   (D)

3 The angle of depression from a kookaburra's feet to a worm on the ground is 40°. The worm is 15 metres from a point on the ground directly below the kookaburra's feet.

NOT TO SCALE
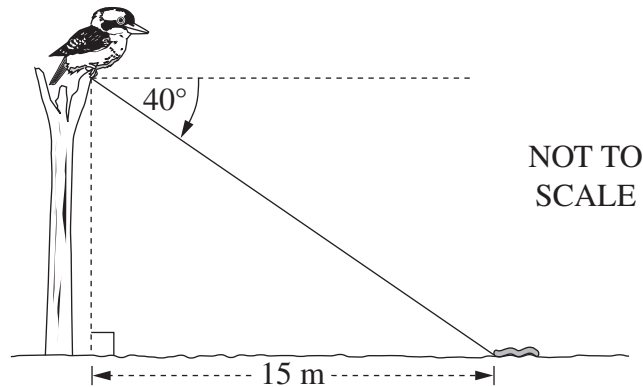
How high above the ground are the kookaburra's feet, to the nearest metre?

(A)   10 m

(B)   11 m

(C)   13 m

(D)   18 m

4 Emma has 16 GB of data storage space available on her computer.

Approximately how many files of average size 7.2 MB can she store?

(A)   450

(B)   461

(C)   2222

(D)   2275

5 Brian owns a car.

Which of the following is included in the cover of compulsory third-party insurance for his car?

(A)   Theft of his own car

(B)   Injury to passengers

(C)   Damage to his own car

(D)   Damage to another driver's car

6   Which frequency histogram shows data that could be normally distributed?

(A)

(B)

(C)

(D)
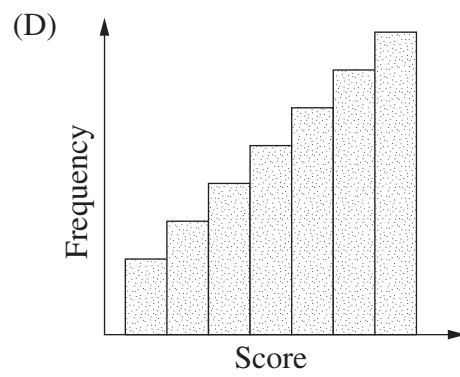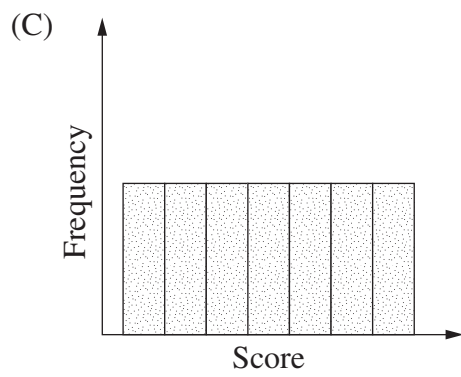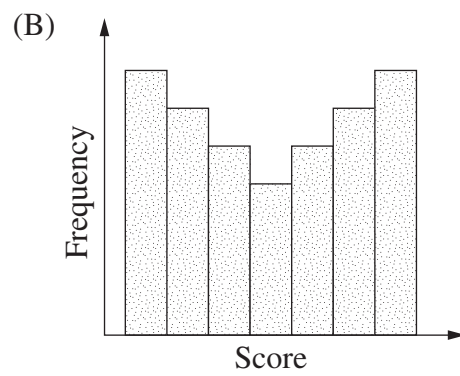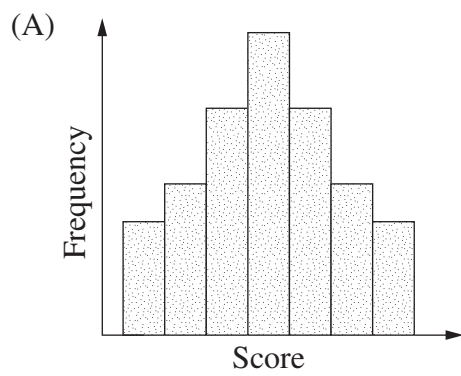
7   What is $\dfrac{6x^2y}{3} \div \dfrac{2y}{5}$ expressed in its simplest form?

(A) $5x^2$

(B) $30x^2y$

(C) $\dfrac{1}{5x^2}$

(D) $\dfrac{5}{4x^2y^2}$

8 The box-and-whisker plots show the distribution of the ages of children in Numbertown in 2002 and 2012.

Distribution of the ages of children in Numbertown

2012

2002

| | 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 |

Age (years)
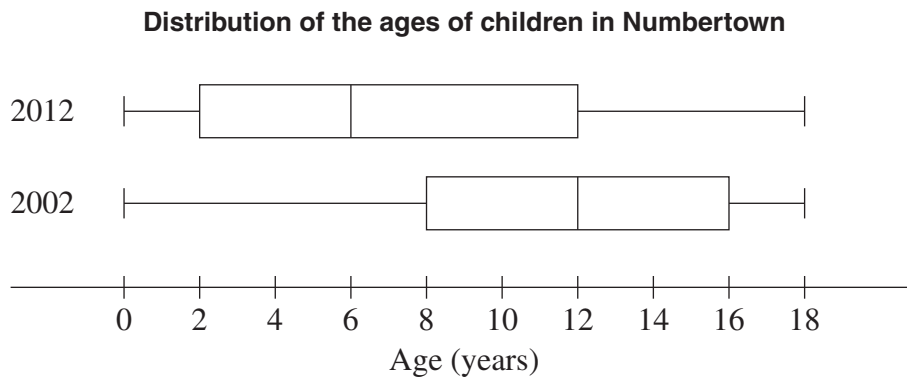
In 2002 Numbertown had 1950 children aged 0–18 years. The number of children aged 12–18 years was the same in both 2002 and 2012.

How many children aged 0–18 years were there in Numbertown in 2012?

(A)   1950

(B)   2600

(C)   2625

(D)   3900

9 The equally spaced cross-sectional areas of a water reservoir are shown.

6.2 km^2

8.1 km^2

7.3 km^2

7.1 km^2

6.0 km^2

8 km
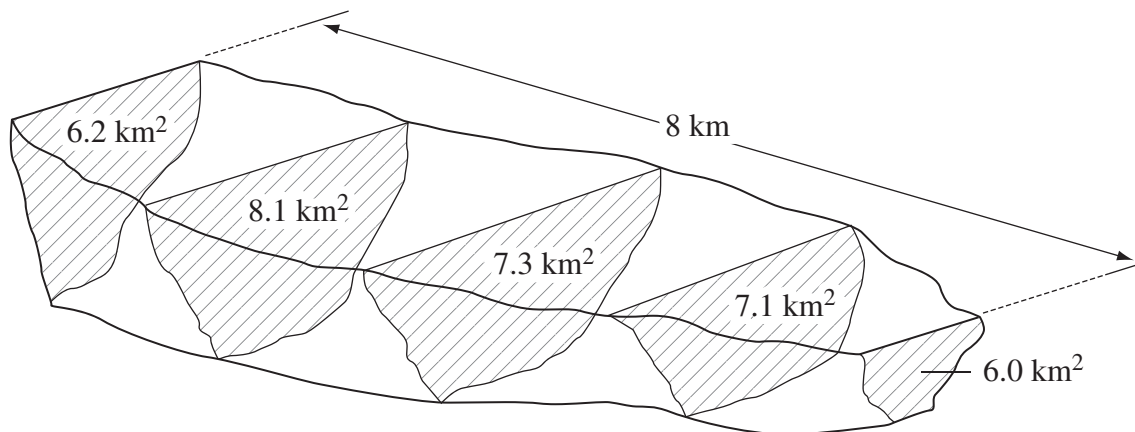
Using Simpson's rule twice, what is the approximate volume of the reservoir?

(A)   31 km^3

(B)   58 km^3

(C)   117 km^3

(D)   234 km^3

10   A plane flies on a bearing of 030° from *A* to *B*, as shown in the diagram.
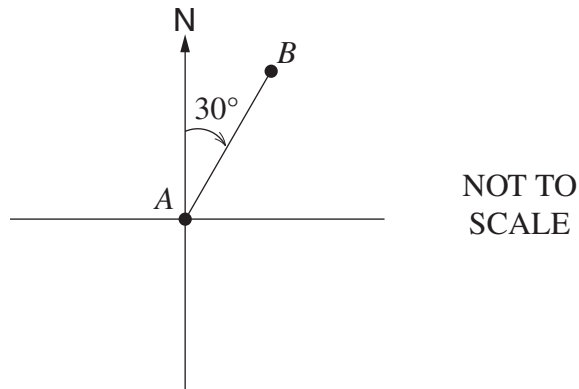
What is the bearing of *A* from *B*?

(A)   030°

(B)   150°

(C)   210°

(D)   330°

11   A television was purchased for $2100 on 12 April 2012 using a credit card. Simple interest was charged at a rate of 19.74% per annum for purchases using the credit card. No other purchases were made and there was no interest-free period. The period for which interest was charged included the date of purchase and the date of payment.

What amount was required to pay the account in full on 20 May 2012?

(A) $2143.16

(B) $2143.59

(C) $2144.29

(D) $2144.74

12   A car is travelling at 80 km/h. It takes the driver two seconds to react to a dangerous situation before applying the brakes.

Approximately how far will the car travel in this time?

(A)   44 m

(B)   160 m

(C)   288 m

(D)   576 m

13 In the diagram, O represents the centre of Earth, and B lies on both the Equator and the Greenwich Meridian.
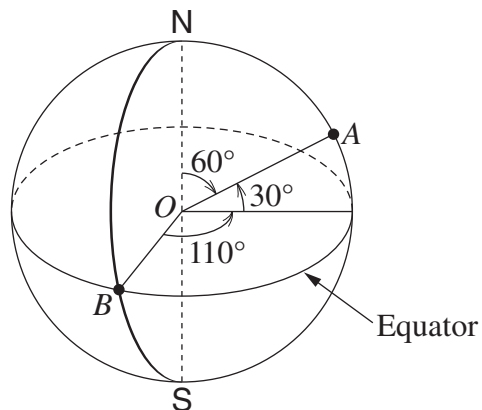
NOT TO SCALE

What is the latitude and longitude of point A?

(A) 30°N 110°E

(B) 30°N 110°W

(C) 60°N 110°E

(D) 60°N 110°W

14 A data set of nine scores has a median of 7.

The scores 6, 6, 12 and 17 are added to the data set.

What is the median of the data set now?

(A) 6

(B) 7

(C) 8

(D) 9

15 A 2400 watt heater is run for 7 hours each day. If electricity is charged at 25.1 c/kWh, what is the cost of running the heater for 10 days, to the nearest cent?

(A) $4.22

(B) $42.17

(C) $421.68

(D) $4216.80

16 A group of 347 people was surveyed and the results recorded in the table.

Survey results

	Doesn't enjoy shopping	*Enjoys shopping*	*Total*
Male	72	3	75
Female	16	256	272
	88	259	347

A person is selected at random from the surveyed group.

What is the probability, to the nearest percent, that the person selected is either a male who doesn't enjoy shopping or a female who enjoys shopping?

(A)   21%

(B)   22%

(C)   95%

(D)   96%

17 Which of the following correctly expresses r as the subject of $v = \sqrt{\dfrac{mr}{\pi}}$?

(A) $r = \dfrac{\pi v^2}{m}$

(B) $r = \dfrac{(\pi v)^2}{m}$

(C) $r = \dfrac{mv^2}{\pi}$

(D) $r = \dfrac{(mv)^2}{\pi}$

18 Lucille bought a new car for $45 000. In the first year the value of the car depreciated by 25%. In the second and third years the value depreciated by 10% per year.

What was the value of the car at the end of the third year, to the nearest dollar?

(A) $17 663

(B) $24 750

(C) $27 000

(D) $27 338

19 Rick is using a spreadsheet to calculate the average pay of his four employees for the week.

	A	B	C	D	E
1	Wages for week ending 15th March 2013				
2 **3**		Number of days worked	Total hours worked	Hourly rate	Weekly pay
4	Alf		38	36.25	
5	Bob	4		40.45	
6	Cath	5	29	33.75	978.75
7	David			21.55	840.45

Sheet 1 / Sheet 2

In the diagram, some of the cells of the spreadsheet have been shaded.

Into which of the shaded cells must Rick yet enter data in order to calculate the average pay for the week?

(A) B4

(B) B7

(C) C5

(D) C7

20 In the Descartes household there are four people. Each person has a shower each day and uses 120 L of water per shower. Water costs $2.13 per kilolitre (kL).

It is decided to install a water-efficient showerhead that uses 40% less water.

How much could the household save on its water costs each year?

(A) $37

(B) $149

(C) $224

(D) $373

21 A hospital patient is given 1.2 litres of fluid over 10 hours by intravenous drip. The fluid is delivered at a rate of 20 drops per mL.

What is the required drip rate, in drops per minute?

(A) 0.1

(B) 2.4

(C) 10

(D) 40

22 Simon is a mechanic who receives a normal rate of pay of $22.35 per hour for a 40-hour week.

When he is needed for emergency call-outs he is paid a special allowance of $150 for that week. Additionally, each time he is called out to an emergency he is paid at double time for a minimum of 4 hours.

In the week beginning 1 February 2012 Simon worked 40 hours normal time and was needed for emergency call-outs. His emergency call-out log book for the week is shown.

| Employee: Simon | |
Week: 1/2/12 to 7/2/12	
Date	*Duration of call-out*
3/2/12	5 hours
5/2/12	1.5 hours

What was Simon's total pay for that week?

(A) $1189.28

(B) $1296.30

(C) $1334.55

(D) $1446.30

23 Lou and Ali are on a fitness program for one month. The probability that Lou will finish the program successfully is 0.7, while the probability that Ali will finish it successfully is 0.6. The probability tree diagram shows this information.
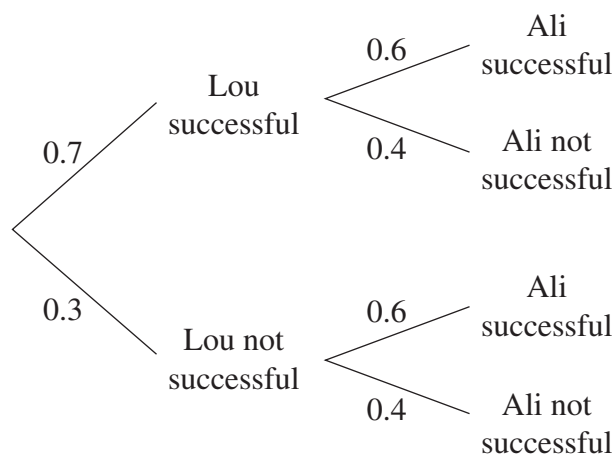
What is the probability that only one of Lou and Ali will be successful?

(A) 0.18

(B) 0.28

(C) 0.42

(D) 0.46

24 A function centre hosts events for up to 500 people. The cost C, in dollars, for the centre to host an event where x people attend is given by:

$$C = 10\,000 + 50x$$

The centre charges \$100 per person. Its income I, in dollars, is given by:

$$I = 100x$$

Income and costs for the function centre
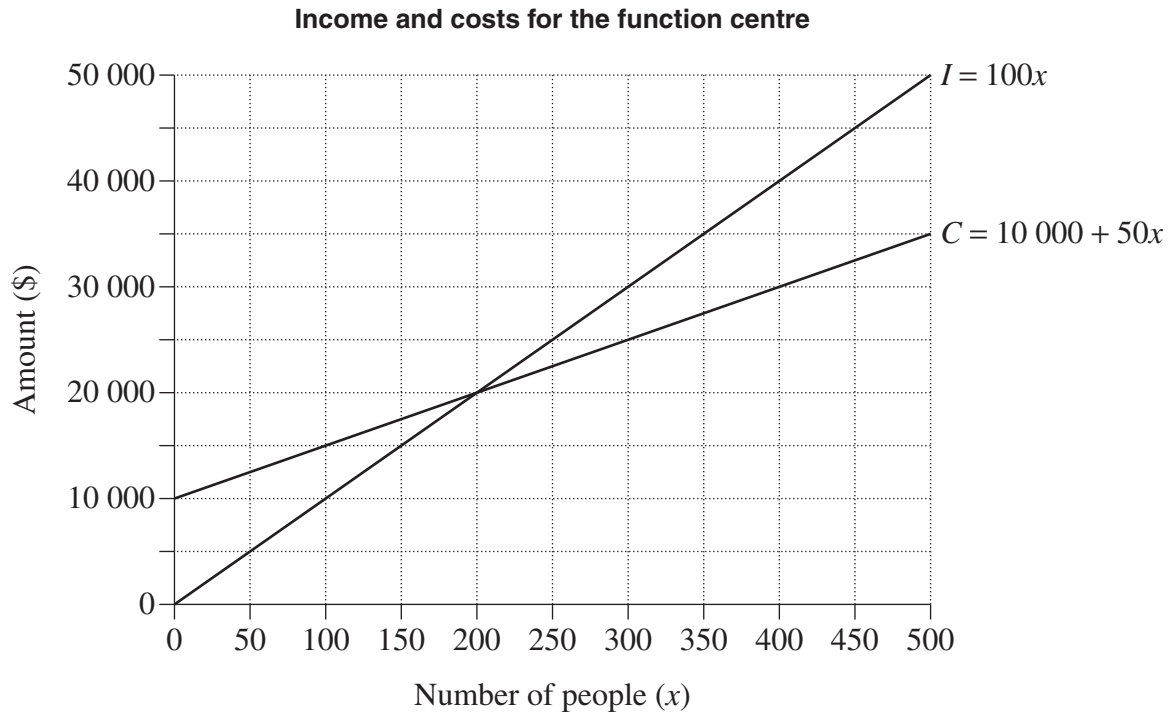
When 500 people attend an event, how much greater is the income of the function centre than its income at the breakeven point?

(A) \$15 000

(B) \$20 000

(C) \$30 000

(D) \$40 000

25 Ying borrowed $250 000 to buy a house. The interest rate and monthly repayment for her loan are shown in the spreadsheet.

	A	B	C	D	E
1	**Home Loan Table**			*This table assumes the*	
2		Amount = $250 000		*same number of days in*	
3		Annual Interest Rate = 7.65%		*each month, ie*	
4		Monthly Repayment (**R**) = $1871.94		Interest = Rate/12 × Principal	
5					
6	**Month**	**Principal (*P*)**	**Interest (*I*)**	***P + I***	***P + I − R***
7	1	$250 000.00	$1593.75	$251 593.75	$249 721.81
8	2	$249 721.81	$1591.98	$251 313.79	$249 441.85
9	3	$249 441.85	$1590.19	$251 032.04	
10	4				

Sheet 1 / Sheet 2

What is the total interest charged for the first four months of this loan?

(A) $6364.32

(B) $6366.11

(C) $6369.67

(D) $6376.25

Mathematics General 2

456
Centre Number

12345678
Student Number

Section II

75 marks
Attempt Questions 26–30
Allow about 1 hour and 55 minutes
for this section

Answer the questions in the spaces provided.

Your responses should include relevant mathematical reasoning and/or calculations.

Extra writing space is provided on page 36. If you use this space, clearly indicate which question you are answering.

Student, Sample

Please turn over

Do NOT write in this area.

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Question 26 (15 marks)

(a) A study on the mobile phone usage of NSW high school students is to be conducted. Data is to be gathered using a questionnaire.

The questionnaire begins with the three questions shown.

```
Q1:    Do you own a mobile phone?
       Yes ☐          No ☐

Q2:    Which phone company do you use?

       .........................................................

Q3:    Do you use prepaid or a plan?
       Prepaid ☐      Plan ☐
```

   (i) Classify the type of categorical data that will be collected in Q2 of the questionnaire.   **1**

....

  (ii) Write a suitable question for this questionnaire that would provide quantitative data.   **1**

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 (iii) An initial study is to be conducted using a stratified sample.   **1**

How could a representative stratified sample be obtained?

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Question 26 (continued)

(b)   The diagram shows a semicircle, from which a trapezium has been cut. **3**
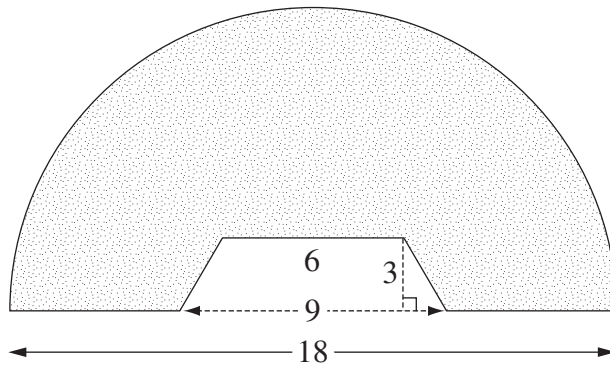
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All measurements
are in centimetres.

What is the area of the remaining shape, to the nearest square centimetre?

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Question 26 continues on page 17

(c)   The diagram shows a can of 'Red Kangaroo', a drink containing alcohol.   **2**

Felicity, who weighs 66 kg, is at a party and consumes three cans of this drink. She commences the first can at 7 pm and finishes the third at 10 pm.

To roughly estimate how long it will take for a person's blood alcohol content (BAC) to reach zero after stopping drinking, this formula can be used:

Number of
hours for BAC $=$ $\dfrac{BAC}{0.015}$
to reach zero

How long will it take for Felicity's BAC to reach zero? Give your answer to the nearest 10 minutes.

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(d)   Perth in Western Australia is 8 hours ahead of Greenwich in England. Santiago   **2**
in Chile is 3 hours behind Greenwich.

What is the day and time in Santiago when it is 8 am on Friday in Perth?

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Question 26 continues on page 18

Question 26 (continued)

(e) Fred and Wilma buy a new family car priced at $50 000. In addition to the purchase price, there are the following costs. **2**

- Dealer delivery charges $1995

- Compulsory third-party insurance $748

- Registration $323

- Comprehensive car insurance $920

- Stamp duty, calculated at
      3% of the car value up to and including $45 000
plus 5% of the car value over $45 000

Calculate the total amount that Fred and Wilma will need to pay.

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Question 26 (continued)

(f)   For her phone plan, Suzie pays $25 per month plus other charges as shown below.   **3**

Rates (for use within Australia)	Costs
	Costs
Standard voice call flagfall	40c per call
Standard voice call rate	45c per 30 sec
SMS to standard Australian mobiles	25c per message
MMS to standard Australian mobiles	55c per message
Standard video call flagfall	35c per call
Standard video call rate	$1 per min
Excess data rate	30c per MB

INCLUDED IN THE PLAN

250 two-minute calls
Unlimited SMS
1.5 GB data

In July, Suzie:

• makes 300 two-minute voice calls

• sends 150 SMS messages

• uses 1.2 GB of data

• sends 20 MMS messages

• makes 10 five-minute video calls.

What is the total amount of Suzie's phone bill for July?

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End of Question 26

Question 27 (15 marks)

(a) The sector shown has a radius of 13 cm and an angle of 230°.　　　　　　　**2**

13 cm

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230°
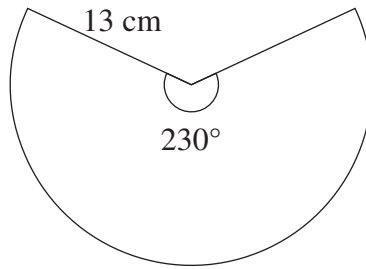
What is the perimeter of the sector, to the nearest centimetre?

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(b) The table shows present value interest factors for some monthly interest rates (r)　**2**
and loan terms in months (N).

Table of present value interest factors						
r	0.0060	0.0065	0.0070	0.0075	0.0080	0.0085
N						
45	39.33406	38.90738	38.48712	38.07318	37.66545	37.26383
46	40.09350	39.64965	39.21263	38.78231	38.35859	37.94133
47	40.84841	40.38714	39.93310	39.48617	39.04622	38.61311
48	41.59882	41.11986	40.64856	40.18478	39.72839	39.27924
49	42.34475	41.84785	41.35905	40.87820	40.40515	39.93975
50	43.08623	42.57113	42.06459	41.56645	41.07653	40.59470

Mark borrows $10 000 for a car. He arranges to repay the loan with monthly
repayments over 4 years. He is charged 7.2% per annum interest.

Using the table, calculate the amount of interest Mark will pay over the term of
this loan.

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– 20 –

Question 27 (continued)

(c) Data were collected from 20 students on the number of text messages that they had sent in the previous 24 hours. The set of data collected is displayed in the stem-and-leaf plot.

Number of text messages

```
0 | 8 9
1 | 1 1 2 2 5 6 8 8 8
2 | 0 1 7 8 8
3 | 4 5 6
4 |
5 | 1
```
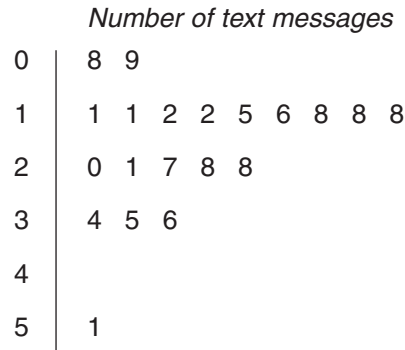
(i) What is the interquartile range of the data?   **1**

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(ii) Is 51 an outlier for this set of data? Justify your answer using suitable calculations.   **2**

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(d) Anne has a new job as a salesperson. She is offered the choice of being paid a salary or a retainer plus commission. A retainer is a fixed amount paid regardless of sales.   **2**

How do these methods of payment differ?

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Question 27 continues on page 22

Question 27 (continued)

(e) The marks in a class test are normally distributed. The mean is 70 and the standard deviation is 10.

(i) Jason's mark is 85. What is his z-score? **1**

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(ii) Mary has a z-score of 0. What mark did she achieve in the test? **1**

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(iii) What percentage of the marks lie between 50 and 80? **2**

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(f)   The diagram shows a map of the Namoi catchment region in NSW.   **2**
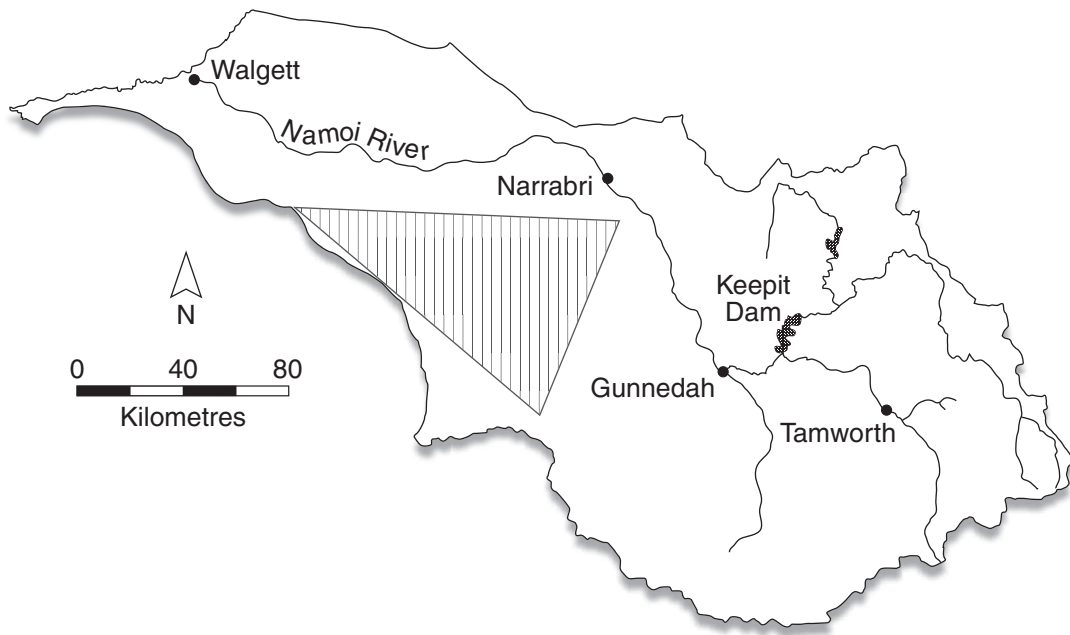
The land use within the shaded area is mainly forestry and conservation.

Using the scale given, calculate the shaded area. Give your answer to the nearest square kilometre.

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End of Question 27

Question 28 (15 marks)

(a)   Solve these equations simultaneously, showing all working.   **2**

$$4x + y = 13$$
$$2x - y = 2$$

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(b)   A design of numberplates has a two-digit number, two letters and then another two-digit number. Examples include ┌──────────┐ `02 AC 14` └──────────┘ and ┌──────────┐ `76 BB 08` └──────────┘.

  (i)   How many different such numberplates are possible?   **1**

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  (ii)   Jo's birthday is 30 December 1992. She would like the numberplate   **2**

┌──────────┐ `30 JO 12` └──────────┘ or the numberplate ┌──────────┐ `19 JO 92` └──────────┘.

Jo can order a numberplate with 'JO' in the middle but will have to have randomly selected numbers on either side.

What is the probability that Jo will be issued with one of the numberplates she would like?

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Question 28 (continued)

(c)   During a flood, 1.5 hectares of land was covered by water to a depth of 17 cm.   **2**

How many kilolitres of water covered the land?

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(d)   Tai plays a game of chance for which there is a: **2**

- $\dfrac{1}{5}$ chance of winning $10

- $\dfrac{1}{2}$ chance of winning $3

- $\dfrac{3}{10}$ chance of losing $8.

The game has a $2 entry fee.

What is Tai's financial expectation for this game?

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Question 28 (continued)

(e)   Helen is conducting a plane table radial survey of the field *ABCD*.   **3**
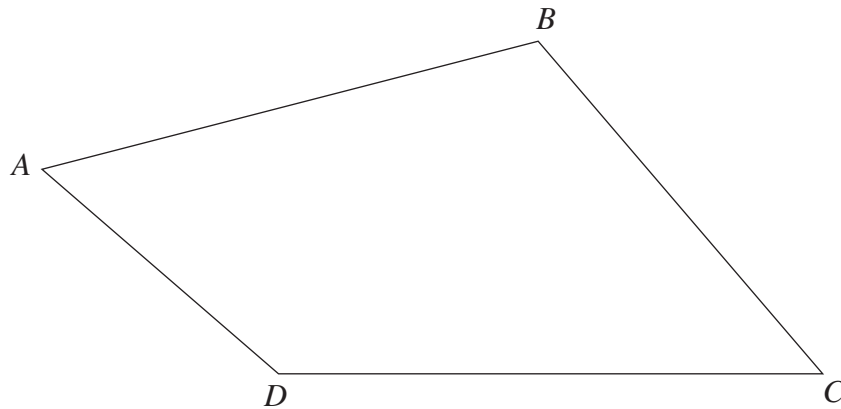
Helen starts with the following steps:

- Place a table centrally in the field.

- Fix a sheet of paper to the top of the table and mark a point *P* on the paper, near the centre.

- Mark a point on the ground, vertically below *P*.

Describe how Helen should complete the survey.

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(f) Joe and a flagpole both cast shadows on the ground. The difference between the   **3**
     lengths of their shadows is 3 metres. The length of Joe's shadow is *d* metres.

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SCALE

4 m

1.5 m

3 m

d m

Shadow of flagpole
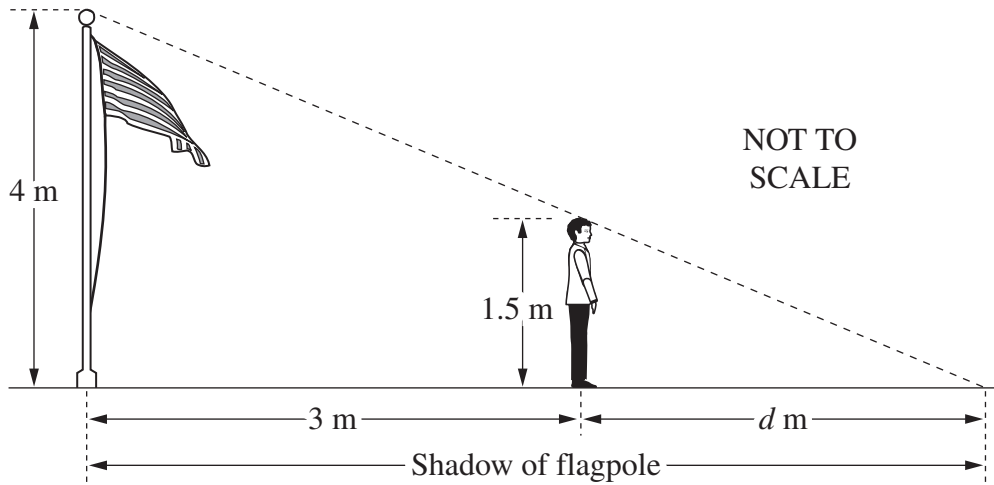
What is the value of *d*?

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End of Question 28

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Question 29 (15 marks)

(a) Solve the equation **3**

$$\frac{5x}{4} + 9 = 10x - 12$$

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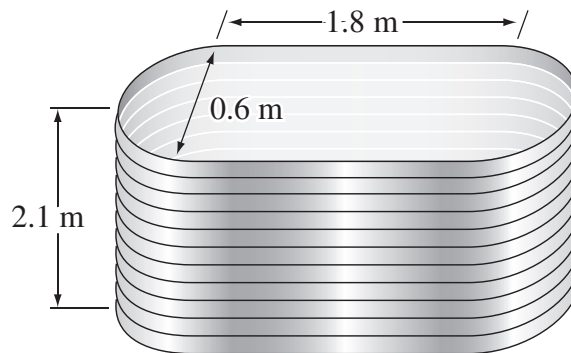
(b) The diagram shows a water tank with semicircular ends and parallel sides.

(i) Find the capacity of the tank. Give your answer to the nearest litre. **3**

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Question 29 continues on page 29

Question 29 (continued)

(ii)   The tank was found to be leaking, losing 5% of its volume each day.   **2**

The volume of the water remaining in the tank after it began leaking can be modelled using the equation

$$V = b(0.95)^n$$

where V is the volume of the water remaining in the tank

b is the volume of the tank when it began leaking

n is the number of days since the tank began leaking.

The tank was initially full.

How much water had the tank lost three weeks after it began leaking? Assume no water was added during these three weeks.

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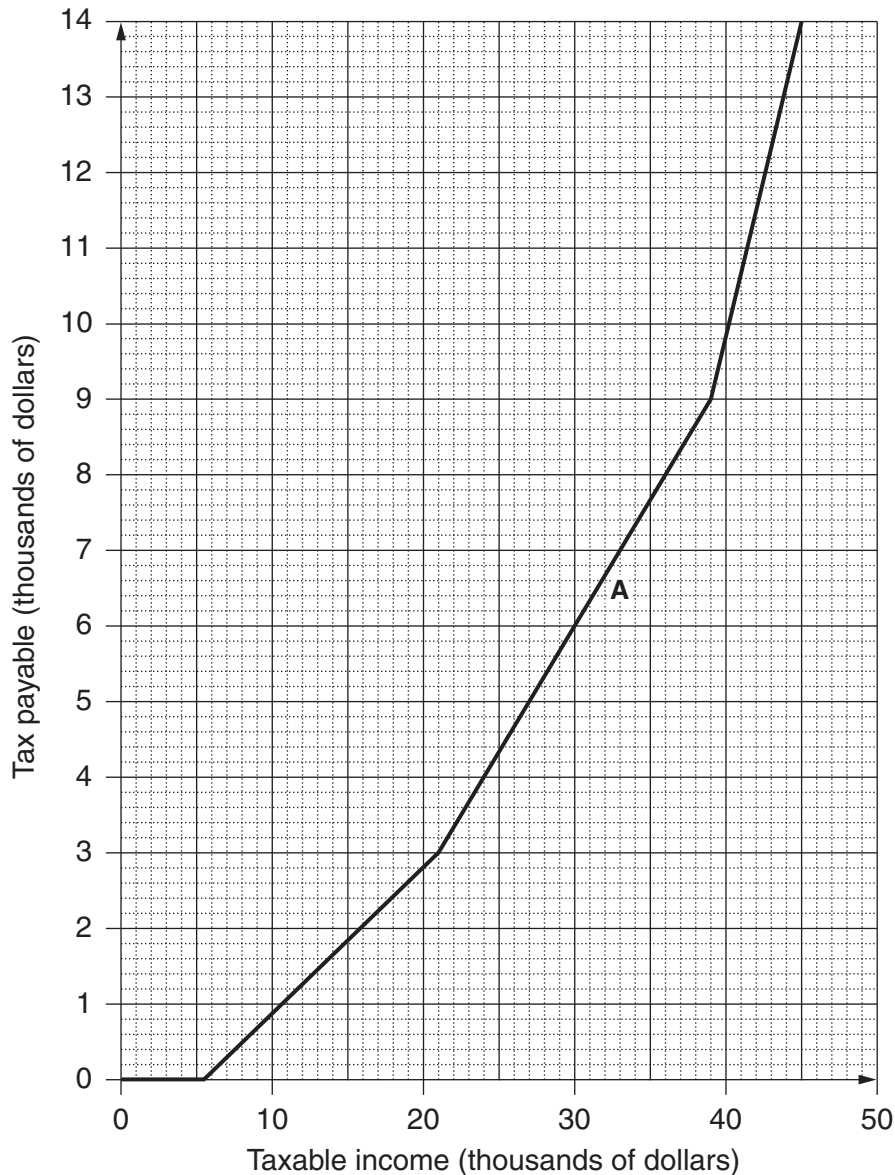
Question 29 continues on page 30

Question 29 (continued)

(c)   The graph shows tax payable against taxable income, in thousands of dollars.

(i)   Using the graph, find the tax payable on a taxable income of $21 000.   **1**

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(ii)   Find the gradient of the section of the graph marked **A**.   **1**

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Question 29 continues on page 31

Question 29 (continued)

(iii) For taxable incomes between $21 000 and $39 000, how much of each dollar is payable in tax?

1

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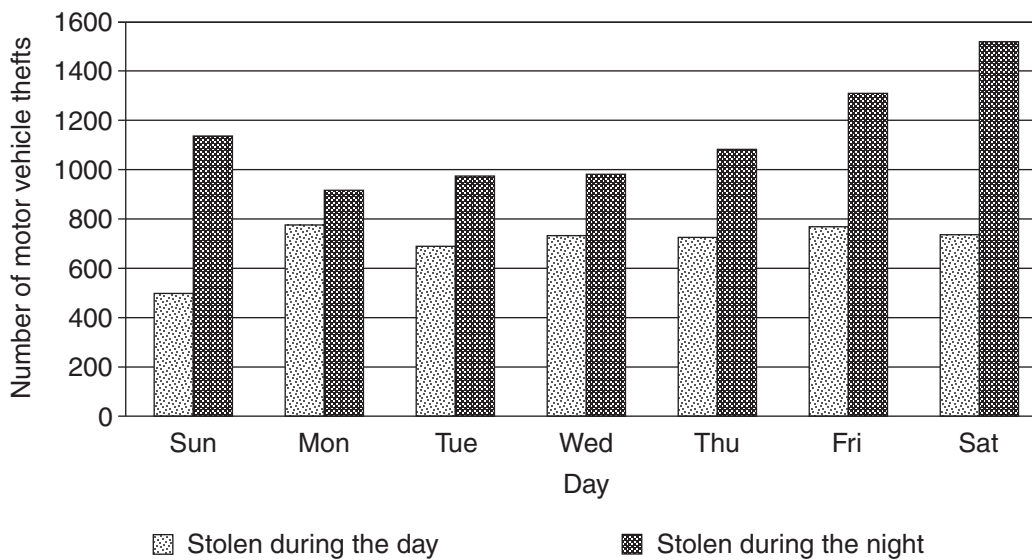..

(iv) Write an equation that could be used to calculate the tax payable T, in terms of the taxable income I, for taxable incomes between $21 000 and $39 000.

2

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(d) The graph shows data on motor vehicle theft in a city during 2012.

2

Time and day of week of motor vehicle thefts in 2012

□ Stolen during the day   ▧ Stolen during the night

What trends about motor vehicle theft in this city during 2012 can be observed from the graph?

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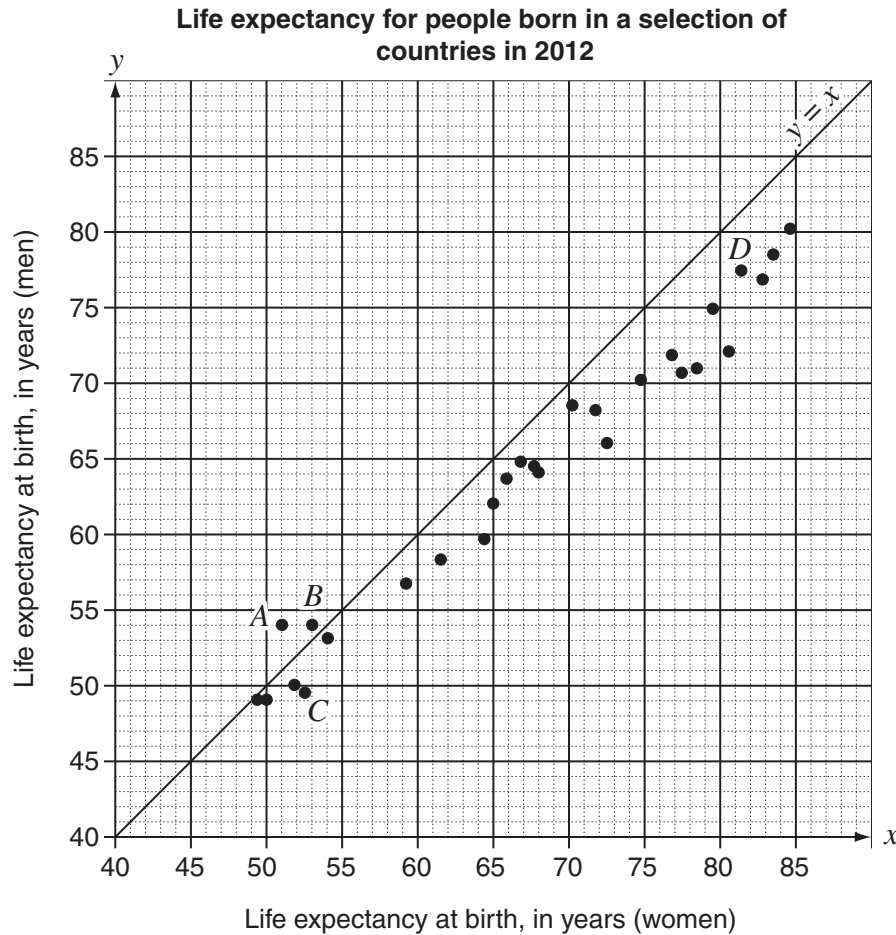
End of Question 29

Question 30 (15 marks)

(a)   Irene investigated the life expectancy of women and men born in a selection of different countries in 2012. She constructed a scatterplot to represent the data obtained.

Life expectancy for people born in a selection of countries in 2012

Life expectancy at birth, in years (women)

(i)   For another country, Estonia, the life expectancy for people born in 2012   **1**
is 80 years for women and 70 years for men.

Plot a point on the graph to represent this information and label it *E*.

(ii)   The trendline for this data can be approximated using the equation

$$y = 0.8x + 9.4$$

(1) What is the value of *y* when $x = 60$?   **1**

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(2) Use this equation to draw the trendline on the graph above.   **2**

Question 30 (continued)

(iii) The line $y = x$ has been drawn on the graph.

Explain what this line might represent in the context of the data.   **1**

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(iv) Most of the points lie below the line $y = x$. What feature of the data does   **1**
this illustrate?

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(v) Compare the life expectancies for women and men in the countries   **1**
represented by the points *A* and *B*.

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(vi) Describe TWO possible reasons for the differences in life expectancy   **2**
between the countries represented by the points *C* and *D*.

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Question 30 (continued)

(b) The spreadsheet shows monthly home loan repayments with interest rate changes from February to October 2012.

Monthly home loan repayments

	A	B	C	D	E
1					
2	*Dates*	Feb 2012	Apr 2012	Jun 2012	Oct 2012
3	*Increase/Decrease*	*−1.0%*	*−0.1%*	*0.05%*	*0.25%*
4	***Rate (pa)***	***5.85%***	***5.75%***	***5.80%***	***6.05%***
5	$1000	$6.35	$6.29	$6.32	$6.47
6	$50 000	$318	$315	$316	$324
7	$100 000	$635	$629	$632	$647
8	$150 000	$953	$944	$948	$971
9	$200 000	$1270	$1258	$1264	$1295
10	$250 000	$1588	$1573	$1580	$1618
11	$300 000	$1905	$1887	$1896	$1942
12	$350 000	$2223	$2202	$2212	$2266
13	$400 000	$2541	$2516	$2529	$2589
14					

Sheet 1 / Sheet 2 /

(i) Xiang's bank approves loans for customers if their loan repayments are no more than 30% of their monthly gross salary.

4

Xiang wanted to borrow money to buy a house. Her monthly gross salary was $7000. She applied for the loan in October 2012.

What was the maximum amount that her bank would approve for her to borrow?

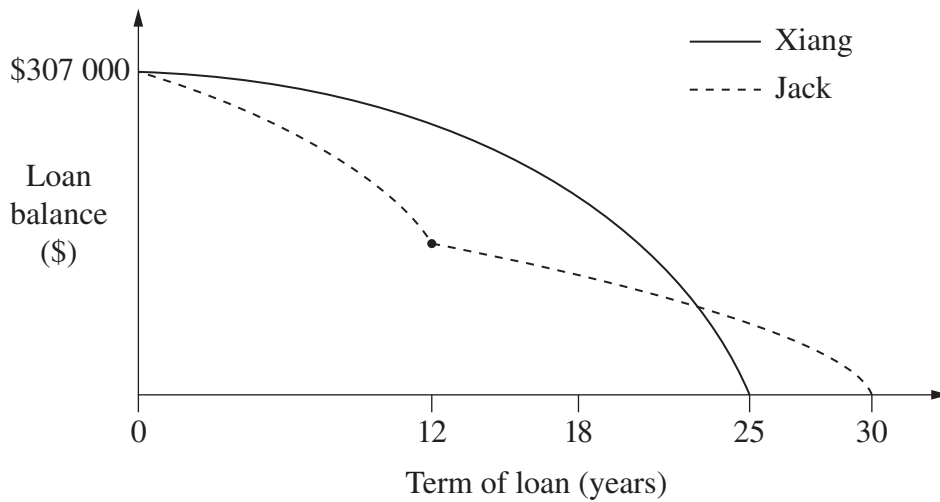..

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Question 30 continues on page 35

Question 30 (continued)

(ii) Xiang and her friend Jack both received loans at the same time and for the same amount. Graphs of their loans are shown.

2

Identify TWO differences between the graphs, and provide a possible explanation for each difference, making reference to interest rates and/or loan repayments.

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End of paper

Section II Extra writing space

If you use this space, clearly indicate which question you are answering.

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FORMULAE AND DATA SHEET

Financial Mathematics

Simple interest

$$I = Prn$$

P is initial amount

r is interest rate per period, expressed as a decimal

n is number of periods

Compound interest

$$A = P(1 + r)^n$$

A is final amount

P is initial amount

r is interest rate per period, expressed as a decimal

n is number of compounding periods

Present value and future value

$$PV = \frac{FV}{(1 + r)^n}, \qquad FV = PV(1 + r)^n$$

r is interest rate per period, expressed as a decimal

n is number of compounding periods

Straight-line method of depreciation

$$S = V_0 - Dn$$

S is salvage value of asset after n periods

V_0 is initial value of asset

D is amount of depreciation per period

n is number of periods

Declining-balance method of depreciation

$$S = V_0(1 - r)^n$$

S is salvage value of asset after n periods

V_0 is initial value of asset

r is depreciation rate per period, expressed as a decimal

n is number of periods

Data Analysis

Mean of a sample

$$\bar{x} = \frac{\text{sum of scores}}{\text{number of scores}}$$

z-score

For any score x,

$$z = \frac{x - \bar{x}}{s}$$

$\bar{x}$ is mean

s is standard deviation

Outlier(s)

score(s) less than $Q_L - 1.5 \times IQR$

or

score(s) more than $Q_U + 1.5 \times IQR$

Q_L is lower quartile

Q_U is upper quartile

IQR is interquartile range

Least-squares line of best fit

$$y = \text{gradient} \times x + y\text{-intercept}$$

$$\text{gradient} = r \times \frac{\text{standard deviation of } y \text{ scores}}{\text{standard deviation of } x \text{ scores}}$$

$$y\text{-intercept} = \bar{y} - (\text{gradient} \times \bar{x})$$

r is correlation coefficient

$\bar{x}$ is mean of x scores

$\bar{y}$ is mean of y scores

Normal distribution

- approximately 68% of scores have z-scores between −1 and 1

- approximately 95% of scores have z-scores between −2 and 2

- approximately 99.7% of scores have z-scores between −3 and 3

Spherical Geometry

Circumference of a circle

$$C = 2\pi r \quad \text{or} \quad C = \pi D$$

r is radius

D is diameter

Arc length of a circle

$$l = \frac{\theta}{360} 2\pi r$$

r is radius

θ is number of degrees in central angle

Radius of Earth

(taken as) 6400 km

Time differences

For calculation of time differences using longitude:

$15° = 1$ hour time difference

Area

Circle

$$A = \pi r^2$$

r is radius

Sector

$$A = \frac{\theta}{360} \pi r^2$$

r is radius

θ is number of degrees in central angle

Annulus

$$A = \pi \left(R^2 - r^2 \right)$$

R is radius of outer circle

r is radius of inner circle

Trapezium

$$A = \frac{h}{2} \left(a + b \right)$$

h is perpendicular height

a and b are the lengths of the parallel sides

Area of land and catchment areas

unit conversion: 1 ha = 10 000 m^2

Surface Area

Sphere

$$A = 4\pi r^2$$

r is radius

Closed cylinder

$$A = 2\pi r^2 + 2\pi rh$$

r is radius

h is perpendicular height

Volume

Prism or cylinder

$$V = Ah$$

A is area of base

h is perpendicular height

Pyramid or cone

$$V = \frac{1}{3} Ah$$

A is area of base

h is perpendicular height

Volume and capacity

unit conversion: 1 m^3 = 1000 L

Approximation Using Simpson's Rule

Area

$$A \approx \frac{h}{3} \left(d_f + 4d_m + d_l \right)$$

h is distance between successive measurements

d_f is first measurement

d_m is middle measurement

d_l is last measurement

Volume

$$V \approx \frac{h}{3} \left\{ A_L + 4A_M + A_R \right\}$$
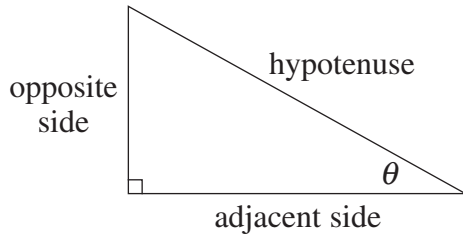
h is distance between successive measurements

A_L is area of left end

A_M is area of middle

A_R is area of right end

Trigonometric Ratios

$$\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$$

$$\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

$$\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$$

Sine rule

In $\triangle ABC$,

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Area of a triangle

In $\triangle ABC$,

$$A = \frac{1}{2} ab \sin C$$

Cosine rule

In $\triangle ABC$,

$$c^2 = a^2 + b^2 - 2ab \cos C$$

or

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

Units of Memory and File Size

$$1 \text{ byte} = 8 \text{ bits}$$

$$1 \text{ kilobyte} = 2^{10} \text{ bytes} = 1024 \text{ bytes}$$

$$1 \text{ megabyte} = 2^{20} \text{ bytes} = 1024 \text{ kilobytes}$$

$$1 \text{ gigabyte} = 2^{30} \text{ bytes} = 1024 \text{ megabytes}$$

$$1 \text{ terabyte} = 2^{40} \text{ bytes} = 1024 \text{ gigabytes}$$

Blood Alcohol Content Estimates

$$BAC_{\text{male}} = \frac{10N - 7.5H}{6.8M}$$

or

$$BAC_{\text{female}} = \frac{10N - 7.5H}{5.5M}$$

N is number of standard drinks consumed

H is number of hours of drinking

M is person's mass in kilograms

Distance, Speed and Time

$$D = ST, \quad S = \frac{D}{T}, \quad T = \frac{D}{S}$$

$$\text{average speed} = \frac{\text{total distance travelled}}{\text{total time taken}}$$

$$\text{stopping distance} = \left\{ \begin{array}{c} \text{reaction-time} \\ \text{distance} \end{array} \right\} + \left\{ \begin{array}{c} \text{braking} \\ \text{distance} \end{array} \right\}$$

Probability of an Event

The probability of an event where outcomes are equally likely is given by:

$$P(\text{event}) = \frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$$

Straight Lines

Gradient

$$m = \frac{\text{vertical change in position}}{\text{horizontal change in position}}$$

Gradient–intercept form

$$y = mx + b$$

m is gradient

b is y-intercept

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