

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 13–34

75 marks

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

Section I

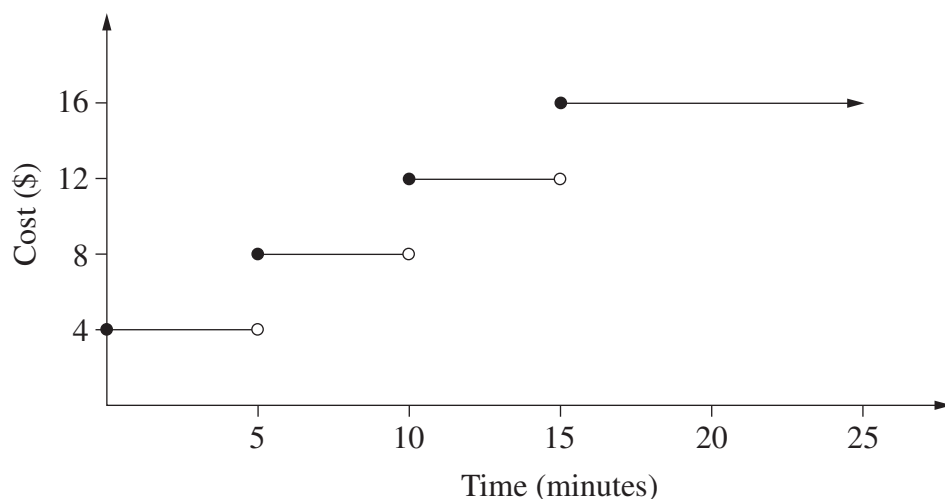
25 marks

Attempt Questions 1–25

Allow about 35 minutes for this section

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

- 1 The step graph shows the cost of telephone calls to China.



Bella made a telephone call at 9.50 pm to a friend in China and spoke to him until 10.07 pm.

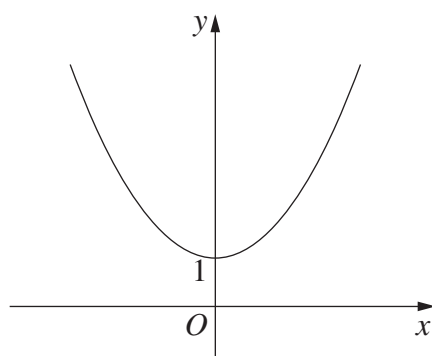
How much did this telephone call cost?

- (A) \$4
 - (B) \$8
 - (C) \$12
 - (D) \$16
- 2 A measurement of 72 cm is increased by 20% and then the result is decreased by 20%.

What is the new measurement, correct to the nearest centimetre?

- (A) 46 cm
- (B) 69 cm
- (C) 72 cm
- (D) 104 cm

- 3 The diagram shows the graph of an equation.



Which of the following equations does the graph best represent?

- (A) $y = \frac{3}{x} + 1$
- (B) $y = 3^x + 1$
- (C) $y = 3x^2 + 1$
- (D) $y = 3x^3 + 1$
- 4 Young's formula below is used to calculate the required dosages of medicine for children aged 1–12 years.

$$\text{Dosage} = \frac{\text{age of child (in years)} \times \text{adult dosage}}{\text{age of child (in years)} + 12}$$

How much of the medicine should be given to an 18-month-old child in a 24-hour period if each adult dosage is 45 mL? The medicine is to be taken every 6 hours by both adults and children.

- (A) 5 mL
- (B) 20 mL
- (C) 27 mL
- (D) 30 mL

5 How many kilobytes are there in 2 gigabytes?

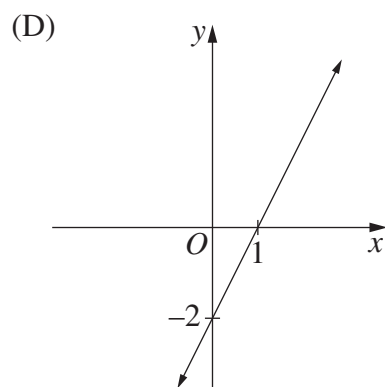
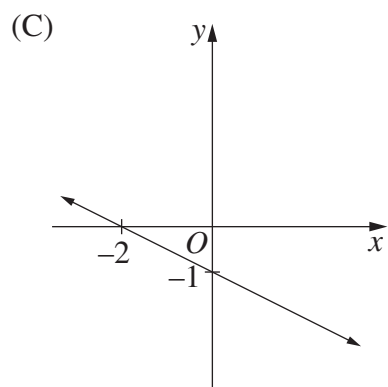
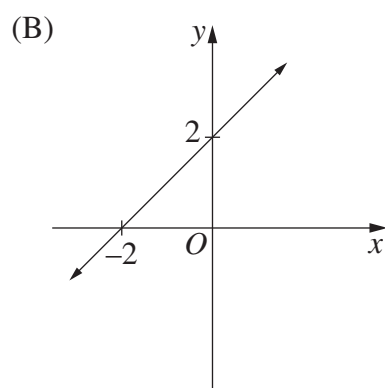
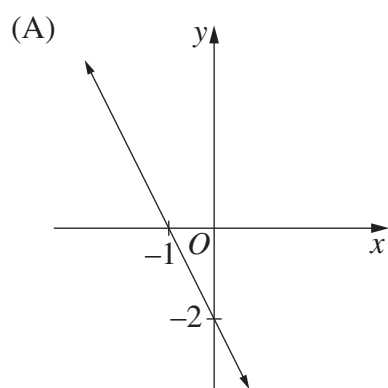
- (A) 2^{20}
- (B) 2^{21}
- (C) 2^{30}
- (D) 2^{31}

6 A cafe menu has 3 entrees, 5 main courses and 2 desserts. Ariana is choosing a three-course meal consisting of an entree, a main course and a dessert.

How many different three-course meals can Ariana choose?

- (A) 3
- (B) 10
- (C) 15
- (D) 30

7 Which of the following is the graph of $y = 2x - 2$?



- 8 A group of 150 people was surveyed and the results recorded.

Survey results			
	<i>Owens a mobile</i>	<i>Does not own a mobile</i>	<i>Total</i>
<i>Male</i>	42	28	70
<i>Female</i>	63	17	80
	105	45	150

A person is selected at random from the surveyed group.

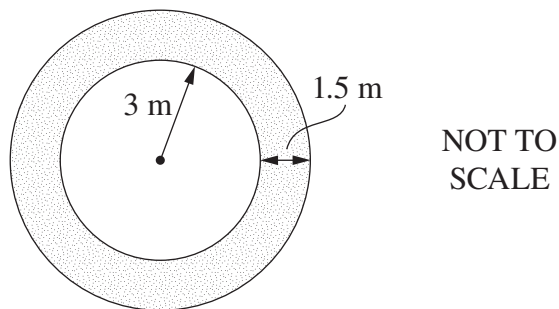
What is the probability that the person selected is a male who does not own a mobile?

- (A) $\frac{28}{150}$
- (B) $\frac{45}{150}$
- (C) $\frac{28}{70}$
- (D) $\frac{45}{70}$
- 9 A car is bought for \$19 990. It will depreciate at 18% per annum.
- Using the declining balance method, what will be the salvage value of the car after 3 years, to the nearest dollar?
- (A) \$8968
- (B) \$9195
- (C) \$11 022
- (D) \$16 392
- 10 The top of the Sydney Harbour Bridge is measured to be 138.4 m above sea level.
- What is the percentage error in this measurement?
- (A) 0.036%
- (B) 0.050%
- (C) 0.072%
- (D) 0.289%

11 Simplify $6w^4 \times \frac{1}{3}w^2$.

- (A) $2w^6$
- (B) $2w^8$
- (C) $18w^6$
- (D) $18w^8$

- 12 A path 1.5 metres wide surrounds a circular lawn of radius 3 metres.



What is the approximate area of the path?

- (A) 7.1 m^2
 - (B) 21.2 m^2
 - (C) 35.3 m^2
 - (D) 56.5 m^2
- 13 Jane sells jewellery. Her commission is based on a sliding scale of 6% on the first \$2000 of her sales, 3.5% on the next \$1000, and 2% thereafter.

What is Jane's commission when her total sales are \$5670?

- (A) \$188.40
- (B) \$208.40
- (C) \$321.85
- (D) \$652.05

- 14** Twenty Year 12 students were surveyed. These students were asked how many hours of sport they play per week, to the nearest hour.

The results are shown in the frequency table.

<i>Hours per week</i>	<i>Frequency</i>
0–2	5
3–5	10
6–8	3
9–11	2

What is the mean number of hours of sport played by the students per week?

- (A) 3.3
(B) 4.3
(C) 5.0
(D) 5.3
- 15** Which expression will give the shortest distance, in kilometres, between Mount Isa (20°S 140°E) and Tokyo (35°N 140°E)?

- (A) $\frac{15}{360} \times 2 \times \pi \times 6400$
(B) $\frac{55}{360} \times 2 \times \pi \times 6400$
(C) $\frac{140}{360} \times 2 \times \pi \times 6400$
(D) $\frac{305}{360} \times 2 \times \pi \times 6400$

- 16** In Mathsville, there are on average eight rainy days in October.

Which expression could be used to find a value for the probability that it will rain on two consecutive days in October in Mathsville?

(A) $\frac{8}{31} \times \frac{7}{30}$

(B) $\frac{8}{31} \times \frac{7}{31}$

(C) $\frac{8}{31} \times \frac{8}{30}$

(D) $\frac{8}{31} \times \frac{8}{31}$

- 17** A child who weighs 14 kg needs to be given 15 mg of paracetamol for every 2 kg of body weight. Every 10 mL of a particular medicine contains 120 mg of paracetamol.

What is the correct dosage of this medicine for the child?

(A) 5.6 mL

(B) 8.75 mL

(C) 11.43 mL

(D) 17.5 mL

- 18** The average NSW annual water consumption from the residential sector is equal to 90 340 litres per person per year. The Building Sustainability Index (BASIX) uses this as the benchmark to set a target for reducing water consumption by up to 40%.

A new building, planned to house 50 people, has been designed to meet a 25% reduction on this water consumption benchmark.

How much water per year, to the nearest kilolitre, is this building designed to save when fully occupied?

(A) 1129

(B) 1807

(C) 2710

(D) 3388

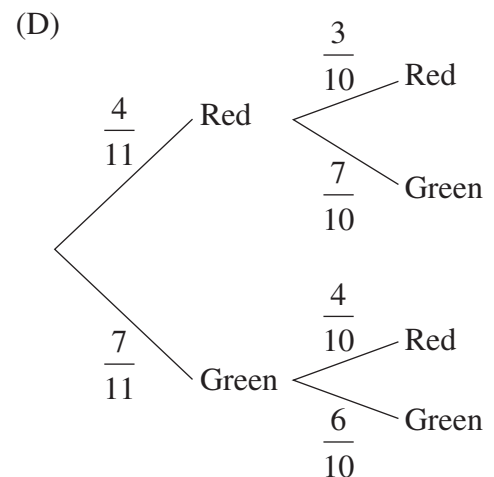
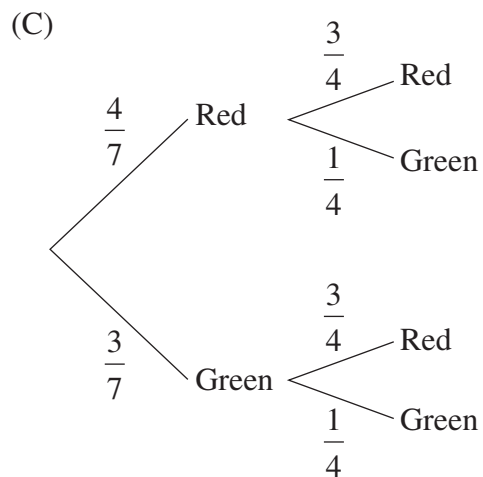
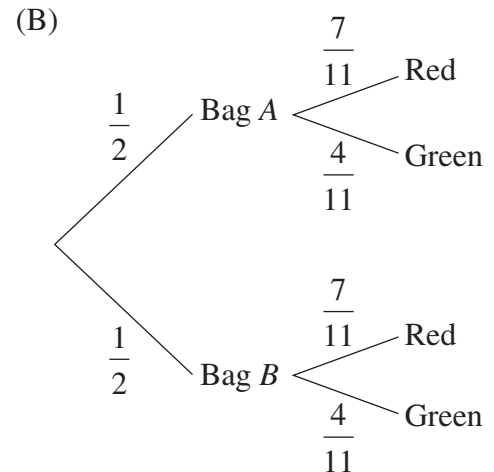
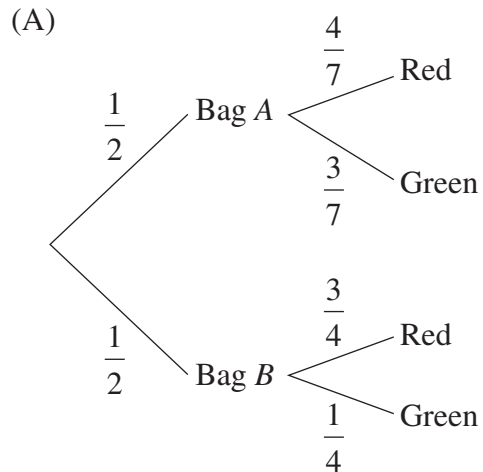
19 Jaz has 2 bags of apples.

Bag A contains 4 red apples and 3 green apples.

Bag B contains 3 red apples and 1 green apple.

Jaz chooses an apple from one of the bags.

Which tree diagram could be used to determine the probability that Jaz chooses a red apple?



- 20 In a household of 4, each member uses an average of 13 minutes of hot water per day.

The household uses a 9 kW hot water unit.

Electricity is charged at 11.97c/kWh when the hot water unit is being used.

What is the electricity cost for the hot water used by this household in one week?

- (A) \$1.63
- (B) \$6.54
- (C) \$392.14
- (D) \$653.56

- 21 A table of future value interest factors is shown.

Table of future value interest factors

<i>Period</i>	<i>Interest rate per period</i>				
	<i>1%</i>	<i>2%</i>	<i>3%</i>	<i>4%</i>	<i>5%</i>
1	1.0000	1.0000	1.0000	1.0000	1.0000
2	2.0100	2.0200	2.0300	2.0400	2.0500
3	3.0301	3.0604	3.0909	3.1216	3.1525
4	4.0604	4.1216	4.1836	4.2465	4.3101

A certain annuity involves making equal contributions of \$25 000 into an account every 6 months for 2 years at an interest rate of 4% per annum.

Based on the information provided, what is the future value of this annuity?

- (A) \$50 500
- (B) \$51 000
- (C) \$103 040
- (D) \$106 162

- 22** Heather's car uses fuel at the rate of 6.6 L per 100 km for long-distance driving and 8.9 L per 100 km for short-distance driving.

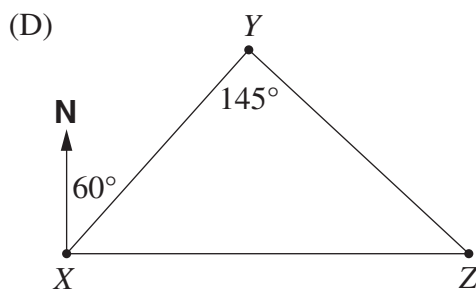
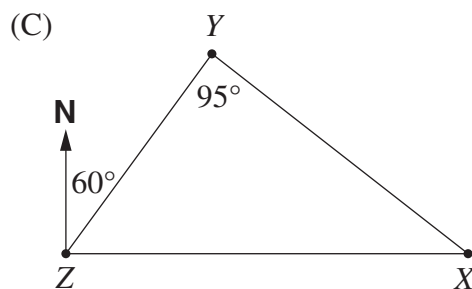
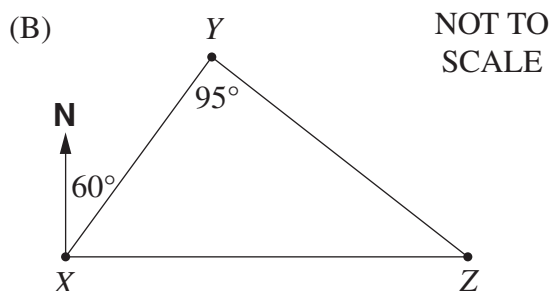
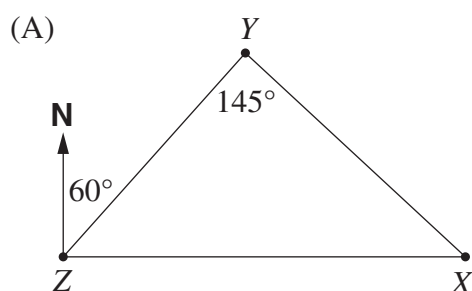
She used the car to make a journey of 560 km, which included 65 km of short-distance driving.

Approximately how much fuel did Heather's car use on the journey?

- (A) 37 L
(B) 38 L
(C) 48 L
(D) 50 L
- 23** The following information is given about the locations of three towns X, Y and Z:

- X is due east of Z
- X is on a bearing of 145° from Y
- Y is on a bearing of 060° from Z.

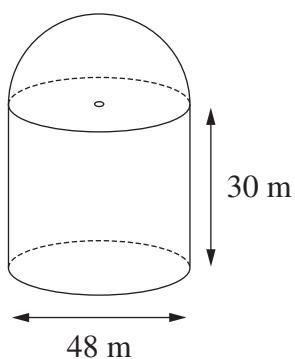
Which diagram best represents this information?



- 24** The weights of 10 000 newborn babies in NSW are normally distributed. These weights have a mean of 3.1 kg and a standard deviation of 0.35 kg.

How many of these newborn babies have a weight between 2.75 kg and 4.15 kg?

- (A) 4985
 - (B) 6570
 - (C) 8370
 - (D) 8385
- 25** A grain silo is made up of a cylinder with a hemisphere (half a sphere) on top. The outside of the silo is to be painted.



What is the area to be painted?

- (A) 8143 m^2
- (B) $11\,762 \text{ m}^2$
- (C) $12\,667 \text{ m}^2$
- (D) $23\,524 \text{ m}^2$

Mathematics General 2

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Centre Number

Section II

75 marks

Attempt Questions 26–30

Allow about 1 hour and 55 minutes
for this section

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Student Number

Answer the questions in the spaces
provided.

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

Extra writing space is provided on
pages 33 and 34. If you use this space,
clearly indicate which question you
are answering.

Write your Centre Number and
Student Number at the top of this
page.

Do NOT write in this area.

Please turn over

Question 26 (15 marks)

- (a) Expand $4x(7x^4 - x^2)$.

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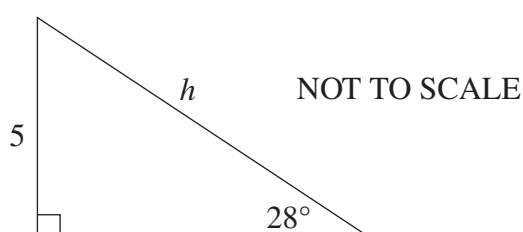
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- (b) Calculate the value of h correct to two decimal places.

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- (c) Solve the equation $\frac{5x+1}{3} - 4 = 5 - 7x$.

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Question 26 continues on page 15

Question 26 (continued)

- (d) Solve these simultaneous equations to find the values of x and y .

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$$y = 2x + 1$$

$$x - 2y - 4 = 0$$

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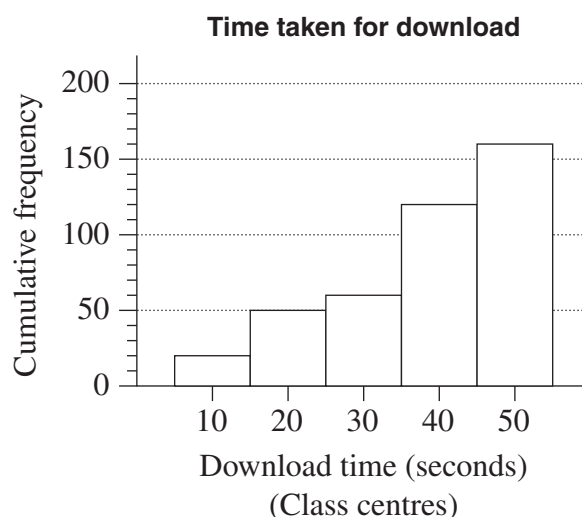
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- (e) The times taken for 160 music downloads were recorded, grouped into classes and then displayed using the cumulative frequency histogram shown.

2



On the diagram, draw the lines that are needed to find the median download time.

Question 26 continues on page 16

Question 26 (continued)

- (f) The weight of an object on the moon varies directly with its weight on Earth. 2
An astronaut who weighs 84 kg on Earth weighs only 14 kg on the moon.

A lunar landing craft weighs 2449 kg when on the moon. Calculate the weight of this landing craft when on Earth.

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Question 26 continues on page 17

Do NOT write in this area.

Question 26 (continued)

- (g) Singapore is located at 1°N 104°E and Sydney is located at 34°S 151°E .

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What is the time difference between Singapore and Sydney? (Ignore daylight saving.)

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End of Question 26

Please turn over

Question 27 (15 marks)

- (a) Alex is buying a used car which has a sale price of \$13 380. In addition to the sale price there are the following costs:

Transfer of registration	\$30
Stamp Duty	

- (i) Stamp Duty for this car is calculated at \$3 for every \$100, or part thereof, of the sale price. 1

Calculate the Stamp Duty payable.

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- (ii) Alex borrows the total amount to be paid for the car including Stamp Duty and transfer of registration. Interest on the loan is charged at a flat rate of 7.5% per annum. The loan is to be repaid in equal monthly instalments over 3 years. 4

Calculate Alex's monthly repayments.

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Question 27 continues on page 19

Question 27 (continued)

- (iii) Alex wishes to take out comprehensive insurance for the car for 12 months. The cost of comprehensive insurance is calculated using the following: 3

Base rate	\$845
Fire Service Levy (FSL)	1% of base rate
Stamp Duty	5.5% of the total of base rate and FSL
GST	10% of the total of base rate and FSL.

Find the total amount that Alex will need to pay for comprehensive insurance.

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- (iv) Alex has decided he will take out the comprehensive car insurance rather than the less expensive non-compulsory third-party car insurance. 1

What extra cover is provided by the comprehensive car insurance?

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Question 27 continues on page 20

Question 27 (continued)

- (b) Xuso is comparing the costs of two different ways of travelling to university. 2

Xuso's motorcycle uses one litre of fuel for every 17 km travelled. The cost of fuel is \$1.67/L and the distance from her home to the university car park is 34 km. The cost of travelling by bus is \$36.40 for 10 single trips.

Which way of travelling is cheaper and by how much? Support your answer with calculations.

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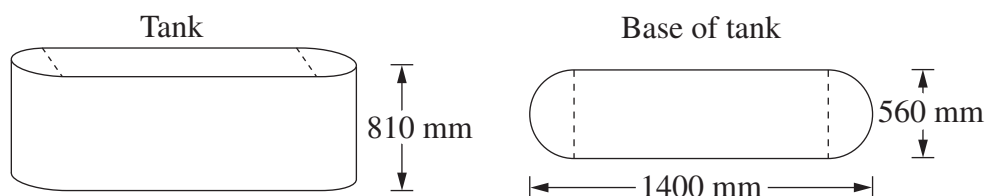
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- (c) The base of a water tank is in the shape of a rectangle with a semicircle at each end, as shown. 4

The tank is 1400 mm long, 560 mm wide, and has a height of 810 mm.



NOT TO SCALE

What is the capacity of the tank, to the nearest litre?

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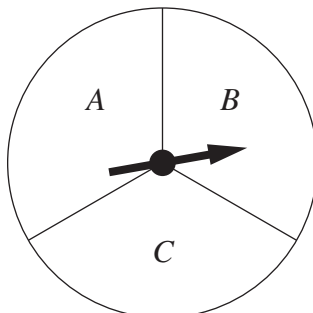
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End of Question 27

Question 28 (15 marks)

- (a) James plays a game involving a spinner with sectors of equal size labelled A , B and C , as shown.

2



He pays \$2 to play the game. He wins \$5 if the spinner stops in A and 50 cents if it stops in B or C .

Calculate James's financial expectation for the game.

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Question 28 continues on page 22

Question 28 (continued)

- (b) A radial compass survey of a sports centre is shown in the diagram.

Awaiting copyright

- (i) Show that the size of angle AOB is 114° .

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Question 28 continues on page 23

Do NOT write in this area.

Question 28 (continued)

- (ii) Calculate the length of the boundary AB , to the nearest metre. 2

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- (iii) Find the area of triangle AOB in hectares, correct to two significant figures. 3

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- (c) A fair coin is tossed three times. Using a tree diagram, or otherwise, calculate the probability of obtaining two heads and a tail in any order. 2

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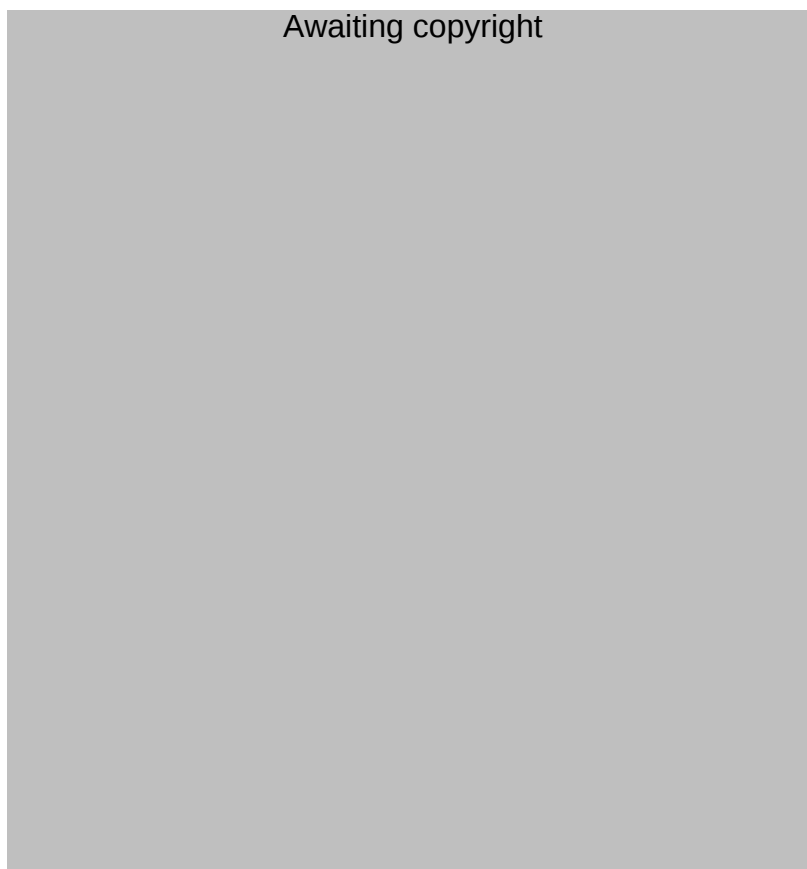
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Question 28 continues on page 24

Question 28 (continued)

- (d) An aerial diagram of a swimming pool is shown.



The swimming pool is a standard length of 50 metres but is not in the shape of a rectangle.

- (i) By measuring the length AB , determine the scale of the diagram. 1

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$1 \text{ cm} = \text{ } \text{m}$

- (ii) Using this scale, calculate the length XY of the car park, in metres. 1

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Question 28 continues on page 25

Question 28 (continued)

- (iii) In the diagram of the swimming pool, the five widths are measured to be: **3**

$$CD = 21.88 \text{ m}$$

$$EF = 25.63 \text{ m}$$

$$GH = 31.88 \text{ m}$$

$$IJ = 36.25 \text{ m}$$

$$KL = 21.88 \text{ m}$$

The average depth of the pool is 1.2 m.

Calculate the approximate volume of the swimming pool, in cubic metres. In your calculations, use TWO applications of Simpson's Rule.

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End of Question 28

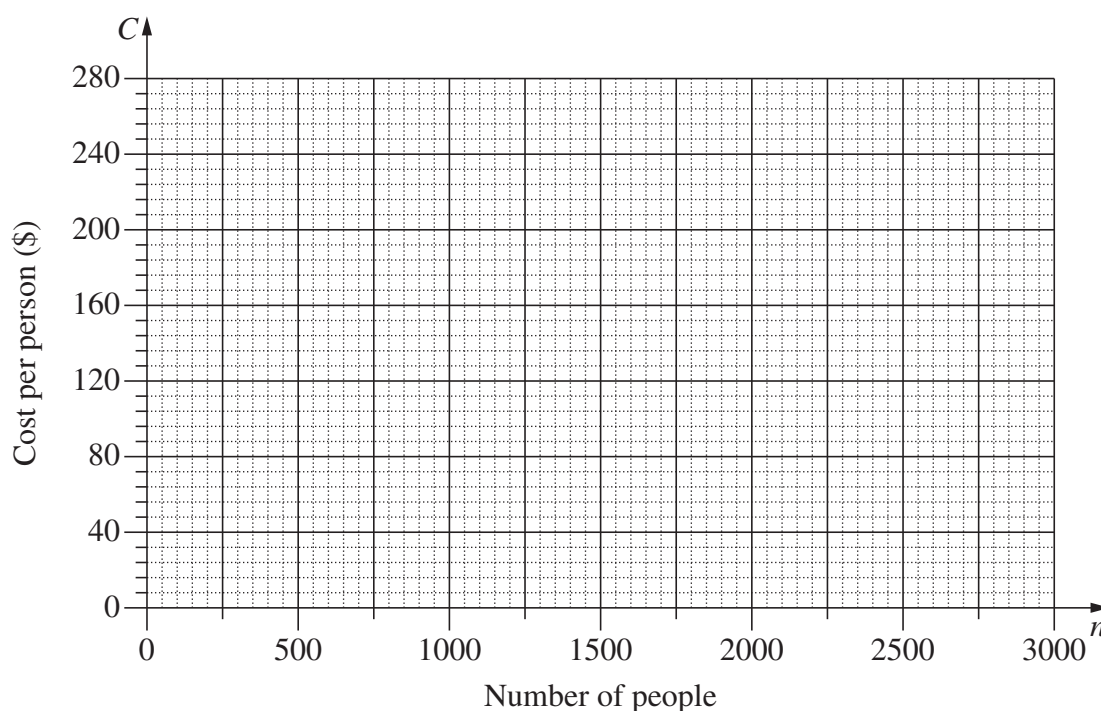
Question 29 (15 marks)

- (a) The cost of hiring an open space for a music festival is \$120 000. The cost will be shared equally by the people attending the festival, so that C (in dollars) is the cost per person when n people attend the festival.

- (i) Complete the table below by filling in the THREE missing values. 1

Number of people (n)	500	1000	1500	2000	2500	3000
Cost per person (C)				60	48	40

- (ii) Using the values from the table, draw the graph showing the relationship between n and C . 2



- (iii) What equation represents the relationship between n and C ? 1

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Question 29 continues on page 27

Question 29 (continued)

- (iv) Give ONE limitation of this equation in relation to this context. 1

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- (v) Is it possible for the cost per person to be \$94? Support your answer with appropriate calculations. 1

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- (b) What is the maximum number of standard drinks that a male weighing 84 kg can consume over 4 hours in order to maintain a blood alcohol content (BAC) of less than 0.05? 3

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Question 29 continues on page 28

Question 29 (continued)

- (c) Terry and Kim each sat twenty class tests. Terry's results on the tests are displayed in the box-and-whisker plot shown in part (i).

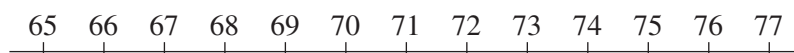
- (i) Kim's 5-number summary for the tests is 67, 69, 71, 73, 75.

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Draw a box-and-whisker plot to display Kim's results below that of Terry's results.



Kim



- (ii) What percentage of Terry's results were below 69?

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- (iii) Terry claims that his results were better than Kim's. Is he correct? Justify your answer by referring to the summary statistics and the skewness of the distributions.

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End of Question 29

– 28 –

Question 30 (15 marks)

- (a) Chandra and Sascha plan to have \$20 000 in an investment account in 15 years time for their grandchild's university fees. **3**

The interest rate for the investment account will be fixed at 3% per annum compounded monthly.

Calculate the amount that they will need to deposit into the account now in order to achieve their plan.

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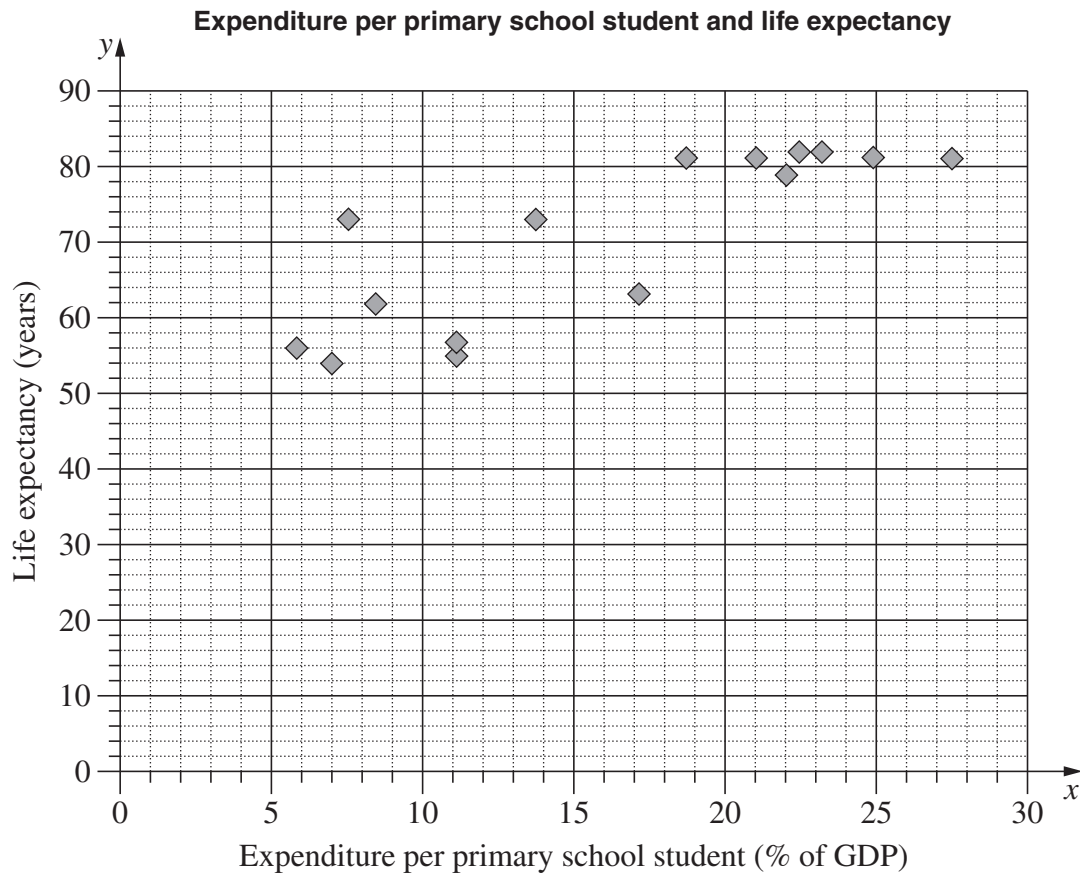
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Question 30 continues on page 30

Question 30 (continued)

- (b) The scatterplot shows the relationship between expenditure per primary school student, as a percentage of a country's Gross Domestic Product (GDP), and the life expectancy in years for 15 countries.



- (i) For the given data, the correlation coefficient, r , is 0.83. What does this indicate about the relationship between expenditure per primary school student and life expectancy for the 15 countries?

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Question 30 continues on page 31

Question 30 (continued)

- (ii) For the data representing expenditure per primary school student, Q_L is 8.4 and Q_U is 22.5. 1

What is the interquartile range?

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- (iii) Another country has an expenditure per primary school student of 47.6% of its GDP. Would this country be an outlier for this set of data? Justify your answer with calculations. 2

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- (iv) The expenditures per primary school student for the 15 countries in the scatterplot are: 2

5.9, 7, 7.6, 8.4, 11.2, 11.2, 13.7, 17.1, 18.7, 21.1, 22, 22.5, 23.2, 24.9, 27.6

Complete the table below by calculating the mean, $\bar{x}$, and the standard deviation, σ_x , of these data. Calculate both values to two decimal places.

The table also shows the mean, $\bar{y}$, and the standard deviation, σ_y , of life expectancy for the same 15 countries.

	Mean	Standard deviation
Expenditure per primary school student	$\bar{x} =$	$\sigma_x =$
Life expectancy	$\bar{y} = 70.73$	$\sigma_y = 10.94$

Question 30 continues on page 32

Question 30 (continued)

- (v) Using the values from the table in part (iv), show that the equation of the least-squares line of best fit is 2

$$y = 1.29x + 49.9.$$

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- (vi) On the scatterplot on page 30, draw the least-squares line of best fit, $y = 1.29x + 49.9$. 2

- (vii) Using this line, or otherwise, estimate the life expectancy in a country which has an expenditure per primary school student of 18% of its GDP. 1

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- (viii) Why is this line NOT useful for predicting life expectancy in a country which has expenditure per primary school student of 60% of its GDP? 1

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Handwriting practice lines for Section II extra writing space.

Section II extra writing space

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Mathematics General 2

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

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

- 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:

$15^\circ = 1$ 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

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

R is radius of outer circle

r is radius of inner circle

Trapezium

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

h is perpendicular height

a and b are the lengths of the parallel sides

Area of land and catchment areas

unit conversion: $1 \text{ ha} = 10\,000 \text{ m}^2$

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: $1 \text{ m}^3 = 1000 \text{ L}$

Approximation Using Simpson's Rule

Area

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

h is distance between successive measurements

d_f is first measurement

d_m is middle measurement

d_l is last measurement

Volume

$$V \approx \frac{h}{3}\{A_L + 4A_M + A_R\}$$

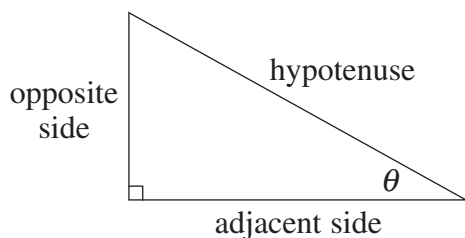
h is distance between successive measurements

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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2014 HSC Mathematics General 2 Marking Guidelines

Section I

Multiple-choice Answer Key

Question	Answer
1	D
2	B
3	C
4	B
5	B
6	D
7	D
8	A
9	C
10	A
11	A
12	C
13	B
14	B
15	B
16	D
17	B
18	A
19	A
20	B
21	C
22	B
23	C
24	D
25	A

Section II

Question 26 (a)

Criteria	Marks
• Provides correct answer	1

Sample answer:

$$\begin{aligned}
 &4x(7x^4 - x^2) \\
 &= 28x^5 - 4x^3
 \end{aligned}$$

Question 26 (b)

Criteria	Marks
• Provides correct answer	2
• Provides correct expression for h involving a correct trigonometric ratio	1

Sample answer:

$$\sin 28^\circ = \frac{5}{h}$$

$$h = \frac{5}{\sin 28^\circ}$$

$$= 10.650\ 27$$

$$= 10.65 \text{ (two decimal places)}$$

Question 26 (c)

Criteria	Marks
• Provides correct solution	3
• Demonstrates more than one correct algebraic step	2
• Demonstrates a correct algebraic step	1

Sample answer:

$$\frac{5x+1}{3} - 4 = 5 - 7x$$

$$\frac{5x+1}{3} = 9 - 7x$$

$$5x+1 = 3(9-7x)$$

$$5x+1 = 27-21x$$

$$26x = 26$$

$$x = 1$$

Question 26 (d)

Criteria	Marks
• Calculates correct values of x and y	3
• Demonstrates correct method	2
• Evaluates one value correctly from this method	
• Shows substitution or equivalent	1

Sample answer:

$$y = 2x + 1$$

$$x - 2y - 4 = 0$$

$$x - 2(2x + 1) - 4 = 0$$

$$x - 4x - 2 - 4 = 0$$

$$-3x = 6$$

$$x = -2$$

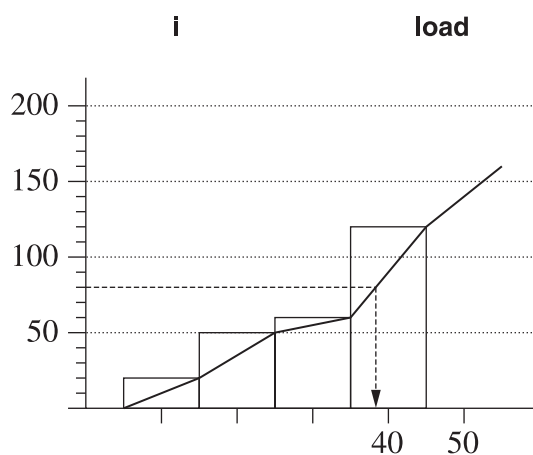
$$y = 2(-2) + 1$$

$$y = -3$$

$$\therefore x = -2, y = -3$$

Question 26 (e)

Criteria	Marks
Draws horizontal and vertical lines on the graph to show correct position of median	2
Draws the correct ogive or equivalent merit	1

Sample answer:**Question 26 (f)**

Criteria	Marks
Provides correct solution	2
Attempts to set up a relevant equation or equivalent	1

Sample answer:

$$W_M = kW_E$$

$$14 = k84$$

$$\frac{1}{6} = k$$

$$W_M = kW_E$$

$$2449 = \frac{1}{6}W_E$$

$$W_E = 14694 \text{ kg}$$

Question 26 (g)

Criteria	Marks
• Provides correct answer	2
• Provides correct longitude difference OR • Finds correct time from incorrect longitude calculation	1

Sample answer:

Longitude difference = 47°

Time difference = 47×4
= 188 minutes
= 3 h 8 min

Question 27 (a) (i)

Criteria	Marks
• Provides correct numerical expression	1

Sample answer:

$$\begin{aligned}\text{Sale price} &= \$13\,380 \\ &= \$13\,400 \text{ (to nearest \$100)}\end{aligned}$$

$$\begin{aligned}\text{Stamp Duty} &= \frac{13\,400}{100} \times 3 \\ &= \$402\end{aligned}$$

Question 27 (a) (ii)

Criteria	Marks
• Provides correct monthly repayment	4
• Makes significant progress towards correct answer eg total to be repaid	3
• Makes significant progress towards total to be repaid	2
• Makes some progress eg evidence of an interest calculation	1

Sample answer:

$$\text{Car price} = \$13\,380$$

$$\text{Transfer of rego} = \$30$$

$$\text{Stamp duty} = \$402$$

$$\text{Total to be borrowed} = \$13\,812$$

$$\begin{aligned}\text{Interest} &= 7.5\% \times 13\,812 \times 3 \\ &= \$3107.70\end{aligned}$$

$$\begin{aligned}\text{Total to be repaid} &= \$13\,812 + \$3107.70 \\ &= \$16\,919.70\end{aligned}$$

$$\begin{aligned}\therefore \text{Monthly repayment} &= \$16\,919.70 \div 36 \\ &= \$469.99\end{aligned}$$

Question 27 (a) (iii)

Criteria	Marks
• Provides correct total amount or numerical expression	3
• Makes progress towards total amount eg correct calculation of stamp duty or GST	2
• Provides correct calculation of FSL OR • Provides correct numerical expression for stamp duty or GST using an incorrect FSL	1

Sample answer:

$$\text{Base rate} = \$845$$

$$\text{FSL} = 1\% \times \$845$$

$$\text{FSL} = \$8.45$$

$$\begin{aligned} \text{Stamp Duty} &= 5.5\% \times (845 + 8.45) \\ &= \$46.94 \end{aligned}$$

$$\begin{aligned} \text{GST} &= 10\% \times (845 + 8.45) \\ &= \$85.35 \end{aligned}$$

$$\begin{aligned} \therefore \text{Total cost} &= 845 + 8.45 + 46.94 + 85.35 \\ &= \$985.74 \end{aligned}$$

Question 27 (a) (iv)

Criteria	Marks
• Provides correct answer	1

Sample answer:

Comprehensive car insurance covers damage to Alex's car but non-compulsory third party only covers other people's property.

Question 27 (b)

Criteria	Marks
• Provides correct conclusion from correct calculations	2
• Provides correct calculation for motorcycle trip	1

Sample answer:

Cost for 10 bus trips = \$36.40

$$\therefore \text{cost for 1 bus trip} = \frac{\$36.40}{10} = \$3.64$$

Cost for 1 motorcycle trip to travel 34 km
 $= 2 \times \$1.67$
 $= \$3.34$

$\therefore$ the motorcycle is cheaper.

Question 27 (c)

Criteria	Marks
• Provides correct solution (ignore rounding) in litres	4
• Makes progress towards calculation of volume	3
• Makes progress towards calculation of base area	2
• Provides evidence of radius and correct length of rectangle or equivalent merit	1

Sample answer:

$$\begin{aligned} \text{Radius} &= \frac{560}{2} \text{ mm} \\ &= 0.28 \text{ m} \end{aligned}$$

$$\begin{aligned} \text{length of rectangle} &= (1400 - 2 \times 280) \text{ mm} \\ &= 840 \text{ mm} \\ &= 0.84 \text{ m} \end{aligned}$$

Total area = rectangle + circle

$$\begin{aligned} \text{Total area} &= (0.84 \times 0.56 + \pi \times 0.28^2) \text{ m}^2 \\ &= 0.7167 \dots \text{ m}^2 \end{aligned}$$

$$\therefore \text{Total area} = 0.7167 \dots \text{ m}^2$$

$$\begin{aligned} \therefore \text{Volume} &= 0.7167 \times 0.81 \\ &= 0.580527 \dots \text{ m}^3 \\ &= 580.527 \dots \text{ litres} \\ &= 581 \text{ L} \end{aligned}$$

Question 28 (a)

Criteria	Marks
• Provides correct financial expectation or numerical expression	2
• Makes some relevant progress	1

Sample answer:

$$\frac{1}{3} \times \$5 + 2 \times \frac{1}{3} \times \$0.5 - \$2 = 0$$

Financial expectation = \$0

Question 28 (b) (i)

Criteria	Marks
• Provides correct solution	1

Sample answer:

$$\begin{aligned}(360 - 320) + 74 &= 40 + 74 \\ &= 114^\circ\end{aligned}$$

Question 28 (b) (ii)

Criteria	Marks
• Provides correct solution	2
• Substitutes correctly into cosine rule	1

Sample answer:

$$\begin{aligned}AB^2 &= 287^2 + 211^2 - 2 \times 287 \times 211 \times \cos 114^\circ \\ &= 176\,151.5018\end{aligned}$$

$$AB = 419.704$$

$$AB = 420 \text{ m}$$

Question 28 (b) (iii)

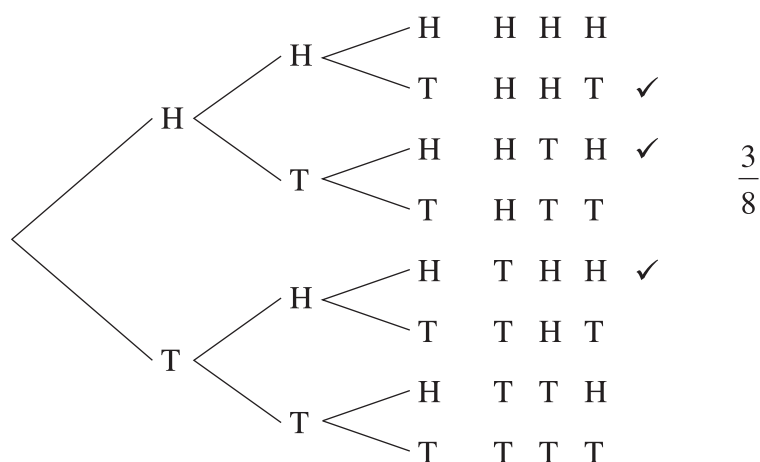
Criteria	Marks
• Provides correct solution in hectares to two significant figures	3
• Calculates correct area	2
• Makes some relevant progress eg correct substitution into appropriate formula; correct conversion into hectares; correct rounding to two significant figures	1

Sample answer:

$$\begin{aligned}
 A &= \frac{1}{2} \times 287 \times 211 \times \sin 114^\circ \\
 &= 27\,660.78614 \text{ m}^2 \\
 &= 2.766 \dots \text{ ha} \\
 &= 2.8 \text{ hectares}
 \end{aligned}$$

Question 28 (c)

Criteria	Marks
• Provides correct numerical expression	2
• Makes some relevant progress	1

Sample answer:

Question 28 (d) (i)

Criteria	Marks
• Provides correct answer	1

Sample answer:

$$1 \text{ cm} = 6.25 \text{ m}$$

Question 28 (d) (ii)

Criteria	Marks
• Provides correct answer using measured length	1

Sample answer:

$$5.1 \times 6.25 = 31.875 \text{ m (Measurement between 5.0 and 5.2, ie length 31.25 m to 32.5 m)}$$

Question 28 (d) (iii)

Criteria	Marks
• Provides correct volume approximation or numerical expression	3
• Makes progress towards eg evidence of two applications of Simpson's Rule	2
• Makes some relevant progress eg correct value of h	1

Sample answer:

$$\begin{aligned}
 A &= \frac{12.5}{3}(21.88 + 4 \times 25.63 + 31.88) + \frac{12.5}{3}(31.88 + 4 \times 36.25 + 21.88) \\
 &= \frac{12.5}{3}(156.28) + \frac{12.5}{3}(198.76) \\
 &= 651.166\ 666\ 7 + 828.166\ 666\ 7 \\
 V &= 1479.33\ \text{m}^2 \times 1.2 \\
 &= 1775.2\ \text{m}^3
 \end{aligned}$$

OR Cross-sectional areas:

$$\begin{aligned}
 CD &= 21.88 \times 1.2 \\
 &= 26.256
 \end{aligned}$$

$$\begin{aligned}
 EF &= 25.63 \times 1.2 \\
 &= 30.756
 \end{aligned}$$

$$\begin{aligned}
 GH &= 31.88 \times 1.2 \\
 &= 38.256
 \end{aligned}$$

$$\begin{aligned}
 IJ &= 36.25 \times 1.2 \\
 &= 43.5
 \end{aligned}$$

$$\begin{aligned}
 KL &= 21.88 \times 1.2 \\
 &= 26.256
 \end{aligned}$$

$$\begin{aligned}
 V &= \frac{12.5}{3}(26.256 + 4 \times 30.756 + 38.256) + \frac{12.5}{3}(38.256 + 4 \times 43.5 + 26.256) \\
 &= 1775.2\ \text{m}^3
 \end{aligned}$$

Question 29 (a) (i)

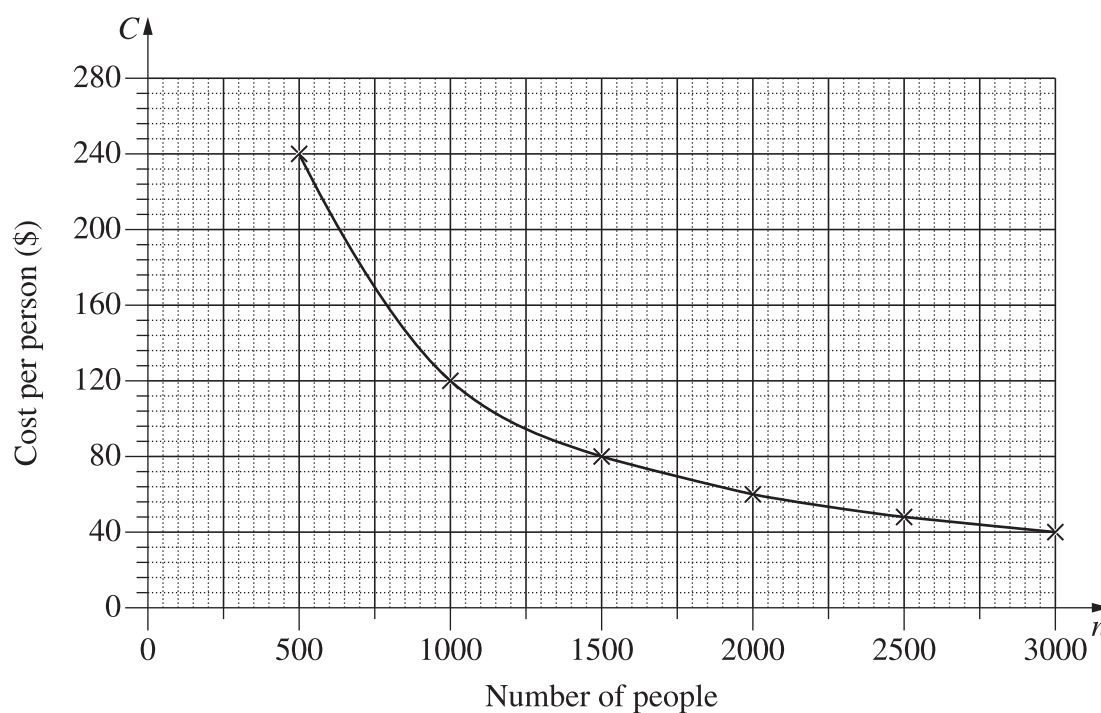
Criteria	Marks
Provides the three correct values	1

Sample answer:

n	500	1000	1500
C	240	120	80

Question 29 (a) (ii)

Criteria	Marks
Draws a smooth continuous curve using values in the table	2
Plots points from table	1

Sample answer:

Question 29 (a) (iii)

Criteria	Marks
• Provides correct answer	1

Sample answer:

$$C = \frac{120\,000}{n}$$

Question 29 (a) (iv)

Criteria	Marks
• Provides a correct limitation	1

Sample answer:

Cost cannot be zero.

OR Number of people cannot be zero.

OR Number of people must be positive integer.

Question 29 (a) (v)

Criteria	Marks
• Provides correct conclusion with appropriate calculations	1

Sample answer:

$$94 = \frac{120\,000}{n}$$

$$94n = 120\,000$$

$$n = 1276.59\dots$$

Cost cannot be \$94 because n must be an integer.

Question 29 (b)

Criteria	Marks
• Provides correct solution	3
• Makes significant progress	2
• Substitutes correctly in a BAC formula	1

Sample answer:

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

$$M = 84$$

$$N = ?$$

$$H = 4$$

$$\frac{10N - 7.5(4)}{6.8 \times 84} < 0.05$$

$$10N - 7.5(4) < 28.56$$

$$10N < 58.56$$

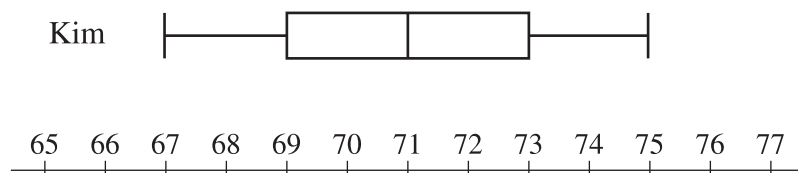
$$N < 5.856$$

$$\therefore N = 5$$

$\therefore$ 5 drinks is the maximum he can have.

Question 29 (c) (i)

Criteria	Marks
• Draws correct box-and-whisker plot	1

Sample answer:**Question 29 (c) (ii)**

Criteria	Marks
• Provides correct answer	1

Sample answer:

50%

Question 29 (c) (iii)

Criteria	Marks
• Supports a conclusion with valid justification with reference to summary statistics and skewness	4
• Supports a conclusion by comparisons of location or spread AND reference to skewness	3
• Provides two correct comparisons with numerical justification where appropriate	2
• Provides one correct comparison	1

Sample answer:

Even though Terry has the highest mark of 76 overall, Kim's results seem better because:

- 75% of Kim's results are above 69 while only 50% of Terry's are above 69
- The range is smaller ($75 - 67 = 8$) compared to Terry's ($76 - 67 = 9$)
- The IRQ is also smaller ($73 - 69 = 4$) compared to Terry's ($74 - 68 = 6$)
- The median of 71 is higher than Terry's 69
- They are symmetrical while Terry's are positively skewed.

Question 30 (a)

Criteria	Marks
• Provides correct solution	3
• Substitutes correct value for r or n into correct formula	2
• Converts rate or time or equivalent	1

Sample answer:

$$PV = \frac{FV}{(1+r)^n}, \quad FV = 20\,000, \quad r = 0.03 \div 12 = 0.0025, \quad n = 180$$

$$= \frac{20\,000}{(1+0.0025)^{180}}$$

$$= 12\,759.72643$$

$\therefore$ The amount they need to invest would be \$12 759.73

Question 30 (b) (i)

Criteria	Marks
• Describes correct relationship	1

Sample answer:

The higher the percentage of GDP spent, the higher the life expectancy.

OR

Strong positive correlation because r is close to 1.

Question 30 (b) (ii)

Criteria	Marks
• Provides correct answer	1

Sample answer:

$$22.5 - 8.4 = 14.1$$

Question 30 (b) (iii)

Criteria	Marks
• Provides correct conclusion from correct calculation	2
• Substitutes into an outlier formula OR • Provides correct justification consistent with incorrect calculation	1

Sample answer:

Yes, it is an outlier.

$$Q_U + 1.5 \times IQR = 22.5 + 1.5 \times 14.1$$

$$= 43.65$$

Since $47.6 > 43.65$

Question 30 (b) (iv)

Criteria	Marks
• Provides correct answers	2
• Provides one correct answer	1

Sample answer:

$$\bar{x} = 16.14$$

$$\sigma_x = 7.03$$

Question 30 (b) (v)

Criteria	Marks
• Substitutes correctly into both the gradient formula and the y-intercept formula	2
• Substitutes correctly into the gradient formula or the y-intercept formula	1

Sample answer:

$$m = \frac{10.94}{7.03} \times 0.83$$

$$= 1.291\,635\,846$$

$$\cong 1.29$$

$$\text{y-intercept} = 70.73 - 1.29 \times 16.14$$

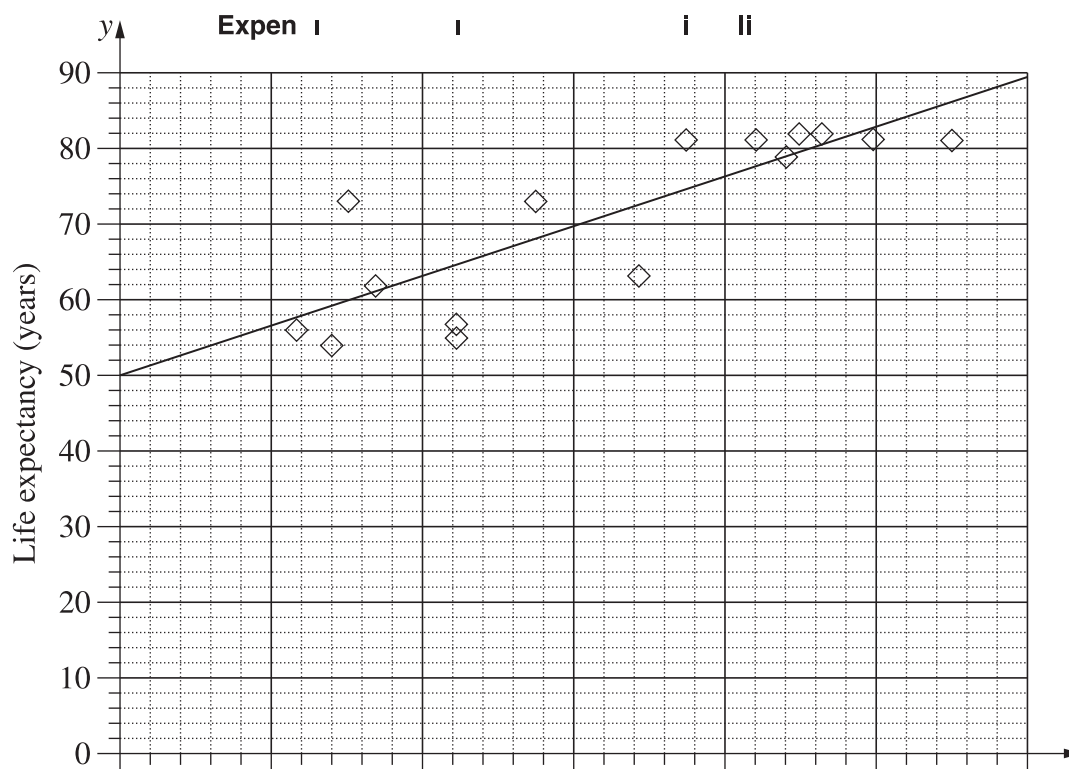
$$= 49.9094$$

$$\approx 49.9$$

$\therefore$ Equation of line of best fit is $y = 1.29x + 49.9$

Question 30 (b) (vi)

Criteria	Marks
• Draws correct line	2
• Draws straight line through y-intercept of approximately 50	1

Sample answer:

Question 30 (b) (vii)

Criteria	Marks
• Provides correct answer	1

Sample answer:

74 years (from graph)

OR $y = 1.29 \times 18 + 49.9$
 $= 73.12$
 $\therefore 73$ years

Question 30 (b) (viii)

Criteria	Marks
• Gives a correct reason	1

Sample answer:

The line is based on x -values from 5% to 30%, and 60% is beyond the bounds of the data points to which it was fitted. So, it is not valid to draw conclusions from it.

Mathematics General 2

2014 HSC Examination Mapping Grid

Section I

Question	Marks	Content	Syllabus outcomes
1	1	FSCo1 Mobile phone plans	MGP-6, MGP-9
2	1	MM1 Units of measurement and applications	MGP-6
3	1	AM5 Modelling non-linear relationships	MG2H-3
4	1	FSHe2 Medication	MG2H-2, MG2H-5, MG-5, MG-10
5	1	FSCo2 Digital downloads and file storage	MGP-5, 9
6	1	PB1 Relative frequency and probability	MGP-8
7	1	AM2 Interpreting linear relationships	MGP-2
8	1	PB2 Multistage event and applications of probability DS4 Interpreting sets of data	MG2H-2, MG2H-8
9	1	FSDr2 Running costs and depreciation	MGP-6
10	1	MM4 Further applications of area and volume	MG2H-5
11	1	AM3 Further algebraic skills and techniques	MG2H-10
12	1	MM4 Further applications of area and volume	MG2H-4
13	1	FM1 Earning and managing money	MGP-6
14	1	DS4 Interpreting sets of data	MG2H-2
15	1	MM6 Spherical geometry	MG2H-4
16	1	FSRe1 Water availability and usage	MG2H-2
17	1	FSHe2 Medication	MG2H-2, MG2H-5
18	1	FSRe3 Energy and sustainability	MG2H-1, MG2H-5
19	1	PB2 Multistage events and applications of probability	MG2H-2, MG2H-8
20	1	FSRe3 Energy and cost	MG2H-1, MG2H-5
21	1	FM5 Annuities and loan repayments	MG2H-3, MG2H-6
22	1	FSDr2 Running costs and depreciation	MGP-6, MGP-9
23	1	MM5 Applications of trigonometry	MG2H-4, MG2H-5
24	1	DS5 The normal distribution	MG2H-7, MG2H-9
25	1	MM4 Further applications of area and volume	MG2H-4

Section II

Question	Marks	Content	Syllabus outcomes
26 (a)	1	AM3 Further algebraic skills and techniques	MG2H–3
26 (b)	2	MM5 Applications of trigonometry	MGH–4
26 (c)	3	AM3 Further algebraic skills and techniques	MG2H–10
26 (d)	3	AM3 Further algebraic skills and techniques	MG2H–10
26 (e)	2	DS4 Interpreting sets of data FSCo2 Digital download and file storage	MGP–2
26 (f)	2	AM4 Modelling linear relationships	MGH–3
26 (g)	2	MM6 Spherical geometry	MG2H–4
27 (a) (i)	1	FSDr1 Cost of purchase and insurance	MGP–5
27 (a) (ii)	4	FM4 Credit and borrowing	MG2H–9
27 (a) (iii)	3	FSDr1 Cost of purchase and insurance	MGP6, MGP–8
27 (a) (iv)	1	FSDr1 Cost of purchase and insurance	MGP–10
27 (b)	2	FSDr2 Running costs and depreciation	MGP–1
27 (c)	4	FSRe1 Water availability and usage	MG2H–4
28 (a)	2	PB2 Multistage events and applications of probability	MG2H–8
28 (b) (i)	1	MM5 Applications of trigonometry	MG2H–4
28 (b) (ii)	2	MM5 Applications of trigonometry	MG2H–4
28 (b) (iii)	3	MM5 Applications of trigonometry	MG2H–5
28 (c)	2	PB2 Multistage events and applications of probability	MG2H–2
28 (d) (i)	1	FSRe2 Dams, land and catchment areas	MG2H–1/5
28 (d) (ii)	1	MM3 Similarity of two dimensional figures, right angled triangles	MGP–4/5
28 (d) (iii)	3	FSRe2 Dams, land and catchment areas	MG2H–4
29 (a) (i)	1	AM5 Modelling non-linear relationships	MG2H–1, MG2H–3
29 (a) (ii)	2	AM5 Modelling non-linear relationships	MG2H–1, MG2H–3
29 (a) (iii)	1	AM5 Modelling non-linear relationships	MG2H–1
29 (a) (iv)	1	AM5 Modelling non-linear relationships	MG2H–3
29 (a) (v)	1	AM5 Modelling non-linear relationships	MG2H–4
29 (b)	3	FSDr3 Safety	MGP–1
29 (c) (i)	1	DS2 Displaying and interpreting single data sets	MGP–7
29 (c) (ii)	1	DS4 Interpreting sets of data	MG2H–1
29 (c) (iii)	4	DS4 Interpreting sets of data	MG2H–2 and 10

Question	Marks	Content	Syllabus outcomes
30 (a)	3	FM4 Credit and borrowing	MG2H–3
30 (b) (i)	1	FSHe3 Life expectancy	MG2H–2
30 (b) (ii)	1	DS4 Interpreting sets of data	MG2H–7
30 (b) (iii)	2	DS4 Interpreting sets of data	MG2H–9
30 (b) (iv)	2	DS3 Summary statistics DS3 Summarise statistics	MGP–9
30 (b) (v)	2	FSHe1 Line of best fit	MG2H–1
30 (b) (vi)	2	FSHe1 Line of best fit FSHe3 Line of best fit	MG2H–7
30 (b) (vii)	1	FSHe3 Interpreting data	MG2H–1 and 2
30 (b) (viii)	1	FSHe3 Interpreting data	MG2H–1 and 3