



NSW Education Standards Authority

2018 HIGHER SCHOOL CERTIFICATE EXAMINATION

Mathematics General 2

General Instructions

- Reading time – 5 minutes
- Working time – $2\frac{1}{2}$ hours
- Write using black pen
- Calculators approved by NESA 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 – 25 marks (pages 2–12)

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

Section II – 75 marks (pages 13–36)

- 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** A set of scores has the following five-number summary.

lower extreme = 2
lower quartile = 5
median = 6
upper quartile = 8
upper extreme = 9

What is the range?

- A. 2
 - B. 3
 - C. 6
 - D. 7
- 2** What is the value of $3x^0 + 1$?
- A. 1
 - B. 2
 - C. 3
 - D. 4
- 3** A survey asked the following question.

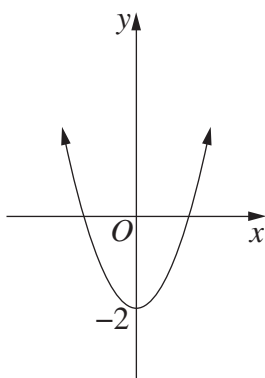
‘How many brothers do you have?’

How would the responses be classified?

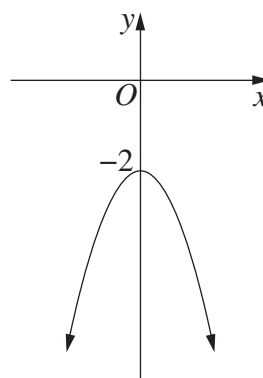
- A. Categorical, ordinal
- B. Categorical, nominal
- C. Quantitative, discrete
- D. Quantitative, continuous

- 4 Which graph best represents the equation $y = x^2 - 2$?

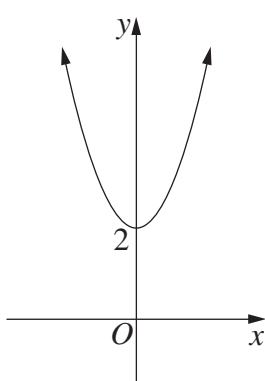
A.



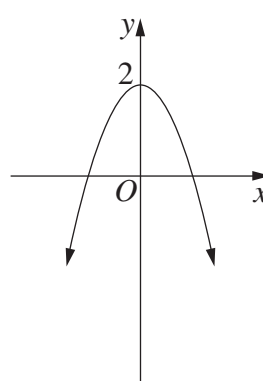
B.



C.



D.

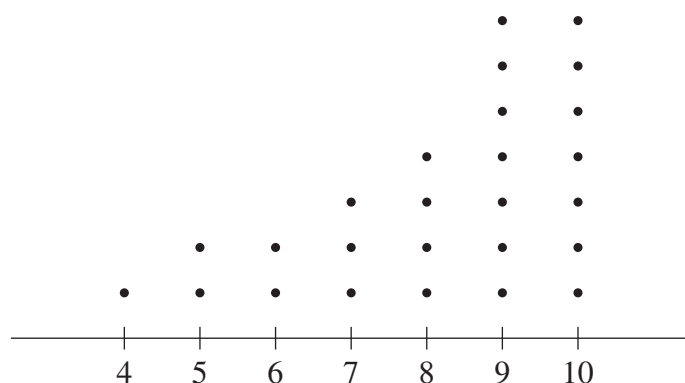


- 5 The driving distance from Alex's home to his work is 20 km. He drives to and from work five times each week. His car uses fuel at the rate of 8 L/100 km.

How much fuel does he use driving to and from work each week?

- A. 16 L
- B. 20 L
- C. 25 L
- D. 40 L

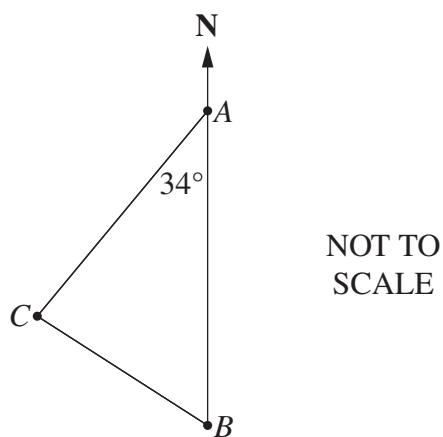
- 6 A set of data is displayed in this dot plot.



Which of the following best describes this set of data?

- A. Symmetrical
 - B. Positively skewed
 - C. Negatively skewed
 - D. Normally distributed
- 7 The diagram shows the positions of towns A , B and C .

Town A is due north of town B and $\angle CAB = 34^\circ$.



What is the bearing of town C from town A ?

- A. 034°
- B. 146°
- C. 214°
- D. 326°

- 8** A nanny charges \$15 per hour, or part thereof, for looking after a child.

What does the nanny charge for looking after a child from 8 am until 3.20 pm on a particular day?

- A. \$105
- B. \$108
- C. \$110
- D. \$120

- 9** An experiment has three distinct outcomes, A , B and C . Outcome A occurs 50% of the time. Outcome B occurs 23% of the time.

What is the expected number of times outcome C would occur if the experiment is conducted 500 times?

- A. 115
- B. 135
- C. 250
- D. 365

- 10** A biologist caught a random sample of 56 parrots in a national park. She tagged them and then released them. She later returned to the park and caught a random sample of 47 parrots. In this sample 29 had been tagged.

Using the capture/recapture technique, what is the estimated number of parrots in the park?

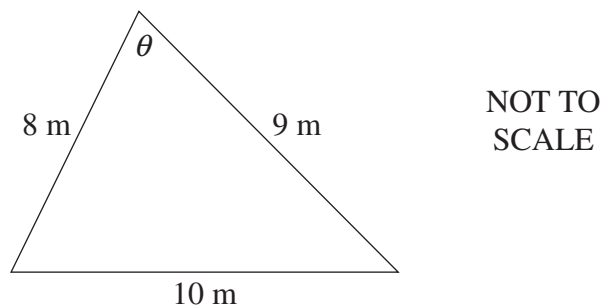
- A. 35
- B. 74
- C. 91
- D. 132

- 11 A set of data is summarised in this frequency distribution table.

<i>Score</i>	<i>Frequency</i>
3	1
4	2
5	6
6	7
7	9
8	5
Total = 30	

Which of the following is true about the data?

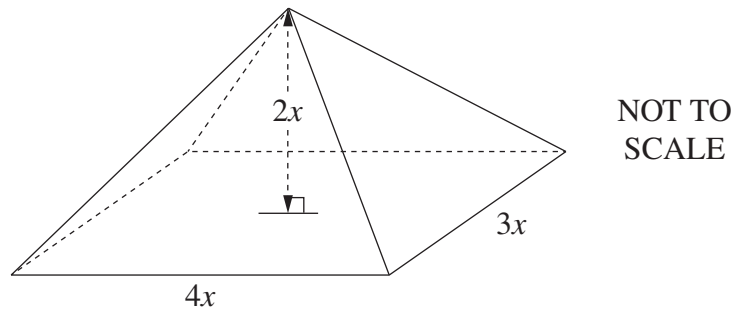
- A. Mode = 7, median = 5.5
 - B. Mode = 7, median = 6
 - C. Mode = 9, median = 5.5
 - D. Mode = 9, median = 6
- 12 The diagram shows a triangle with side lengths 8 m, 9 m and 10 m.



What is the value of θ , marked on the diagram, to the nearest degree?

- A. 49°
- B. 51°
- C. 59°
- D. 72°

- 13** A rectangular pyramid has base side lengths $3x$ and $4x$. The perpendicular height of the pyramid is $2x$. All measurements are in metres.



What is the volume of the pyramid in cubic metres?

- A. $8x^3$
 - B. $9x^3$
 - C. $12x^3$
 - D. $24x^3$
- 14** To determine the retail price of an item, a shop owner increases its cost price by 30%. In a sale, the retail price is reduced by 30% to give the sale price.

How does the sale price compare to the cost price?

- A. The sale price is less than the cost price.
 - B. The sale price is the same as the cost price.
 - C. The sale price is more than the cost price.
 - D. It is impossible to compare without knowing the cost price.
- 15** Sam is the driver at fault in a car accident.

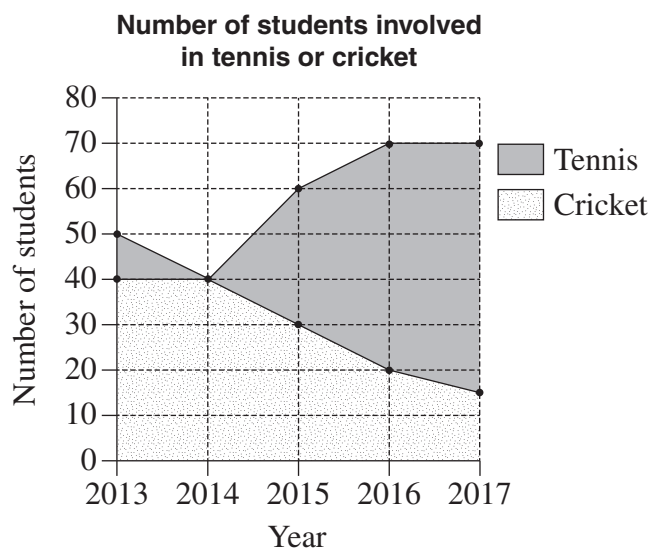
Which of the following is covered by Sam's compulsory third-party (CTP) insurance?

- A. Repairs to Sam's car
- B. Injury to the other driver
- C. Damage to the other driver's car
- D. Cost of repairing a building damaged in the accident

16 Which expression is equivalent to $\frac{k^2}{10} \div \frac{5}{k}$?

- A. $\frac{2}{k}$
- B. $\frac{k}{2}$
- C. $\frac{50}{k^3}$
- D. $\frac{k^3}{50}$

17 The area chart shows the number of students involved in tennis or cricket at a school over a number of years.



In which year was the number of students involved in tennis equal to the number of students involved in cricket?

- A. 2013
- B. 2014
- C. 2015
- D. 2016

- 18 The length of a window is measured as 2.4 m.

Which calculation will give the percentage error for this measurement?

- A. $\pm \left(\frac{0.05}{2.4} \right) \times 100$
- B. $\pm \left(\frac{0.05}{100} \right) \times 2.4$
- C. $\pm \left(\frac{0.5}{2.4} \right) \times 100$
- D. $\pm \left(\frac{0.5}{100} \right) \times 2.4$
- 19 The table shows the compounded values of \$1 at different interest rates over different periods.

Compounded values of \$1

<i>Number of periods</i>	<i>Interest rate per period</i>				
	1%	2%	3%	4%	5%
2	1.0201	1.0404	1.0609	1.0816	1.1025
4	1.0406	1.0824	1.1255	1.1699	1.2155
6	1.0615	1.1262	1.1941	1.2653	1.3401
8	1.0829	1.1717	1.2668	1.3686	1.4775
10	1.1046	1.2190	1.3439	1.4802	1.6289
12	1.1268	1.2682	1.4258	1.6010	1.7959

Amy hopes to have \$21 000 in 2 years to buy a car. She opens an account today which pays interest of 4% pa, compounded quarterly.

Using the table, which expression calculates the minimum single sum that Amy needs to invest today to ensure she reaches her savings goal?

- A. $21\,000 \times 1.0816$
- B. $21\,000 \div 1.0816$
- C. $21\,000 \times 1.0829$
- D. $21\,000 \div 1.0829$

- 20** During a year, the maximum temperature each day was recorded. The results are shown in the table.

	<i>Number of days with maximum temperature less than 25°C</i>	<i>Number of days with maximum temperature greater than or equal to 25°C</i>	<i>Total number of days</i>
Summer	42	48	90
Autumn	57	35	92
Winter	71	21	92
Spring	53	38	91
Total number of days	223	142	365

From the days with a maximum temperature less than 25°C, one day is selected at random.

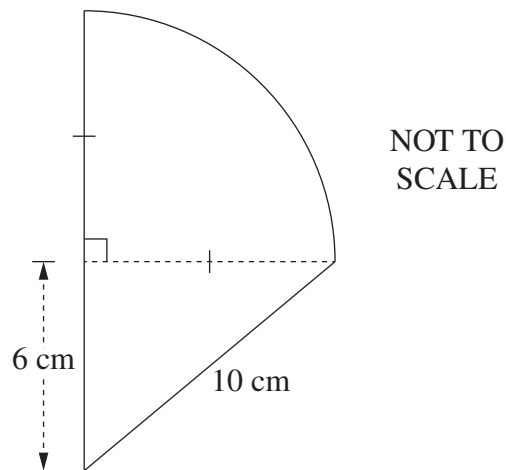
What is the probability, to the nearest percentage, that the selected day occurred during winter?

- A. 19%
 - B. 25%
 - C. 32%
 - D. 77%
- 21** David earns a gross income of \$890 per week. Each week, 25% of this income is deducted in taxation. David budgets to save 20% of his net income.

How much does he budget to save each week?

- A. \$44.50
- B. \$133.50
- C. \$489.50
- D. \$534.00

- 22** A shape consisting of a quadrant and a right-angled triangle is shown.



What is the perimeter of this shape, correct to one decimal place?

- A. 28.6 cm
 - B. 36.6 cm
 - C. 66.3 cm
 - D. 74.3 cm
- 23** A set of data is normally distributed with a mean of 48 and a standard deviation of 3.
- Approximately what percentage of the scores lies between 39 and 45?

- A. 15.85%
- B. 31.7%
- C. 47.5%
- D. 49.85%

- 24** The coordinates of city *A* are (39°N, 75°W). City *B* lies on the same longitude and is 5700 km south of city *A*.

What is the latitude of city *B*?

- A. 51°N
 - B. 51°S
 - C. 12°N
 - D. 12°S
- 25** Which of the following expresses v as the subject of $k = \frac{1}{2}mv^2$?

- A. $v = \pm \sqrt{\frac{2k}{m}}$
- B. $v = \pm \frac{\sqrt{k}}{2m}$
- C. $v = \pm \sqrt{\frac{k}{2m}}$
- D. $v = \pm \frac{2\sqrt{k}}{m}$

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Centre Number

Mathematics General 2

Section II Answer Booklet

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Student Number

75 marks

Attempt Questions 26–30

Allow about 1 hour and 55 minutes for this section

Instructions

- Write your Centre Number and Student Number at the top of this page.
 - Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.
 - Your responses should include relevant mathematical reasoning and/or calculations.
 - Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which question you are answering.
-

Please turn over

Question 26 (15 marks)

- (a) Jeremy rolled a biased 6-sided die a number of times. He recorded the results in a table. 1

Number	1	2	3	4	5	6
Frequency	23	19	48	20	21	19

What is the relative frequency of rolling a 3?

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- (b) Clark's formula, given below, is used to determine the dosage of medicine for children. 2

$$\text{Dosage} = \frac{\text{weight in kg} \times \text{adult dosage}}{70}$$

For a particular medicine, the adult dosage is 325 mg and the correct dosage for a specific child is 90 mg.

How much does the child weigh, to the nearest kg?

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- (c) Ali made monthly deposits of \$100 into an annuity for 5 years. 1

Calculate the total amount Ali deposited into the annuity over this period.

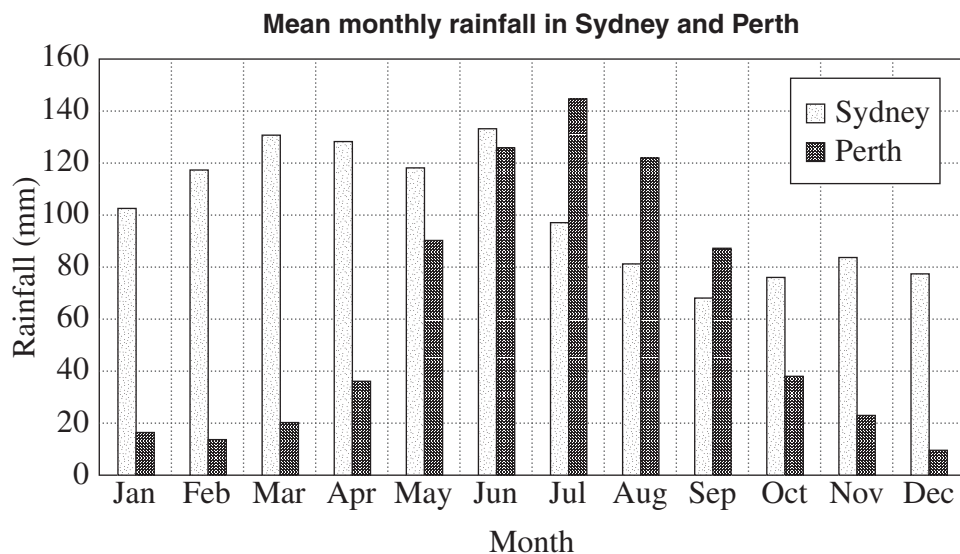
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Question 26 continues on page 15

Question 26 (continued)

- (d) The graph displays the mean monthly rainfall in Sydney and Perth.



- (i) For how many months is the mean monthly rainfall higher in Perth than in Sydney?

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- (ii) For which of the two cities is the standard deviation of the mean monthly rainfall smaller? Justify your answer **WITHOUT** calculations.

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Question 26 continues on page 16

Question 26 (continued)

- (e) A cumulative frequency table for a data set is shown.

2

<i>Score</i>	<i>Cumulative frequency</i>
1	5
2	9
3	16
4	20
5	34
6	42

What is the interquartile range of this data set?

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Question 26 continues on page 17

Do NOT write in this area.

Question 26 (continued)

- (f) A toy shop sells buckets and spades separately. Buckets are available in one of six colours. Spades are also available in one of the same six colours. **1**

Abdul wants to buy a bucket-and-spade set where the bucket and spade are of different colours.

How many different bucket-and-spade sets are possible for Abdul to buy?

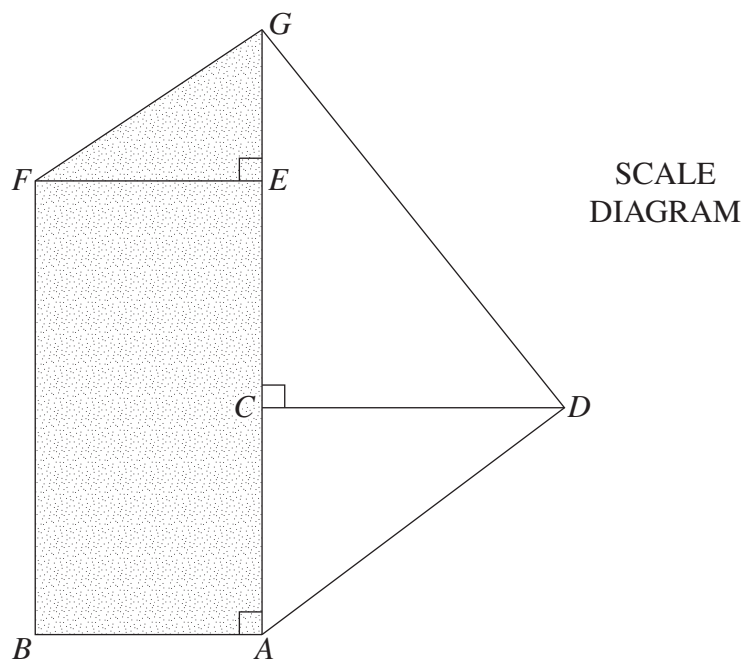
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Question 26 continues on page 18

Question 26 (continued)

- (g) A field diagram of a block of land has been drawn to scale. The shaded region $ABFG$ is covered in grass.



The actual length of AG is 24 m.

- (i) Show that the scale of the diagram is 1 cm = 3 m.

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Question 26 continues on page 19

Question 26 (continued)

- (ii) How much fertiliser would be needed to fertilise the grassed area $ABFG$ at the rate of 26.5 g/m^2 ? 3

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- (h) A car is purchased for \$23 900. 2

The value of the car is depreciated by 11.5% each year using the declining-balance method.

What is the value of the car after three years?

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End of Question 26

Question 27 (15 marks)

- (a) Jenny used her mobile phone while she was overseas for one month.

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Her mobile phone plan has a base monthly cost of \$50. While overseas, she is also charged 33 cents per SMS message sent and 26 cents per MB of data used.

During her month overseas, Jenny sent 120 SMS messages and used 1400 MB of data.

What was her mobile phone bill for the month overseas?

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- (b) Find the values of x and y which satisfy the following equations simultaneously.

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$$\begin{aligned}y &= x + 5 \\ 3y - x &= 7\end{aligned}$$

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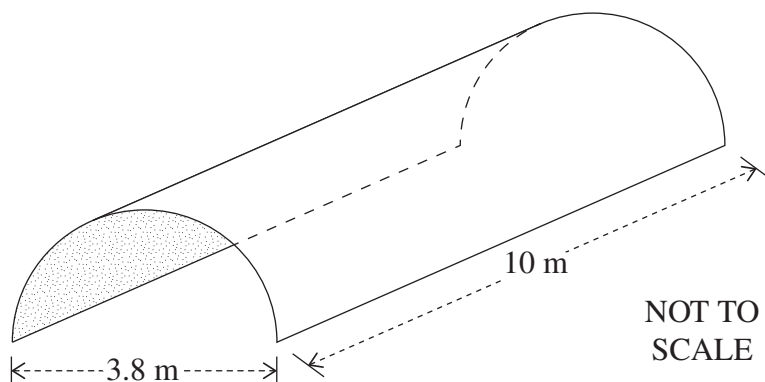
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Question 27 continues on page 21

Question 27 (continued)

- (c) A shade shelter is to be constructed in the shape of half a cylinder with open ends. The diameter is 3.8 m and the length is 10 m.

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The curved roof is to be made of plastic sheeting.

What area of plastic sheeting is required, to the nearest m^2 ?

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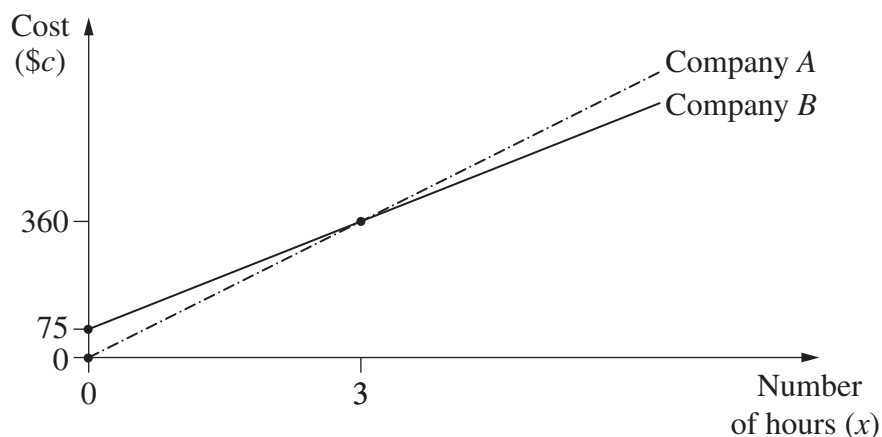
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Question 27 continues on page 22

Question 27 (continued)

- (d) The graph displays the cost (\$ c) charged by two companies for the hire of a minibus for x hours.



Both companies charge \$360 for the hire of a minibus for 3 hours.

- (i) What is the hourly rate charged by Company A?

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- (ii) Company B charges an initial booking fee of \$75.

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Write a formula, in the form of $c = mx + b$, for the cost of hiring a minibus from Company B for x hours.

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- (iii) A minibus is hired for 5 hours from Company B.

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Calculate how much cheaper this is than hiring from Company A.

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Question 27 continues on page 23

Question 27 (continued)

(e) Joanna sits a Physics test and a Biology test.

- (i) Joanna's mark in the Physics test is 70. The mean mark for this test is 58 and the standard deviation is 8. **1**

Calculate the z -score for Joanna's mark in this test.

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- (ii) In the Biology test, the mean mark is 64 and the standard deviation is 10. **2**

Joanna's z -score is the same in both the Physics test and the Biology test.

What is her mark in the Biology test?

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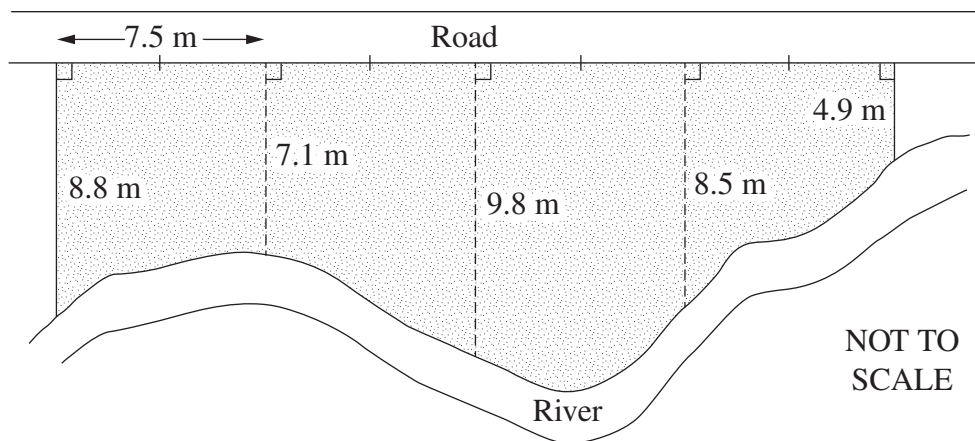
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End of Question 27

Question 28 (15 marks)

- (a) A field is bordered on one side by a straight road and on the other side by a river, as shown. Measurements are taken perpendicular to the road every 7.5 metres along the road.

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Use TWO applications of Simpson's Rule to find an approximation to the area of the field.

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Question 28 continues on page 25

Question 28 (continued)

- (b) Solve the equation $\frac{2x}{5} + 1 = \frac{3x + 1}{2}$, leaving your answer as a fraction.

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- (c) Every day, a 1200-watt microwave oven is used for 45 minutes at 40% power. Electricity is charged at \$0.25 per kWh.

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What is the cost of running this microwave oven for 180 days?

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Question 28 continues on page 26

Question 28 (continued)

- (d) Yanika opens a new credit card account, with interest and fees as shown.

Interest

- Flat rate of 12.3% per annum
- No interest-free period

Fees

- \$0 for online repayments
- \$3 for repayments in cash
(fee added to balance immediately after repayment)

Yanika makes a single purchase of \$849 with the credit card.

- (i) Show that the balance owing on the credit card 24 days after making the purchase is \$855.87. 2

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- (ii) Yanika makes her first repayment 24 days after making the purchase. She makes a cash repayment of \$450. 1

What is the balance owing on the credit card immediately after her repayment is made and the repayment fee has been charged?

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Question 28 continues on page 27

Question 28 (continued)

- (e) Sophie is driving at 70 km/h. She notices a branch on the road ahead and decides to apply the brakes. Her reaction time is 1.5 seconds. Her braking distance (D metres) is given by $D = 0.01v^2$, where v is speed in km/h.

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What is Sophie's stopping distance, to the nearest metre?

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End of Question 28

Question 29 (15 marks)

- (a) The time in Brisbane is $4\frac{1}{2}$ hours ahead of the time in New Delhi. John flew from New Delhi to Brisbane via Singapore. His plane left New Delhi at 11.30 am (New Delhi time), stopped for 3 hours in Singapore, and arrived in Brisbane at 9.00 am the following day (Brisbane time). 3

What was the plane's total flying time?

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- (b) A TV program which has a file size of 495 MB (megabytes) is to be downloaded. The download speed is 82.7 megabits per second. 2

How long will it take to download this program? Give your answer correct to the nearest second. (Note: 1 megabit = 1 000 000 bits)

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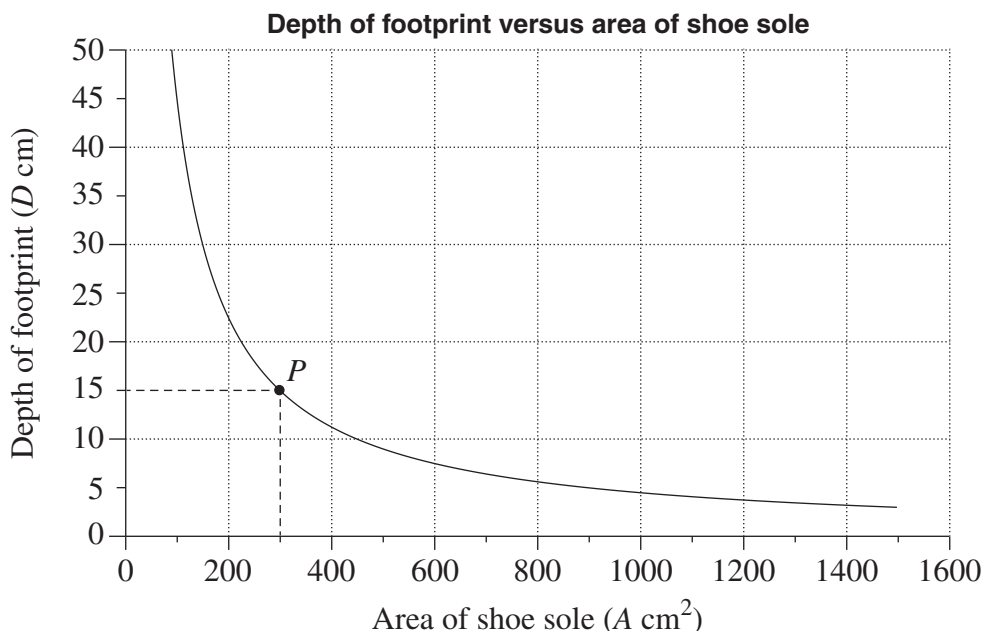
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Question 29 continues on page 29

Question 29 (continued)

- (c) When people walk in snow, the depth (D cm) of each footprint depends on both the area (A cm²) of the shoe sole and the weight of the person.

The graph shows the relationship between the area of the shoe sole and the depth of the footprint in snow, for a group of people of the same weight.



- (i) The graph is a hyperbola because D is inversely proportional to A . The point P lies on the hyperbola.

2

Find the equation relating D and A .

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- (ii) A man from this group walks in snow and the depth of his footprint is 4 cm.

1

Use your equation from part (i) to calculate the area of his shoe sole.

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Question 29 continues on page 30

Question 29 (continued)

- (d) Data for life expectancy (expected remaining years of life) for females at selected ages are given in the table.

<i>Age</i> (x years)	<i>Life expectancy</i> (y years) <i>for females</i>
0	84.6
5	79.9
10	74.9
15	69.9
20	65.0
25	60.1
30	55.1
35	50.2
40	45.4
$\bar{x} = 20$	$\bar{y} = 65.01$ (to 2 decimal places)

- (i) A student is finding the equation of the least-squares line of best fit relating the life expectancy (y) for females and their age (x). 1

The student has calculated the gradient to be -0.984 .

Use this value and the given values for $\bar{x}$ and $\bar{y}$ to show that the y -intercept of the line is 84.69 .

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- (ii) A student uses the least-squares line of best fit from part (i) to estimate the life expectancy of her grandmother who is currently aged 87. 1

Explain why this does NOT give a valid estimate.

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Question 29 continues on page 31

Question 29 (continued)

- (iii) Sally is a female aged 37.

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Use the least-squares line of best fit for females, $y = -0.984x + 84.69$, to calculate her life expectancy.

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- (iv) For males, the least-squares line of best fit relating life expectancy (
- y
-) and age (
- x
-) has the equation
- $y = -0.972x + 80.44$
- .

2

James is a male. He marries Sally who is aged 37. On their wedding day, they have the same life expectancy.

Calculate James's age on their wedding day. Give your answer in years.

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- (e) Andrew borrowed \$20 000 to be repaid in equal monthly repayments of \$243 over 10 years. Having made this monthly repayment for 4 years, he increased his monthly repayment to \$281. As a result, Andrew paid off the loan one year earlier.

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How much less did he repay altogether by making this change?

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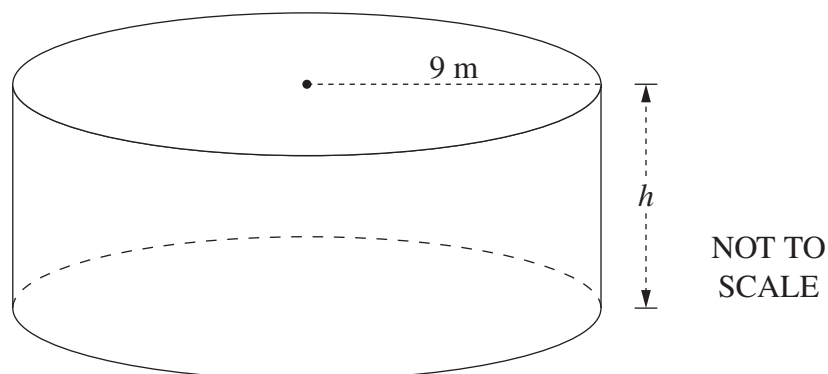
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End of Question 29

Question 30 (15 marks)

- (a) A cylindrical water tank has a radius of 9 metres and a capacity of 1.26 megalitres.

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What is the height of the water tank? Give your answer in metres, correct to two decimal places.

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Question 30 continues on page 33

Question 30 (continued)

- (b) Last year, Luke's taxable income was \$87 000 and the tax payable on this income was \$19 822. This year, Luke's taxable income has increased by \$16 800.

- (i) Use the table to calculate the tax payable by Luke this year.

2

<i>Taxable income (\$)</i>	<i>Tax payable</i>
\$0 – \$18 200	Nil
\$18 201 – \$37 000	19c for each \$1 over \$18 200
\$37 001 – \$87 000	\$3572 plus 32.5c for each \$1 over \$37 000
\$87 001 – \$180 000	\$19 822 plus 37c for each \$1 over \$87 000
\$180 001 and over	\$54 232 plus 45c for each \$1 over \$180 000

© Australian Taxation Office

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- (ii) How much extra money will Luke have this year, after paying tax, as a result of the increase in his taxable income? Ignore the Medicare levy.

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Question 30 continues on page 34

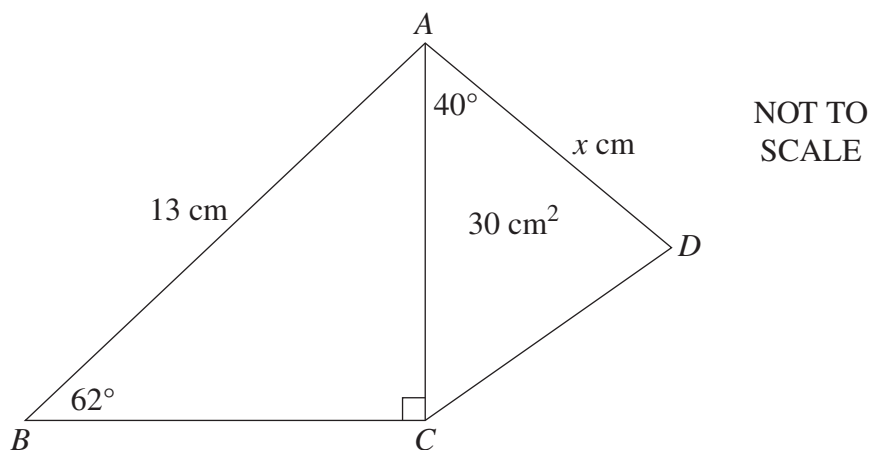
Question 30 (continued)

- (c) The diagram shows two triangles.

3

Triangle ABC is right-angled, with $AB = 13$ cm and $\angle ABC = 62^\circ$.

In triangle ACD , $AD = x$ cm and $\angle DAC = 40^\circ$. The area of triangle ACD is 30 cm^2 .



What is the value of x , correct to one decimal place?

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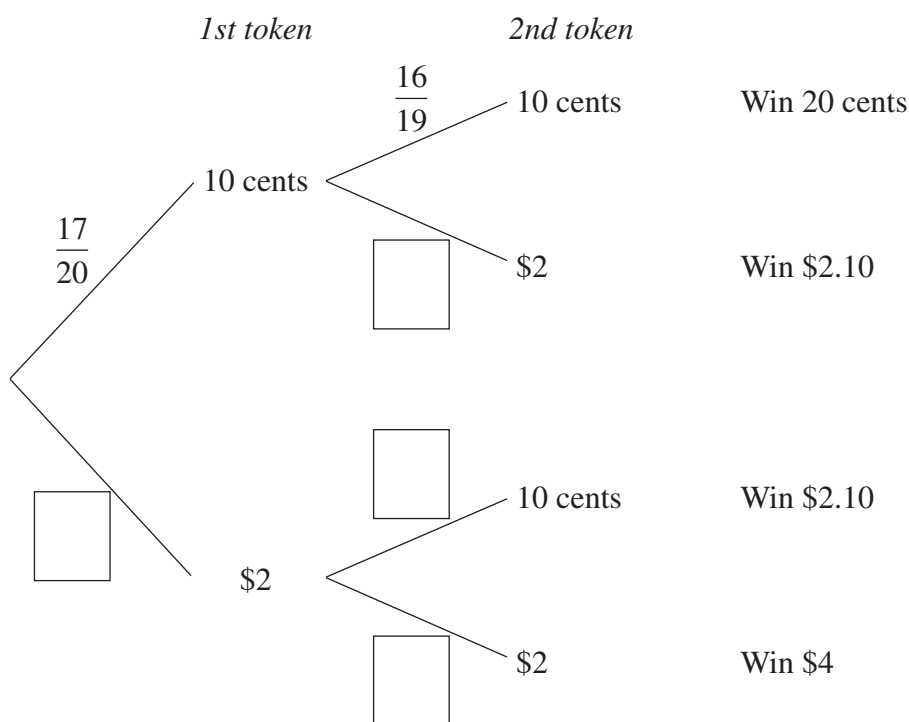
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Question 30 continues on page 35

Question 30 (continued)

- (d) A game consists of two tokens being drawn at random from a barrel containing 20 tokens. There are 17 tokens labelled 10 cents and 3 tokens labelled \$2. The player wins the total value of the two tokens drawn.

- (i) Complete the probability tree by writing the missing probabilities in the boxes. 2



- (ii) Considering that the game costs \$1 to play, calculate the financial expectation of the game. 3

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End of paper

Section II extra writing space

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

Do NOT write in this area.

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

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

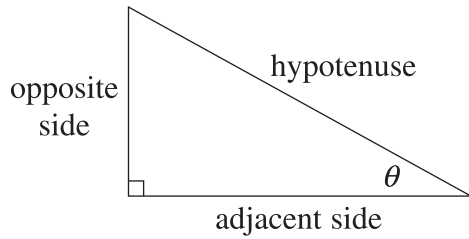
h is distance between successive measurements

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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2018 HSC Mathematics General 2 Marking Guidelines

Section I

Multiple-choice Answer Key

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

Section II

Question 26 (a)

Criteria	Marks
• Provides correct answer or correct numerical expression	1

Sample answer:

$$\begin{aligned}\text{Relative frequency} &= \frac{48}{23 + 19 + 48 + 20 + 21 + 19} \\ &= \frac{48}{150}\end{aligned}$$

Question 26 (b)

Criteria	Marks
• Provides correct answer or correct numerical expression	2
• Substitutes correctly into formula, or equivalent merit	1

Sample answer:

Let x be the weight of the child.

$$90 = \frac{x \times 325}{70}$$

$$x = \frac{90 \times 70}{325}$$

$$= 19 \text{ kg}$$

Question 26 (c)

Criteria	Marks
• Provides correct answer	1

Sample answer:

$$\begin{aligned}\text{Amount} &= 12 \times 100 \times 5 \\ &= \$6000\end{aligned}$$

Question 26 (d) (i)

Criteria	Marks
• Provides correct answer	1

Sample answer:

3

Question 26 (d) (ii)

Criteria	Marks
• Identifies correct city and provides correct explanation	1

Sample answer:

Sydney has the smaller standard deviation because it has less variation in mean monthly rainfall than Perth.

Question 26 (e)

Criteria	Marks
• Provides correct answer	2
• Calculates one quartile, or equivalent merit	1

Sample answer:

Total of 42 scores split into two halves of 21 scores.

We need the 11th and 32nd scores (when arranged in ascending order)

IQ range = $5 - 3 = 2$

Question 26 (f)

Criteria	Marks
• Provides correct answer or correct numerical expression	1

Sample answer:

$6 \times 5 = 30$

Question 26 (g) (i)

Criteria	Marks
• Provides correct solution	1

Sample answer:

The measured length of AG is 8 cm.

Therefore, 8 cm = 24 m.

Dividing by 8, 1 cm = 3 m.

Question 26 (g) (ii)

Criteria	Marks
• Provides correct solution	3
• Calculates correct area, or equivalent merit	2
• Provides a correct relevant length or equivalent merit	1

Sample answer:

AB measures 3 cm and therefore the actual length of AB is 9 m.

BF measures 6 cm and therefore the actual length of BF is 18 m.

$$\text{Area } ABFG = \frac{9}{2}(18 + 24)$$

$$= 189 \text{ m}^2$$

$$\text{Fertiliser needed} = 26.5 \times 189$$

$$= 5008.5 \text{ grams}$$

Question 26 (h)

Criteria	Marks
• Provides correct solution	2
• Substitution into correct formula, or equivalent merit	1

Sample answer:

$$\text{Value after three years} = 23\,900 (1 - 0.115)^3$$

$$= 16\,566.3835\dots$$

$$= \$16\,566.38$$

Question 27 (a)

Criteria	Marks
• Provides correct answer or correct numerical expression	2
• Calculates correct cost of SMS or data, or equivalent merit	1

Sample answer:

$$\begin{aligned}\text{Amount owing} &= 50 + 0.33 \times 120 + 0.26 \times 1400 \\ &= \$453.60\end{aligned}$$

Question 27 (b)

Criteria	Marks
• Provides correct answer	3
• Provides one correct value or equivalent merit	2
• Attempts to substitute for y into second equation, or equivalent merit	1

Sample answer:

$$\begin{aligned}3(x+5) - x &= 7 \\ 3x + 15 - x &= 7 \\ 2x &= -8 \\ x &= -4 \\ \therefore y &= -4 + 5 \\ y &= 1 \\ \therefore \text{Solution is } x &= -4 \text{ and } y = 1\end{aligned}$$

Question 27 (c)

Criteria	Marks
• Provides correct solution or correct numerical expression	2
• Attempts to calculate curved surface area, or equivalent merit	1

Sample answer:

$$\text{The radius is } \frac{3.8}{2} = 1.9 \text{ m}$$

$$\begin{aligned}\text{Area} &= 2\pi rh \div 2 \\ &= 2\pi \times 1.9 \times 10 \div 2 \\ &= 59.69... \\ &= 60 \text{ m}^2\end{aligned}$$

Question 27 (d) (i)

Criteria	Marks
• Provides correct answer or correct numerical expression	1

Sample answer:

$$\begin{aligned}\text{Hourly rate} &= \frac{360}{3} \\ &= \$120\end{aligned}$$

Question 27 (d) (ii)

Criteria	Marks
• Provides correct equation	2
• Calculates correct y-intercept or gradient, or equivalent merit	1

Sample answer:

From the graph, $b = 75$

$$\begin{aligned}\text{Gradient, } m &= \frac{360 - 75}{3} \\ &= 95\end{aligned}$$

Substituting,

$$c = 95x + 75$$

Question 27 (d) (iii)

Criteria	Marks
• Provides correct solution	2
• Calculates one correct cost or equivalent merit	1

Sample answer:

Company A cost is $5 \times 120 = \$600$

Company B cost is $95 \times 5 + 75 = \$550$

$\therefore$ Company B is \$50 cheaper than Company A.

Question 27 (e) (i)

Criteria	Marks
• Provides correct answer	1

Sample answer:

$$\begin{aligned}
 z &= \frac{x - \bar{x}}{s} \\
 &= \frac{70 - 58}{8} \\
 &= 1.5
 \end{aligned}$$

Question 27 (e) (ii)

Criteria	Marks
• Provides correct answer or correct numerical expression	2
• Correctly substitutes into z-score formula, or equivalent merit	1

Sample answer:

$$\begin{aligned}
 z &= \frac{x - \bar{x}}{s} \\
 1.5 &= \frac{x - 64}{10} \\
 15 &= x - 64 \\
 x &= 79
 \end{aligned}$$

Question 28 (a)

Criteria	Marks
• Provides correct solution or correct numerical expression	3
• Correctly applies Simpson's rule (one application), or equivalent merit	2
• Makes progress towards solution	1

Sample answer:

$$h = 7.5$$

$$\begin{aligned} \text{Approximate area} &= \frac{7.5}{3}(8.8 + 4 \times 7.1 + 9.8) + \frac{7.5}{3}(9.8 + 4 \times 8.5 + 4.9) \\ &= 117.5 + 121.75 \\ &= 239.25 \text{ m}^2 \end{aligned}$$

Question 28 (b)

Criteria	Marks
• Provides correct solution	3
• Makes significant progress towards solution	2
• Demonstrates a correct algebraic step, or equivalent merit	1

Sample answer:

$$\begin{aligned} \frac{2x}{5} + \frac{5}{5} &= \frac{3x+1}{2} \\ 2(2x+5) &= 5(3x+1) \\ 4x+10 &= 15x+5 \\ 5 &= 11x \\ x &= \frac{5}{11} \end{aligned}$$

Question 28 (c)

Criteria	Marks
• Provides correct solution or correct numerical expression	3
• Calculates correct total energy usage (kWh), or equivalent merit	2
• Correctly calculates one conversion, or equivalent merit	1

Sample answer:

$$\begin{aligned} \text{kW} &= 1200 \div 1000 \\ &= 1.2 \end{aligned}$$

$$\begin{aligned} \text{kWh per day} &= 1.2 \times \left(\frac{45}{60} \times 0.4 \right) \\ &= 0.36 \end{aligned}$$

$$\begin{aligned} \text{kWh for 180 days} &= 180 \times 0.36 \\ &= 64.8 \end{aligned}$$

$$\begin{aligned} \text{Running cost} &= 0.25 \times 64.8 \\ &= \$16.20 \end{aligned}$$

Question 28 (d) (i)

Criteria	Marks
• Provides correct solution	2
• Makes progress towards solution	1

Sample answer:

$$\begin{aligned} \text{Interest charged} &= \$849 \times 0.123 \times \frac{24}{365} \\ &= \$6.86643... \\ &= \$6.87 \end{aligned}$$

$$\begin{aligned} \text{Balance owing} &= \$849 + \$6.87 \\ &= \$855.87 \end{aligned}$$

Question 28 (d) (ii)

Criteria	Marks
• Provides correct answer or correct numerical expression	1

Sample answer:

$$\begin{aligned} \text{Balance owing} &= 855.87 - 450 + 3 \\ &= \$408.87 \end{aligned}$$

Question 28 (e)

Criteria	Marks
• Provides correct solution	3
• Correctly finds reaction-time distance, or equivalent merit	2
• Correctly finds braking distance, or equivalent merit	1

Sample answer:

$$70 \text{ km/h} = \frac{70 \times 1000}{60 \times 60}$$

$$= 19.4 \text{ m/s}$$

$$\text{Reaction-time distance} = 19.4 \times 1.5$$

$$= 29.16 \text{ m}$$

$$\text{Braking distance} = 0.01 \times 70^2$$

$$= 49 \text{ m}$$

$$\text{Stopping distance} = 29.16 + 49$$

$$= 78.16$$

$$= 78 \text{ m (nearest metre)}$$

Question 29 (a)

Criteria	Marks
• Provides correct answer	3
• Makes significant progress towards solution	2
• Makes progress towards solution	1

Sample answer:

John leaves New Delhi at 11.30 am (New Delhi time) which is 4 pm Brisbane time.

John arrives in Brisbane at 9 am the following day.

John arrives 17 hours after departing.

$$\begin{aligned}\text{Flying time} &= 17 - 3 \\ &= 14 \text{ hours}\end{aligned}$$

Question 29 (b)

Criteria	Marks
• Provides correct answer or correct numerical expression	2
• Divides their calculated number of megabits by 82.7, or equivalent merit	1

Sample answer:

$$495 \text{ MB} = 495 \times 2^{20} \times 8 \text{ bits}$$

$$\begin{aligned}\text{Time taken} &= \frac{495 \times 2^{20} \times 8}{82.7 \times 1000\,000} \\ &= 50.2... \\ &= 50 \text{ seconds (nearest second)}\end{aligned}$$

Question 29 (c) (i)

Criteria	Marks
• Provides correct equation	2
• Identifies equation as $D = \frac{k}{A}$, or equivalent merit	1

Sample answer:

$$D = \frac{k}{A}$$

Substituting point P , we have

$$\begin{aligned} 15 &= \frac{k}{300} \\ \therefore k &= 4500 \\ \therefore D &= \frac{4500}{A} \end{aligned}$$

Question 29 (c) (ii)

Criteria	Marks
• Provides correct answer or correct numerical expression	1

Sample answer:

$$\begin{aligned} 4 &= \frac{4500}{A} \\ 4A &= 4500 \\ A &= \frac{4500}{4} \\ \text{Area} &= 1125 \text{ cm}^2 \end{aligned}$$

Question 29 (d) (i)

Criteria	Marks
Provides correct solution using the formula $y\text{-intercept} = \bar{y} - (\text{gradient} \times \bar{x})$ (from formulae and data sheet)	1

Sample answer:

$$\begin{aligned}
 b &= \bar{y} - (\text{gradient} \times \bar{x}) \\
 &= 65.01 - (-0.984 \times 20) \\
 &= 84.69
 \end{aligned}$$

Question 29 (d) (ii)

Criteria	Marks
Provides correct explanation	1

Sample answer:

This involves extrapolation beyond the range of the data and therefore does not give a valid estimate.

OR

$$\begin{aligned}
 \text{Substituting } x = 87, \text{ we get } y &= -0.984 \times 87 + 84.69 \\
 &= -0.918
 \end{aligned}$$

A negative life expectancy is not valid.

Question 29 (d) (iii)

Criteria	Marks
Provides correct answer	1

Sample answer:

$$\begin{aligned}
 \text{Life expectancy} &= -0.984 \times 37 + 84.69 \\
 &= 48.282 \text{ years}
 \end{aligned}$$

Question 29 (d) (iv)

Criteria	Marks
• Provides correct solution	2
• Substitutes their y from part (iii) into the male life expectancy equation, or equivalent merit	1

Sample answer:

$$48.282 = -0.972x + 80.44$$

$$0.972x = 80.44 - 48.282$$

$$x = \frac{32.158}{0.972}$$

$$= 33.08\dots$$

$$= 33 \text{ years}$$

Question 29 (e)

Criteria	Marks
• Provides correct answer or correct numerical expression	2
• Provides a correct repayment amount, or equivalent merit	1

Sample answer:

Based on the original repayments, Andrew has to pay $243 \times 6 \times 12 = \$17\,496$ after the end of year 4.

Based on the increased repayment, Andrew has to pay $281 \times 5 \times 12 = \$16\,860$ after the end of year 4.

He pays $17\,496 - 16\,860 = \$636$ less.

Question 30 (a)

Criteria	Marks
• Provides correct solution or correct numerical expression	3
• Calculates h correctly from their volume, or equivalent merit	2
• Converts ML to cubic metres, or equivalent merit	1

Sample answer:

$$\begin{aligned}
 1.26 \text{ megalitres} &= 1.26 \times 1\,000\,000 \\
 &= 1\,260\,000 \text{ litres} \\
 &= \frac{1\,260\,000}{1000} \\
 &= 1260 \text{ m}^3
 \end{aligned}$$

$$1260 = \pi \times 9^2 \times h$$

$$\therefore h = \frac{1260}{81 \times \pi}$$

$$= 4.9514\dots$$

$$= 4.95 \text{ m (two decimal places)}$$

Question 30 (b) (i)

Criteria	Marks
• Provides correct answer, or correct numerical expression	2
• Attempts to use the correct tax bracket for the correct taxable income, or equivalent merit	1

Sample answer:

$$\text{New income} = 87\,000 + 16\,800$$

$$= \$103\,800$$

$$\text{Tax payable} = 19\,822 + 0.37 \times (103\,800 - 87\,000)$$

$$= \$26\,038$$

Question 30 (b) (ii)

Criteria	Marks
• Provides correct answer, or correct numerical expression	2
• Provides one correct net annual pay, or equivalent merit	1

Sample answer:

$$\text{Net annual income before pay rise} = 87\,000 - 19\,822$$

$$= \$67\,178$$

$$\text{Net annual income after pay rise} = 87\,000 + 16\,800 - 26\,038$$

$$= \$77\,762$$

$$\text{Extra money} = 77\,762 - 67\,178$$

$$= \$10\,584$$

Question 30 (c)

Criteria	Marks
• Provides correct solution	3
• Correctly substitutes into $A = \frac{1}{2}ab\sin C$, or equivalent merit	2
• Calculates the length of AC, or equivalent merit	1

Sample answer:

$$\sin 62^\circ = \frac{AC}{13}$$

$$\begin{aligned} AC &= 13 \times \sin 62^\circ \\ &= 11.478... \text{ cm} \end{aligned}$$

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

$$30 = \frac{1}{2} \times 11.478... \times x \sin 40$$

$$30 = 3.689... x$$

$$x = \frac{30}{3.689...}$$

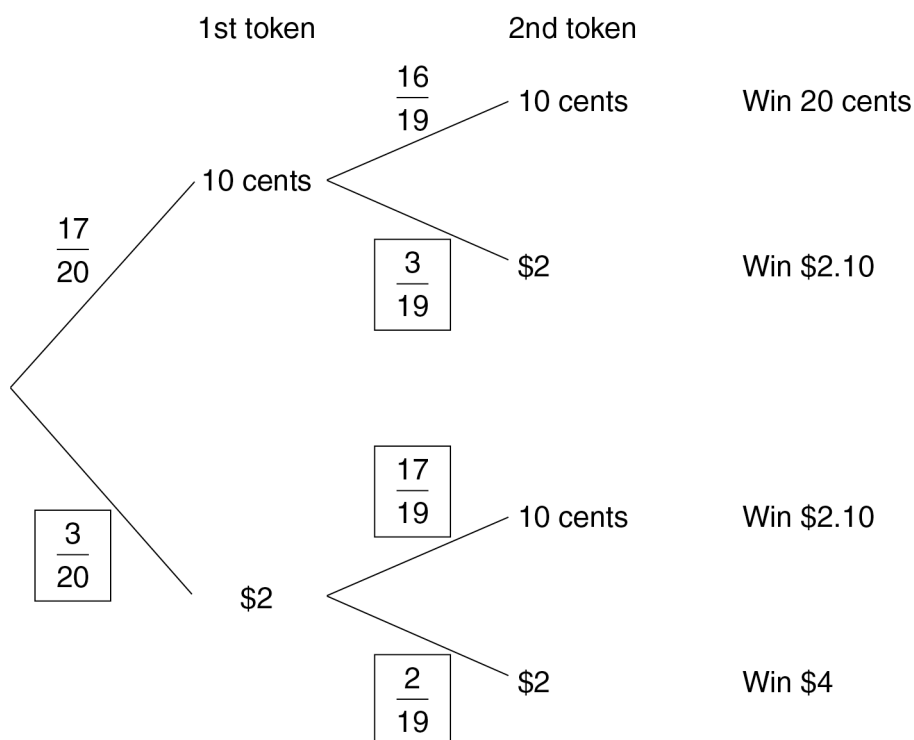
$$= 8.132...$$

$$= 8.1 \text{ (one decimal place)}$$

Question 30 (d) (i)

Criteria	Marks
• Provides all correct probabilities	2
• Provides two correct probabilities	1

Sample answer:



Question 30 (d) (ii)

Criteria	Marks
• Provides correct solution, or equivalent merit	3
• Makes significant progress towards solution	2
• Makes progress towards solution	1

Sample answer:

Financial expectation

$$= \frac{17}{20} \times \frac{16}{19} \times 0.2 + \frac{17}{20} \times \frac{3}{19} \times 2.1 + \frac{3}{20} \times \frac{17}{19} \times 2.1 + \frac{3}{20} \times \frac{2}{19} \times 4 - 1$$

$$= -\$0.23$$

∴ The financial expectation is a loss of 23 cents

2018 HSC Mathematics General 2 Mapping Grid

Section I

Question	Marks	Content	Syllabus outcomes
1	1	DS2 Displaying and interpreting single data sets (p34, ●8)	MGP-7
2	1	AM3 Further algebraic skills and techniques (p100, ●4)	MG2H-3
3	1	DS1 Statistics and society, data collection and sampling (p32, ●4)	MGP-7
4	1	AM5 Modelling non-linear relationships (p104, ●2)	MG2H-3
5	1	FSDr2 Running costs and depreciation (p66, ●1, ●2)	MGP-5
6	1	DS4 Interpreting sets of data (p80, ●8)	MG2H-2
7	1	MM5 Applications of trigonometry (p90, ●10)	MG2H-4
8	1	FM1 Earning and managing money (p24, ●1)	MGP-6
9	1	PB2 Multistage events and applications of probability (p96, ●8)	MG2H-8
10	1	DS6 Sampling and populations (p84, ●4)	MG2H-2, MG2H-7
11	1	DS4 Interpreting sets of data (p80, ●3)	MG2H-2
12	1	MM5 Applications of trigonometry (p90, ●7)	MG2H-4
13	1	MM4 Further applications of area and volume (p88, ●8)	MG2H-4
14	1	MM1 Units of measurement and applications (p40, ●10)	MGP-3
15	1	FSDr1 Costs of purchase and insurance (p64, ●2)	MGP-1
16	1	AM1 Algebraic manipulation (p52, ●2)	MGP-3
17	1	DS4 Interpreting sets of data (p80, ●15)	MG2H-2
18	1	MM4 Further applications of area and volume (p88, ●1)	MG2H-5
19	1	FM2 Investing money (p26, ●6)	MGP-6
20	1	PB1 Relative frequency and probability (p48, ●6)	MGP-2
21	1	FM1 Earning and managing money (p24, ●11)	MGP-6
22	1	MM2 Applications of perimeter, area and volume (p42, ●3)	MGP-4
23	1	DS5 The normal distribution (p82, ●5)	MG2H-7
24	1	MM6 Spherical geometry (p92, ●4)	MG2H-4
25	1	AM3 Further algebraic skills and techniques (p100, ●8)	MG2H-3

Section II

Question	Marks	Content	Syllabus outcomes
26 (a)	1	PB1 Relative frequency and probability (p48, ●5)	MGP-8
26 (b)	2	FSHe2 Medication (p110, ●5)	MG2H-5
26 (c)	1	FM5 Annuities and loan repayments (p76, ●1)	MG2H-6
26 (d) (i)	1	DS2 Displaying and interpreting single data sets (p34, ●12)	MGP-7
26 (d) (ii)	1	DS3 Summary statistics (p36, ●8)	MGP-7
26 (e)	2	DS4 Interpreting sets of data (p80, ●3)	MG2H-2
26 (f)	1	PB2 Multistage events and applications of probability (p96, ●1)	MG2H-8
26 (g) (i)	1	MM3 Similarity of two-dimensional figures, right-angled triangles (p44, ●1)	MGP-4
26 (g) (ii)	3	FSRe2 Dams, land and catchment areas (p118, ●4)	MG2H-4
26 (h)	2	FSDr2 Running costs and depreciation (p66, ●6)	MGP-6
27 (a)	2	FSCo1 Mobile phone plans (p58, ●4, ●5)	MGP-6
27 (b)	3	AM3 Further algebraic skills and techniques (p100, ●9)	MG2H-3, MH2H-10
27 (c)	2	MM4 Further applications of area and volume (p88, ●6)	MG2H-4
27 (d) (i)	1	AM4 Modelling linear relationships (p102, ●5)	MG2H-3
27 (d) (ii)	2	AM2 Interpreting linear relationships (p54, ●13) AM4 Modelling linear relationships (p102, ●5)	MGP-3, MG2H-3
27 (d) (iii)	2	AM4 Modelling linear relationships (p102, ●5)	MG2H-10
27 (e) (i)	1	DS5 The normal distribution (p82, ●3)	MG2H-7
27 (e) (ii)	2	DS5 The normal distribution (p82, ●3)	MG2H-7
28 (a)	3	MM4 Further applications of area and volume (p88, ●4)	MG2H-4
28 (b)	3	AM3 Further algebraic skills and techniques (p100, ●6)	MG2H-3
28 (c)	3	FSRe3 Energy and sustainability (p120, ●4)	MG2H-5
28 (d) (i)	2	FM4 Credit and borrowing (p74, ●1)	MG2H-1, MG2H-6, MG2H-10
28 (d) (ii)	1	FM4 Credit and borrowing (p74, ●1)	MG2H-1, MG2H-6, MG2H-10
28 (e)	3	FSDr3 Safety (p68, ●2)	MGP-3, MGP-5
29 (a)	3	MM6 Spherical geometry (p92, ●6)	MG2H-5
29 (b)	2	FSCo2 Digital download and file storage (p60, ●4)	MGP-5
29 (c) (i)	2	AM5 Modelling non-linear relationships (p104, ●8)	MG2H-3
29 (c) (ii)	1	AM5 Modelling non-linear relationships (p104, ●8)	MG2H-3
29 (d) (i)	1	FSHe1 Body measurements (p108, ●9)	MG2H-7

Question	Marks	Content	Syllabus outcomes
29 (d) (ii)	1	FSHe1 Body measurements (p108, ●4) FSHe3 Life expectancy (p112, ●1) AM4 Modelling linear relationships (p102, ●12)	MG2H-3
29 (d) (iii)	1	FSHe1 Body measurements (p108, ●10)	MG2H-3
29 (d) (iv)	2	FSHe1 Body measurements (p108, ●10) FSHe3 Life expectancy (p112, ●1)	MG2H-7
29 (e)	2	FM5 Annuities and loan repayments (p76, ●7)	MG2H-6
30 (a)	3	FSRe1 Water availability and usage (p116, ●8)	MG2H-4
30 (b) (i)	2	FM3 Taxation (p28, ●4)	MGP-6
30 (b) (ii)	2	FM3 Taxation (p28, ●4)	MGP-6
30 (c)	3	MM5 Applications of trigonometry (p90, ●11)	MG2H-4
30 (d) (i)	2	PB2 Multistage events and applications of probability (p96, ●3, ●7)	MG2H-8
30 (d) (ii)	3	PB2 Multistage events and applications of probability (p96, ●10)	MG2H-8