Student Number:……

2024 Higher School Certificate
Trial Examination
Mathematics Standard 2

General Instructions

- Reading time – 10 minutes
- Working time – 2 hours and 30 minutes
- Write using black pen
- Write your student number on the examination and multiple-choice answer sheet
- Calculators approved by NESA may be used
- A reference sheet is provided at the back of this paper
- For questions in Section II, show relevant mathematical reasoning and/or calculations

Total marks: 100

Section I – 15 marks (pages 2-6)

- Attempt Questions 1–15
- Write your answers on the answer sheet
- Allow about 25 minutes for this section

Section II – 85 marks (pages 7-24)

- Attempt Questions 16–40
- Allow about 2 hours and 5 minutes for this section

Section I
15 marks

Attempt Questions 1–15
Allow about 25 minutes for this section.

Use the multiple-choice answer sheet for Questions 1–15.

---

1 Solve $2(3x - 4) = 16$.

A. $x = \frac{4}{3}$

B. $x = \frac{10}{3}$

C. $x = 4$

D. $x = 18$

2 An item was purchased for a price of \$915. The price included 10% GST (Goods and Services Tax).

What is the amount of GST included in the price?

A. \$9.15

B. \$83.18

C. \$91.50

D. \$82.35

3 Which of these is NOT an example of discrete data?

A. The number of goals scored by a football team in a year

B. The time taken to run 100 m at the Olympic Games

C. The number of cars parked in a Sydney CBD carpark complex

D. The number of Year 12 students sitting the HSC this year

4 Which of the following is the fastest speed?

A. 72 000 m/h

B. 21 m/s

C. 60 km/h

D. 917 m/min

5 In the Term 1 Year 12 Mathematics assessment task, the mean was recorded as 62.5% with a standard deviation of 9%.

If Benjamin's z-score on this task was 2.5, what was his mark for this assessment task?

A. 56%

B. 60%

C. 74%

D. 85%

6 A patient is to receive 620 mL of liquid through an IV drip delivering 20 drops/minute. If there are 12 drops/mL, how long will the IV drip take?

A. 3.72 hours

B. 3 hours 43 minutes

C. 6 hours 12 minutes

D. 17 hours 13 minutes

7 The table below shows the future value of $1 compounding at various rates and time periods.

Interest rate per period on $1							
Period	4%	5%	6%	7%	8%	9%	10%
1	1.0400	1.0500	1.0600	1.0700	1.0800	1.0900	1.1000
2	1.0816	1.1025	1.1236	1.1449	1.1664	1.1881	1.2100
3	1.1249	1.1576	1.1910	1.2250	1.2597	1.2950	1.3310
4	1.1699	1.2155	1.2625	1.3108	1.3605	1.4116	1.4641
5	1.2167	1.2763	1.3382	1.4026	1.4693	1.5386	1.6105
6	1.2653	1.3401	1.4185	1.5007	1.5869	1.6771	1.7716

What is the future value of $5 000 invested at 8% p.a. interest compounded half-yearly for 3 years?

A. $6 298.50

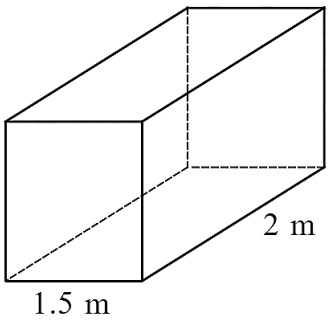
B. $6 326.50

C. $5 624.50

D. $7 934.50

8 The rectangular box shown in the diagram below is closed at the top and at the bottom. It has a volume of $6\ m^3$. The base dimensions are 1.5 m$\times$ 2 m.

DIAGRAM NOT TO SCALE



What is the total surface area of this box?

A. $10\ m^2$

B. $13\ m^2$

C. $20\ m^2$

D. $27\ m^2$

9 The results of a Year 12 Mathematics Standard 2 Exam were normally distributed. Brandon gained a z-score of -1.

Approximately what percentage of students scored better than Brandon?

A. 97.5%

B. 50%

C. 84%

D. 68%

10 Calvin has shares with a current market value of \$7.35 each. He has received a cheque for the total dividend of \$512.

If he owns 450 of these shares, calculate his current dividend yield on these shares.

A. 0.15%

B. 6.46%

C. 8.36%

D. 15.48%

11 Which one of the following statements about the line with equation $12x - 4y = 0$ is **not** true?

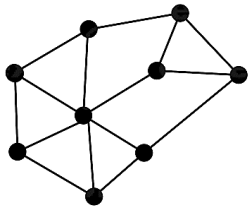
A. The line passes through the origin

B. The line has a slope of 12

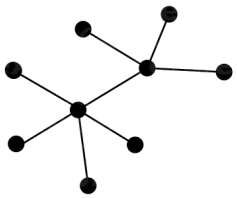
C. The line has the same slope as the line with the equation $12x - 4y = 12$

D. For this line, as x increases y increases

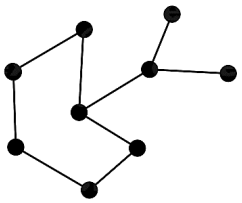
12 Which of the following is a possible spanning tree of the network below?



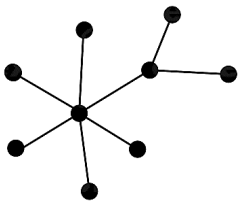
A.



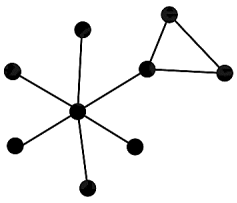
B.



C.



D.



13 Penny measures the length of a window in her room to be 320 cm to the nearest centimetre. What is the percentage error in her measurement?

A. $\pm$ 0.003125%

B. $\pm$ 0.3125%

C. $\pm$ 0.0015625%

D. $\pm$ 0.15625%

14 Year 12 students at the local high school were surveyed to find the number of hours they worked last week, and the results are given in the table below:

Number of Hours Worked	Cumulative Frequency
8	20
9	24
10	30
11	32
12	40
13	50

According to the information in the table, which of the following statements is **incorrect**?

A. The mode number of hours worked is 8

B. The median number of hours worked is 10

C. 30 students surveyed worked 10 hours last week

D. 20% of the students surveyed worked 13 hours last week

15 Making x the subject of the formula $S = 2a^3 - 4ax$ gives the equation:

A. $x = \dfrac{S - 2a^3}{4a}$

B. $x = \dfrac{2a^2 - S}{4}$

C. $x = \dfrac{S - 2a^2}{4}$

D. $x = \dfrac{2a^3 - S}{4a}$

End of Section I

Mathematics Standard
Section II Answer Booklet

85 marks
Attempt Questions 16–40
Allow about 2 hours and 5 minutes for this section.

Instructions

- 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.

Question 16 (2 marks)

A formal clothing store marked up its dresses by 40% from the wholesale price. These dresses were then put on sale after a 12.5% discount and sold at a price of $135

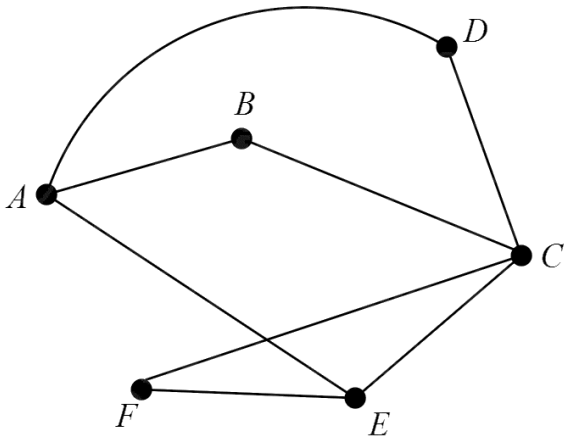
Determine the original wholesale price of the dresses, correct to the nearest cent. **2**

Question 17 (2 marks)

The U18s Sydney FC Academy Squad welcomed six new members to the team for the new season. These players are Archie, Bob, Cody, David, Emmett, and Fred.

The network diagram below shows the players who had played together in other teams in previous seasons.

Please note that vertex A, B, C, D, E and F respectively represents Archie, Bob, Cody, David, Emmett, and Fred.



a) According to the diagram, who has played with the most players in previous seasons? **1**

b) During the season, Greg joined the team. He had played with all the players in previous seasons, except for Emmett. Represent this information on the diagram above. **1**

Question 18 (3 marks)

The first three chapters in a Mathematics Standard 2 textbook have pages in the ratio 2 : 5 : 4.

a) If there are 26 pages in the first chapter, how many pages are there in total in the first three chapters of this textbook? **2**

b) The ratio of the number of pages in the first three chapters to the whole textbook is 1 : 8. How many pages are there in the whole textbook? **1**

Question 19 (4 marks)

Justin wants to purchase a car that is worth $85 000.

He paid a 10% deposit, and the balance is charged a simple interest of 4.3% p.a. over 5 years.

a) Calculate the amount of the deposit. **1**

b) Calculate the amount of each monthly repayment during the 5 years, correct to the nearest cent. **3**

Question 20 (6 marks)

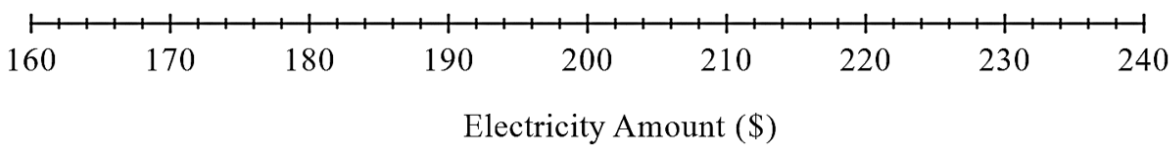
Twenty-four households were surveyed to find the amount of their quarterly electricity bill in dollars. The results are listed below:

197	194	185	192	183	176	200	163
216	187	198	209	169	234	176	172
167	232	195	179	166	184	211	163

a) Construct an ordered stem-and-leaf plot to represent this data.
Use the key 19 | 7 = \$197. **2**

b) Calculate the five-number summary for this data. **2**

c) Illustrate this data using a box-and-whisker plot. **2**



Question 21 (2 marks)

A Christmas tree decoration is in the shape of a sphere. It has a diameter of 4.5 cm. Twelve of these decorations are to fit into a rectangular box that is 10 cm wide and 5 cm high.

What is the minimum length the box can be if it is to hold all 12 decorations? **2**

Question 22 (3 marks)

Jessica wants to purchase a new air-conditioner for the mathematics staffroom and needs to consider the annual running costs.

The average rate for electricity is 29.788 c/kWh. Jessica expects her faculty to run the air-conditioner an average of 4 hours per day, for 5 days a week, for 40 weeks each year.

How much money would be saved in a year if Jessica purchased a 3500-watt unit, as opposed to a 5000-watt unit? **3**

Question 23 (3 marks)

A house plan is drawn to a scale of 1:100

a) The pergola is 5500 mm wide. What would be its measurement on the plan? **1**

b) The interior ceiling of the house is 1.6 metres high, and all windows in the house are 1 square metre. The master bedroom has one door, one window and the wardrobes have doors with mirrored glass and cover one complete wall from floor to ceiling.

A painter charges $25 per square metre. This includes the walls and door but excludes any windows, wardrobes and ceiling. Determine the cost of painting the bedroom, if each wall of the master bedroom has a width of 2.5 cm on the plan. **2**

Question 24 (2 marks)

A person's Body Mass Index can be calculated using:

$$B = \frac{m}{h^2}$$

where $m =$ mass in kilograms and

$h =$ height in metres

Thomas is 73 kg with a body mass index of 23.6. How tall is Thomas? Leave your answer to the nearest centimetre. **2**

Question 25 (5 marks)

A Year 12 class of 24 students were surveyed about the type of exercise they prefer. 12 said they go to the gym, 13 said they run and 4 said they neither go to the gym nor run.

a) Complete the two-way table below to represent this data. **2**

	Gym	**Do Not Gym**	**Total**
Run			13
Do Not Run		4	
Total	12		

b) Find the probability that a student who runs also goes to the gym. **1**

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c) Find the percentage of runners who do not go to the gym. Leave your answer to the nearest percentage. **2**

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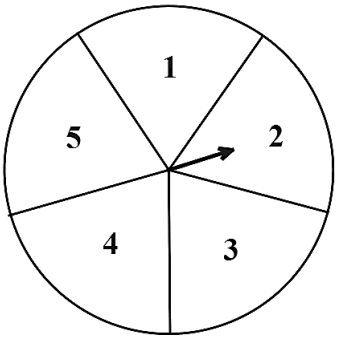
Question 26 (4 marks)

A spinner is marked with the numbers 1 to 5. When it is spun, each of the numbers is equally likely to occur.



The spinner is spun 3 times.

a) What is the probability that an even number occurs on the first spin? **1**

b) What is the probability that the number 3 occurs on all three spins? **1**

c) What is the probability that an even number occurs on at least one of the three spins? **2**

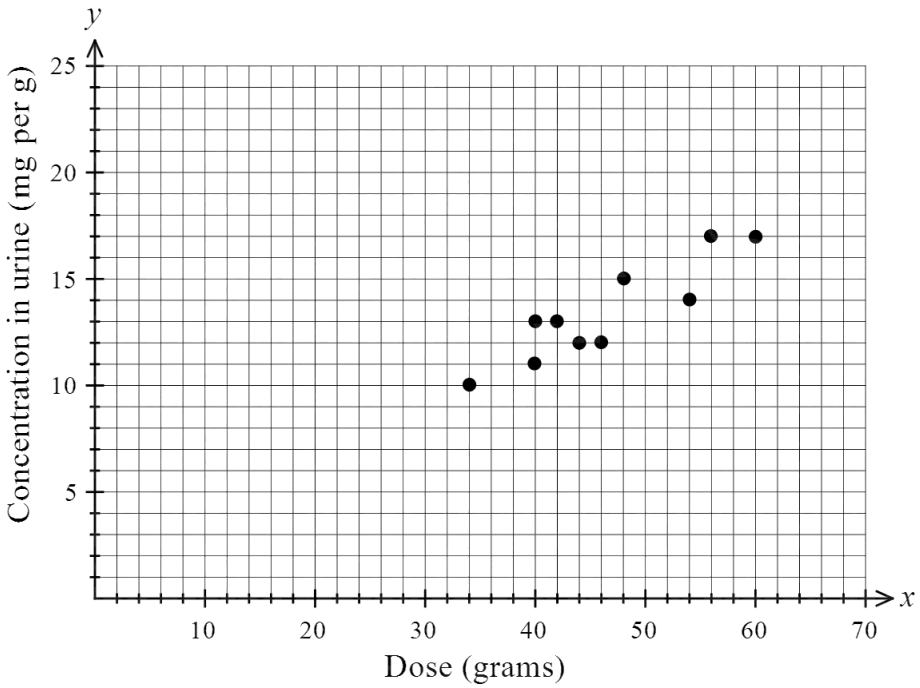
Question 27 (2 marks)

Riley is an animal activist concerned about the pigeon population in her town. She collects 135 pigeons and tags them.

A couple of months later, she collected 42 pigeons and found 9 of them were tagged. What is her estimate of the pigeon population, using the capture-recapture method? **2**

Question 28 (3 marks)

A dose of Epiandrosterone (x) in grams, and concentration in urine, y, in mg/g of a fluid after intravenous administration are measured for 10 people. The scatterplot below represents this data.



a) Find the Pearson's correlation coefficient between x and y, correct to two decimal places. **1**

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b) Find the equation of the line of best fit $y = A + Bx$. Round your values of A and B correct to two decimal places. **2**

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Question 29 (3 marks)

Marvin invested \$75 000 in an account paying 5.2% per annum interest compounding monthly. How much interest will he have in the account after 15 years? Answer correct to the nearest cent. **3**

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Question 30 (2 marks)

Five videogame programmers need to create a new toddler game with nine activities. The activities and their immediate predecessors are shown in the table below. The duration of each activity is not yet known.

Activity	Immediate Predecessors
A	-
B	-
C	-
D	A
E	B
F	C
G	D, E
H	F
I	G, H

Use the information above to draw the network diagram. **2**

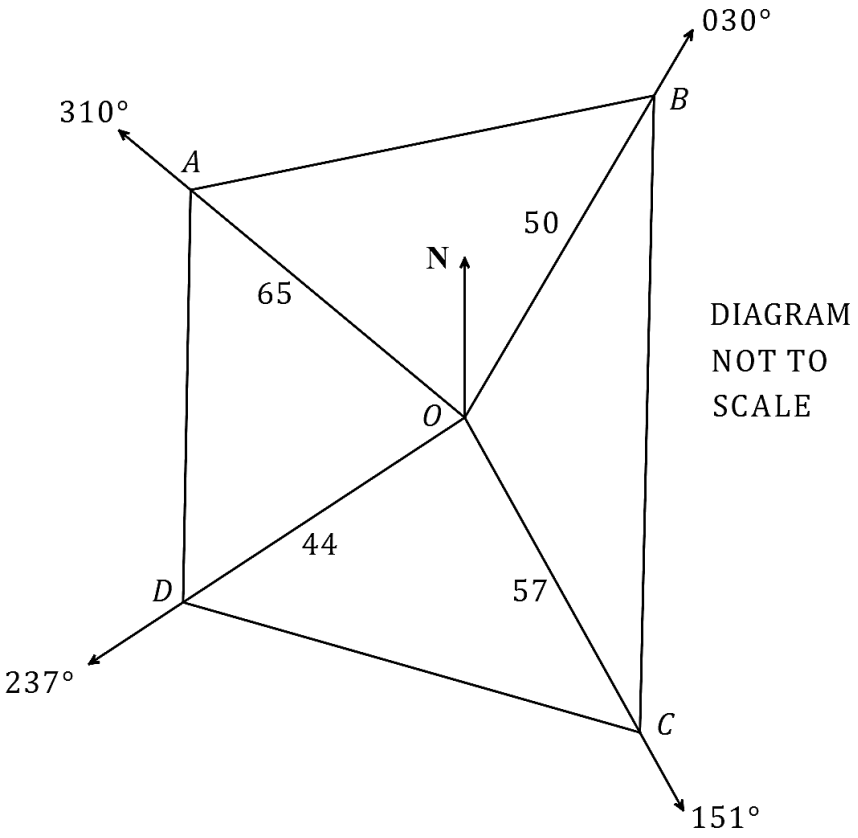
Question 31 (3 marks)

Evan and Rudy are brothers who live 3 km from their school. Evan walks to school at an average speed of 6 km/h and Rudy rides his bicycle to school at an average speed of 12.5 km/h.

If Evan leaves home at 8:05 am, what time must Rudy leave home so he arrives at school at the same time as his brother? **3**

Question 32 (5 marks)

The radial survey of a farm is drawn below. All distances are in metres.

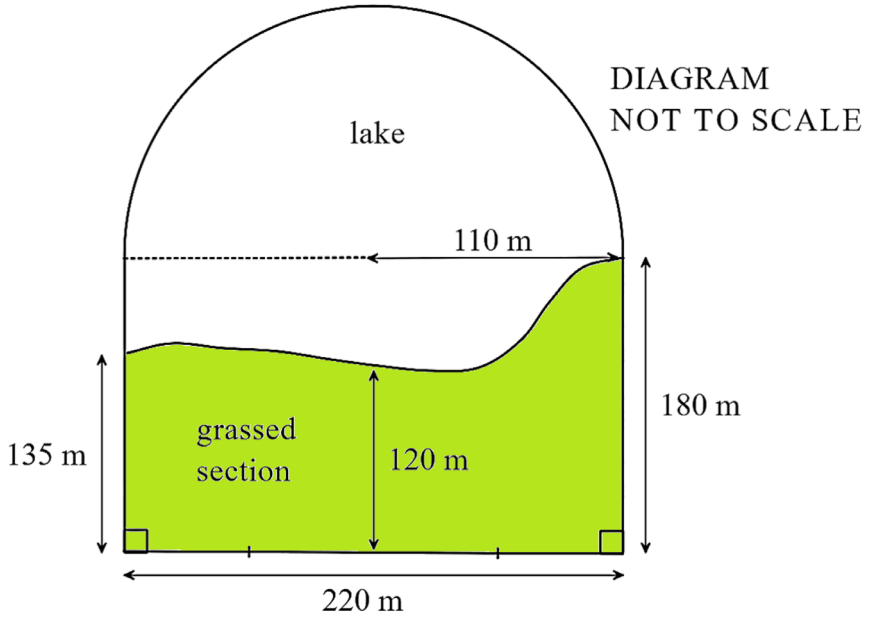


a) Calculate the area of the section of the farm labelled *BOC*, correct to one decimal place. **2**

b) Calculate the length of *AB*, correct to one decimal place. **3**

Question 33 (4 marks)

A landscaper wanted to ask the local council to renovate the park near his home. His suggestion was to have a park partially occupied by a lake and the rest is a grassed section, as shown in the diagram below.



The park consists of a rectangle with dimensions, 220 m and 180 m, and a semi-circle with a radius of 110 m. Some measurements from the end of the grassed section to the edge of the lake are also shown.

a) Using two applications of the Trapezoidal rule, calculate the approximate area of the grassed section. **2**

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b) Hence calculate the approximate area of the lake, to the nearest square metre. **2**

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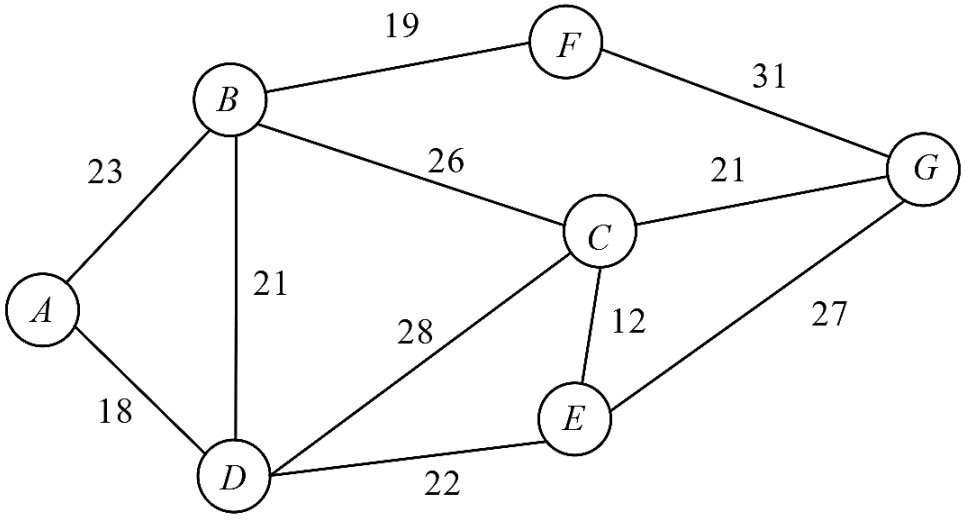
Question 34 (4 marks)

The network diagram below represents a network of roads joining towns in country NSW. All roads can be travelled in either direction. The numbers indicate the travel time between towns in minutes.



a) Complete the missing values in the table below to represent this network diagram. **2**

	A	*B*	*C*	*D*	*E*	*F*	*G*
A		23					–
B	23					19	–
C				28			
D					22		–
E			12	22			27
F							31
G					27	31	–

b) Determine the shortest travel time between towns A and G, and the roads which would be followed to achieve this. **2**

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Question 35 (3 marks)

Vivian and Louis want to buy a house. Their combined gross income is $2 270 per fortnight. They can afford 25% of their gross monthly income for all loan repayments. From the 25% of their gross monthly income dedicated to loans, the couple are already paying off a car loan at $260 per month.

The bank offers a loan with monthly repayments of $8.36 per $1000 borrowed.

Calculate the largest loan Vivian and Louis can afford, correct to the nearest dollar. **3**

Question 36 (3 marks)

Andrew is driving at 80 km/h when he notices a branch on the road ahead and decides to apply the brakes.

His reaction time is 1.7 seconds, and the braking distance (D metres) is given by : $D = 0.01s^2$, where s is speed in km/h.

Stopping distance can be calculated using the following formula

stopping distance = {reaction time distance} + {braking distance}

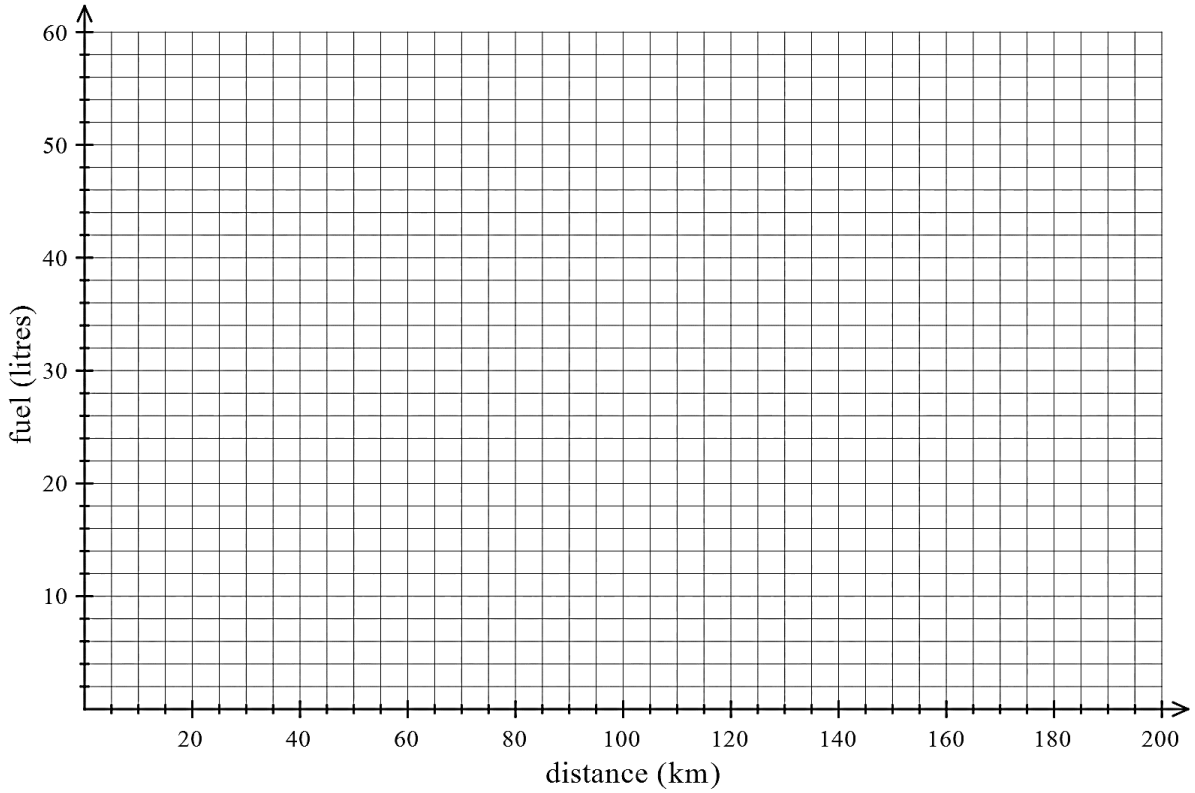
What is Andrew's stopping distance, to the nearest metre? **3**

Question 37 (6 marks)

Ronald operates a mobile dog grooming service. In one particular week, Ronald began with 60 litres of fuel in the tank of his dog grooming van. After he had travelled 120 km, there were 30 litres of fuel left in the tank of his van.

The amount of fuel remaining in the tank of Ronald's van followed a linear trend.

a) Use the information above to draw the linear graph that represents the amount of fuel in Ronald's van in comparison to the distance he travelled. **1**



b) Determine the equation of the line drawn in the graph above, in part (a). **2**

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c) Assume this linear trend continues and that Ronald does not add fuel to the tank of his van. After travelling 120 km, how much further will he be able to travel before the tank is empty? **2**

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Question 36 continues on the next page

d) Ronald stopped to refuel his van when there were 9 litres of fuel left in the tank. He filled the tank in 4 and a half minutes, when the fuel was flowing from the pump at a rate of 16 litres per minute.
How much fuel does the tank hold when it is completely full? Leave your answer in litres. **1**

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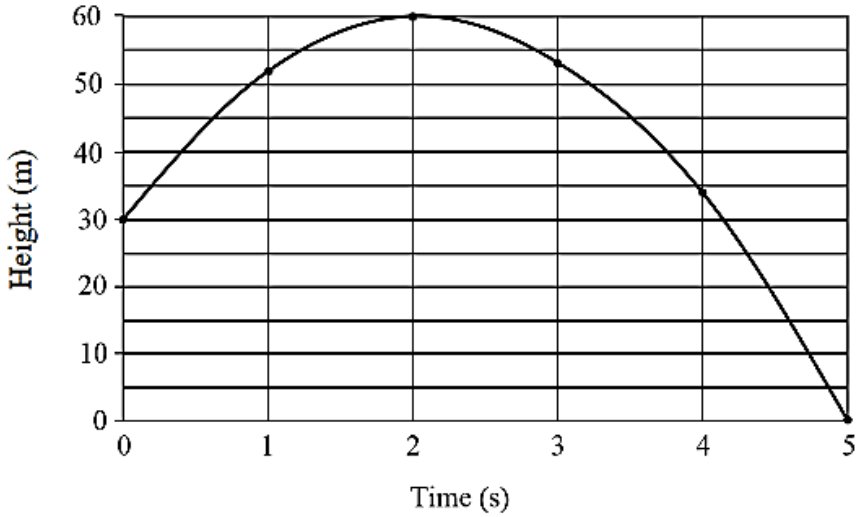
Question 38 (3 marks)

During a science experiment, a ball was thrown from the second floor of a building. The height of the ball above the ground was recorded at one-second intervals.
The results are shown in the graph below.

Height of ball above ground level



a) What was the height of the second floor? **1**

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b) According to the graph, approximately what maximum height, above ground, was reached by the ball? **1**

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c) The height, h (in metres), of the ball above the ground at a certain time t (in seconds) after it was thrown, can be modelled by the formula:

$$h = 30 + 29t - 7t^2$$

Use this formula to predict the height of the ball after 3.5 seconds. **1**

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Question 39 (4 marks)

A closed cylindrical water tank has an external diameter of 4.2 metres. The external height of the tank is 5.5 metres. The walls, floor and top of the tank are made of concrete 0.25 m thick.

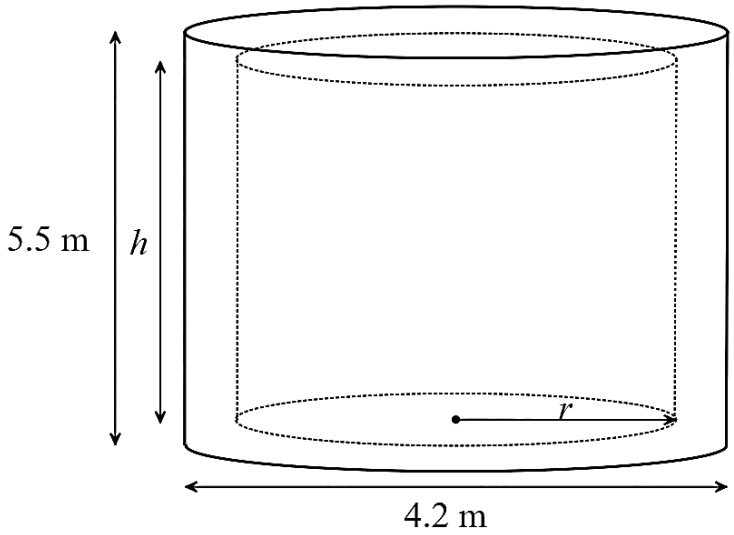


DIAGRAM
NOT TO SCALE

a) What is the internal radius, r, and height, h, of the tank? **2**

b) Determine the maximum amount of water this tank could hold. Write your answer to the nearest litre. **2**

Question 40 (4 marks)

A plane at a height of 1000 metres sights the runway at an angle of depression of 8°. The plane continues flying at the same height towards the runway, which is later sighted at the angle of depression of 33°.

a) Draw a diagram to represent the information above. **1**

b) Calculate the distance the plane travelled between sightings, correct to the nearest metre. **4**

Section II extra writing space

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

Section II extra writing space

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

Student Number:…….……

MATHEMATICS STANDARD 2– MULTIPLE-CHOICE ANSWER SHEET

ATTEMPT ALL QUESTIONS

PLACE A CROSS (X) IN THE BOX TO INDICATE YOUR ANSWER

Question				
1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
5	A	B	C	D
6	A	B	C	D
7	A	B	C	D
8	A	B	C	D
9	A	B	C	D
10	A	B	C	D
11	A	B	C	D
12	A	B	C	D
13	A	B	C	D
14	A	B	C	D
15	A	B	C	D

Mathematics Standard Reference Sheet

Measurement

Limits of accuracy

Absolute error $= \frac{1}{2} \times$ precision

Upper bound = measurement + absolute error

Lower bound = measurement − absolute error

Length

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

Area

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

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

$$A = \frac{h}{2}(d_f + d_l)$$

Surface area

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

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

Volume

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

$$V = \frac{4}{3}\pi r^3$$

Trigonometry

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

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

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

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

Financial Mathematics

$$FV = PV(1 + r)^n$$

Straight-line method of depreciation

$$S = V_0 - Dn$$

Declining-balance method of depreciation

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

Statistical Analysis

An outlier is a score

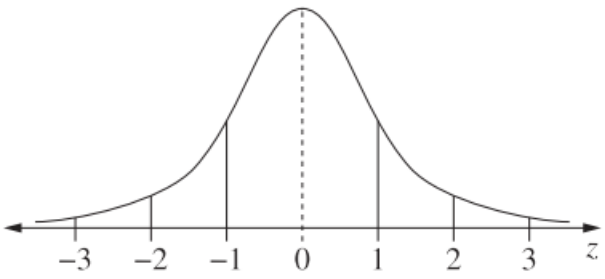
less than $Q_1 - 1.5 \times IQR$

or

more than $Q_3 + 1.5 \times IQR$

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

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

2024 Higher School Certificate
Trial Examination
Mathematics Standard 2
Marking Guidelines

Section I

Multiple-Choice Answer Key

Question	Answer	Working out
1	C	$2(3x-4)=16$ $3x-4=8$ $3x=12$ $x=4$
2	B	$110\%=915$ $10\%=915\div 11$ $10\%=\$83.18$
3	B	A – goals scored is discrete data B – time is continuous data C – number of cars is discrete data D – number of Year 12 student is discrete data
4	B	72 000m/h = 72 km/h 21 m/s $=21\times 3600\div 1000=75.6$ km/h 60 km/h 917 m/min $=917\times 60\div 1000=55.02$ km/h
5	D	Benjamin's mark $=62.5+2.5\times 9$ $=85\%$
6	C	Number of drops $=620\times 12$ $=7440$ Time $=7440\div 20$ $=372$ minutes $=372\div 60$ $=6.2$ hours $=6$ hours 12 minutes
7	B	$r=8\div 2=4\%$ per half-yearly $n=3\times 2=6$ half-yearly $FV=5000\times 1.2653$ $FV=\$6326.50$
8	C	$h=6\div(1.5\times 2)$

		$h = 2$ m $SA = 2 \times 1.5 \times 2 + (2 \times 1.5 + 2 \times 2) \times 2$ $SA = 20\ m^2$
9	C	Using the empirical rule: $= 34 + 50$ $= 84\%$
10	D	Dividend yield $= \frac{512}{7.35 \times 450} \times 100$ $= 15.48\%$
11	B	When $x = 0, y = 0 \rightarrow$ passes through the origin Gradient $12x - 4y = 0$ $4y = 12x$ $y = 3x$ $m = 3$ not 12 Gradient of $12x - 4y = 12$ $4y = 12x - 12$ $y = 3x - 3$ $m = 3$ which is the same as $12x - 4y = 0$ Positive gradient means as x increases, y increases
12	C	A – has two vertices joining that do not connect in the network B – has a circuit C – possible spanning tree as you can get from one vertex to any other but not back without repeating an edge D – has a circuit
13	D	Smallest unit = 1cm Absolute error $= \pm$ 0.5 cm Percentage error $= \pm\frac{0.5}{320} \times 100$ $= \pm 0.15625\ \%$

<table>
<tr><td>14</td><td>C</td><td>Adding a frequency column to the table
<table><tr><th>Number of Hours Worked</th><th>c.f</th><th>f</th></tr><tr><td>8</td><td>20</td><td>20</td></tr><tr><td>9</td><td>24</td><td>4</td></tr><tr><td>10</td><td>30</td><td>6</td></tr><tr><td>11</td><td>32</td><td>2</td></tr><tr><td>12</td><td>40</td><td>8</td></tr><tr><td>13</td><td>50</td><td>10</td></tr></table>Mode is 8 hours.
Median is the average of the 25th and 26th numbers which is 10.
30 students worked at least 10 hours but only 6 worked 10 hours.
% of students who worked 13 hours (continues next page)
$= \frac{10}{50} \times 100$
$= 20\%$</td></tr>
<tr><td>15</td><td>D</td><td>$S = 2a^3 - 4ax$
$4ax = 2a^3 - S$
$x = \frac{2a^3 - S}{4a}$</td></tr>
</table>

Section II

Question 16

Criteria	Marks
• Correct answer given to the nearest cent	2
• Working out provided which indicates either an increase of 40% or a decrease of 12.5%, or equivalent merit	1

Sample answer
Let $x =$ original wholesale price
$x \times 1.4 \times 0.875 = 135$
$x = 135 \div (1.4 \times 0.875)$
$x = \$110.20$

The original wholesale price of the dresses are $110.20.

Question 17
17(a)

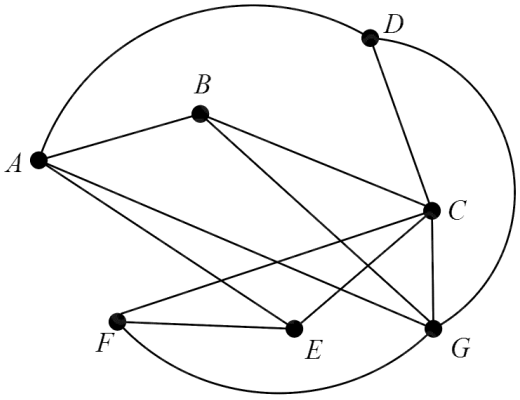
Criteria	Mark
• Correct player stated	1

Sample answer
Based on the network diagram, C has links to 4 other vertices.
Therefore, Cody has played with the most players in other teams in previous seasons.

17(b)

Criteria	Mark
• Provides correct solution where there are links from G to every other point except E	1

Sample answer
Let Greg be G
One possible network diagram with G connecting to everything but E is:



Question 18
18(a)

Criteria	Marks
• Provides correct solutions	2
• Correctly calculating the number of pages for one part	1

Sample answer
2 parts = 26 pages
1 part = 13 pages
First three chapters have a total of 11 parts
11 parts = 11 × 13 = 143 pages

18(b)

Criteria	Mark
• Provides correct answer	1

Sample answer
Using what was found in part i) where first three chapters = 143 pages
Total number of pages in the textbook
= 8 ×143
= 1144 pages

Question 19

19(a)

Criteria	Mark
• Provides the correct deposit	1

Sample answer
Deposit
$= 0.1 \times 85000$
$= \$8500$

19(b)

Criteria	Marks
• Provides the correct answer to the nearest cent	3
• Working out demonstrates some form of understanding on calculating the monthly repayments, given the balance and interest was found	2
• Provides working out or solution for balance or interest, or equivalent merit	1

Sample answer
Balance
$= 85000 - 8500$
$= \$76500$

Interest
$= 76500 \times 0.043 \times 5$

$= \$16447.50$

Monthly repayments
$= (76500 + 16447.5) \div (5 \times 12)$
$= 92947.5 \div 60$
$= \$1549.13$

Question 20

20(a)

Criteria	Marks
• Provides correct solution	2
• The stem goes from 16 to 23 (without 22 being left off the stem and leaf plot), or equivalent merit	1

Sample answer

Stem	*Leaf*				
16	*3*	*3*	*6*	*7*	*9*
17	*2*	*6*	*6*	*9*	
18	*3*	*4*	*5*	*7*	
19	*2*	*4*	*5*	*7*	*8*
20	*0*	*9*			
21	*1*	*6*			
22					
23	*2*	*4*			

20(b)

Criteria	Marks
• Provides the correct solution	2
• Identifies the lowest score, highest scores and/or median, or equivalent merit	1

Sample answer
Lowest score = 163
Highest score = 234

Median
$= \dfrac{12th + 13th}{2}$
$= \dfrac{185 + 187}{2}$
$= 186$

Lower quartile
$= \dfrac{6th + 7th}{2}$

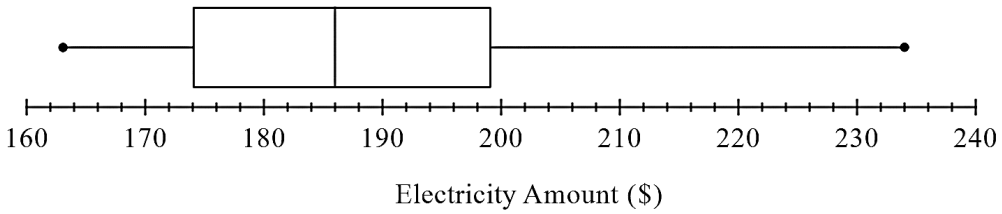
$$= \frac{172 + 176}{2}$$
$$= 174$$

Upper quartile
$$= \frac{18th + 19th}{2}$$
$$= \frac{198 + 200}{2}$$
$$= 199$$

20(c)

Criteria	Marks
• Provides correct solution	2
• Box and whisker plot was drawn based on the answers given in part (b), or equivalent merit	1

Sample answer



Question 21

Criteria	Marks
• Provides correct solution	2
• Calculations demonstrates understanding of diameter, or equivalent merit	1

Sample answer
Can fit two Christmas decorations along the width of the box, as the width is 10 cm and two decorations is $2 \times 4.5 = 9$ *cm*

Length of 6 christmas decorations
$= 6 \times 4.5$
$= 27$ *cm*

Therefore, minimum length of the box for packing would be 27 cm.

Question 22

Criteria	Marks
• Provides correct solution	3
• Calculates the cost of running the 3500-watt and 5000-watt unit, or equivalent merit	2
• Calculates only one of the costs, or equivalent merit	1

Sample answer
Cost of 3500-watt air-con unit
3500 watts = 3.5 kW

$= 3.5 \times 4 \times 5 \times 40 \times 0.29788$
$= \$834.06$

Cost of 5000-watt air-con unit
5000 watts = 5 kW

$= 5 \times 4 \times 5 \times 40 \times 0.29788$
$= \$1191.52$
Amount saved

$= 1191.52 - 834.06$
$= \$357.46$
Jessica would save $357.46 per year if she purchased the 3500-watt air con unit.

23(a)

Criteria	Mark
• Provides correct dimension for the plan	1

Sample answer
Pergola
$= 5500\ mm \div 10$
$= 550\ cm$

Using the scale
$\frac{x}{550} = \frac{1}{100}$
$x = 5.5\ cm$

The pergola would be 5.5 cm on the plan

23(b)

Criteria	Marks
• Provides correct answer	2
• Calculates the total area needed to be painted, or equivalent merit	1

Sample answer

Interior ceiling
$= 1.6\ m$ *in real life*
$= 160\ cm$
$= 1.6\ cm$ *on the plan*

Bedroom walls
$= (1.6 \times 2.5)\ cm^2$
$= (160 \times 250)\ cm^2$ *in real life*
$= (1.6 \times 2.5)\ m^2$
$= 4\ m^2$

Area to paint
$= 3 \times 4 - 1$
$= 11\ m^2$

Cost
$= 11 \times 25$
$= \$275$

Question 24

Criteria	Marks
• Provides correct answer to the nearest centimetre	2
• Substitutes the correct values into the given formula, or equivalent merit	1

Sample answer

$$B = \frac{m}{h^2}$$

$$23.6 = \frac{73}{h^2}$$

$$h^2 = \frac{73}{23.6}$$

$$h = \sqrt{\frac{73}{23.6}}$$

$$h = 1.7587\ m$$

$h = 1.76\ m$ *or* $176\ cm$ *(to the nearest centimetre)*

Question 25

25(a)

Criteria	Marks
• Provides the correct solutions in the table	2
• Placing 24 in the cell that has total vertically and horizontally, or equivalent merit	1

Sample answer

	Gym	***Do Not Gym***	***Total***
Run	*5*	*8*	*13*
Do Not Run	*7*	*4*	*11*
Total	*12*	*12*	*24*

25(b)

Criteria	Mark
• Provides correct answer as a fraction	1

Sample answer

$P(runs\ and\ gyms) = \frac{5}{24}$

25(c)

Criteria	Mark
• Provides correct percentage	1

Sample answer

Percentage of runners who do not go to the gym

$= \frac{8}{13} \times 100$

$= 61.538$

$= 62\ \%$

Question 26

26(a)

Criteria	Mark
• Provides correct answer	1

Sample answer

$P(even\ number\ on\ first\ spin) = \frac{2}{5}$

26(b)

Criteria	Mark
• Provides correct answer	1

Sample answer

P(3 occurs on all spin)

$$= \frac{1}{5} \times \frac{1}{5} \times \frac{1}{5}$$

$$= \frac{1}{125}$$

26(c)

Criteria	Marks
• Provides correct solution	2
• Calculates the probability of getting an even number for one scenario, or equivalent merit	1

Sample answer

P(at least one even number)

$= 1 - P(\text{no even numbers})$

$$= 1 - \left(\frac{3}{5} \times \frac{3}{5} \times \frac{3}{5}\right)$$

$$= \frac{98}{125}$$

Question 27

Criteria	Marks
• Provides correct answer	2
• Demonstrates calculations using ratios, or equivalent merit	1

Sample answer

Let $x =$ estimate of the pigeon population

$$\frac{x}{135} = \frac{42}{9}$$

$$x = \frac{42 \times 135}{9}$$

$$x = 630$$

Therefore, Riley's estimate of the pigeon population is 630.

Question 28

28(a)

Criteria	Mark
• Provides correct answer	1

Sample answer
Inputting the following frequency table into the calculator

x	34	40	40	42	44	46	48	54	56	60
y	10	11	13	13	12	12	15	14	17	17

$\therefore r = 0.90$

28(b)

Criteria	Marks
• Provides correct answer	2
• Values of A and B were found, or equivalent merit	1

Sample answer
Results from the calculator gives
$A = 1.27272$
$B = 0.26136$
Therefore, the equation of the line of best fit is $y = 1.27 + 0.26x$

Question 29

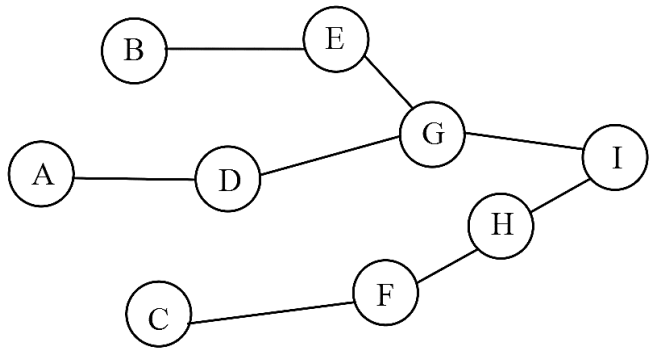
Criteria	Marks
• Provides correct solution	3
• Calculates the amount earned using the compound interest formula, or equivalent merit	2
• Correct application of the compound interest formula	1

Sample answer
$r = \frac{5.2}{12}\%$ *per month* $= 0.004\dot{3}$
$n = 15 \times 12 = 180$ months
$I = A - P$
$I = 75000\left(1 + 0.004\dot{3}\right)^{180} - 75000$
$I = 163334.95 - 75000$
$I = \$88\ 334.95$

Question 30

Criteria	Marks
• Provides correct diagram	2
• Shows a network with E, D and C correctly linked to their predecessors, or equivalent merit	1

Sample answer



Question 31

Criteria	Marks
• Provides correct solution	3
• Calculates the time Evan would get to school, or equivalent merit	2
• Calculates how long it would take Evan and Rudy to travel to school, or equivalent merit	1

Sample answer
Time it takes Evan to get to school
$= 3 \div 6$
$= 0.5$ *hours*
= 30 minutes, this means he will get to school at 8.35 am

Time it takes Rudy to get to school
$= 3 \div 12.5$
$= 0.24$ *hours*
= 14 minutes

Rudy will need to leave home at 8.21 am to arrive at school at the same time as Evan.

Question 32

32(a)

Criteria	Marks
• Provides correct answer	2
• Calculates the value of $\angle BOC$, or equivalent merit	1

Sample answer
$\angle BOC = 151 - 30 = 121°$
$A = \frac{1}{2} \times 50 \times 57 \times \sin 121$
$A = 1221.5\ m^2$ *(to 1 d.p)*

32(b)

Criteria	Marks
• Provides correct solution	3
• Correct substitution into the cosine rule, or equivalent merit	2
• Calculates $\angle AOB$ and/, or equivalent merit	1

Sample answer
$\angle AOB = (360 - 310) + 30 = 80°$
$AB^2 = 65^2 + 50^2 - 2(65)(50)\cos 80$
$AB = \sqrt{6725 - 6500\cos 80}$
$AB = 74.8\ m$

Question 33

33(a)

Criteria	Marks
• Provides correct solution	2
• Substituting the correct values into the Trapezoidal Rule, or equivalent merit	1

Sample answer
$A = \frac{110}{2}(135 + 120) + \frac{110}{2}(120 + 180)$
$A = 30525\ m^2$

OR

$A = \frac{110}{2}(135 + 2 \times 120 + 180)$
$A = 30525\ m^2$

33(b)

Criteria	Marks
• Provides correct solution	2
• Calculates the composite area of the semi-circle and rectangle, or equivalent merit	1

Sample answer
Overall area
$= \frac{1}{2} \times \pi \times 110^2 + 180 \times 220$
$= 58606.63555$

Area of the lake
$= 58606.63555 - 30525$
$= 28081.63555$
$= 28\ 082\ m^2$

Question 34

34(a)

Criteria	Marks
• Provides correct solution	2
• Recognising the symmetrical pattern within the table to ensure correct placement of values	1

Sample answer

	A	B	C	D	E	F	G
A	–	23	–	18	–	–	–
B	23	–	26	21	–	19	–
C	–	26	–	28	12	–	21
D	18	21	28	–	22	–	–
E	–	–	12	22	–	–	27
F	–	19	–	–	–	–	31
G	–	–	21	–	27	31	–

34(b)

Criteria	Marks
• Provides correct solution	2
• Shortest travel time was found to be 67 minutes, or equivalent merit	1

Sample answer
Solutions can either be
A – D – E – G
$= 18 + 22 + 27$
$= 67$ *minutes*

OR

A – D – C – G
$= 18 + 28 + 21$
$= 67$ *minutes*

Question 35

Criteria	Marks
• Provides correct answer, given to the nearest dollar	3
• Demonstrates understanding of using the rate provided, or equivalent merit	2
• Calculates the amount of monthly income available for loan repayments, or equivalent merit	1

Sample answer

Amount available for loan repayments

$= 0.25 \times 2\,270 \times 26 \div 12 - 260$

$= \$969.58$

Largest loan possible

$= 969.58 \div 8.36 \times 1000$

$= \$115\,978.77$

$= \$115\,979$

The largest loan that Vivian and Louis can afford is $115 979

Question 36

Criteria	Marks
• Provides correct answer, given to the nearest metre.	3
• Calculates the braking distance and converts the speed or equivalent merit.	2
• Calculates the braking distance or equivalent merit.	1

Sample answer

$D = 0.01 \times 80^2$

$= 64\ metres$

$\frac{80km}{h} = \frac{22.2m}{s}$

$22.2 \times 1.7 = 37.7\ metres$

Stopping distance = 64 + 37.7 = 102.7 metres

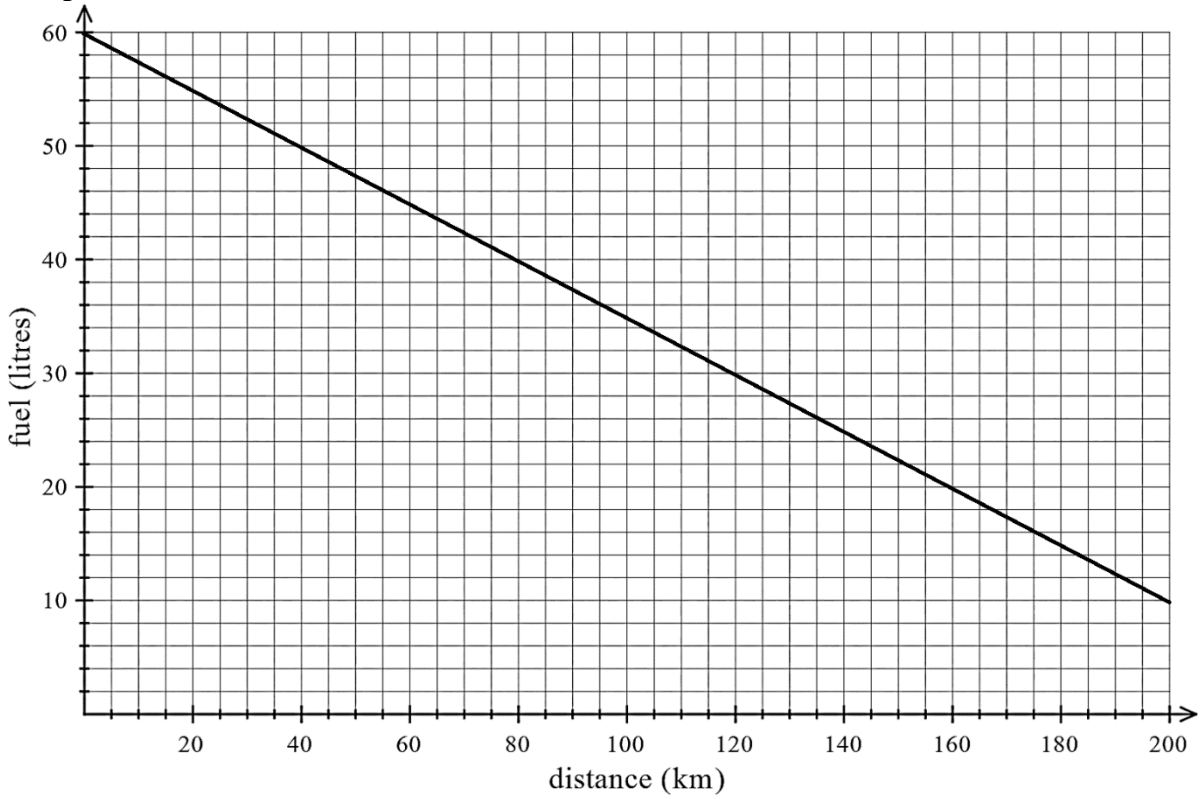
Stopping distance is 102 metres

Question 37

37(a)

Criteria	Mark
• Correct line drawn where it starts at 60 on the vertical axis and goes through (120, 30)	1

Sample answer



37(b)

Criteria	Marks
• Provides correct solution	2
• Correct y-intercept was used, or correct gradient was found, or equivalent merit	1

Sample answer

$y = mx + c$

$c = 60$ *as it is the y-intercept*

$m = \frac{30}{120} = \frac{1}{4}$

Slope is going down, so it is a negative gradient (ie. $m = -\frac{1}{4}$)

Equation of the line is $y = -\frac{1}{4}x + 60$

37(c)

Criteria	Marks
• Provides correct solution	2
• Recognising to substitute $y = 0$ into the equation to find the answer	1

Sample answer

Substitute $y = 0$ *into* $y = -\frac{1}{4}x + 60$

$-\frac{1}{4}x + 60 = 0$

$\frac{1}{4}x = 60$

$x = 240$

Since Ronald has already travelled 120 km, he can travel for another 120 km before the tank is empty.

37(d)

Criteria	Mark
• Provides correct solution	1

Sample answer
Amount of fuel
$= 9 + 4.5 \times 16$
$= 81$ *litres*

Question 38

38(a)

Criteria	Mark
• Provides correct solution	1

Sample answer
Starting point of the parabola $= 30$ m

38(b)

Criteria	Mark
• Provides correct solution	1

Sample answer
Turning point of the parabola $= 60$ m

38(c)

Criteria	Mark
• Provides correct solution	1

Sample answer
Substituting $t = 3.5$ into $h = 30 + 29t - 7t^2$

$h = 30 + 29 \times 3.5 - 7 \times 3.5^2$
$h = 45.75$ m

Question 39

39(a)

Criteria	Marks
• Provides correct solution	2
• Correct internal radius found, or correct internal height found, or equivalent merit	1

Sample answer
Internal radius
$= (4.2 - 0.25 \times 2) \div 2$
$= 3.7 \div 2$
$= 1.85\ m$

Internal height
$= 5.5 - 0.25 \times 2$
$= 5\ m$

39(b)

Criteria	Marks
• Provides correct solution	2
• Calculates the volume of a cylinder, or equivalent merit	1

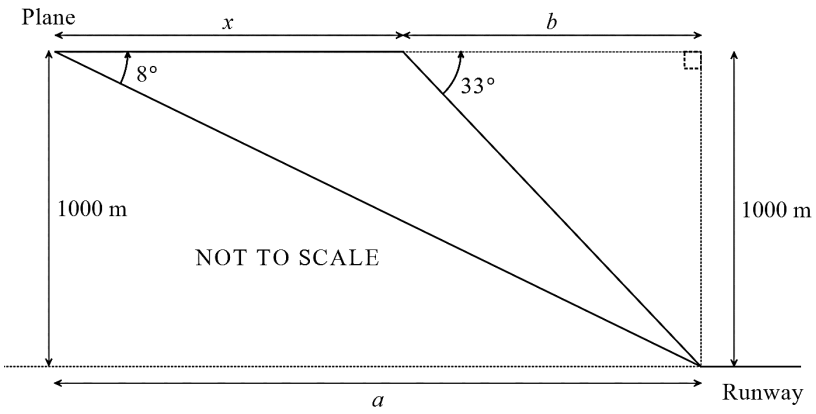
Sample answer
$V = \pi \times 1.85^2 \times 5$
$V = 53.760\ 50428\ m^3$

Capacity
$= 53.76050428 \times 1000$
$= 53\ 761\ L$ *(to the nearest litre)*

Question 40 (a)

Criteria	Marks
• Provides correct solution	1

Sample answer



Question 40 (b)

Criteria	Marks
• Provides correct solution	4
• Calculates the lengths of a and b, or equivalent merit	3
• Demonstrates using trigonometric ratios of right-angled triangles to calculate lengths, or equivalent merit	2
• Stating a and b needs to be found before finding the value of x	1

Sample answer

Let a and b be unknown distances.
Distance that the plane has travelled between sighting is x
Angle of depression = angle of elevation

$$\tan 8 = \frac{1000}{a}$$
$$a = \frac{1000}{\tan 8}$$
$$\tan 33 = \frac{1000}{b}$$
$$b = \frac{1000}{\tan 33}$$

Distance the plane has travelled:

$$x = a - b$$
$$x = \frac{1000}{\tan 8} - \frac{1000}{\tan 33}$$
$$x = 5575.504 \ldots$$
$$x = 5576\ m \text{ (to the nearest metre)}$$