SHORE

School Exam No: | | | |

Set: | |

Year 12
Mathematics Standard 2
Trial HSC Examination
2019

General Instructions

- Reading time – 10 minutes
- Working time – $2\frac{1}{2}$ hours
- Write using black pen
- Questions 1 to 15 will be answered on the multi-choice answer sheet provided
- Questions 16 to 20 will be written in the writing booklets provided
- NESA reference sheet will be provided
- Students are to bring approved scientific calculator and other appropriate equipment.
  No other materials such as class notes, textbooks or any other reference material are permitted

Note: Any time you have remaining should be spent revising your answers.

Total marks – 100

Section I Pages 2 – 8

15 marks

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

Section II Pages 9 – 48

85 marks

- Attempt Questions 16–20
- Allow about 2 hours 5 minutes for this section

DO NOT REMOVE THIS PAPER FROM THE EXAMINATION ROOM

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

Assume 52 weeks in a year, and 365 days in a year, where necessary.

1 Which of the following is the correct simplification of $x + 2y - 3x$?

A. $-2x + 2y$

B. xy

C. $2y$

D. $2y - 4x$

2 Jack collected data with a survey. One of the questions from his survey is shown below.

How good is the camera on your smart phone?

1 – Excellent
2 – Good
3 – Not great
4 – Really bad

What type of data did Jack collect with this question?

A. Numerical continuous.

B. Numerical discrete.

C. Categorical nominal.

D. Categorical ordinal.

3 Which one of the following **cannot** be the probability of an event occurring?

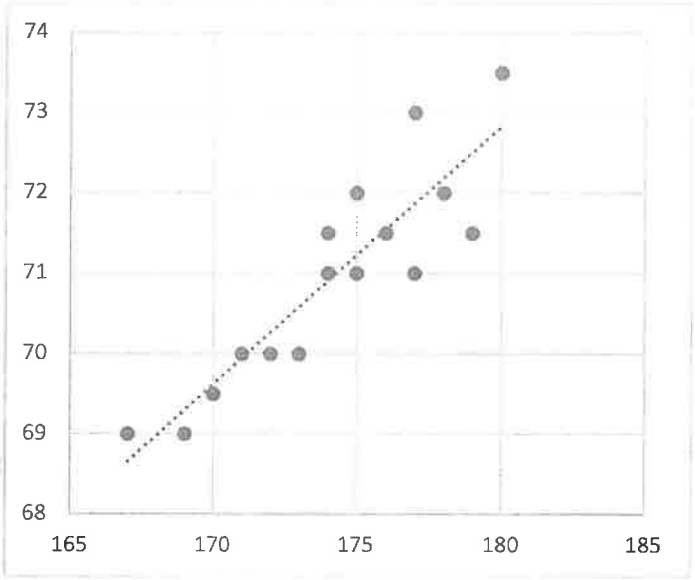
A. 110%

B. $0.\dot{2}$

C. 0.001

D. $\frac{5000}{5001}$

4 Nick created a scatter plot with its trendline, shown below.



Which of the following best describes the correlation of the data in Nick's scatter plot?

A. Weak negative.

B. Weak positive.

C. Strong negative.

D. Strong positive.

5 If $m = 2p - 5$ and $m = 13$, what is the value of p?

A. 4

B. 9

C. 10

D. 18

6 The table shows income tax payable.

Taxable income	Tax on this income
0 - $18,200	Nil
$18,201 - $37,000	19c for each $1 over $18,200
$37,001 - $87,000	$3,572 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

Tom's taxable income is $102 000. What is the tax payable on Tom's income?

A. $5550

B. $19 822

C. $25 372

D. $37 740

7 A set of 6 scores is shown, with one missing value, represented by X. If the **median** is 8, what is the **mean** of the scores?

1, 1, 4, X, 12, 12

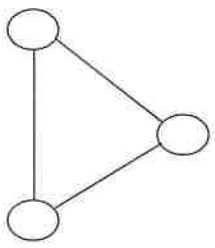
A. $6.3\dot{}$

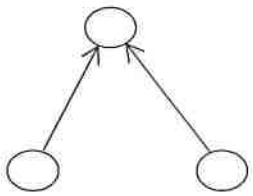
B. 7

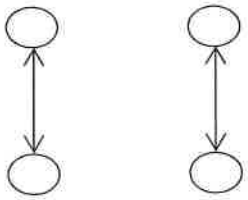
C. 7.5

D. $8.3\dot{}$

8 Which of the following are **not** connected networks?

I 

II 

III 

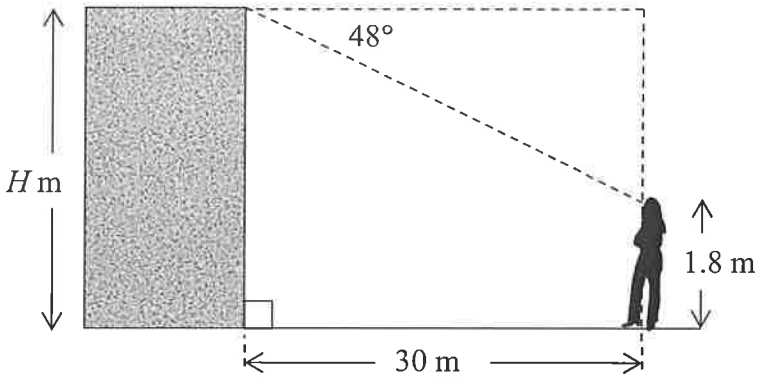
A. II

B. III

C. I and II

D. II and III

9 Sophie is standing 30 metres from a building. The angle of depression from the top of the building to Sophie is 48°.



NOT TO SCALE

If Sophie is 1.8 metres tall, what is the height (H metres) of the building, to the nearest metre?

A. 22 m

B. 24 m

C. 33 m

D. 35 m

10 A taxi company charges a flag fall of \$2 and then \$1.20 per kilometre travelled. They also charge a fee of \$4 to book a taxi in advance. Xavier booked a taxi in advance and travelled a distance of 40 km.

How much was he charged for the trip?

A. \$50

B. \$54

C. \$128

D. \$132

11 Max used his new credit card to buy a set of cutlery costing \$150 on 13th January 2019, and a set of crockery costing \$200 on 15th January. He made no other purchases with his credit card and there was no interest-free period. **Simple interest** was charged daily at a rate of 21.99% per annum, including the date purchased and the date of payment.

What amount did Max pay when he paid the account in full on 4th February 2019?

A. \$350.00

B. \$354.40

C. \$354.61

D. \$354.64

12 Ben bought a new fridge for $1500. It has an energy consumption of 482 kWh per year. Energy is charged at the rate of $0.33/kWh.

How much will it cost in total to purchase and then run this fridge for 4 years?

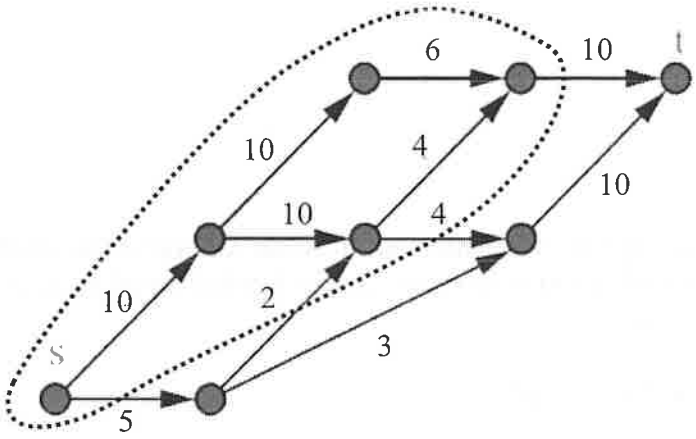
A. $636.24

B. $1659.06

C. $2136.24

D. $6636.24

13 In the network shown, 's' is the source and 't' is the sink. A cut has been made (indicated with the dotted line). What is the capacity of the cut?



A. 15

B. 19

C. 21

D. 24

14 The number of kilojoules burned per kilogram of body mass per 30 minutes when cycling at an average speed of 10 km/h is 9 kJ/kg. Megan weighs 60 kg. She consumes a BigB hash brown which contains 600 kJ.

For how long must Megan cycle at 10 km/h to burn off the energy contained in the hash brown, to the nearest minute?

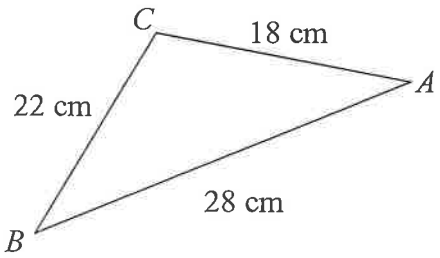
A. 7 minutes

B. 10 minutes

C. 27 minutes

D. 33 minutes

15 What is the size of the angle ABC in the triangle shown, to the nearest degree?



NOT TO SCALE

A. 38°

B. 40°

C. 52°

D. 66°

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SHORE

School Exam No: | | | |

Set: | |

Year 12
Mathematics Standard 2
Trial HSC Examination
2019

Date

Question Number
16

Instructions

- **Complete all boxes** on the front cover of this writing booklet.
- Write using black pen.
- If you need more space, use the extra writing space at the back of this writing booklet.

Section II

75 marks
Attempt Questions 16–20
Allow about 2 hours and 5 minutes for this section

Answer the questions in the spaces provided.

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

Extra writing space is provided at the end of each question booklet. If you use this space, clearly indicate which question you are answering.

Assume 52 weeks in a year, and 365 days in a year where necessary.

Question 16 (17 marks) **Marks**

(a) Angus plays a game with three coins. To win the game he must toss the coins and get 2 heads and 1 tail.

(i) Draw a tree diagram for a single game to find the sample space. **2**

(ii) Use your tree diagram to find the probability that Angus will win a single game. **1**

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Question 16 continues on page 12

(iii) What is the probability that at least one coin will come up tails? **1**

(b) An eight-sided die was rolled 100 times and the results recorded in the table below.

Number obtained	1	2	3	4	5	6	7	8
Frequency	22	21	19	15	12	7	3	1

(i) What is the relative frequency of rolling a 5? **1**

(ii) Describe the distribution of the results (as positively or negatively skewed, or symmetrical). **1**

Question 16 continues on page 12

(c) Jackson collected data on the number of goals his team scored in each of ten games. He recorded the results in a frequency distribution table, shown below.

Goals scored (x)	*f*	*cf*	*fx*
1	4		
2	2		
3	1		
4	3		
TOTAL	10	10	23

(i) Complete the table by filling in the cumulative frequency (*cf*) and *fx* columns. **2**

(ii) Show that the mean is 2.3 goals scored. **1**

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(iii) Find the median number of goals scored. **1**

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(iv) Which of these measures is the best measure (mean or median) of average for this data set? Give a reason for your answer. **1**

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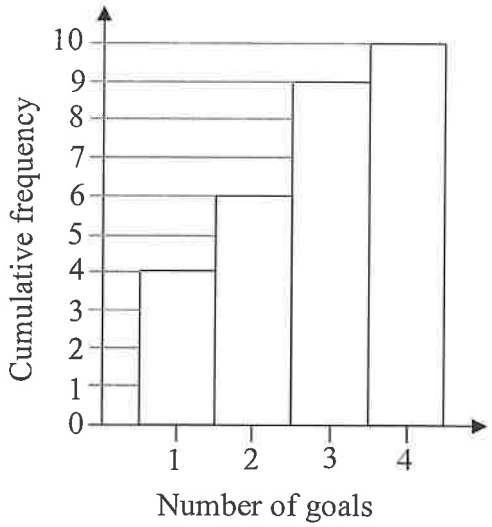
Question 16 continues on page 13

(v) Oliver recorded the results for a second team, using a cumulative frequency histogram, shown below.



(α) What is the range for Oliver's data? **1**

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(β) Draw an ogive on the cumulative frequency histogram and use it to find the median for Oliver's data. **2**

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(vi) Additional statistical measures for the two teams' data are shown in the table. **2**

Team	Standard Deviation	Mean
Jackson's	1.2689	2.3
Oliver's	1.0440	2.1

Based on the table, which team was more consistent, Jackson's or Oliver's? Give a reason for your answer.

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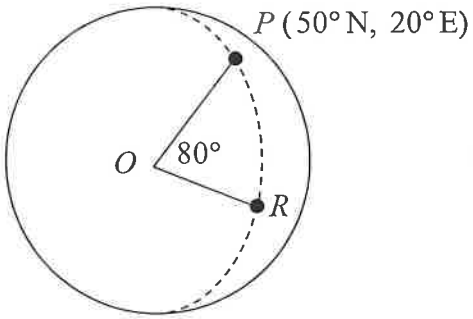
Question 16 continues on page 14

Question 16 (continued)

(d) Cities P and R are on the same longitude. City P is north of city R and the angle at the centre of Earth (O), between P and R is $80°$. **1**



NOT TO SCALE

What is the latitude and longitude of city R?

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End of Question 16

Question 16 Extra writing space
If you use this space, clearly indicate which question you are answering.

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SHORE

School Exam No:

Set:

Year 12
Mathematics Standard 2
Trial HSC Examination
2019

Date

Question Number **17**

Instructions

- **Complete all boxes** on the front cover of this writing booklet.
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Question 17 (17 marks) **Marks**

(a) Josh is interested in two jobs, advertised as shown.

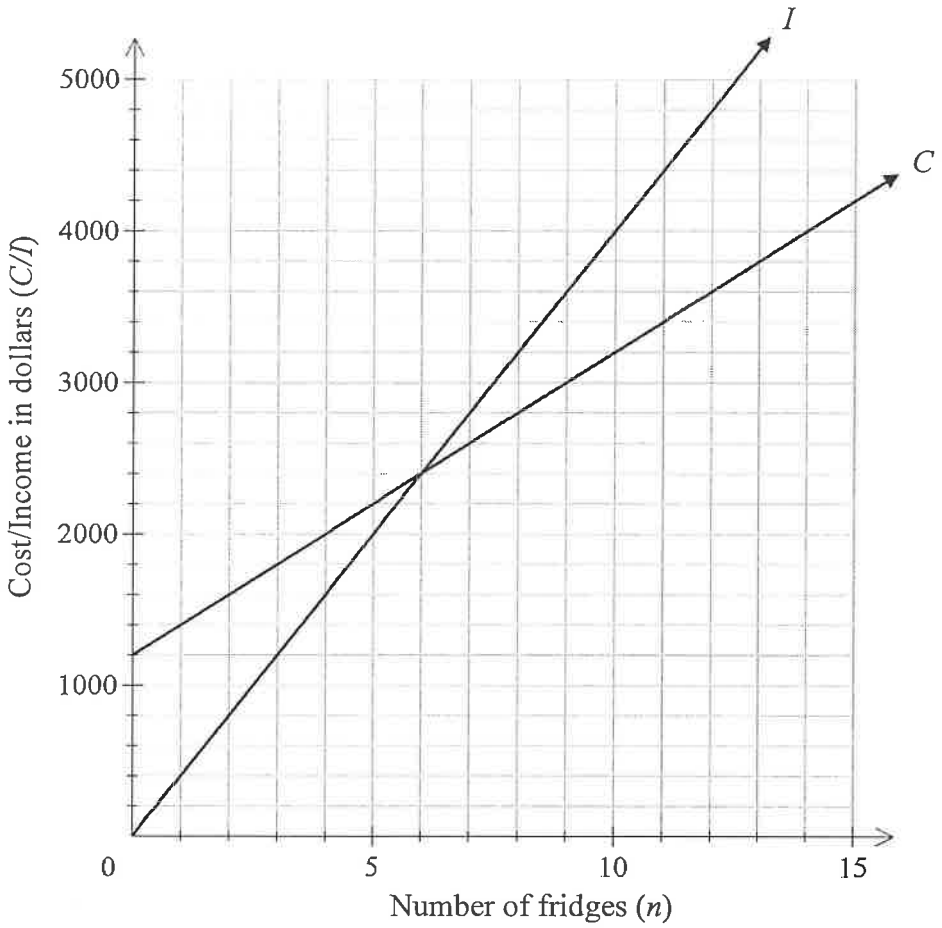
Senior Office Admin 40 hours a week $30 per hour	Lab Technician 40 hours a week $67 200 per annum

(i) What is the Lab Technician's monthly pay, before tax? **1**

(ii) What is the difference in the monthly pay, between these two jobs? Show suitable calculations to justify your answer. **2**

Question 17 continues on page 19

(b) The graphs of cost, C, and income, I, for Fraser's Fridges are displayed on the grid below.



(i) Write the equation for cost, C, when n fridges are made. **2**

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(ii) How many fridges must be sold for Fraser to break even? **1**

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(iii) Fraser sells 11 fridges. **Use the graph** to find how much profit he makes. Indicate how you arrived at your answer on the graph. **2**

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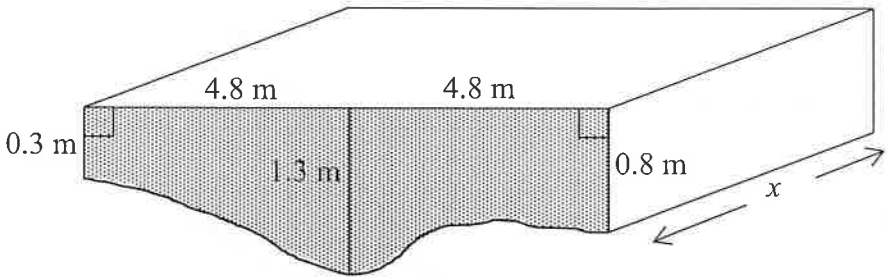
Question 17 continues on page 20

(c) Ethan knows that the dam on his property has a uniform cross section, shaded in the diagram below.



NOT TO SCALE

(i) Use two applications of the trapezoidal rule to show that the area of the cross section is approximately 9 m^2. **2**

(ii) Ethan also knows that when the dam is full, it holds 0.36 Megalitres of water. **3**

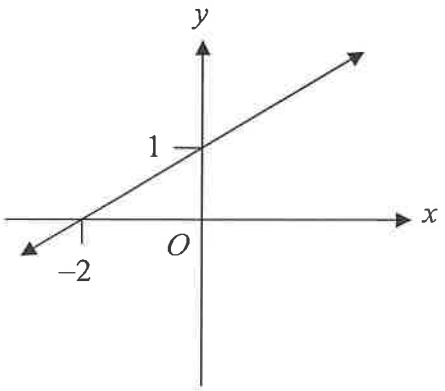
What is the length of the dam (indicated by x in the diagram), in metres?
(Note 1 ML = 1000 kL)

Question 17 continues on page 21

(d) Rearrange the equation to make T the subject. **2**

$$h = \frac{T}{2} + 1$$

(e) Write down the equation of the line shown. **2**



End of Question 17

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SHORE

School Exam No: | | | |

Set: | |

Year 12
Mathematics Standard 2
HSC Trial Examination
2019

Date

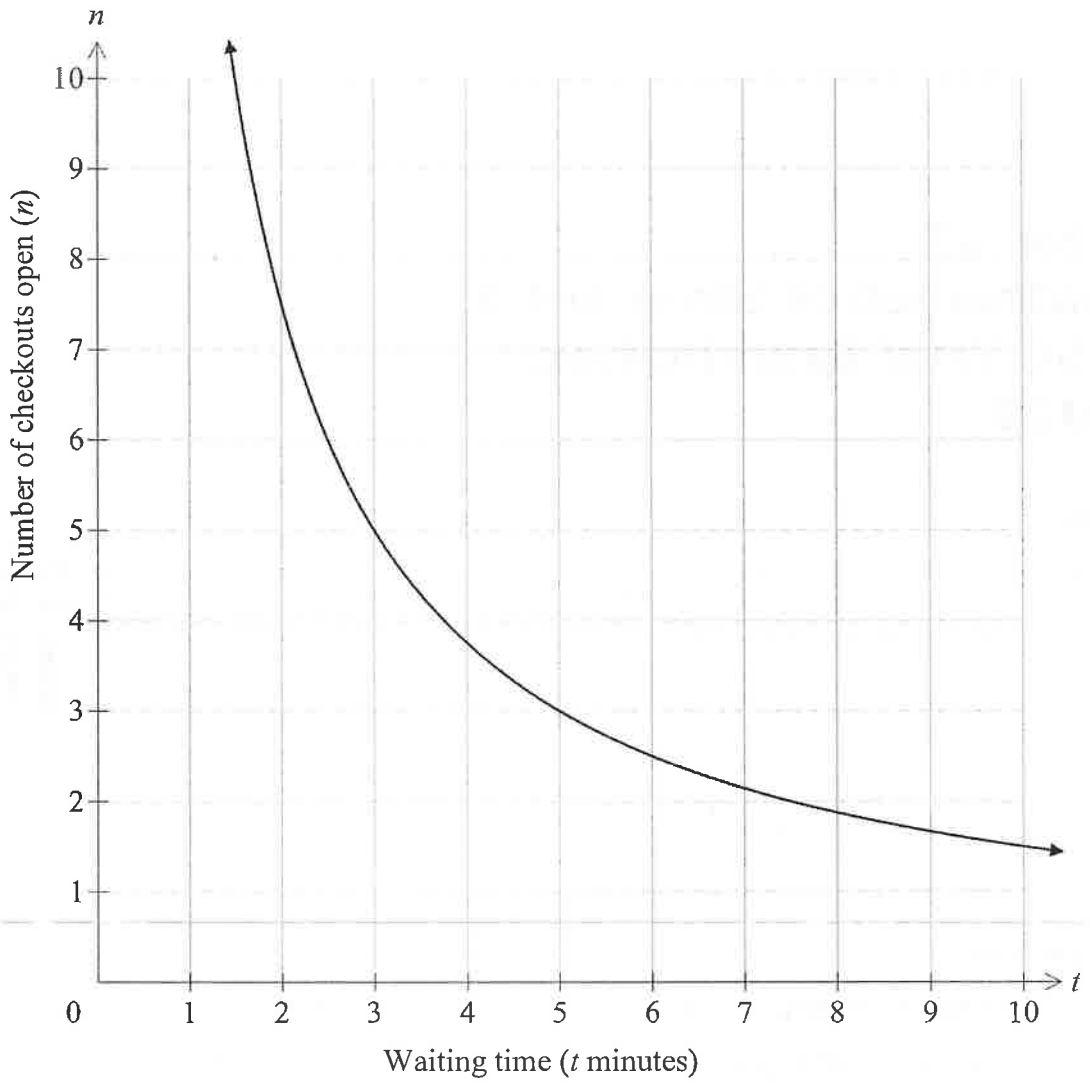
Question Number
18

Instructions

- **Complete all boxes** on the front cover of this writing booklet.
- Write using black pen.
- If you need more space, use the extra writing space at the back of this writing booklet.

Question 18 (17 marks) **Marks**

(a) Millie observes that the number of checkouts (n) which are open in Sam's Supamart is inversely proportional to the waiting time (t minutes) at each checkout. The graph shows the relationship between n and t.



(i) Use the graph to find the waiting time when 3 checkouts are open. **1**

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(ii) Find the equation relating n and t. **2**

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Question 18 continues on page 27

(b) Sarah owns her own clothing company. Her company makes a profit of $200 000 and she distributes 85% of this to her shareholders as a dividend.

(i) If there are 100 000 shares owned by shareholders, what is the dividend on each share? **2**

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(ii) Werner owns 500 shares in Sarah's company. The current share price is $44. What is the dividend yield? Give your answer to one decimal place. **2**

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Question 18 continues on page 28

(c) The weights of boxes of Doggy Bix are normally distributed, with a mean of 1 kg and a standard deviation of 0.012 kg.

(i) What is the weight of a box of Doggy Bix with a z-score of -3? **1**

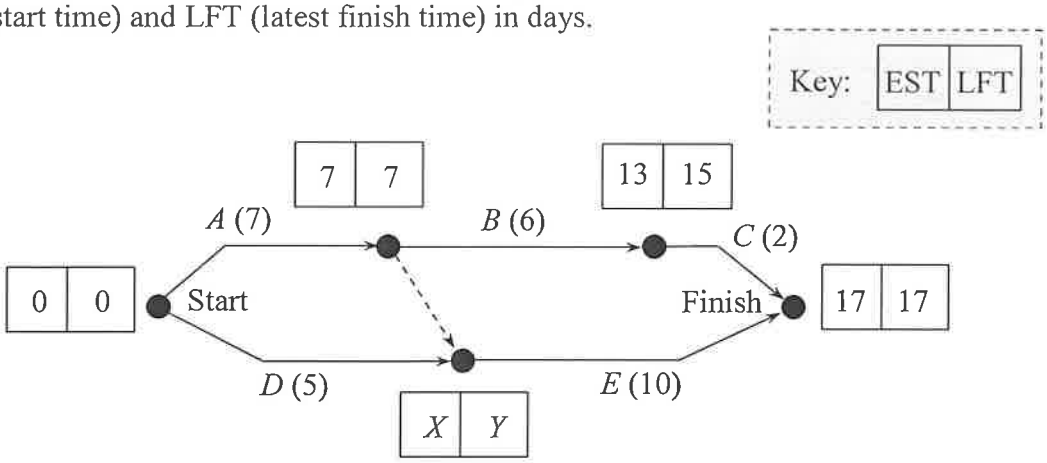
(ii) What will be the z-score of a box of Doggy Bix if it weighs 1.009 kg? **2**

(iii) The probability that a box of Doggy Bix will weigh less than 1.009 kg is 0.77337. **2**

What is the probability that a box of Doggy Bix will weigh between 1 kg and 1.009 kg?

Question 18 continues on page 29

(d) Consider the activity chart for a project, given below, which includes EST (earliest start time) and LFT (latest finish time) in days.



(i) What are the missing values, X and Y? **2**

$X =$ .....

$Y =$ .....

(ii) What is the float time of activity B? **1**

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(iii) What is the critical path? **1**

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(iv) If Activity B took 10 days instead of 6, how many days would it take to finish the project? **1**

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End of Question 18

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SHORE

School Exam No:

Set:

Year 12
Mathematics Standard 2
HSC Trial Examination
2019

Date

Question Number
19

Instructions

- **Complete all boxes** on the front cover of this writing booklet.
- Write using black pen.
- If you need more space, use the extra writing space at the back of this writing booklet.

Question 19 (17 marks) **Marks**

(a) Hamish is looking at two investment options.

Option A is a compound interest investment of $5000 for 10 years at a rate of 3.2% per annum, compounding quarterly.

Option B is an annuity, involving contributions of $1200 per annum for 5 years. The interest rate is 3.5% per annum, compounding annually.

(i) Calculate the future value of Option A. **2**

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(ii) A table of future value interest factors for an annuity of $1 is shown. **2**

Period	Interest rate per period				
	2.5%	3%	3.5%	4%	4.5%
1	1.0000	1.0000	1.0000	1.0000	1.0000
2	2.0250	2.0300	2.0350	2.0400	2.0450
3	3.0756	3.0909	3.1062	3.1216	3.1370
4	4.1525	4.1836	4.2149	4.2465	4.2782
5	5.2563	5.3091	5.3625	5.4163	5.4707
6	6.3877	6.4684	6.5502	6.6330	6.7169

Use the table to find the future value of Option B.

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Question 19 continues on page 35

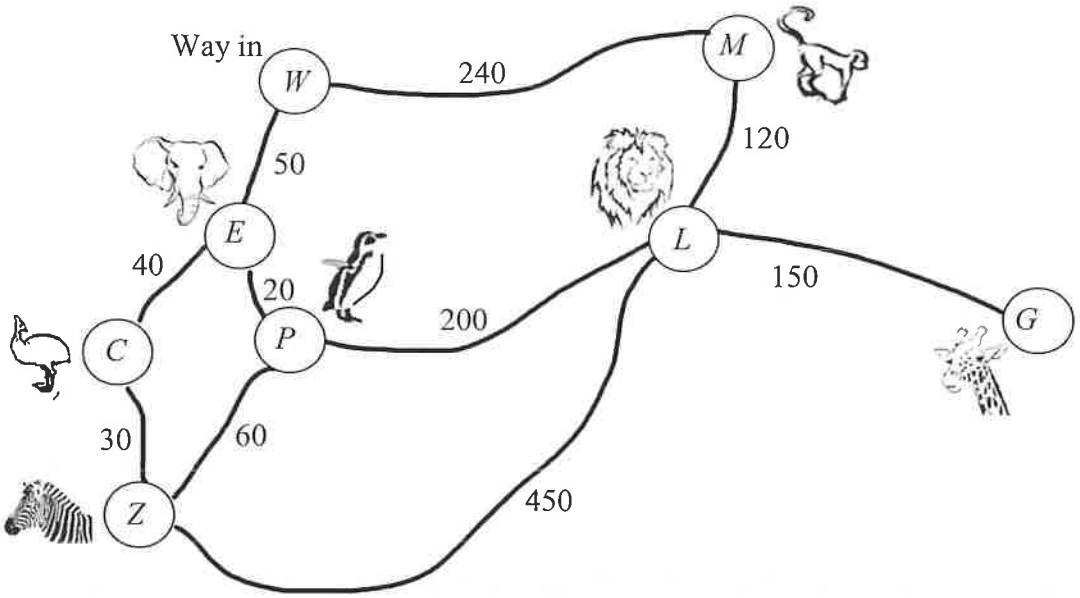
(iii) Which option pays most interest? Show suitable working to justify your answer. **3**

(b) Amanda purchased a rectangular doormat which was advertised as being 60 cm by 90 cm, with each measurement given to the nearest centimetre. **2**

Between what lower and upper limits does the actual area of the doormat lie?

Question 19 continues on page 36

(c) A map of Ziggy's Zoo is shown. Each animal enclosure and the way in are represented with a vertex. The weight on each edge is the distance from vertex to vertex, in metres.



(i) Draw a minimum spanning tree in the space below, with the correct weightings. **2**

Question 19 continues on page 37

(ii) The zoo needs to put in pipes to take sewage away from each animal enclosure. What is the shortest total length of pipe that will be needed to connect all of the animal enclosures (**not including the Way In**)? **1**

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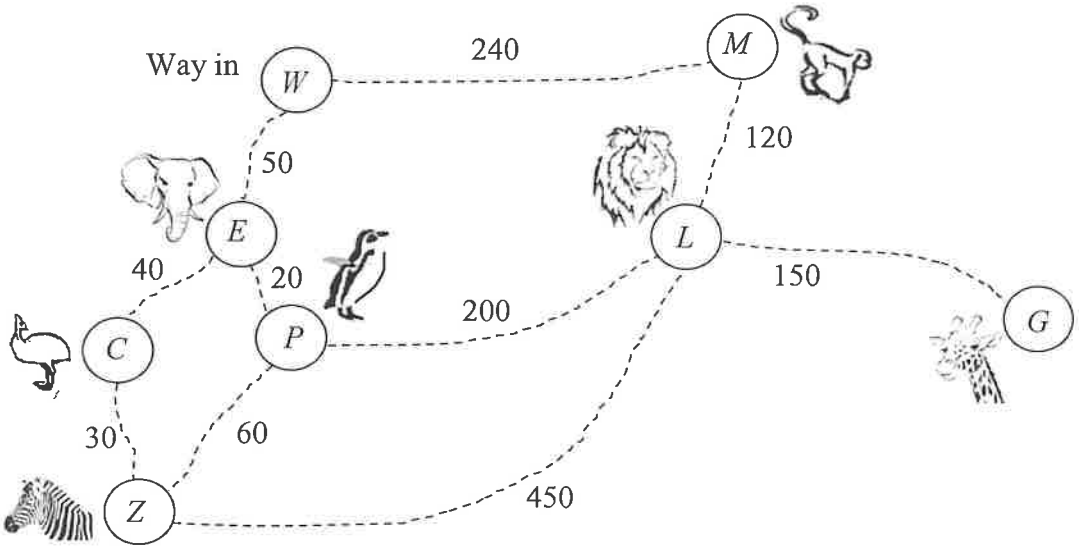
(iii) Find the shortest path from the Monkey enclosure (*M*) to the Zebra enclosure (*Z*). The map of Ziggy's Zoo is redrawn below for your working. **1**



State the shortest path below, using the correct letters.

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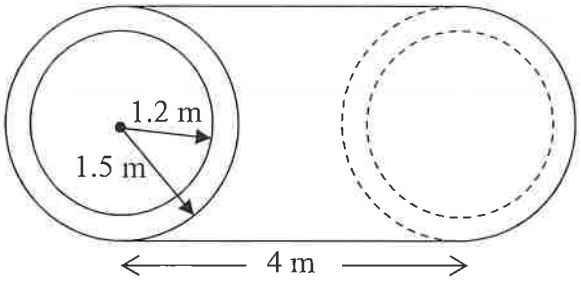
Question 19 continues on page 38

(d) A four-metre length of cylindrical pipe is shown. The outer radius is 1.5 metres and the inner radius is 1.2 metres.



NOT TO SCALE

(i) What **volume** of water can be contained in this pipe, to the nearest cubic metre? **2**

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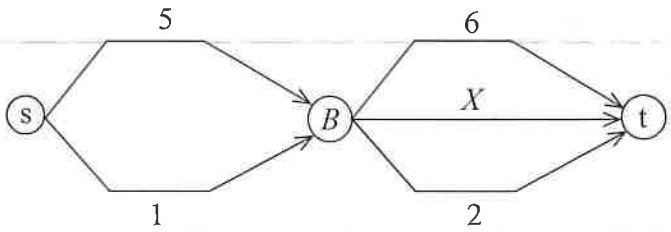
(ii) This four-metre length of pipe is shown in the network diagram below (X), connecting B to the sink (t). Weights on the edges are the volume of water each pipe can carry, in cubic metres.



(α) What is the flow capacity of the current network? **1**

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(β) In order to maximise the flow in this network, one more pipe is to be added between the source (s) and B. What must this pipe's capacity be, in cubic metres? **1**

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End of Question 19

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Question Number
20

Instructions

- **Complete all boxes** on the front cover of this writing booklet.
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Question 20 (17 marks) **Marks**

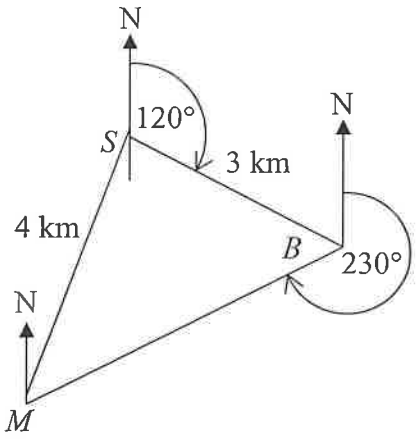
(a) George took a flight from Vancouver to Bermuda, where the time is 4 hours ahead of the time in Vancouver. His flight left Vancouver on a Thursday at 11.00 pm (Vancouver time), stopped for 3 hours in Toronto, and arrived in Bermuda at 1.15 pm (Bermuda time) on Friday.

(i) What was the plane's total flying time? Give your answer in hours and minutes. **3**

(ii) When George arrived in Bermuda, he called his friend Will to tell him he had arrived safely. If it was 2 pm on Friday in Bermuda, what was the day and time in Vancouver, when George rang Will? **1**

Question 20 continues on page 43

(b) Yachts in a race must sail 3 km from the start (S), on a bearing of 120° to a buoy (B), and then on a bearing of 230° to a marker (M), before sailing 4 km to return to the start. The race course is shown below.



NOT TO SCALE

(i) Show that $\angle SBM$ is 70°. **1**

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(ii) On what bearing must yachts sail for the final leg (MS) of the race? **3**

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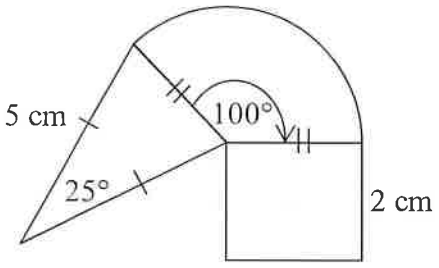
Question 20 continues on page 44

Question 20 (continued)

(c) Hazel owns her own company, called Duck Doonas. She designs a logo with a sector of a circle, an isosceles triangle and a rectangle, as shown.



NOT TO SCALE

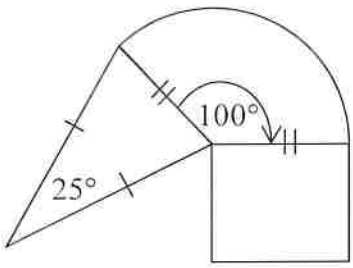
(i) Show that the radius of the sector is 2.2 cm, to one decimal place. **2**

(ii) What is the total area of the logo, to the nearest square centimetre? **4**

Question 20 continues on page 45

Question 20 (continued)

(iii) Hazel is going to print the logo on her letter writing paper, but wants the measurements reduced to a scale of 1 : 2. The logo is drawn below. **3**



NOT TO SCALE

What will be the **perimeter** of the scaled down logo on her letterhead, to the nearest centimetre?

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End of Paper ☺

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SHORE

School Exam No: | | | |

Set: | |

Year 12
Mathematics Standard 2
Trial HSC Examination
2019

General Instructions

- Reading time – 10 minutes
- Working time – $2\frac{1}{2}$ hours
- Write using black pen
- Questions 1 to 15 will be answered on the multi-choice answer sheet provided
- Questions 16 to 20 will be written in the writing booklets provided
- NESA reference sheet will be provided
- Students are to bring approved scientific calculator and other appropriate equipment.
  No other materials such as class notes, textbooks or any other reference material are permitted

Note: Any time you have remaining should be spent revising your answers.

Total marks – 100

Section I Pages 2 – 8

15 marks

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

Section II Pages 9 – 48

85 marks

- Attempt Questions 16–20
- Allow about 2 hours 5 minutes for this section

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

DO NOT REMOVE THIS PAPER FROM THE EXAMINATION ROOM

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

Assume 52 weeks in a year, and 365 days in a year, where necessary.

1 Which of the following is the correct simplification of $x + 2y - 3x$?

A. $-2x + 2y$
B. xy
C. $2y$
D. $2y - 4x$

2 Jack collected data with a survey. One of the questions from his survey is shown below.

How good is the camera on your smart phone?

1 – Excellent
2 – Good
3 – Not great
4 – Really bad

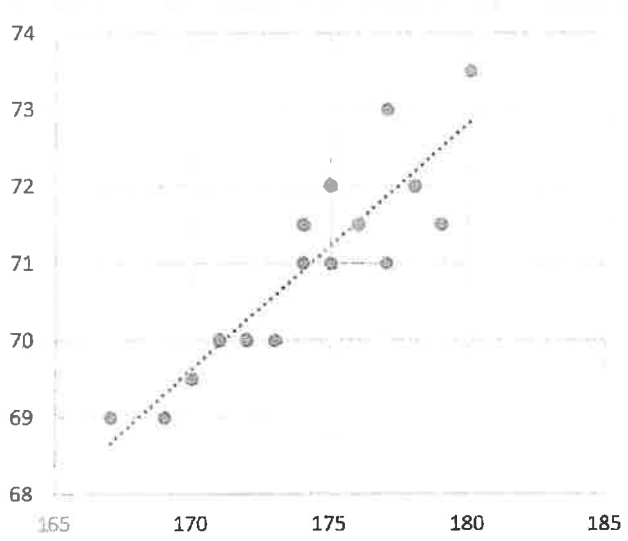
What type of data did Jack collect with this question?

A. Numerical continuous.
B. Numerical discrete.
C. Categorical nominal.
D. Categorical ordinal.

3 Which one of the following **cannot** be the probability of an event occurring?

A. 110%
B. $0.\dot{2}$
C. 0.001
D. $\frac{5000}{5001}$

4 Nick created a scatter plot with its trendline, shown below.



Which of the following best describes the correlation of the data in Nick's scatter plot?

A. Weak negative.
B. Weak positive.
C. Strong negative.
D. Strong positive.

5 If $m = 2p - 5$ and $m = 13$, what is the value of p?

A. 4
B. 9
C. 10
D. 18

$M = 2p - 5$
$13 = 2p - 5$
$2p = 18$
$p = 9$

6 The table shows income tax payable.

Taxable income	Tax on this income
0 - $18,200	Nil
$18,201 - $37,000	19c for each $1 over $18,200
$37,001 - $87,000	$3,572 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

Tom's taxable income is $102 000. What is the tax payable on Tom's income?

A. $5550

B. $19 822

C. $25 372

D. $37 740

7 A set of 6 scores is shown, with one missing value, represented by X. If the **median** is 8, what is the **mean** of the scores?

1, 1, 4, X, 12, 12

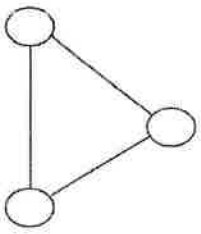
A. $6.\dot{3}$

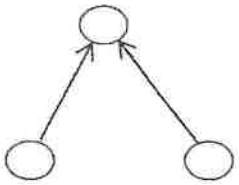
B. 7

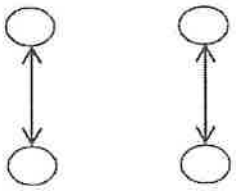
C. 7.5

D. $8.\dot{3}$

8 Which of the following are **not** connected networks?

I 

II 

III 

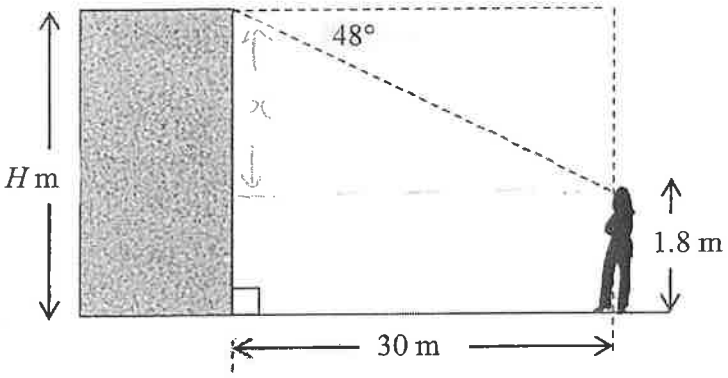
A. II

B. III

C. I and II

D. II and III

9 Sophie is standing 30 metres from a building. The angle of depression from the top of the building to Sophie is 48°.



NOT TO SCALE

If Sophie is 1.8 metres tall, what is the height (H metres) of the building, to the nearest metre?

A. 22 m

B. 24 m

C. 33 m

D. 35 m

10 A taxi company charges a flag fall of $2 and then $1.20 per kilometre travelled. They also charge a fee of $4 to book a taxi in advance. Xavier booked a taxi in advance and travelled a distance of 40 km.

How much was he charged for the trip?

A. $50

B. $54

C. $128

D. $132

11 Max used his new credit card to buy a set of cutlery costing $150 on 13th January 2019, and a set of crockery costing $200 on 15th January. He made no other purchases with his credit card and there was no interest-free period. **Simple interest** was charged daily at a rate of 21.99% per annum, including the date purchased and the date of payment.

What amount did Max pay when he paid the account in full on 4th February 2019?

A. $350.00

B. $354.40

C. $354.61

D. $354.64

12 Ben bought a new fridge for $1500. It has an energy consumption of 482 kWh per year. Energy is charged at the rate of $0.33/kWh.

How much will it cost in total to purchase and then run this fridge for 4 years?

A. $636.24

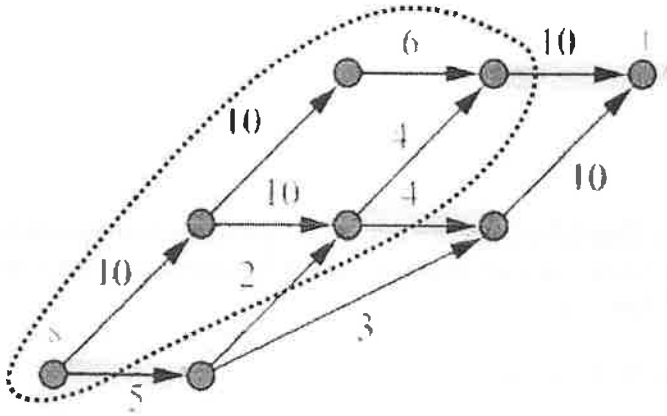
B. $1659.06

C. $2136.24

D. $6636.24

cost = 1500 + 482 × 4 × 0.33
= $2136.24

13 In the network shown, 's' is the source and 't' is the sink. A cut has been made (indicated with the dotted line). What is the capacity of the cut?



A. 15

B. 19

C. 21

D. 24

Capacity = 5 + 4 + 10
= 19

14 The number of kilojoules burned per kilogram of body mass per 30 minutes when cycling at an average speed of 10 km/h is 9 kJ/kg. Megan weighs 60 kg. She consumes a BigB hash brown which contains 600 kJ.

For how long must Megan cycle at 10 km/h to burn off the energy contained in the hash brown, to the nearest minute?

A. 7 minutes

B. 10 minutes

C. 27 minutes

D. 33 minutes

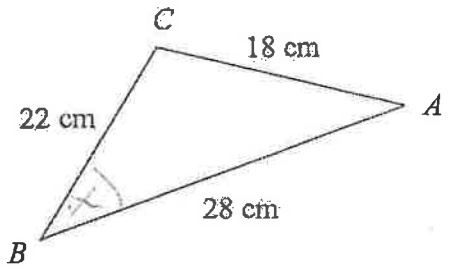
$kJ = 9 \times 60$

$= 540 \text{ kJ} / 30 \text{ min}$

$\text{time} = \frac{600}{540}$

$= 33.\dot{3} \text{ min}$

15 What is the size of the angle ABC in the triangle shown, to the nearest degree?



NOT TO SCALE

A. 38°

B. 40°

C. 52°

D. 66°

$\cos H = \frac{b^2 + c^2 - a^2}{2bc}$

$x = \cos^{-1}\left(\frac{22^2 + 28^2 - 18^2}{2 \times 22 \times 28}\right)$

$= 39.95\ldots^\circ$

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SHORE

School Exam No: | | | |

Set: | |

Year 12
Mathematics Standard 2
Trial HSC Examination
2019

Date

Question Number
16

Instructions

- **Complete all boxes** on the front cover of this writing booklet.
- Write using black pen.
- If you need more space, use the extra writing space at the back of this writing booklet.

Section II

75 marks
Attempt Questions 16–20
Allow about 2 hours and 5 minutes for this section

Answer the questions in the spaces provided.

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

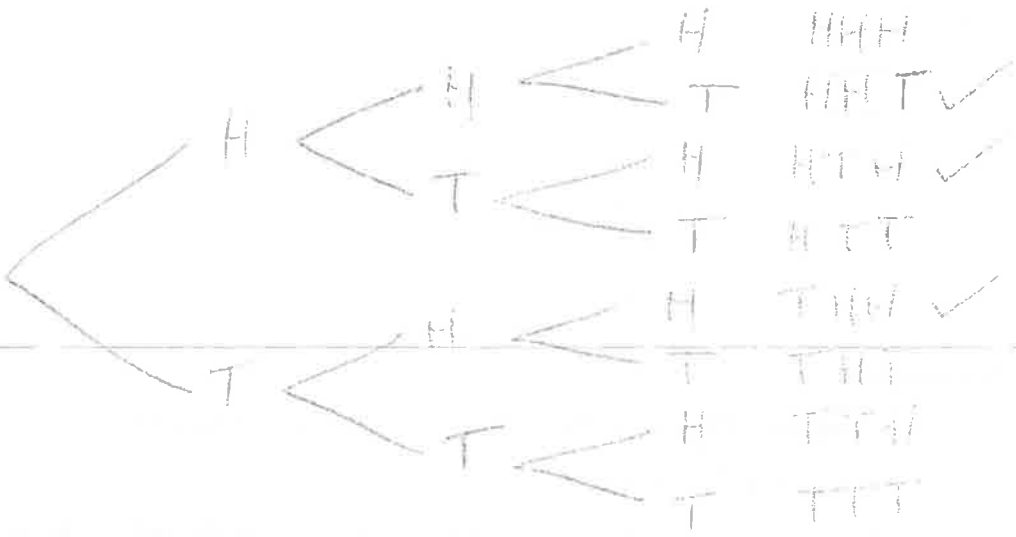
Extra writing space is provided at the end of each question booklet. If you use this space, clearly indicate which question you are answering.

Assume 52 weeks in a year, and 365 days in a year where necessary.

Question 16 (17 marks) **Marks**

(a) Angus plays a game with three coins. To win the game he must toss the coins and get 2 heads and 1 tail.

(i) Draw a tree diagram for a single game to find the sample space. **2**



(ii) Use your tree diagram to find the probability that Angus will win a single game. **1**

$P(\text{win}) = \frac{3}{8}$

Question 16 continues on page 12

Question 16 (continued)

(iii) What is the probability that at least one coin will come up tails? 1

P(at least one T) = 1 − P(HHH)

$= 1 - \frac{1}{8}$

$= \frac{7}{8}$

(b) An eight sided die was rolled 100 times and the results recorded in the table below.

Number obtained	1	2	3	4	5	6	7	8
Frequency	22	21	19	15	12	7	3	1

i) What is the relative frequency of rolling a 5? 1

rel freq $= \frac{12}{100}$

$= \frac{3}{25}$

ii) Describe the distribution of the results (as positively or negatively skewed, or symmetrical). 1

positively skewed

Question 16 continues on page 12

Question 16 (continued)

(c) Jackson collected data on the number of goals his team scored in each of ten games. He recorded the results in a frequency distribution table, shown below.

Goals scored (x)	***f***	***cf***	***fx***
1	4	4	4
2	2	6	4
3	1	7	3
4	3	10	12
TOTAL	10	10	23

(i) Complete the table by filling in the cumulative frequency (*cf*) and *fx* columns. **2**

(ii) Show that the mean is 2.3 goals scored. **1**

$\bar{x} = \frac{23}{10}$

$= 2.3$

(iii) Find the median number of goals scored. **1**

2

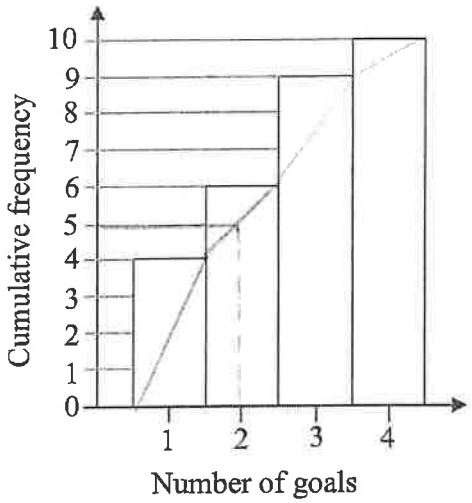
(iv) Which of these measures is the best measure (mean or median) of average for this data set? Give a reason for your answer. **1**

The mean is best measure as there are no outliers and the mean uses all of the scores

Question 16 continues on page 13

Question 16 (continued)

(v) Oliver recorded the results for a second team, using a cumulative frequency histogram, shown below.



(α) What is the range for Oliver's data? **1**

range = 4 − 1

= 3

(β) Draw an ogive on the cumulative frequency histogram and use it to find the median for Oliver's data. **2**

2

(vi) Additional statistical measures for the two teams' data are shown in the table. **2**

Team	Standard Deviation	Mean
Jackson's	1.2689	2.3
Oliver's	1.0440	2.1

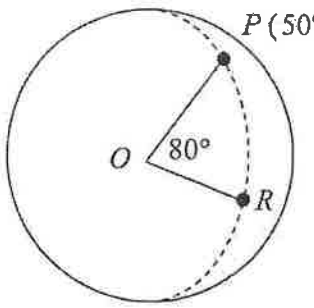
Based on the table, which team was more consistent, Jackson's or Oliver's? Give a reason for your answer.

Oliver's team, as the standard deviation is lower

Question 16 continues on page 14

Question 16 (continued)

(d) Cities P and R are on the same longitude. City P is north of city R and the angle at the centre of Earth (O), between P and R is 80°. **1**



NOT TO SCALE

What is the latitude and longitude of city R?

(30° S, 20° E)

End of Question 16

SHORE

School Exam No: | | | |

Set: | |

Year 12
Mathematics Standard 2
Trial HSC Examination
2019

Date

Question Number
17

Instructions

- **Complete all boxes** on the front cover of this writing booklet.
- Write using black pen.
- If you need more space, use the extra writing space at the back of this writing booklet.

Question 17 (17 marks) **Marks**

(a) Josh is interested in two jobs, advertised as shown.

Senior Office Admin	Lab Technician
40 hours a week	40 hours a week
$30 per hour	$67 200 per annum

(i) What is the Lab Technician's monthly pay, before tax? **1**

Lab tech pay = 67 200 / 12

= $5600

(ii) What is the difference in the monthly pay, between these two jobs? Show suitable calculations to justify your answer. **2**

Senior Admin monthly = 40 × 30 × 52 / 12

= $5200 / month

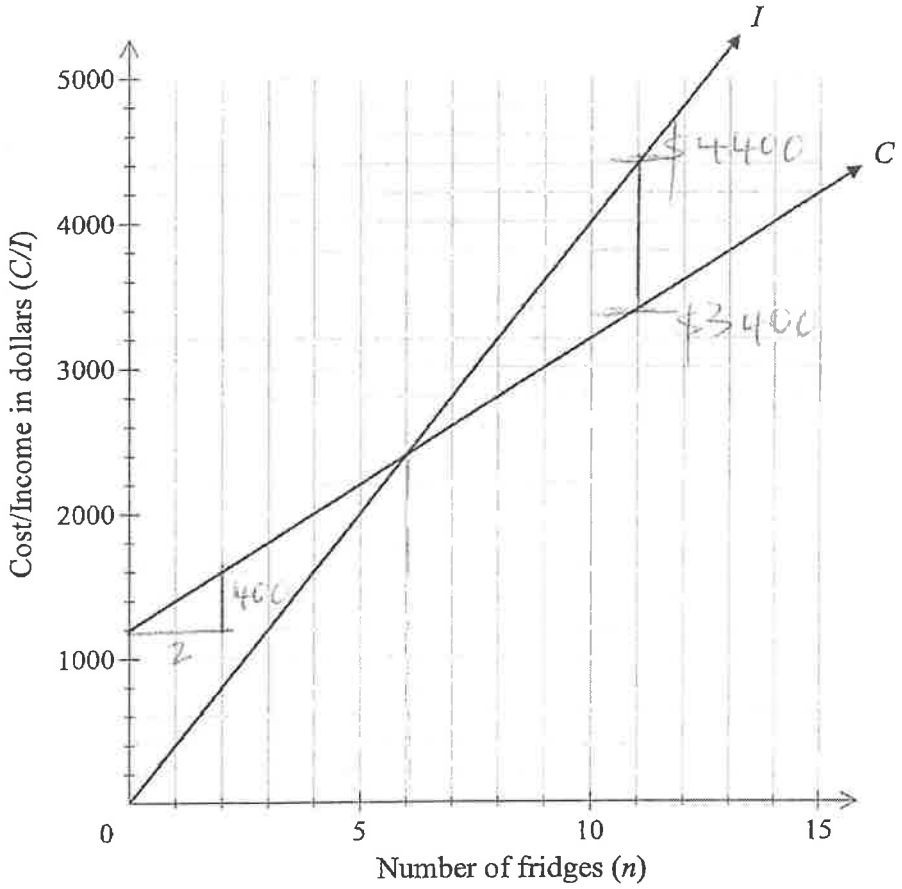
difference = 5600 − 5200

= $400

Question 17 continues on page 19

Question 17 (continued)

(b) The graphs of cost, C, and income, I, for Fraser's Fridges are displayed on the grid below.



(i) Write the equation for cost, C, when n fridges are made. **2**

$C = 1200 + 200n$

(ii) How many fridges must be sold for Fraser to break even? **1**

6

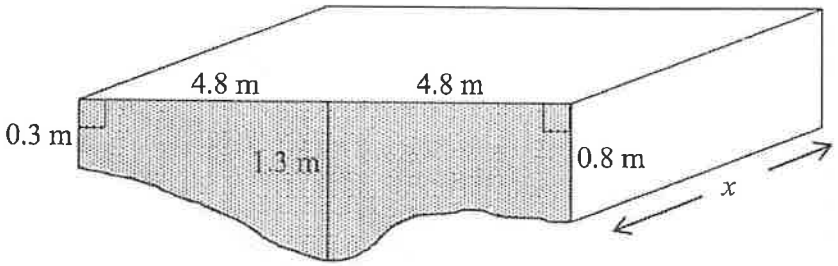
(iii) Fraser sells 11 fridges. Use the graph to find how much profit he makes. **2**
Indicate how you arrived at your answer on the graph.

Profit = $4400 - $3400
= $1000

Question 17 continues on page 20

Question 17 (continued)

(c) Ethan knows that the dam on his property has a uniform cross section, shaded in the diagram below.



NOT TO SCALE

(i) Use two applications of the trapezoidal rule to show that the area of the cross section is approximately 9 m^2. **2**

$A = \frac{h}{2}(d_1 + d_3)$

$= \frac{4.8}{2}(0.3 + 1.3 + 1.3 + 0.8)$

$= 8.88$

$= 9\ m^2$

(ii) Ethan also knows that when the dam is full, it holds 0.36 Megalitres of water. **3**

What is the length of the dam (indicated by x in the diagram), in metres?
(Note 1 ML = 1000 kL)

$0.36\ ML = 360\ kL$

$V = Ax$

$360 = 9x$

$x = \frac{360}{9}$

$= 40\ m$

Question 17 continues on page 21

Question 17 (continued)

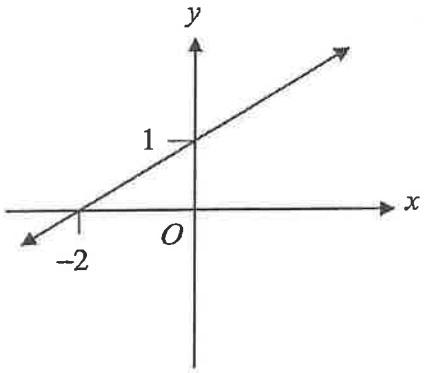
(d) Rearrange the equation to make T the subject. **2**

$$h = \frac{T}{2} + 1$$

$h - 1 = \frac{T}{2}$

$T = 2h - 2$

(e) Write down the equation of the line shown. **2**



$y = \frac{1}{2}x + 1$

End of Question 17

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School Exam No: | | | |

Set: | |

Year 12
Mathematics Standard 2
HSC Trial Examination
2019

Date

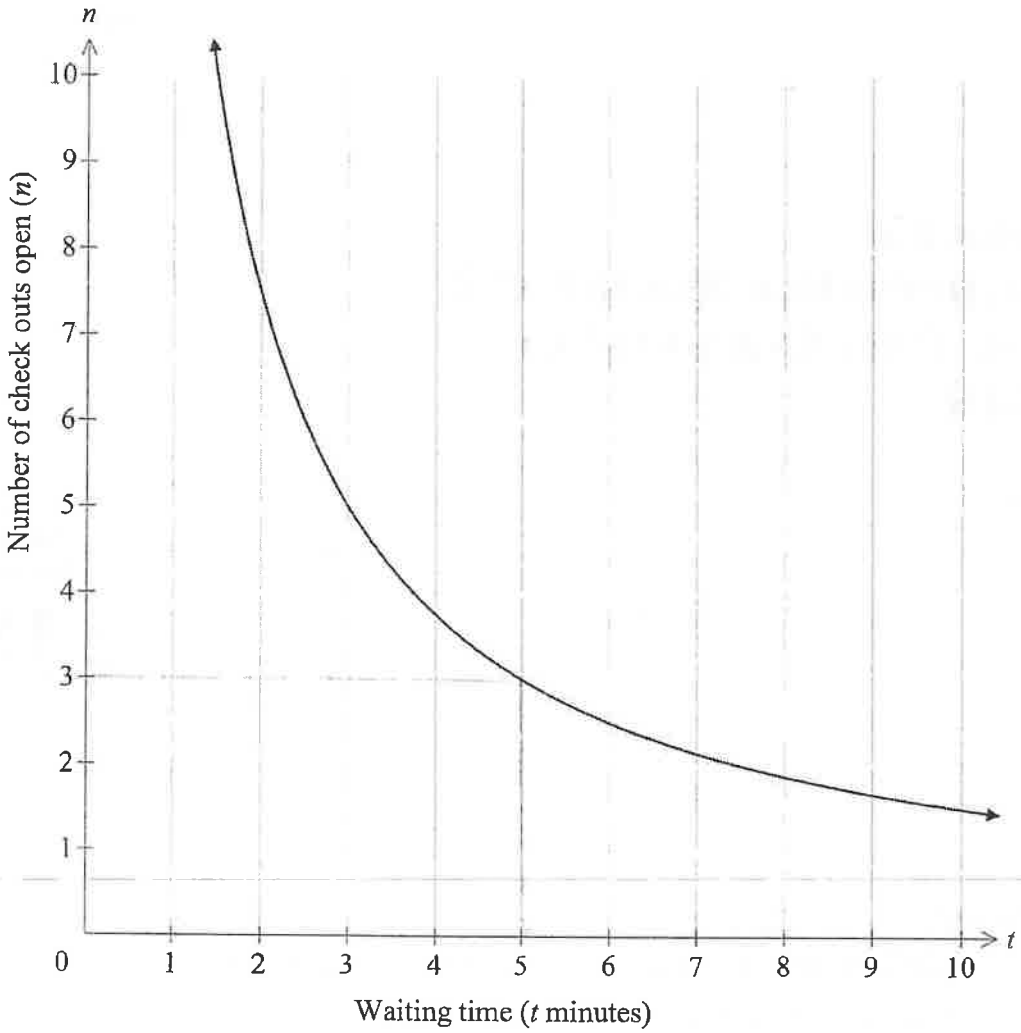
Question Number
18

Instructions

- **Complete all boxes** on the front cover of this writing booklet.
- Write using black pen.
- If you need more space, use the extra writing space at the back of this writing booklet.

Question 18 (17 marks) **Marks**

(a) Millie observes that the waiting time (t minutes) at each checkout in Sam's Supamart is inversely proportional to the number of checkouts (n) which are open. The graph shows the relationship between t and n.



(i) Use the graph to find the waiting time when 3 checkouts are open. **1**

5 minutes

(ii) Find the equation relating n and t. **2**

$n = \frac{k}{t}$

$3 = \frac{k}{5}$

$k = 15$ ✓ equation ✓

$n = \frac{15}{t}$

Question 18 continues on page 27

(b) Sarah owns her own clothing company. Her company makes a profit of $200 000 and she distributes 85% of this to her shareholders as a dividend.

(i) If there are 100 000 shares owned by shareholders, what is the dividend on each share? **2**

$$\text{div} = \frac{200\,000 \times 0.85}{100\,000}$$

$$= \$1.70$$

(ii) Werner owns 500 shares in Sarah's company. The current share price is $44. What is the dividend yield? Give your answer to one decimal place. **2**

$$\text{div. yield} = \frac{1.70}{44} \times 100\%$$

$$= 3.863\ldots$$

$$\doteq 3.9\%$$

Question 18 continues on page 28

(c) The weights of boxes of Doggy Bix are normally distributed, with a mean of 1 kg and a standard deviation of 0.012 kg.

(i) What is the weight of a box of Doggy Bix with a z-score of -3? **1**

$z = \frac{x - \bar{x}}{s}$ OR Weight $= 1000 - 3 \times 12$

$-3 = \frac{x - 1}{0.012}$ $= 964$ g

$-0.036 = x - 1$

$x = 1 - 0.036$

$= 0.964$ kg

(ii) What will be the z-score of a box of Doggy Bix if it weighs 1.009 kg? **2**

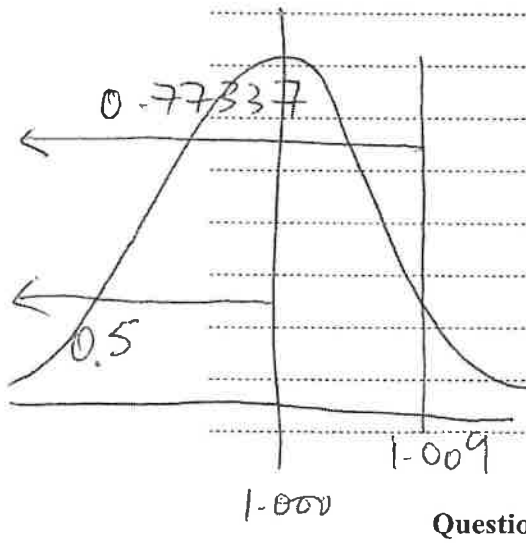
$z = \frac{x - \bar{x}}{s}$

$= \frac{1.009 - 1}{0.012}$

$= 0.75$

(iii) The probability that a box of Doggy Bix will weigh less than 1.009 kg is 0.77337. **2**

What is the probability that a box of Doggy Bix will weigh between 1 kg and 1.009 kg?

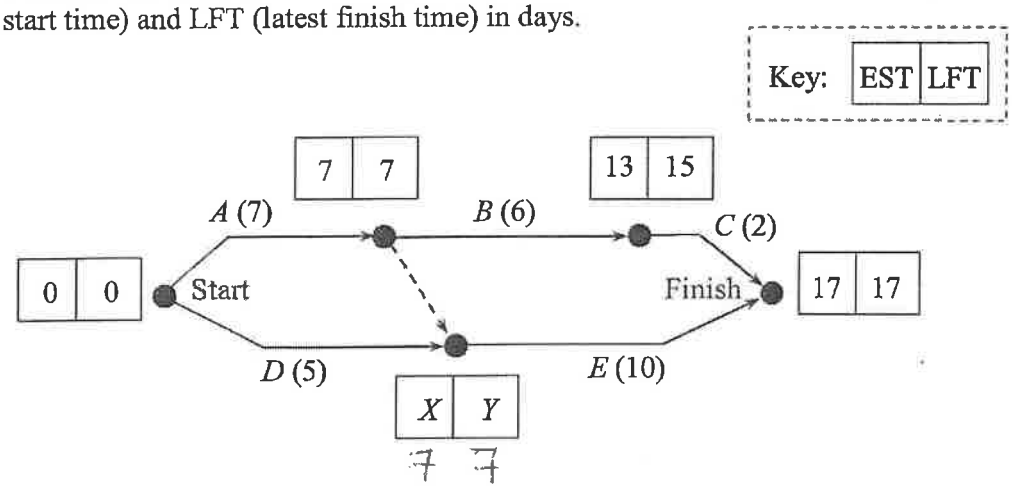


$P(1 < x < 1.009) = 0.77337 - 0.5$

$= 0.27337$

Question 18 continues on page 29

(d) Consider the activity chart for a project, given below, which includes EST (earliest start time) and LFT (latest finish time) in days.



(i) What are the missing values, X and Y? **2**

$X =$ 7

$Y =$ 7

(ii) What is the float time of activity B? **1**

float = 15 − 13

= 2 days.

(iii) What is the critical path? **1**

A E

(iv) If Activity B took 10 days instead of 6, how many days would it take to finish the project? **1**

19 days.

End of Question 18

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School Exam No:

Set:

Year 12
Mathematics Standard 2
HSC Trial Examination
2019

Date

Question Number
19

Instructions

- **Complete all boxes** on the front cover of this writing booklet.
- Write using black pen.
- If you need more space, use the extra writing space at the back of this writing booklet.

Question 19 (17 marks) **Marks**

(a) Hamish is looking at two investment options.

Option A is a compound interest investment of \$5000 for 10 years at a rate of 3.2% per annum, compounding quarterly.

Option B is an annuity, involving contributions of \$1200 per annum for 5 years. The interest rate is 3.5% per annum, compounding annually.

(i) Calculate the future value of Option A. **2**

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

$= 5000\left(1+\frac{0.032}{4}\right)^{40}$

$= 6576.877$

$= \$6876.58$

(ii) A table of future value interest factors for an annuity of \$1 is shown. **2**

Period	Interest rate per period				
	2.5%	3%	3.5%	4%	4.5%
1	1.0000	1.0000	1.0000	1.0000	1.0000
2	2.0250	2.0300	2.0350	2.0400	2.0450
3	3.0756	3.0909	3.1062	3.1216	3.1370
4	4.1525	4.1836	4.2149	4.2465	4.2782
5	5.2563	5.3091	5.3625	5.4163	5.4707
6	6.3877	6.4684	6.5502	6.6330	6.7169

Use the table to find the future value of Option B.

$FVA = FVIF \times c$

$= 5.3625 \times 1200$

$= \$6435$

Question 19 continues on page 35

Question 19 (continued)

(iii) Which option pays most interest? Show suitable working to justify your answer. 3

Option A $I = 6876.55 - 5000$
$= \$1876.55$

Option B $I = 6435 - (5 \times 1200)$
$= \$435$

∴ Option A pays more interest
$(1876.55 > 435)$

(b) Amanda purchased a rectangular doormat which was advertised as being 60 cm by 90 cm, with each measurement given to the nearest centimetre. 2

Between what lower and upper limits does the actual area of the doormat lie?

$A_{ll} = 60.5 \times 90.5$
$= 5475.25 \text{ cm}^2$

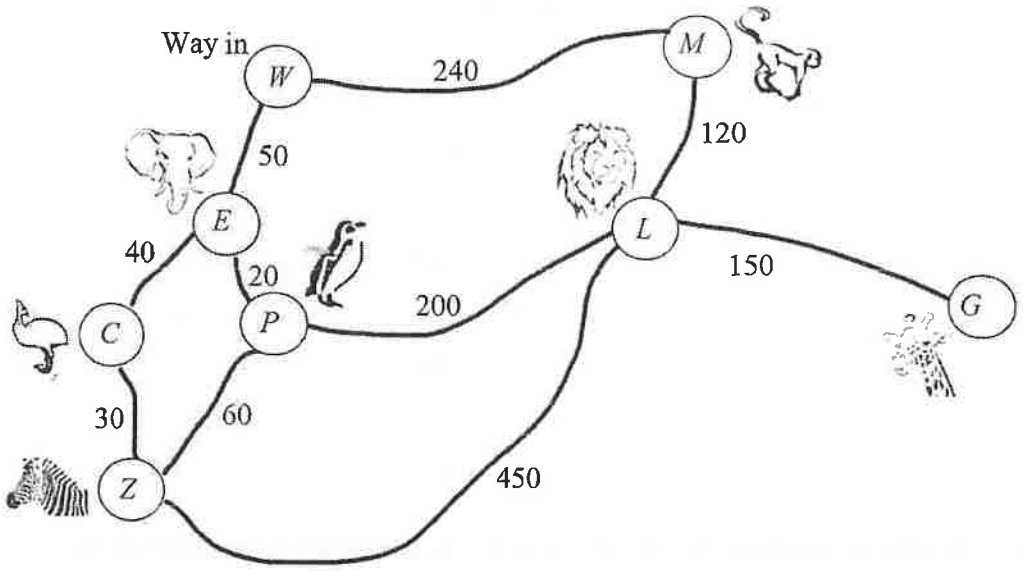
$A_{ll} = 59.5 \times 89.5$
$= 5325.25 \text{ cm}^2$

Limits are 5325.25 cm^2 and 5475.25 cm^2

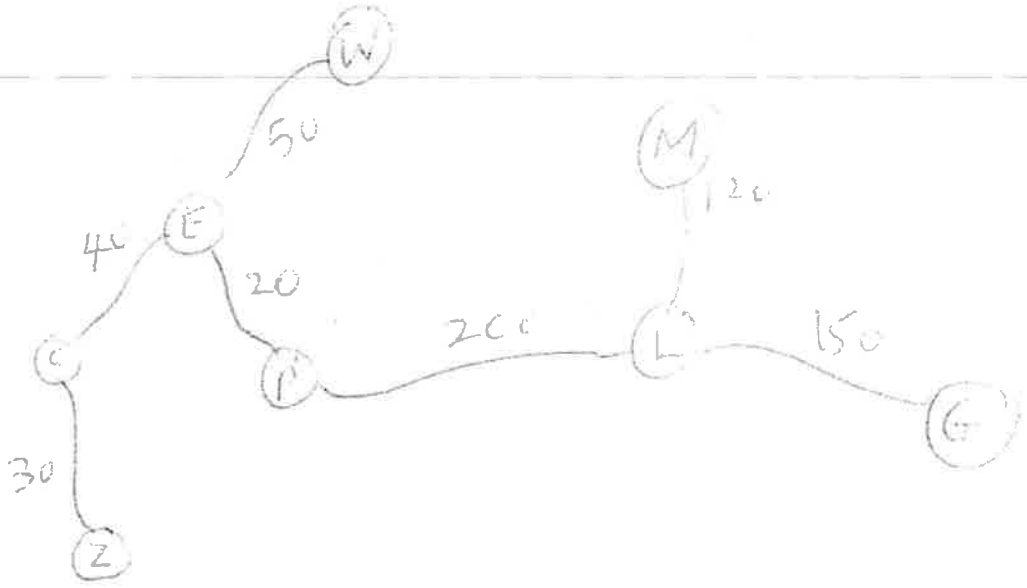
Question 19 continues on page 36

Question 19 (continued)

(c) A map of Ziggy's Zoo is shown. Each animal enclosure and the way in are represented with a vertex. The weight on each edge is the distance from vertex to vertex, in metres.



(i) Draw a minimum spanning tree in the space below, with the correct weightings. **2**



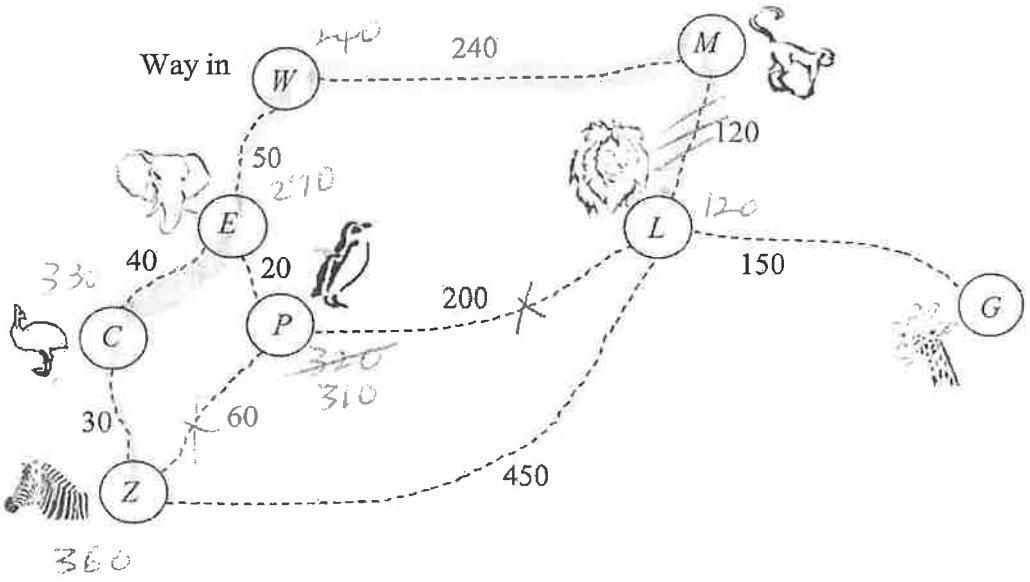
Question 19 continues on page 37

Question 19 (continued)

(ii) The zoo needs to put in pipes to take sewage away from each animal enclosure. What is the shortest total length of pipe that will be needed to connect all of the animal enclosures **(not including the Way In)**? **1**

length = 30 + 40 + 20 + 200 + 120 + 150
= 560 m

(iii) Find the shortest path from the Monkey enclosure (*M*) to the Zebra enclosure (*Z*). The map of Ziggy's Zoo is redrawn below for your working. **1**

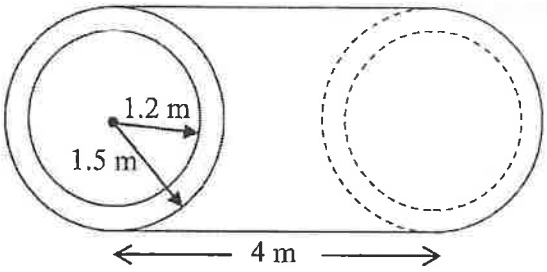


State the shortest path below, using the correct letters.

MWECZ

Question 19 continues on page 38

(d) A four-metre length of cylindrical pipe is shown. The outer radius is 1.5 metres and the inner radius is 1.2 metres.



NOT TO SCALE

(i) What **volume** of water can be contained in this pipe, to the nearest cubic metre? **2**

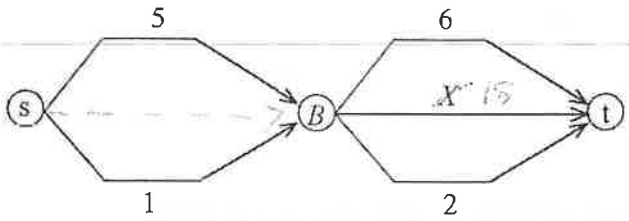
$V = \pi r^2 h$

$= \pi \times 1.2^2 \times 4$

$= 18.095$

$\approx 18\ m^3$

(ii) This four-metre length of pipe is shown in the network diagram below (X), connecting B to the sink (t). Weights on the edges are the **volume of water** each pipe can carry, in **cubic metres**.



(α) What is the **flow capacity** of the current network? **1**

max capacity = 6

(β) In order to **maximise the flow** in this network, one more pipe is to be added between the source (s) and B. What must this pipe's capacity be, in cubic metres? **1**

cap' = 6 + 15 + 2 − 6

$= 26\ m^3$

End of Question 19

SHORE

School Exam No:

Set:

Year 12
Mathematics Standard 2
HSC Trial Examination
2019

Date

Question Number
20

Instructions

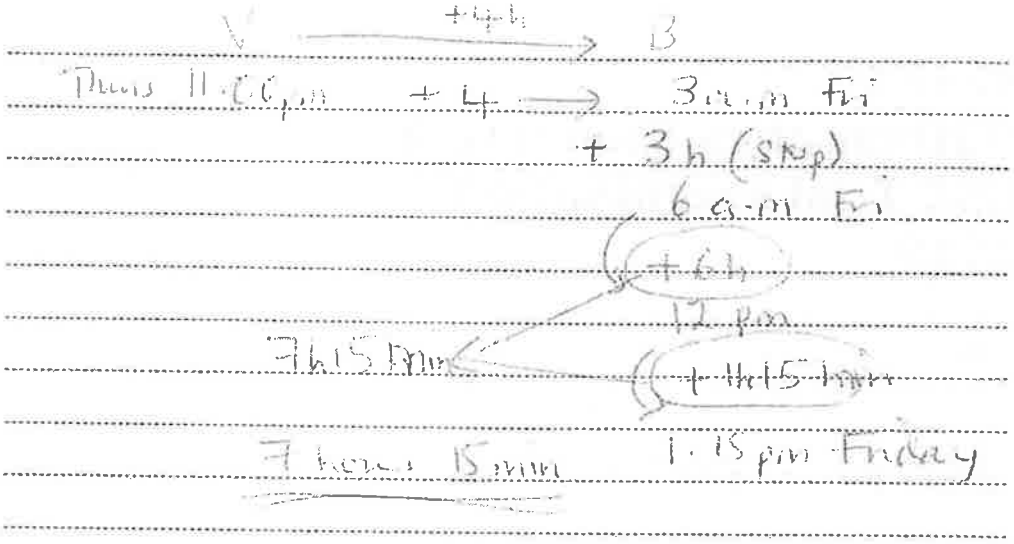
- **Complete all boxes** on the front cover of this writing booklet.
- Write using black pen.
- If you need more space, use the extra writing space at the back of this writing booklet.

Question 20 (17 marks)

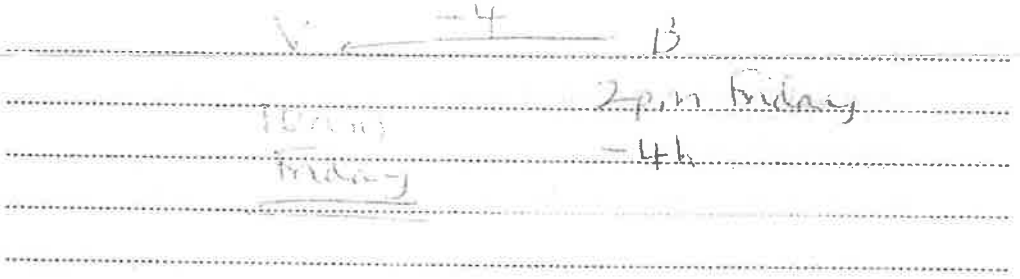
Marks

(a) George took a flight from Vancouver to Bermuda, where the time is 4 hours ahead of the time in Vancouver. His flight left Vancouver on a Thursday at 11.00 pm (Vancouver time), stopped for 3 hours in Toronto, and arrived in Bermuda at 1.15 pm (Bermuda time) on Friday.

(i) What was the plane's total flying time? Give your answer in hours and minutes. **3**



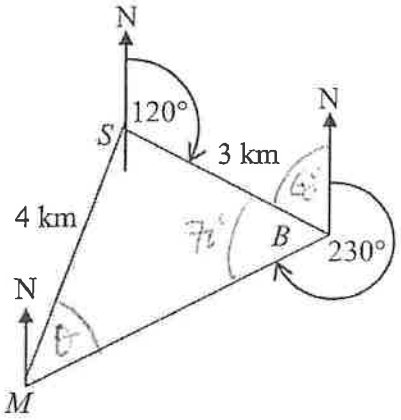
(ii) When George arrived in Bermuda, he called his friend Will to tell him he had arrived safely. If it was 2 pm on Friday in Bermuda, what was the day and time in Vancouver, when George rang Will? **1**



Question 20 continues on page 43

Question 20 (continued)

(b) Yachts in a race must sail 3 km from the start (S), on a bearing of 120° to a buoy (B), and then on a bearing of 230° to a marker (M), before sailing 4 km to return to the start. The race course is shown below.



NOT TO SCALE

(i) Show that $\angle SBM$ is 70°. **1**

$\angle SBM = 360 - 230 - 60$

$= 70°$

(ii) On what bearing must yachts sail for the final leg (MS) of the race? **3**

$\frac{\sin\theta}{3} = \frac{\sin 70}{4}$

$\theta = \sin^{-1}\left(\frac{3\sin 70}{4}\right)$

$= 44.81...$

$\therefore$ bearing $= 180 - (70 + 60) - 44.81...$

$= 5.19...$

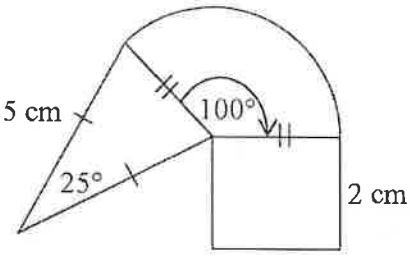
$= 5°$

$= 005°$

Question 20 continues on page 44

Question 20 (continued)

(c) Hazel owns her own company, called Duck Doonas. She designs a logo with a sector of a circle, an isosceles triangle and a rectangle, as shown.



NOT TO SCALE

(i) Show that the radius of the sector is 2.2 cm, to one decimal place. **2**

$a^2 = b^2 + c^2 - 2bc\cos A$

$r = \sqrt{5^2 + 5^2 - 2 \times 5 \times 5 \cos 25°}$

$= 2.164...$

$= 2.2$ cm

(ii) What is the total area of the logo, to the nearest square centimetre? **4**

$A = \frac{1}{2}ab\sin C + \frac{\theta}{360}\pi r^2 + lb$

$= \frac{1}{2} \times 5 \times 5 \sin 25° + \frac{100}{360}\pi \times 2.2^2 + 2 \times 2.2$

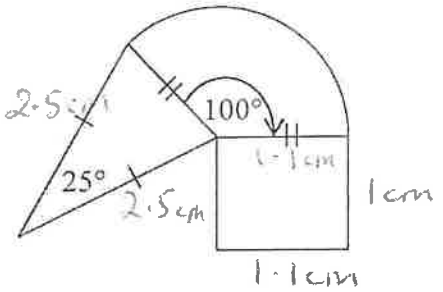
$= 13.966...$

$= 14$ cm^2

Question 20 continues on page 45

Question 20 (continued)

(iii) Hazel is going to print the logo on her letter writing paper, but wants the measurements reduced to a scale of 1 : 2. The logo is drawn below. 3



NOT TO SCALE

What will be the **perimeter** of the scaled down logo on her letterhead to the nearest cm?

$P = \frac{100}{360} \times 2\pi \times 1.1 + 2.5 \times 2 + 1 \times 2 + 1.1$

$= \frac{100}{360} \times 2\pi \times 1.1 + 5 + 3.1$

$= 10.019...$

$= 10\text{ cm}$

End of Paper ☺

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