NAME: _____

CLASS: 11MTS___

Circle your Teacher's name

Poulos	Luu	Bartlett	Johnson	Efimova	Kaur

CHERRYBROOK TECHNOLOGY HIGH SCHOOL

2019

YEAR 11

AP2

Mathematics Standard

General Instructions

- Reading time – 10 minutes
- Working time – 2 hours
- Write using black pen
- NESA approved calculators may be used
- A reference sheet is provided at the back of this paper
- For questions in Section II, show relevant mathematical reasoning and calculations

Total Marks: 72

Section I – 10 marks (pages 3–6)

- Attempt Questions 1–10
- Allow about 15 minutes for this section

Section II – 62 marks (pages 8–19)

- Attempt Questions 11–20
- Allow about 1 hour and 45 minutes for this section

Section I

10 marks
Attempt Questions 1-10
Allow about 20 minutes for this section

Use the multiple choice answer sheet for Questions 1-10

---

1. Alexander is paid a wage of $22 per hour. In a week where he works 35 hours, how much is Alexander's gross pay?

A $770

B $57

C $40,040

D $3080

2. Harold uses a scale to measure the weight of a fish he caught to be 325 grams. If the scale measures in increments of 5 grams, which is closest to the percentage error of the measurement?

A 7.7%

B 0.77%

C 1.5%

D 0.015%

3. The length that a spring stretches varies directly with the weight attached to the spring. If a certain spring stretches 3cm when a weight of 2kg is applied, how far will it stretch if a weight of 3kg is applied?

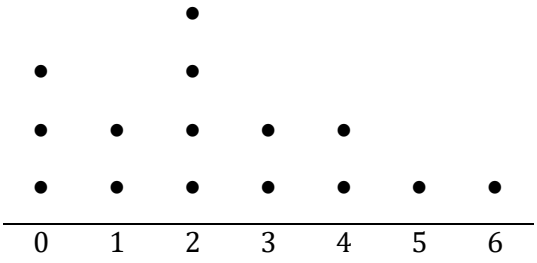
A 4 cm

B 2 cm

C 4.5 cm

D 3.3 cm

4. A sample of 15 people were asked to indicate the time (in hours) they had spent watching television on the previous night. The results are displayed in the dot plot below.



Time spent watching television (hours)

Correct to one decimal place, the mean and sample standard deviation of these times are respectively:

A $\bar{x} = 2.3$ and $s = 1.7$

B $\bar{x} = 2.3$ and $s = 1.8$

C $\bar{x} = 2.4$ and $s = 1.7$

D $\bar{x} = 2.4$ and $s = 1.8$

5. The time in Greenwich on the prime meridian is 2:00 pm. What is the standard time in Jakarta (GMT +7)?

A 9:00 am

B 9:00 pm

C 7:00 am

D 7:00 pm

6. Jacob is a photographer who is paid a retainer of $260 per month, plus a royalty of 2% of the sales of his photographs. In the last six months these sales totalled $546 000. What was his average weekly income over the last six months?

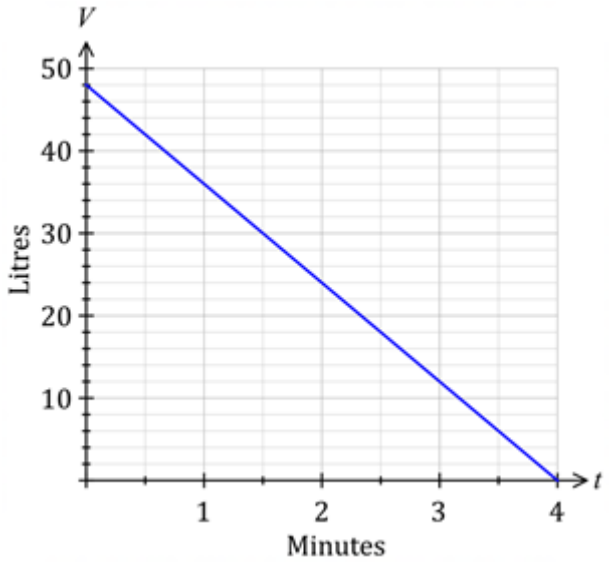
A $480

B $960

C $2080

D $12 480

7. The following graph shows the changing water level in a leaking container.



Which of the following linear equations represents the information in the graph above?

A $t = 48V + 4$

B $t = -4V + 12$

C $V = 4t - 48$

D $V = -12t + 48$

8. The stem-and-leaf plot below represents the daily sales of cakes from a school canteen.

Stem	Leaf
1	**A** 8 8
2	0 1 2 7
3	3 4 4 9
4	1 5 5
5	0 4
6	3 4 7

If the range of sales is 53, then what is the value of **A**?

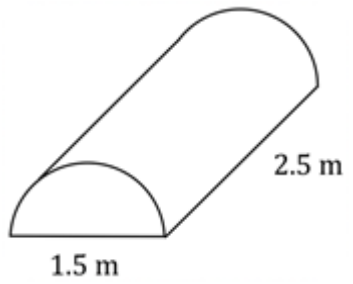
A 0

B 4

C 8

D 14

9. A tent with semicircular ends is in the shape of half a cylinder.
The diameter of the ends is 1.5m. The tent is 2.5m long.



The total surface area of the tent, including the base, is closest to:

A 7.7m^2

B 8.8m^2

C 11.4m^2

D 15.3m^2

10. Find the value of a in the formula $a = 2b - 4c$, where $b = 3$ and $c = -2$.

A -16

B -2

C 0

D 14

End of Section I

Mathematics Standard

Section II Answer Booklet

62 marks
Attempt Questions 11–20
Allow about 1 hour and 40 minutes for this section

Instructions

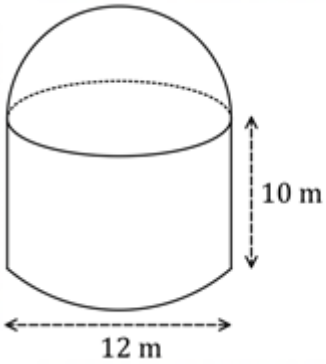
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- Your responses should include relevant mathematical reasoning and/or calculations.
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Question 11 (8 marks)

a) Holly is paid a wage of $28.40 per hour for up to 8 hours per shift, then overtime at time and a half for the next two hours and double time for any further hours in that shift. In one shift she worked 12 hours. Calculate how much Holly is paid? **2**

b) How many millilitres are in 4.5L? **1**

c) **3**



Not to scale

The solid above consists of a cylinder topped by a hemisphere. What is the volume of the solid, correct to the nearest 10 cubic metres?

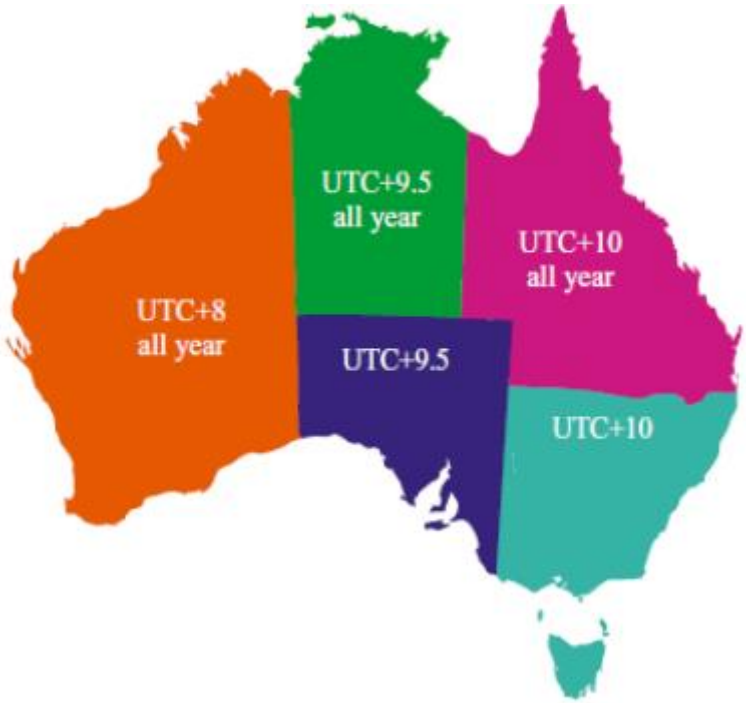
d) Simplify $1-(6y-5)-2y$ **2**

End of Question 11

Question 12 (7 marks)

a) A plane is flying over Alice Springs, which has the coordinates (24°S, 134°E). If the plane flies a further 30° to the north and 10° to the east, what will the plane's new coordinates be? **2**

b) It is 9:00 am in Sydney, Daylight savings time. What is the time in Alice Springs in the Northern Territory? **1**



Question 12 continued on next page

c) The following is Tuesday's schedule for the train to the airport.

Station	Arrival/Departure Time			
Green Square	08:06	08:12	08:21	08:27
Mascot	08:09	08:15	08:24	08:30
Domestic Airport	08:12	08:18	08:27	08:33
International Airport	08:14	08:20	08:29	08:35

Ahmad plans to board a train at Green Square. He will be taking the train to the International Airport to catch a flight to Los Angeles, which is scheduled to depart at 11:25am Tuesday.

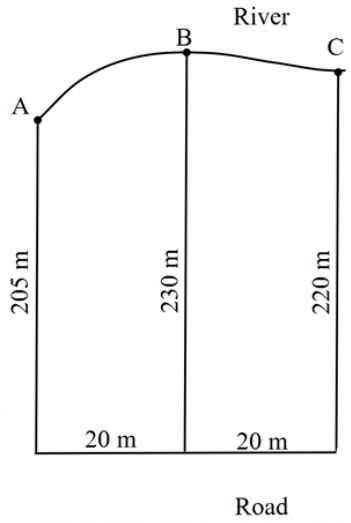
i) If it takes Ahmad exactly 14 minutes to walk from his home to the train station, and he would like to arrive at the International Airport at least 3 hours before his flight is scheduled to depart, what is the latest time he can leave his home? (Assume the trains will run on-time.) **1**

ii) Ahmad's flight takes 14.5 hours. If Sydney's time zone is currently UTC +10 and Los Angeles is UTC -8, what day and time will it be when he arrives? **3**

End of Question 12

Question 13 (5 marks)

Haile plans on selling part of his property along the river and wishes to estimate its area. Below are the measurements he took from the road to the river, each 20 metres apart.



NOT TO SCALE

a) Use two applications of the Trapezoidal Rule to estimate the area of the land in hectares, to the nearest whole number. (1 hectare = $10\ 000m^2$) **3**

b) Before Haile can sell the land, he must install a retaining wall along the river between A & B to prevent flooding. Estimate the length of the wall to the nearest metre by drawing a straight line from A to B, then finding the length in metres. **2**

End of Question 13

Question 14 (4 marks)

Mila is following a cake recipe. The ingredients that contain kilojoules are listed below.

Ingredient	**Amount**
Sugar	¾ cup
Flour	2 cups
Eggs	2 eggs
Butter	125 grams

Mila would like to know how many kilojoules each serving of cake will be. She compiles the following list.

Ingredient	**Kilojoules**
Sugar	3238 kJ per cup
Flour	1904 kJ per cup
Eggs	300 kJ per egg
Butter	30 kJ per gram

The cake is to be divided into eight portions. By calculating the kJ of each ingredient, then the kJ of each portion, find how many calories will be in each portion. Note: 1 kilocalorie (Cal) = 4.184 kJ **4**

End of Question 14

Question 15 (7 marks)

Julius and Victoria are at a party where alcoholic drinks are being served. They have both been drinking over a three-hour period.

Julius has had 2 beers which were each 1.3 standard drinks, and most recently one strong mixed drink containing 2.3 standard drinks.

Victoria has had 4 mixed drinks.

a) Julius tells Victoria that he has had less alcohol, since he has consumed fewer drinks than she has. **2**

Victoria has had 4.8 standard drinks. Determine if Julius is correct by calculating the number of standard drinks he has consumed.

b) Julius and Victoria are now discussing who has the lower blood alcohol content (BAC). Julius, who weighs 78 kg, thinks his BAC is lower, since he is a male. Victoria, who weighs 85 kg thinks, her BAC is lower since she weighs more than Julius. **3**

Determine who has the lower BAC using the BAC formulas given below,

$$\text{BAC}_{\text{Male}} = \frac{10N - 7.5H}{6.8M} \qquad \text{BAC}_{\text{Female}} = \frac{10N - 7.5H}{5.5M}$$

where N is the number of standard drinks, H is the number of hours drinking, and M is the person's weight in kilograms.

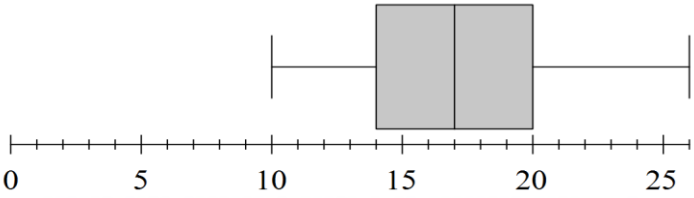
Question 15 continued on the next page

c) Julius tells Victoria that he can drive now since he is on a full license and his BAC is under 0.05. Victoria isn't so sure. Using Julius' current BAC and one limitation of the BAC formula, how could Victoria convince Julius not to drive? **2**

End of Question 15

Question 16 (5 marks)

a) A box plot is shown below. **3**



Calculate the upper and lower bounds for outliers and determine if the data contains any outliers.

b) Solve: $12x + 8 = 8x - 4$ **2**

End of Question 16

Question 17 (12 marks)

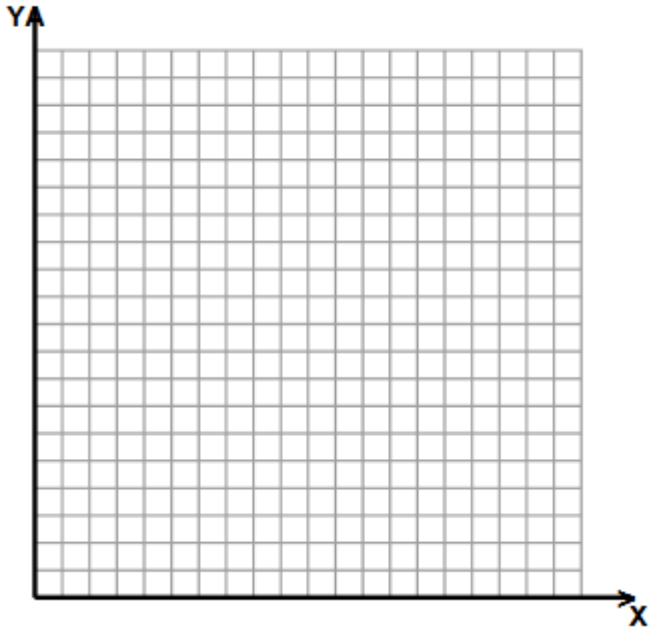
William has collected data from his classmates regarding how many mobile devices their families use regularly. The responses are listed below.

2	3	5	4	4	8	6	6	7	5
2	6	8	6	7	4	2	4	5	7

a) Complete the tally and frequency column in the table below using the data William collected. **3**

Number of Devices	Tally	Frequency	Cumulative Frequency
2			
3			
4			
5			
6			
7			
8			

b) Use the grid provided below to construct a cumulative frequency histogram and ogive for the data William collected. **4**



Question 17 continued on next page

c) Using your graph find the median. **1**

d) The mean of 5 scores is 25. **2**

When a sixth score is added to the data set, the mean decreases by 2.5.

What score was added to the data set?

e) William only collected data on 20 of his 100 classmates. To collect the data, he chose their names at random, with all classmates equally likely to be chosen. **2**

Can he generalise his findings to all of his classmates? Give a reason to support your conclusion.

End of Question 17

Question 18 (3 marks)

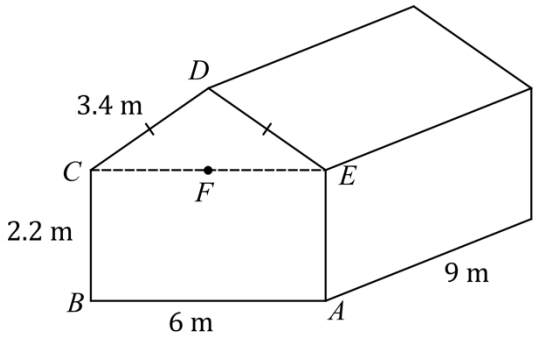
Tamar has a 2200-watt electric kettle. She has found on average it takes 3 minutes to boil water, and she estimates that she uses the kettle about twice a day, every day. **3**

If she pays 52 cents per kilowatt-hour, how much will it cost Tamar to use her kettle in this manner for a year, to the nearest cent?

End of Question 18

Question 19 (7 marks)

The shed is in the shape of a prism. $ABCE$ is a rectangle and F is the midpoint of CE.



Not to scale

a) Calculate the length of DF. **2**

Question 19 continued on next page

b) All inside surfaces of the shed, including the floor, will be painted. Find the total area that will be painted. Determine the number of 5 L tins of paint that are required if one litre of paint will cover an area of 16 m^2. **5**

End of Question 19

Question 20 (4 marks)

The table below shows the average energy used, in kilojoules per kilogram of body mass, by a person walking for 10 minutes at different speeds. **4**

Walking speed	*Energy used in 10 minutes*
3 km/h	1.8 kJ/kg
4 km/h	2.2 kJ/kg

Edward, who weighs 70 kg, drinks an energy drink. It contains 330 kilocalories.

For approximately how long must Edward walk at 4 km/h to burn off the energy contained in one energy drink? (1 kilocalorie = 4.184 kJ)

END OF EXAMINATION

Section II extra writing space

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

Student Name: _____

Class: 11MTS _____ Teacher _____

Year 11 Mathematics Standard Section I - Answer Sheet

Select the alternative A, B, C or D that best answers the question.

Fill in the response oval completely.

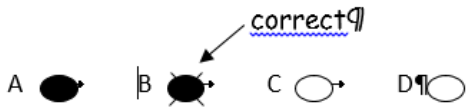
Sample: 2 + 4 = (A) 2 (B) 6 (C) 8 (D) 9

A ○ B ● C ○ D ○

- If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ● B ⊗ C ○ D ○

- If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word correct and drawing an arrow as follows.



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 ○
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9. A ○ B ○ C ○ D ○
10. A ○ B ○ C ○ D ○

MC	/10
Q11	/7
Q12	/8
Q13	/6
Q14	/4
Q15	/6
Q16	/5
Q17	/11
Q18	/3
Q19	/7
Q20	/3
Total	**/70**

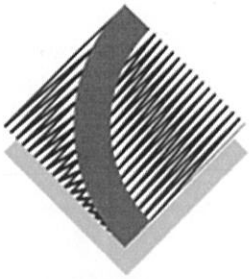
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CHERRYBROOK TECHNOLOGY HIGH SCHOOL



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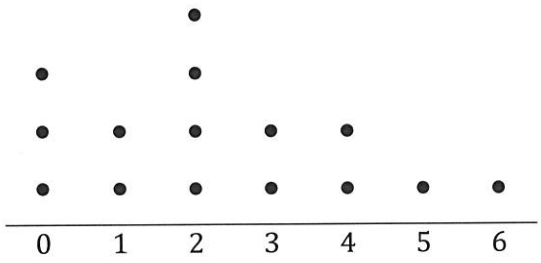
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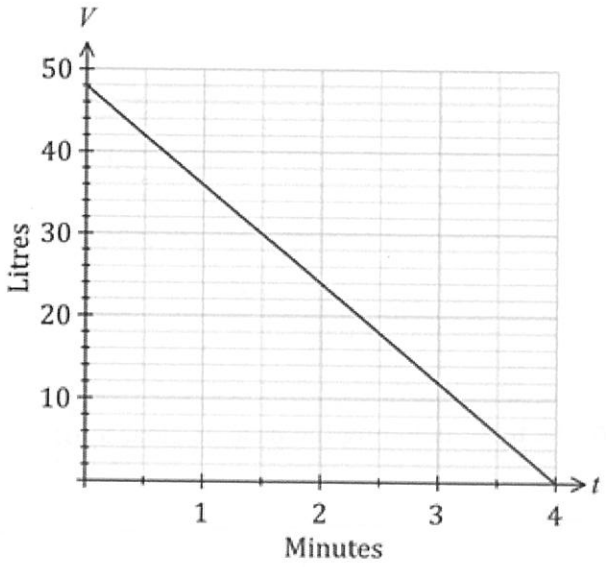
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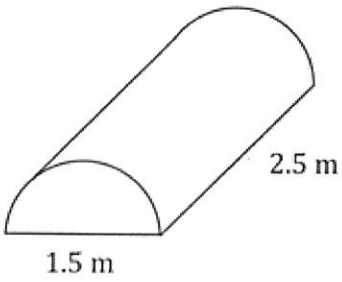
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End of Section I

Mathematics Standard
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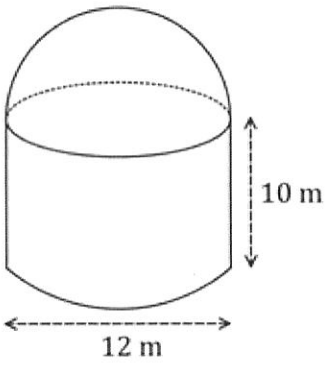
$28.40 \times 8 + 1.5 \times 28.40 \times 2 + 2 \times 28.40 \times 2 = \$426$

b) How many millilitres are in 4.5L? **1**

$4.5\,L = 4.5 \times 1000$

$= 4500\,ml$

c) **3**



Not to scale

The solid above consists of a cylinder topped by a hemisphere. What is the volume of the solid, correct to the nearest 10 cubic metres?

$r = 6\,m \quad V = \frac{1}{2} \times \left(\frac{4}{3}\pi r^3\right) + \pi r^2 h$

$V = \frac{1}{2} \times \frac{4}{3}\pi \times 6^3 + \pi \times 6^2 \times 10$

$= 1583.362697\,m^3$

$\approx 1580\,m^3$

d) Simplify $1 - (6y - 5) - 2y$ **2**

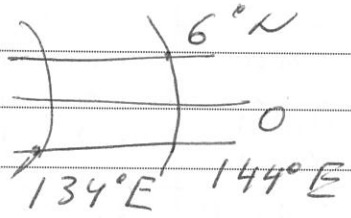
$1 - 6y + 5 - 2y = 6 - 8y$

End of Question 11

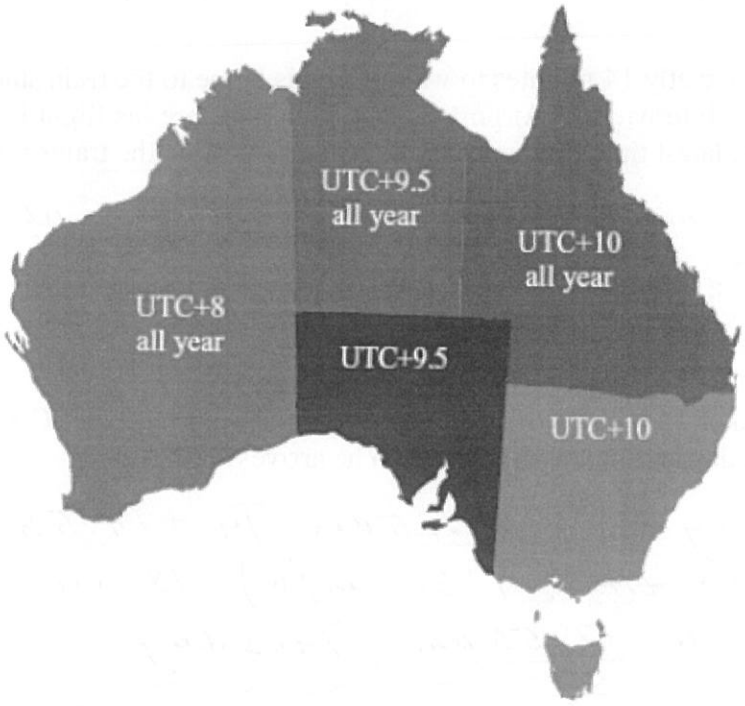
Question 12 (7 marks)

a) A plane is flying over Alice Springs, which has the coordinates (24°S, 134°E). If the plane flies a further 30° to the north and 10° to the east, what will the plane's new coordinates be? **2**

(6°N, 144°E)



b) It is 9:00 am in Sydney, Daylight savings time. What is the time in Alice Springs in the Northern Territory? **1**



9am − 1 1/2 hours = 7.30 am

Question 12 continued on next page

c) The following is Tuesday's schedule for the train to the airport.

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Ahmad plans to board a train at Green Square. He will be taking the train to the International Airport to catch a flight to Los Angeles, which is scheduled to depart at 11:25am Tuesday.

i) If it takes Ahmad exactly 14 minutes to walk from his home to the train station, and he would like to arrive at the International Airport at least 3 hours before his flight is scheduled to depart, what is the latest time he can leave his home? (Assume the trains will run on-time.) **1**

Ahmad must leave his house no later than 7:58 am.

ii) Ahmad's flight takes 14.5 hours. If Sydney's time zone is currently UTC +10 and Los Angeles is UTC −8, what day and time will it be when he arrives? **3**

In Sydney time: 11:25 am Tu + 14.5 hours = 1:55 am W
Los Angeles time: 1:55 am (W) − 18 hours = 7:55 am Tu
It will be 7:55 am, Tuesday

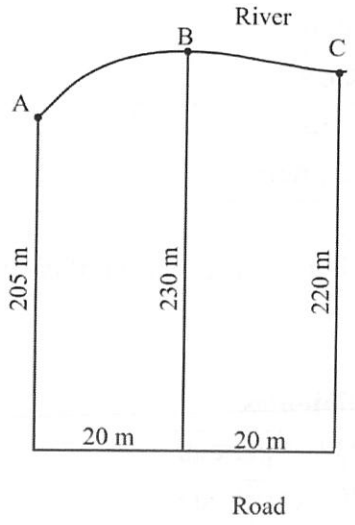
(or add 6 hours and subtract 1 day for crossing the International Date Line)

or +14.5 − 18 = −3.5
11.25 Tue − 3.5
3h 30m
Tue 7.55 am

End of Question 12

Question 13 (5 marks)

Haile plans on selling part of his property along the river and wishes to estimate its area. Below are the measurements he took from the road to the river, each 20 metres apart.



NOT TO SCALE

a) Use two applications of the Trapezoidal Rule to estimate the area of the land in hectares, to the nearest whole number. (1 hectare = 10 000m^2) **3**

$A \approx \frac{20}{2}(205+230) + \frac{20}{2}(230+220)$

$A \approx 8850\ m^2$ $\quad 1\ ha = 10,000 m^2$

$8850 \div 10\,000 = 0.885\ ha$

b) Before Haile can sell the land, he must install a retaining wall along the river between A & B to prevent flooding. Estimate the length of the wall to the nearest metre by drawing a straight line from A to B, then finding the length in metres. **2**

$AB = \sqrt{20^2+25^2}$

$= \sqrt{400+625}$

$= \sqrt{1025}$

$= 32.0156...$

$\approx 32m$

End of Question 13

Question 14 (4 marks)

Mila is following a cake recipe. The ingredients that contain kilojoules are listed below.

Ingredient	Amount
Sugar	¾ cup
Flour	2 cups
Eggs	2 eggs
Butter	125 grams

Mila would like to know how many kilojoules each serving of cake will be. She compiles the following list.

Ingredient	Kilojoules
Sugar	3238 kJ per cup
Flour	1904 kJ per cup
Eggs	300 kJ per egg
Butter	30 kJ per gram

The cake is to be divided into eight portions. By calculating the kJ of each ingredient, then the kJ of each portion, find how many calories will be in each portion. Note: 1 kilocalorie (Cal) = 4.184 kJ **4**

Sugar: $3238 \times 3/4 = 2428.5$ kJ

Flour: $1904 \times 2 = 3808$ kJ

Eggs: $300 \times 2 = 600$ kJ

Butter: $30 \times 125 = 3750$ kJ

$2428.5 + 3808 + 600 + 3750 = 10\,586.5$ kJ

$10\,586.5 \div 8 = 1323.3125$ kJ

$1323.3125 \div 4.184 = 316.279...$

≈ 316 Cal

$\approx 316\,279$ calories

End of Question 14

Question 15 (7 marks)

Julius and Victoria are at a party where alcoholic drinks are being served. They have both been drinking over a three-hour period.

Julius has had 2 beers which were each 1.3 standard drinks, and most recently one strong mixed drink containing 2.3 standard drinks.

Victoria has had 4 mixed drinks.

a) Julius tells Victoria that he has had less alcohol, since he has consumed fewer drinks than she has. **2**

Victoria has had 4.8 standard drinks. Determine if Julius is correct by calculating the number of standard drinks he has consumed.

Julius: $2\times1.3+1\times2.3=4.9$ standard drinks

Victoria: 4.8 standard drinks

$4.9>4.8$

Julius is wrong. He has consumed more standard drinks.

b) Julius and Victoria are now discussing who has the lower blood alcohol content (BAC). Julius, who weighs 78 kg, thinks his BAC is lower, since he is a male. Victoria, who weighs 85 kg thinks, her BAC is lower since she weighs more than Julius. **3**

Determine who has the lower BAC using the BAC formulas given below,

$$\text{BAC}_{\text{Male}} = \frac{10N - 7.5H}{6.8M} \qquad \text{BAC}_{\text{Female}} = \frac{10N - 7.5H}{5.5M}$$

where N is the number of standard drinks, H is the number of hours drinking, and M is the person's weight in kilograms.

Julius: $BAC_{Male} = \frac{10\times4.9-7.5\times3}{6.8\times78} = \frac{26.5}{530.4}$

$= 0.04996\ldots$

Victoria: $BAC_{Female} = \frac{10\times4.8-7.5\times3}{5.5\times85} = \frac{25.5}{467.5}$

$= 0.05454\ldots$

Julius has the lower BAC

Question 15 continued on the next page

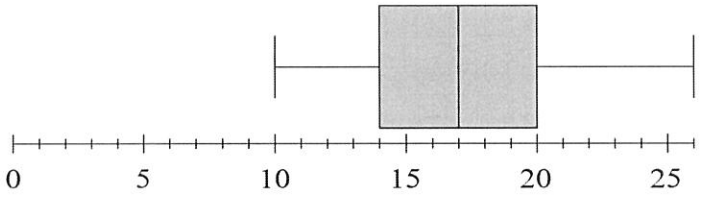
c) Julius tells Victoria that he can drive now since he is on a full license and his BAC is under 0.05. Victoria isn't so sure. Using Julius' current BAC and one limitation of the BAC formula, how could Victoria convince Julius not to drive? **2**

Julius' calculated BAC is very close to the legal limit of 0.05 and his actual BAC may very well be 0.05 or higher. The BAC formula assumes that all drinks were equally spread out, but Julius had a stronger drink last.
(Other limitations are also acceptable)

End of Question 15

Question 16 (5 marks)

a) A box plot is shown below. **3**



Calculate the upper and lower bounds for outliers and determine if the data contains any outliers.

$IQR = Q_3 - Q_1$
$= 20 - 14$
$= 6$

Lower bound: $Q_1 - 1.5 \times IQR = 14 - 1.5 \times 6$
$= 5$

Upper bound: $Q_3 + 1.5 \times IQR = 20 + 1.5 \times 6$
$= 29$

There are no outliers in this data set, as the minimum score is 10 and maximum score is 26.

b) Solve: $12x + 8 = 8x - 4$ **2**

$12x - 8x = -4 - 8$
$4x = -12$
$x = -3$

End of Question 16

Question 17 (12 marks)

William has collected data from his classmates regarding how many mobile devices their families use regularly. The responses are listed below.

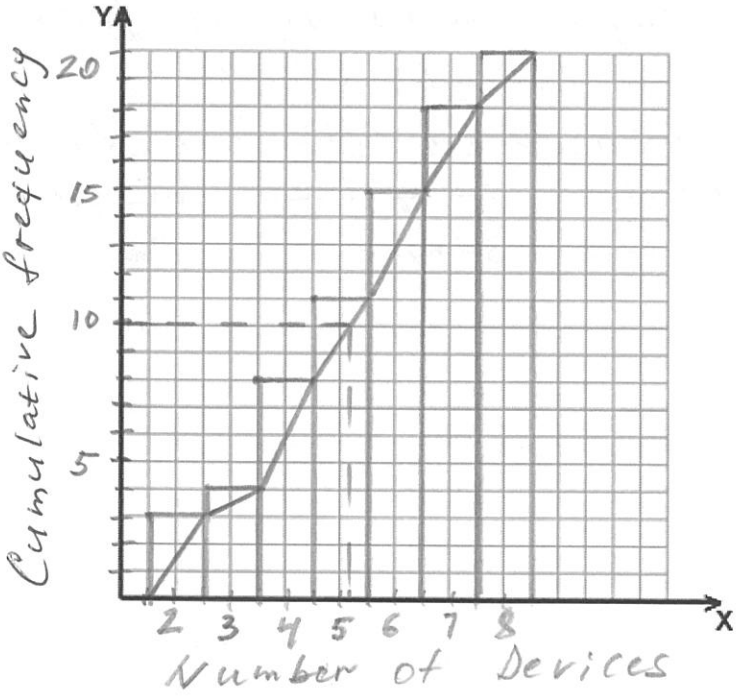
2	3	5	4	4	8	6	6	7	5
2	6	8	6	7	4	2	4	5	7

a) Complete the tally and frequency column in the table below using the data William collected. **3**

Number of Devices	Tally	Frequency	Cumulative Frequency
2	III	3	3
3	I	1	4
4	IIII	4	8
5	III	3	11
6	IIII	4	15
7	III	3	18
8	II	2	20

b) Use the grid provided below to construct a cumulative frequency histogram and ogive for the data William collected. **4**

Mobile Devices



Question 17 continued on next page

c) Using your graph find the median. **1**

5

d) The mean of 5 scores is 25. **2**

When a sixth score is added to the data set, the mean decreases by 2.5.

What score was added to the data set?

$\bar{x} = 25$ Total of 5 scores $= 5 \times 25 = 125$

New $\bar{x} = \frac{125+x}{6} = 25 - 2.5$ $\frac{125+x}{6} = 22.5$

$125 + x = 135$

$x = 10$

e) William only collected data on 20 of his 100 classmates. To collect the data, he chose their names at random, with all classmates equally likely to be chosen. **2**

Can he generalise his findings to all of his classmates? Give a reason to support your conclusion.

Sample size should be at least $\sqrt{N}$, where N is population.

$\sqrt{100} = 10$ Sample should be at least 10, but William has a sample of 20.

∴ Yes, he can generalise his findings, as he used random sampling and took a relatively large sample.

End of Question 17

Question 18 (3 marks)

Tamar has a 2200-watt electric kettle. She has found on average it takes 3 minutes to boil water, and she estimates that she uses the kettle about twice a day, every day. **3**

If she pays 52 cents per kilowatt-hour, how much will it cost Tamar to use her kettle in this manner for a year, to the nearest cent?

OR

Kilowatts: $2200 \div 1000 = 2.2$ kW

Hours: $3 \div 60 = 0.05$ hours

Kilowatt-hours for twice a day, 365 days

$2.2 \times 0.05 \times 2 \times 365 = 80.3$ kWh

Cost: $80.3 \times 0.52 = \$41.756$

$\approx \$41.76$

$2200 \text{ watts} \times (3 \text{ min} \times 2 \times 365)$

2190 min/year

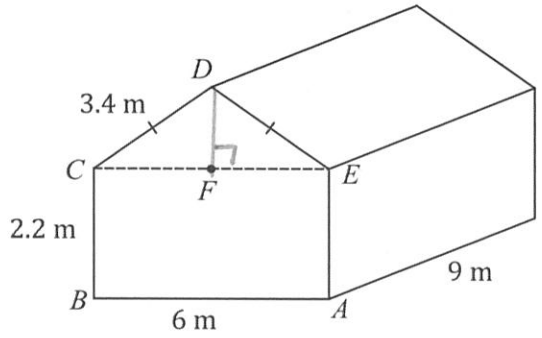
$\frac{2200}{1000}\text{kW} \times \frac{2190}{60}\text{hrs} \times 0.52 =$

$= \$41.76$

End of Question 18

Question 19 (7 marks)

The shed is in the shape of a prism. $ABCE$ is a rectangle and F is the midpoint of CE.



Not to scale

a) Calculate the length of DF. **2**

$CF = 3$m, $DF^2 = 3.4^2 - 3^2$

$= \sqrt{2.56}$

$= 1.6$ m

Question 19 continued on next page

b) All inside surfaces of the shed, including the floor, will be painted. Find the total area that will be painted. Determine the number of 5 L tins of paint that are required if one litre of paint will cover an area of 16 m^2. **5**

sides rectangle front/back floor roof front △

$SA = 9 \times 2.2 \times 2 + 6 \times 2.2 \times 2 + 6 \times 9 + 9 \times 3.4 \times 2 + 2 \times \frac{1}{2} \times 6 \times 1.6$

$= 66 + 115.2 + 9.6 = 190.8\ m^2$ $\quad A_{\triangle} = \frac{1}{2} \times 6 \times 1.6$

$\approx 191\ m^2$

Paint: $190.8 \div 16 = 11.925$

$\approx 12L$

Number of tins: $12 \div 5 = 2.4$

It will require 3 tins of paint

End of Question 19

Question 20 (4 marks)

The table below shows the average energy used, in kilojoules per kilogram of body mass, by a person walking for 10 minutes at different speeds. **4**

Walking speed	*Energy used in 10 minutes*
3 km/h	1.8 kJ/kg
4 km/h	2.2 kJ/kg

Edward, who weighs 70 kg, drinks an energy drink. It contains 330 kilocalories.

For approximately how long must Edward walk at 4 km/h to burn off the energy contained in one energy drink? (1 kilocalorie = 4.184 kJ)

Energy drink: $330 \times 4.184 = 1380.72$ kJ

Energy used by Edward per 10 min:
$2.2 \times 70 = 154$ kJ

Time walking: $\frac{1380.72}{154} = 8.9657$
≈ 9 10 min blocks

$9 \times 10 = 90$ min or 1 hr 30 min or $1\frac{1}{2}$ hrs
or 9 x 10 min blocks

END OF EXAMINATION

Section II extra writing space

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