SYDNEY GRAMMAR SCHOOL

CANDIDATE NUMBER

2019 FORM VI TRIAL EXAMINATION

Mathematics Standard 2

Date: Monday 12 August

General Instructions

- Reading time — 10 minutes
- Working time — $2\frac{1}{2}$ hours
- Write using black pen
- Calculators approved by NESA may be used
- A reference sheet is provided as a separate loose sheet
- In Questions 16–41, show relevant mathematical reasoning and calculations

Total Marks: 100

Section I – 15 marks

- Attempt questions 1–15
- Allow about 20 minutes for this section

Section II – 85 marks

- Attempt questions 16–41
- Allow about 2 hours and 10 minutes for this section

Checklist

- Examination booklet
- Reference sheet
- Multiple-choice answer sheet
- Candidature: 8 boys

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. Which one of the following statements about the line with equation $15x - 3y = 0$ is NOT true?

A. The line has a gradient of 15.

B. The line passes through the origin.

C. The point $(1, 5)$ lies on the line.

D. The line has a positive gradient.

2. Felix's regular morning coffee order is a macchiato. This is approximately 60 mL of coffee, to the nearest mL.

What is the percentage error in this measurement, correct to one significant figure?

A. $\pm 0{\cdot}5\%$

B. $\pm 0{\cdot}8\%$

C. $\pm 1\%$

D. $\pm 2\%$

3. Yerevan in Armenia is 3 hours ahead of Lagos in Nigeria. Reykjavik in Iceland is 4 hours behind Yerevan. What is the time in Reykjavik when it is 3 pm in Lagos?

A. 10 am

B. 2 pm

C. 4 pm

D. 6 pm

4. Which expression is equivalent to $5x(x + 3x^2) + x^2$?

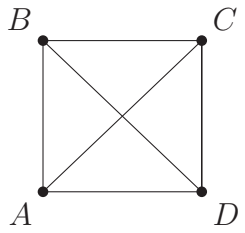
A. $6x^2 + 8x^3$

B. $6x^2 + 15x^3$

C. $5x + 15x^3 + x^2$

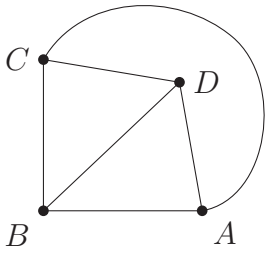
D. $7x^2 + 15x^3$

5. A network of four points A, B, C and D is drawn below.

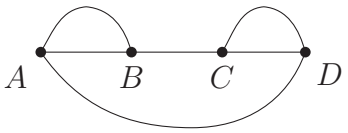


Which of the following network diagrams is NOT an equivalent graph of the network above?

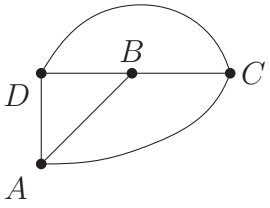
A.



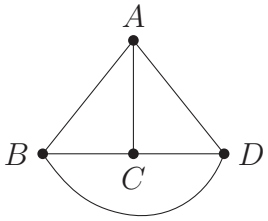
B.



C.



D.



6. Last year, Sam bought 300 shares at \$1.75 per share. They are now worth \$2.00 per share and Sam receives a dividend of \$0.15 per share.

What is the the dividend yield?

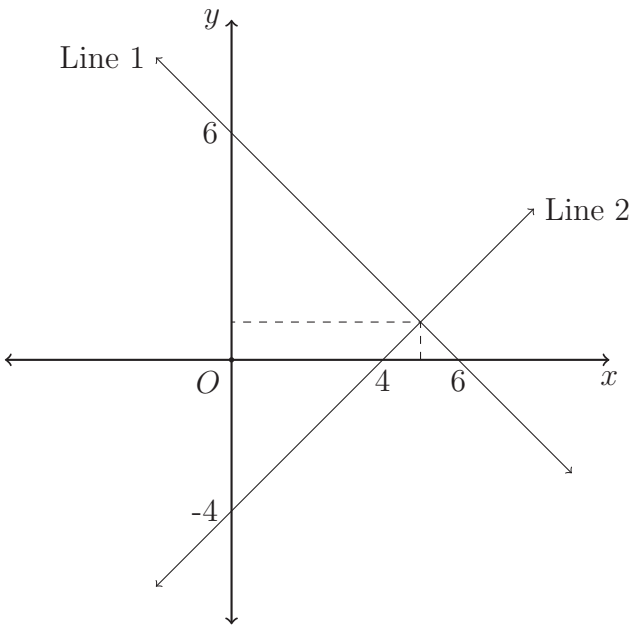
A. 7·5%

B. 8·6%

C. 12·5%

D. 14·3%

7. The lines $x + y - 6 = 0$ and $x - y - 4 = 0$ are sketched on the diagram below.



Which row of the table correctly matches the equations and identifies the solution when the equations are solved simultaneously?

	$x - y - 4 = 0$	$x + y - 6 = 0$	Solution
Row 1	Line 1	Line 2	$x = 1,\ y = 5$
Row 2	Line 1	Line 2	$x = 5,\ y = 1$
Row 3	Line 2	Line 1	$x = 1,\ y = 5$
Row 4	Line 2	Line 1	$x = 5,\ y = 1$

A. Row 1

B. Row 2

C. Row 3

D. Row 4

8. Tom's normal rate of pay is \$23.75 per hour. In one week he worked 18 hours at the normal rate, 6 hours at time-and-a-half and $2\frac{1}{2}$ hours at double time. He was also paid a wet weather allowance of \$65 for the week.

What were his total earnings for the week?

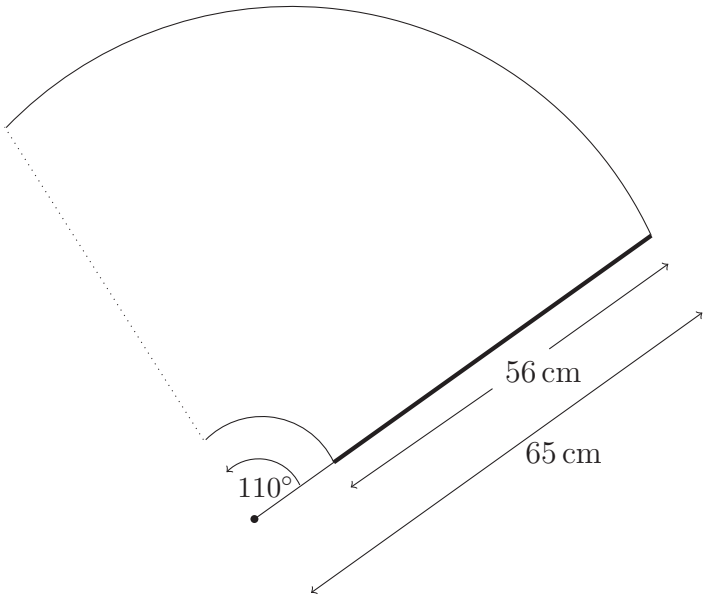
A. \$629.38

B. \$694.30

C. \$760

D. \$825

9. A windscreen wiper blade on a 2013 Land Rover Defender is approximately 56 cm in length. The blade is attached to a 65 cm arm and the blade and the arm move back and forth in a circular arc of 110°. It will clean an area of glass as shown in the diagram below.



Which calculation shows the area that is cleaned by the blade?

A. $\frac{110}{360} \times \pi \times 56^2$

B. $\frac{110}{360} \times \pi \times 65^2$

C. $\frac{110}{360} \times \pi \times (56^2 - 9^2)$

D. $\frac{110}{360} \times \pi \times (65^2 - 9^2)$

10. Two coins are tossed 100 times. The results are tabulated below.

Outcome	**Frequency**
HH	27
HT	22
TH	23
TT	28

What is the experimental probability of tossing a head and a tail?

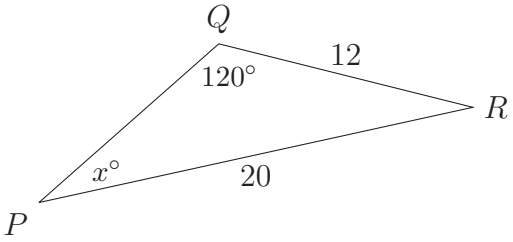
A. $\frac{22}{100}$

B. $\frac{23}{100}$

C. $\frac{45}{100}$

D. $\frac{1}{2}$

11. Which calculation should be used to find the value of x in $\triangle PQR$?



A. $x^2 = 20^2 + 12^2 - 2 \times 20 \times 12 \times \cos 120°$

B. $\frac{\sin x°}{12} = \frac{\sin 120°}{20}$

C. $\sin x° = \frac{12}{20}$

D. $x = \frac{1}{2} \times 12 \times 20 \times \sin 120°$

12. Joshua was asked to solve an equation for homework. His solution below has TWO errors.

$$\begin{aligned}
\frac{2x+3}{4} - \frac{x+2}{3} - 1 &= 0 && \text{Line 0}\\
\frac{2x+3}{4} - \frac{x+2}{3} &= 1 && \text{Line 1}\\
\frac{6x+9-4x+8}{12} &= 1 && \text{Line 2}\\
2x+17 &= 1 && \text{Line 3}\\
2x &= -16 && \text{Line 4}\\
x &= -8 && \text{Line 5}
\end{aligned}$$

Which lines DO NOT follow correctly from the previous lines?

A. Line 1 and Line 3

B. Line 2 and Line 3

C. Line 2 and Line 4

D. Line 3 and Line 4

13. Lachlan works in an ice-cream store and, based on sales over two weeks, conducted a survey of the five most popular flavours. What type of data is this?

A. Categorical nominal

B. Categorical ordinal

C. Quantitative continuous

D. Quantitative discrete

14. Which of the following curves would correctly model exponential decay, where a is a positive constant?

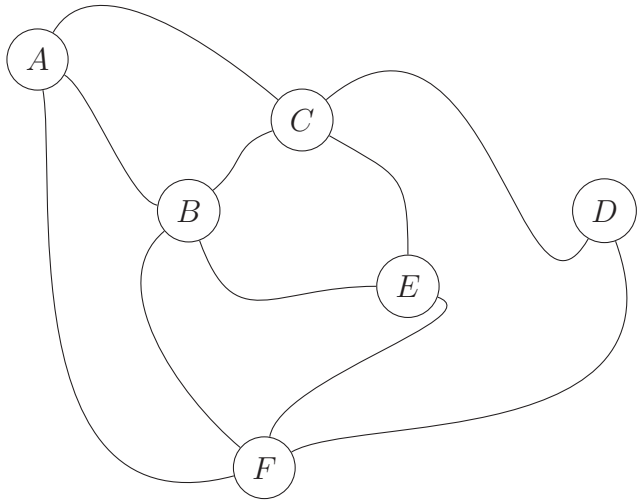
A. $M = ax^{-2}$

B. $M = 2a^{-x}$

C. $M = -ax^{-\frac{x}{2}}$

D. $M = -2a^{x}$

15. A collection of bushwalking tracks is modelled by the network below. There are six checkpoints labelled A, B, C, D, E and F. Which of the following two edges should be removed so that a bushwalker could walk along every track exactly once?



A. AB and BE

B. CB and BF

C. CD and DF

D. CE and BF

End of Section I

Section II - Written Response

Answers for this section should be recorded in the space provided in this paper.
Show all necessary working.

Question 16 (2 marks)

Solve $5x - 3(2 + x) = x - 12$. **2**

.....

.....

.....

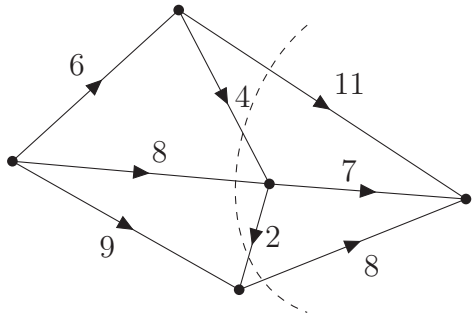
.....

.....

.....

Question 17 (1 mark)

Find the capacity of the cut shown in the network diagram below. **1**



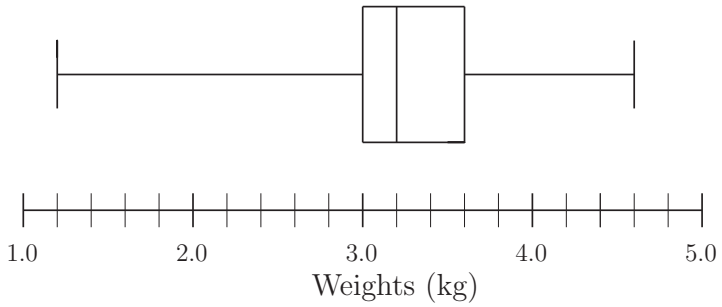
.....

.....

.....

Question 18 (4 marks)

The birth weights of babies born in Australia during 2017 is presented in the following box-and-whisker diagram.



(a) What is the weight of the lightest baby born during 2017? **1**

.....

.....

(b) Find the interquartile range. **1**

.....

.....

(c) Calculate the limits for outliers in this data set. **2**

.....

.....

.....

.....

Question 19 (2 marks) **2**

In a raffle, the total prize money is shared among the first three tickets drawn in the ratio $4 : 3 : 2$.

The prize for the second ticket drawn is \$750.

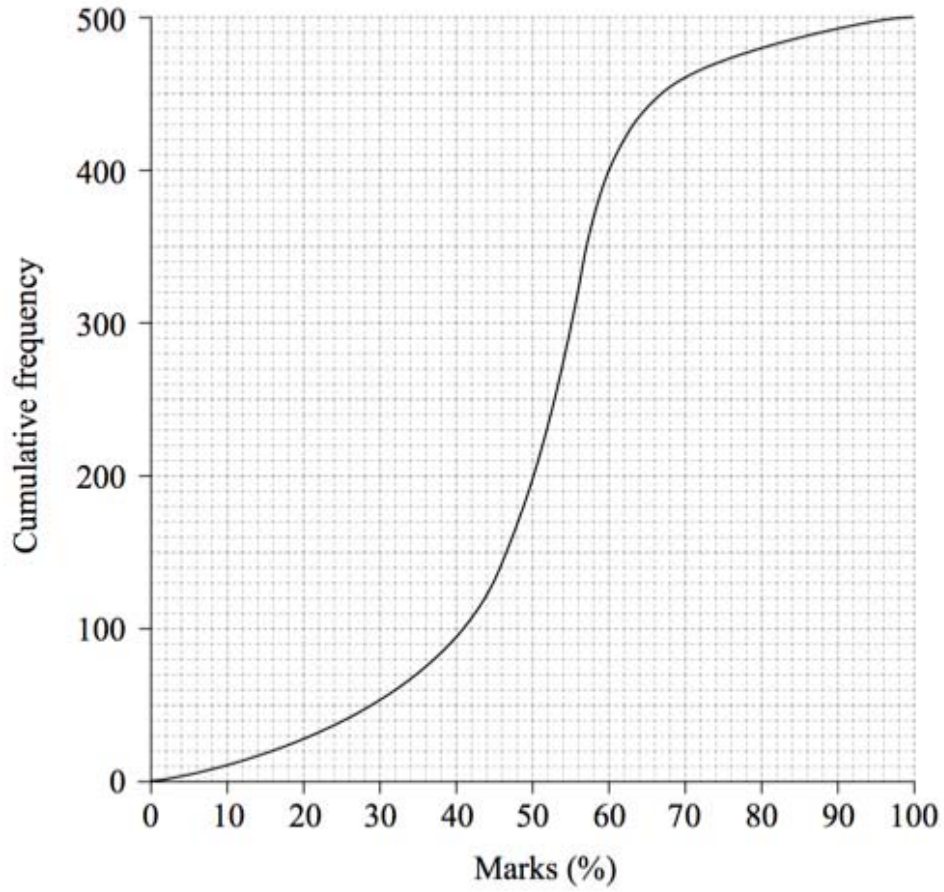
What is the total prize money?

.....

.....

Question 20 (2 marks)

The cumulative frequency curve below displays the percentage marks attained by 500 students in an examination.



(a) Those scoring less than 50% failed the examination. Find the number of students who failed the examination. **1**

.....

.....

(b) The top 20% of students are eligible for further study. Find the lowest mark to be eligible for further study. **1**

.....

.....

Question 21 (3 marks) **3**

An intravenous drip is delivering 30 drops/min. There are 15 drops/mL and 1·2 L of liquid to be delivered. How long will the drip take to deliver the required dose?

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Question 22 (2 marks) **2**

An eight year-old child weighing $24 \cdot 5$ kg needs to have the correct dosage of medicine. The dosage d is calculated using the formula:

$$d = \frac{mA}{70}$$

where m is the mass of the child in kilograms, and
A is the adult dosage.

If the adult dosage is 20 mL twice a day, how many days will a 250 mL bottle of medicine last for?

. . . . . .

. . . . . .

. . . . . .

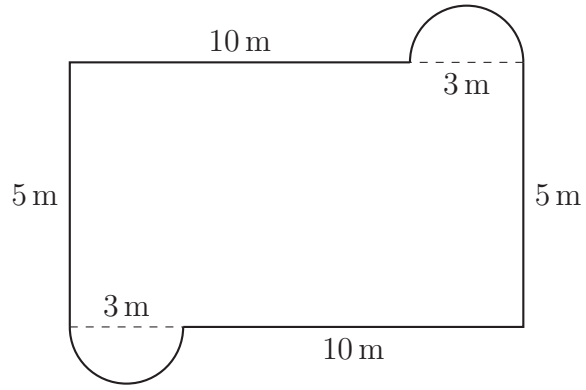
. . . . . .

. . . . . .

. . . . . .

Question 23 (5 marks)

A rectangular swimming pool has two semi-circular sections at each end. The dimensions of the pool are given in the diagram below.



(a) Calculate the perimeter of the pool to the nearest metre. **2**

.....

.....

.....

.....

.....

(b) The rectangular section of the pool has a constant depth of 1·5 m, and the semi-circular sections both have a depth of 40 cm. Find the volume of water in the pool, to the nearest kilolitre. **3**

.....

.....

.....

.....

.....

.....

.....

.....

Question 24 (4 marks) **4**

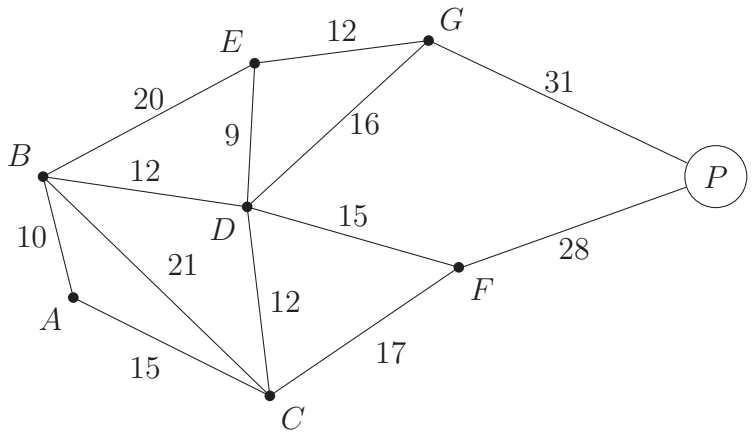
Isaac has earned a gross annual salary of $102 500 in 2018-19 and his employer has paid $27 500 PAYG tax on his behalf. Isaac has calculated that his total allowable deductions were $1280 for work-related travel, $350 for stationery and $450 for professional subscriptions. Isaac must pay the medicare levy of 2% on his taxable income.

Using the tax table provided by the ATO below, determine how much Isaac's tax refund or tax liability will be.

Taxable income	Tax payable
0 – $18 200	Nil
$18 201 – $37 000	19c for each $1 over $18 200
$37 001 – $90 000	$3572 plus 32.5c for each $1 over $37 000
$90 001 – $180 000	$20 797 plus 37c for each $1 over $90 000
$180 001 and over	$54 097 plus 45c for each $1 over $180 000

Question 25 (4 marks)

Cabins in a national park are to be connected to the power source at P. The weighted graph below shows the distances in metres between certain cabins and the power source.



(a) Use Kruskal's algorithm to draw a minimum spanning tree for this network. **3**

(b) What is the weight of this minimum spanning tree? **1**

.....

.....

.....

Question 26 (5 marks)

Lieutenant Smith mapped out an orienteering course for the Bravo cadets. He left point A on a bearing of 050° and walked for 7 km and placed a marker B. From point B he then left on a bearing of 120° and walked for 8 km to a point C.

(a) Draw a diagram to represent this information. **1**

(b) Find the distance from point C to point A, to 1 decimal place. **2**

.....

.....

.....

.....

.....

.....

(c) What is the bearing of C from A? **2**

.....

.....

.....

.....

.....

.....

Question 27 (4 marks)

Alice has 3 'large' glasses of wine over two and a half hours. A 'large' glass of wine is $1{\cdot}5$ standard drinks and she weighs 53 kg. The formula to calculate her Blood Alcohol Content is:

$$BAC_{\text{Female}} = \frac{10N - 7{\cdot}5H}{5{\cdot}5M}$$

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

(a) Calculate Alice's Blood Alcohol Content after two and a half hours. **2**

.....

.....

.....

.....

.....

(b) If Alice has no more alcohol, determine how much longer she must wait until her Blood Alcohol Content returns to zero. **2**

.....

.....

.....

.....

.....

.....

.....

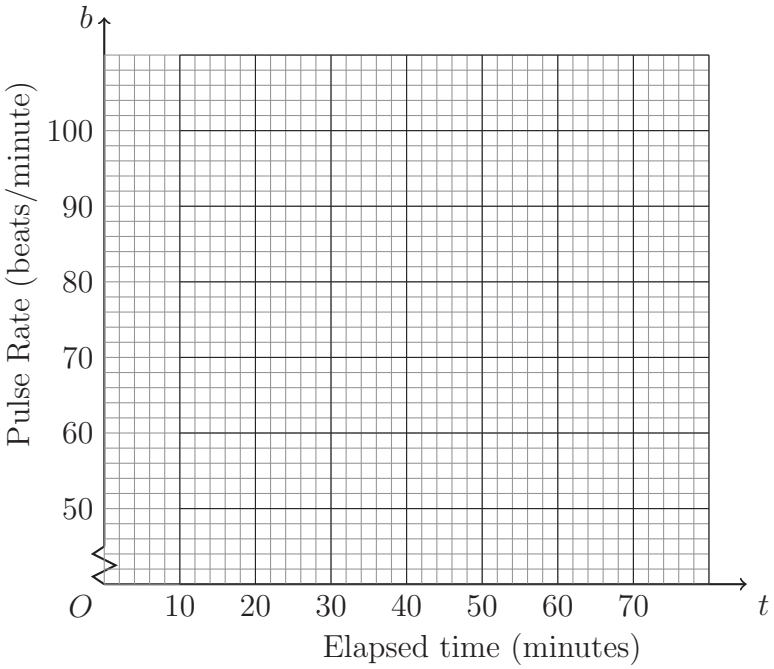
.....

Question 28 (5 marks)

Harry measures his pulse rate at various intervals while watching his football team play in the grand-final. This information is recorded in the table below.

Elapsed time = t minutes	5	8	16	20	30	42	48	53	60	65
Pulse Rate = b beats/minute	97	90	85	76	75	60	69	60	55	59

(a) Draw a scatterplot and line of best fit on the graph below. **2**



(b) Write an equation for line of best fit. **1**

.....

.....

(c) Calculate the value of the correlation coefficient, correct to 1 decimal place. **2**

.....

.....

Question 29 (2 marks) **2**

Oliver has a credit card with no annual fee, although it charges 19·9% p.a. with interest calculated and added daily on all purchases from the date of purchase. Oliver used his credit card to buy a new TV for \$1190 on the 17th July. Calculate how much will he need to repay on the 10th August so that he has a zero balance on his card.

.....

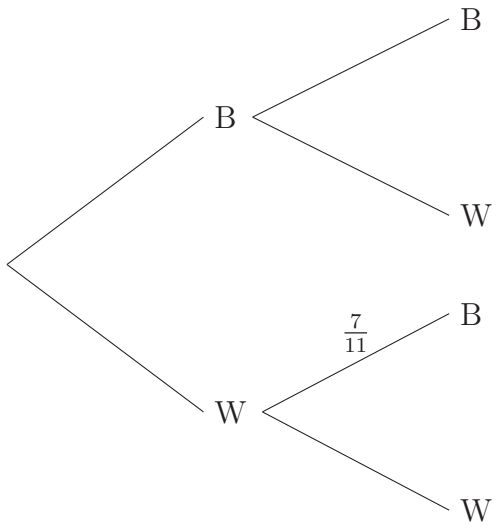
.....

.....

.....

Question 30 (3 marks) **3**

A bag contains 7 black balls and 5 white balls. Two balls are selected at random without replacement. A partially completed tree diagram is shown below.



Complete the tree diagram and calculate the probability of selecting two balls of different colours.

.....

.....

.....

Question 31 (2 marks)

The stem and leaf plot below shows the number of goals scored by the football teams in the A-League across the 2018/2019 season.

3	1	8	9		
4	0	1	2	7	9
5	4	9			

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

.....

.....

.....

(b) Describe the shape of the distribution. **1**

.....

.....

.....

Question 32 (3 marks) **3**

Richard is considering purchasing a new refrigerator and has narrowed down his choice to two options:

Electrodux: 3 star energy rating of 394 kWh/year

Kevinator: $4\frac{1}{2}$ star energy rating of 310 kWh/year

How much would Richard save in electricity in one year by purchasing the more efficient refrigerator? You can assume that electricity charges will remain constant at 28.5 c/kWh.

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Question 33 (3 marks)

The maximum daily temperatures during the summer months in Mount Isa are recorded. These maximum temperatures are normally distributed with a mean of $33 \cdot 8$°C and a standard deviation of $4 \cdot 1$°C.

(a) What temperature has a z-score of -1? **1**

.....

.....

.....

(b) What percentage of summer days in Mount Isa would you expect to be between $29 \cdot 7$°C and $42 \cdot 0$°C? **2**

.....

.....

.....

.....

.....

.....

Question 34 (2 marks) **2**

A new start-up company purchases \$24 500 worth of office equipment. It is depreciated using the declining balance method at a rate of 18% per annum. Calculate the value of the equipment after 3 years.

.....

.....

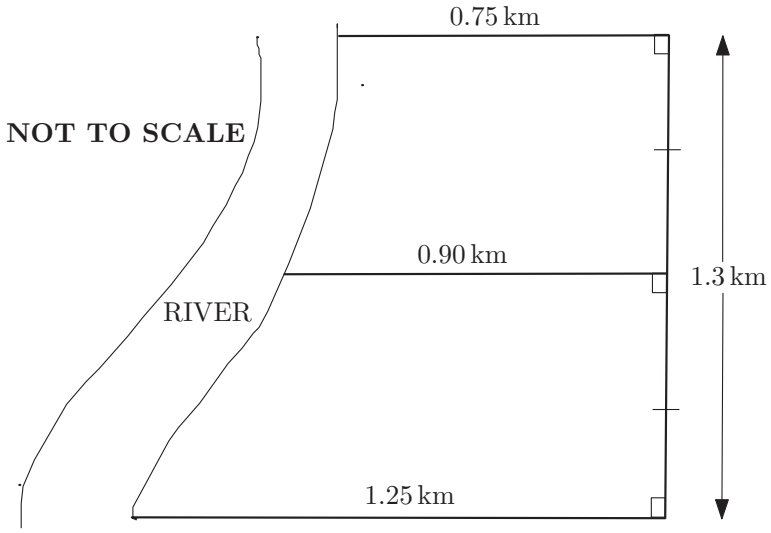
.....

.....

.....

Question 35 (4 marks)

The diagram below represents a property that borders a river.



(a) Use two applications of the trapezoidal rule to estimate the area of the property. **2**

.....

.....

.....

.....

.....

(b) Annual rates payable to the local council are charged at the rate of 0.125 cents per square metre. Calculate the annual rates due for this property. **2**

.....

.....

.....

.....

.....

Question 36 (4 marks)

The number of seats in a row at a cinema varies inversely with the width of each seat. The present configuration has 42 seats in a row, each of width 47 cm, and this uses up all of the allowed space to comply with safety regulations. The owners of the cinema are considering a refurbishment.

(a) How many seats of width 52 cm can be installed? **2**

.....

.....

.....

.....

.....

(b) If only 34 seats are required in each row, what is the maximum width of each seat? **2**

.....

.....

.....

.....

.....

Question 37 (6 marks)

A surfboard manufacturer has initial costs of \$42 500 to set up the factory to produce the surfboards. After the initial set-up costs, every 20 surfboards produced cost a further \$2500. The surfboards are sold to retail outlets for \$465 each.

(a) Write down the cost of production function $C(n)$, and the revenue function $R(n)$, where n is the number of surfboards manufactured or sold respectively. **2**

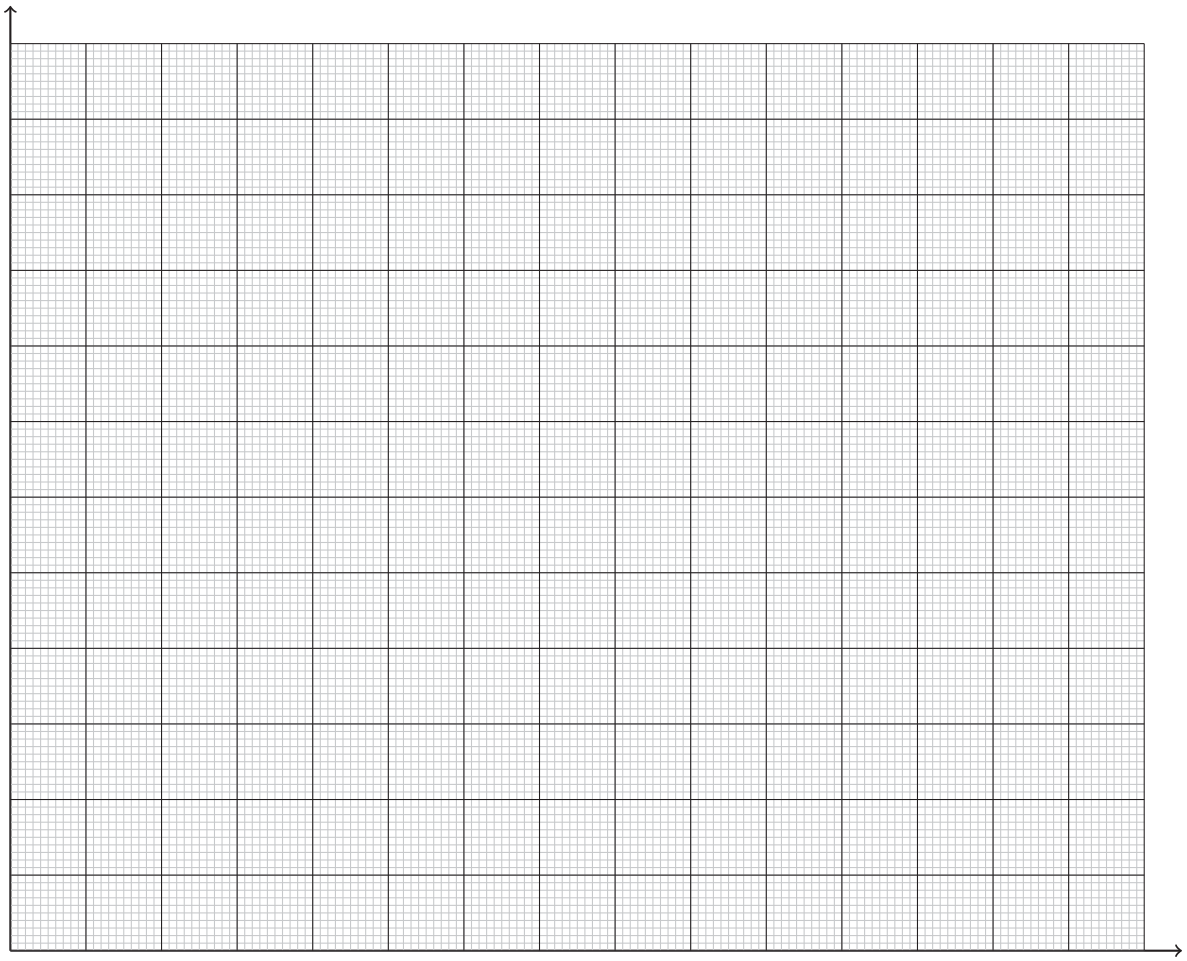
.....

.....

.....

.....

(b) Graph $C(n)$ and $R(n)$ below on the same set of axes for $0 \leq n \leq 300$. Ensure that your axes are marked and labelled properly. **3**



(c) Find the number of surfboards that must be sold in order to break-even. **1**

. . . . . .

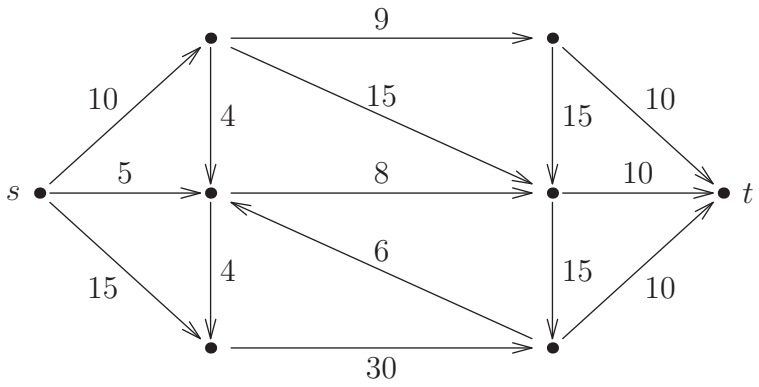
. . . . . .

. . . . . .

. . . . . .

Question 38 (3 marks)

The diagram below shows a weighted network.



(a) Find the maximum flow in the network. **2**

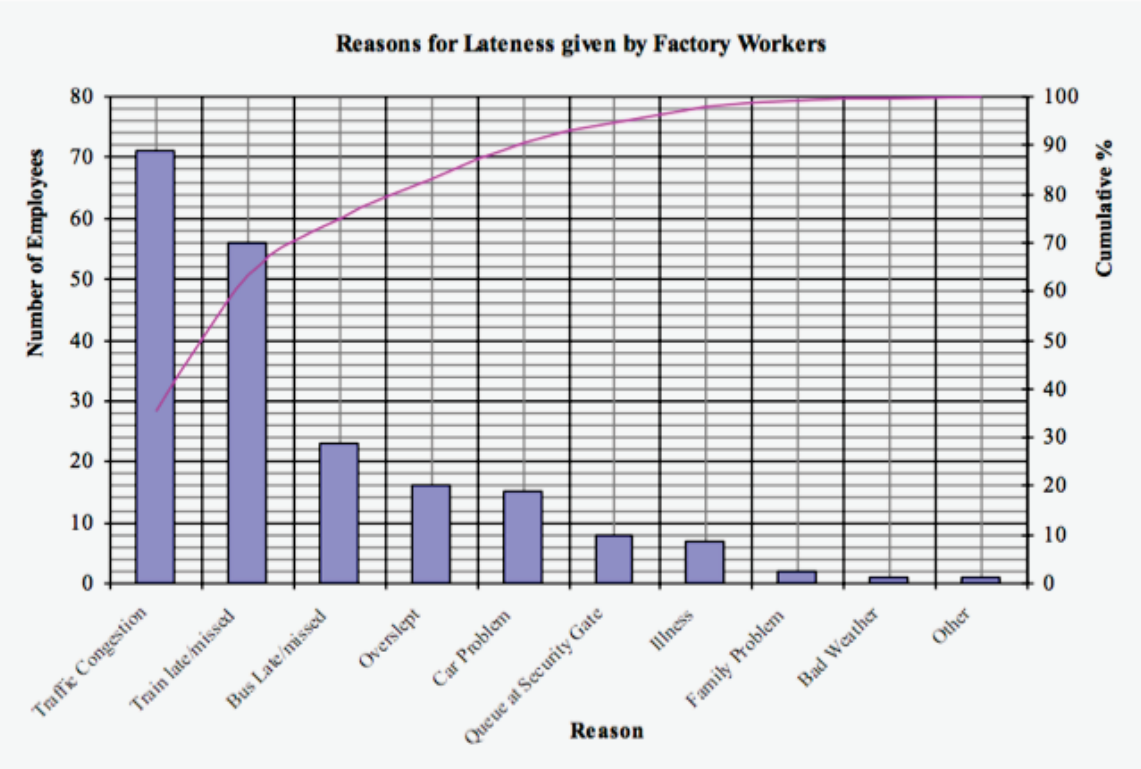
. . . . . .

(b) Hence find the minimum cut for the network. **1**

. . . . . .

Question 39 (2 marks)

A random sample of 200 factory workers was conducted to find out the reasons why workers were late for work. The results are represented in the Pareto Chart below.



(a) What percentage of latecomers blamed traffic congestion? **1**

.....

.....

.....

(b) List the main causes that account for 80% of the reasons. **1**

.....

.....

.....

.....

.....

Question 40 (3 marks)

The table below shows the future value of an annuity of $1 for varying interest rates and time periods. Contributions are made at the beginning of each time period.

n	1%	2%	3%	4%	5%
1	1.0100	1.0200	1.0300	1.0400	1.0500
2	2.0301	2.0604	2.0909	2.1216	2.1525
3	3.0604	3.1216	3.1836	3.2465	3.3101
4	4.1010	4.2040	4.3091	4.4163	4.5256
5	5.1520	5.3081	5.4684	5.6330	5.8019
6	6.2135	6.4343	6.6625	6.8983	7.1420
7	7.2857	7.5830	7.8923	8.2142	8.5491
8	8.3685	8.7546	9.1591	9.5828	10.0265
9	9.4622	9.9497	10.4639	11.0061	11.5779
10	10.5668	11.1687	11.8078	12.4864	13.2068
11	11.6825	12.4121	13.1920	14.0258	14.9171
12	12.8093	13.6803	14.6178	15.6268	16.7130

(a) Lachlan invests $500 at the start of each year for 12 years at an interest rate of 5% p.a. Calculate the future value of Lachlan's investment after 12 years. **1**

.....

.....

(b) Hugo is planning to buy a new car in 3 years time and he wants to save $8000 in that time. He intends to make regular quarterly payments into an account that earns 4% p.a. compounded quarterly. What is the minimum quarterly payment into the account, to the nearest dollar, that Hugo needs to make in order to have saved $8000? Support your answer with calculations. **2**

.....

.....

.....

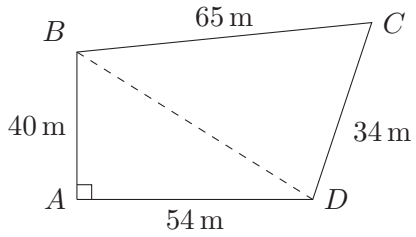
.....

.....

.....

Question 41 (5 marks) **5**

The quadrilateral $ABCD$ represents a block of land, where $AB = 40\,\text{m}$, $BC = 65\,\text{m}$, $CD = 34\,\text{m}$, $AD = 54\,\text{m}$ and $\angle BAD$ is 90°. This information is shown in the diagram below.



Find the area of the land.

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

End of Paper

CANDIDATE NUMBER

SOLUTIONS

SYDNEY GRAMMAR SCHOOL

2019
Trial Examination
FORM VI
MATHEMATICS STANDARD
Monday 12th August 2019

- Record your multiple choice answers by filling in the circle corresponding to your choice for each question.
- Fill in the circle completely.
- Each question has only one correct answer.

Question One
A ● B ○ C ○ D ○

Question Two
A ○ B ● C ○ D ○

Question Three
A ○ B ● C ○ D ○

Question Four
A ○ B ● C ○ D ○

Question Five
A ○ B ● C ○ D ○

Question Six
A ● B ○ C ○ D ○

Question Seven
A ○ B ○ C ○ D ●

Question Eight
A ○ B ○ C ○ D ●

Question Nine
A ○ B ○ C ○ D ●

Question Ten
A ○ B ○ C ● D ○

Question Eleven
A ○ B ● C ○ D ○

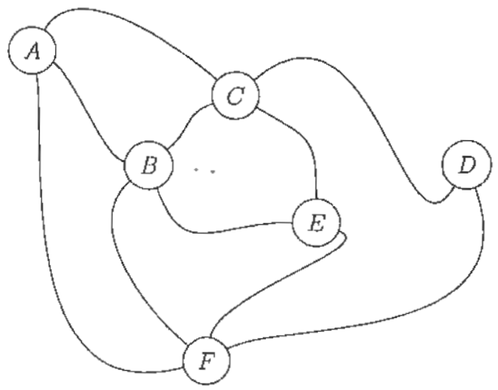
Question Twelve
A ○ B ● C ○ D ○

Question Thirteen
A ● B ○ C ○ D ○

Question Fourteen
A ○ B ● C ○ D ○

Question Fifteen
A ● B ○ C ○ D ○

15. A collection of bushwalking tracks is modelled by the network below. There are six checkpoints labelled A, B, C, D, E and F. Which of the following two edges should be removed so that a bushwalker could walk along every track exactly once?



A. AB and BE

B. CB and BF

C. CD and DF

D. CE and BF

End of Section I

Section II - Written Response

Answers for this section should be recorded in the space provided in this paper.

Show all necessary working.

Question 16 (2 marks)

Solve $5x \quad 3(2 \quad x) \quad x - 12$. **2**

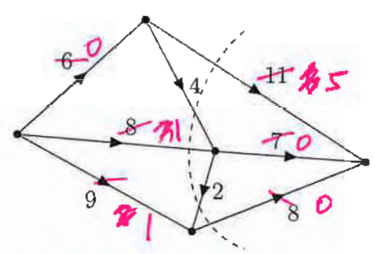
$5x - 6 - 3x = x - 12$ ✓

$x - 6 = -12$

$x = -6$ ✓

Question 17 (1 mark)

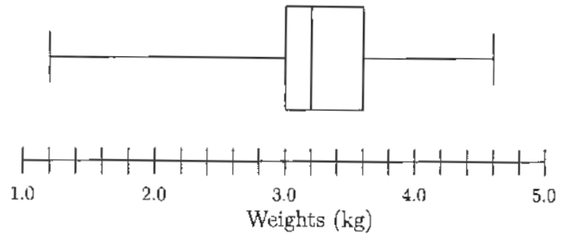
Find the capacity of the cut shown in the network diagram below. **1**



$11 + 4 + 8 + 2 + 8 = 33$ ✓

Question 18 (4 marks)

The birth weights of babies born in Australia during 2017 is presented in the following box-and-whisker diagram.



(a) What is the weight of the lightest baby born during 2017? 1

1·2kg

(b) Find the interquartile range. 1

0·6kg

(c) Calculate the limits for outliers in this data set. 2

Upper limit = $Q_3 + 1.5 \times IQR$
$= 3.6 + 1.5 \times 0.6 = 4.5$ ✓
Lower limit = $Q_1 - 1.5 \times IQR$
$= 2.0 - 1.5 \times 0.6 = 2.1$ ✓
Limits : $2.1 \leq$ outliers ≤ 4.5

Question 19 (2 marks) 2

In a raffle, the total prize money is shared among the first three tickets drawn in the ratio 4 : 3 : 2.

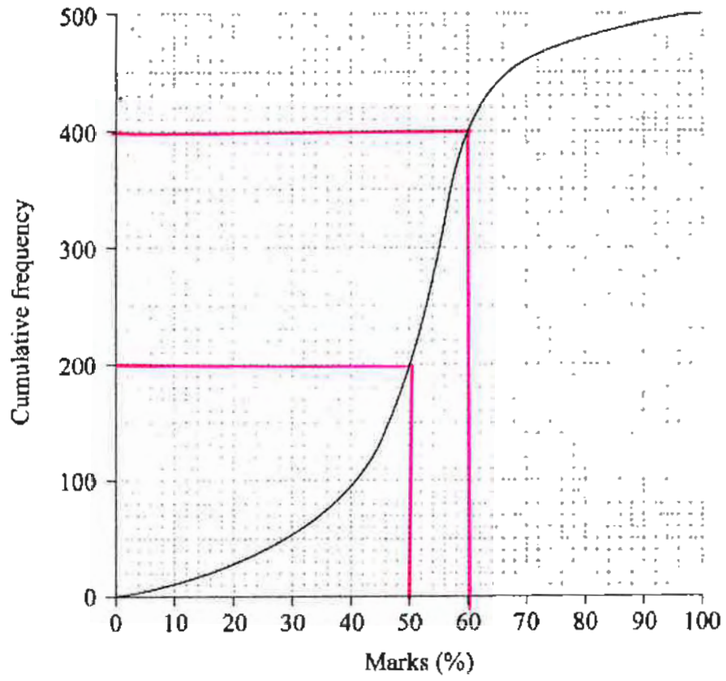
The prize for the second ticket drawn is \$750.

What is the total prize money?

3 parts = 750 so 1 part = 250 ✓
total prize money = 9 × 250 ✓
= \$2250

Question 20 (2 marks)

The cumulative frequency curve below displays the percentage marks attained by 500 students in an examination.



(a) Those scoring less than 50% failed the examination. Find the number of students who failed the examination. 1

200

(b) The top 20% of students are eligible for further study. Find the lowest mark to be eligible for further study. 1

60%

Question 21 (3 marks) **3**

An intravenous drip is delivering 30 drops/min. There are 15 drops/mL and 1·2 L of liquid to be delivered. How long will the drip take to deliver the required dose?

$15 \times 1200 = 18000$ drops ✓

time $= \frac{18000}{30}$ ✓

$= 600$ min

$= 10$ hours ✓

Question 22 (2 marks) **2**

An eight year-old child weighing 24·5 kg needs to have the correct dosage of medicine. The dosage d is calculated using the formula:

$$d = \frac{mA}{70}$$

where m is the mass of the child in kilograms, and
A is the adult dosage.

If the adult dosage is 20 mL twice a day, how many days will a 250 mL bottle of medicine last for?

$d = \frac{24.5 \times 20}{70}$

$= 7$ mL

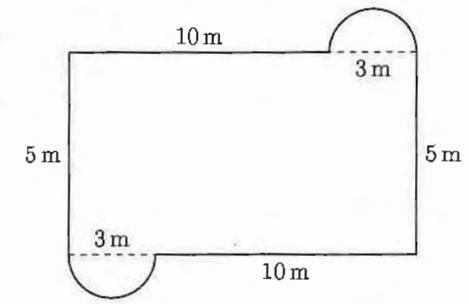
so 14mL a day ✓

$\frac{250}{14} = 17.8$

So the bottle will last for 17 days ✓

Question 23 (5 marks)

A rectangular swimming pool has two semi-circular sections at each end. The dimensions of the pool are given in the diagram below.



(a) Calculate the perimeter of the pool to the nearest metre. **2**

$P = 2(10+5) + 2\pi(1.5)$ ✓

$= 30 + 3\pi$

$= 39.42$

$\doteq 39$m (to the nearest metre) ✓

(b) The rectangular section of the pool has a constant depth of 1·5 m, and the semi-circular sections both have a depth of 40 cm. Find the volume of water in the pool, to the nearest kilolitre. **3**

$Vol = (5 \times 13 \times 1.5) + \pi(1.5)^2 \times 0.4$ ✓

$= 97.5 + 2.827$

$= 100.327$ m^3 ✓

$= 100$ kL ✓

Question 24 (4 marks)

Isaac has earned a gross annual salary of $102 500 in 2018-19 and his employer has paid $27 500 PAYG tax on his behalf. Isaac has calculated that his total allowable deductions were $1280 for work-related travel, $350 for stationery and $450 for professional subscriptions. Isaac must pay the medicare levy of 2% on his taxable income.

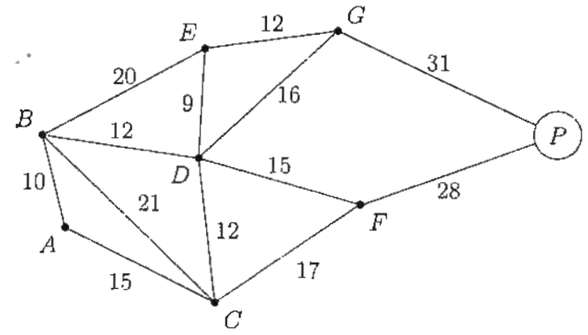
Using the tax table provided by the ATO below, determine how much Isaac's tax refund or tax liability will be.

Taxable income	Tax payable
0 – $18 200	Nil
$18 201 – $37 000	19c for each $1 over $18 200
$37 001 – $90 000	$3572 plus 32.5c for each $1 over $37 000
$90 001 – $180 000	$20 797 plus 37c for each $1 over $90 000
$180 001 and over	$54 097 plus 45c for each $1 over $180 000

Taxable income = 102500 − (1280 + 350 + 450) ✓
= 100420
Income tax = 20797 + (0·37 × 100420)
= 20797 + 3855·40 ✓
= 24652·40
Medicare Levy = 0·02 × 100420 = 2008·40 ✓
Tax payable = $26660·80.
Refund = 27500 − 26660·80 ✓
= $ 831·20.

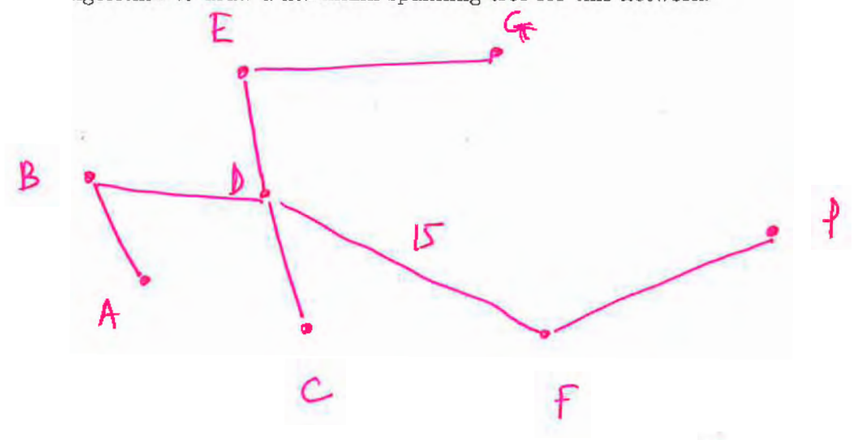
Question 25 (4 marks)

Cabins in a national park are to be connected to the power source at P. The weighted graph below shows the distances in metres between certain cabins and the power source.



(a) Use Kruskal's algorithm to draw a minimum spanning tree for this network. 3

ED = 9 ✓
BA = 10 ✓
BD = 12 ✓
EG = 12 ✓
DC = 12 ✓
DF = 15 ✓
AC = 15 ×
DG = 16 ×
GF = 17 ×
BE = 20 ×
FP = 28 ✓
GP = 31 ×



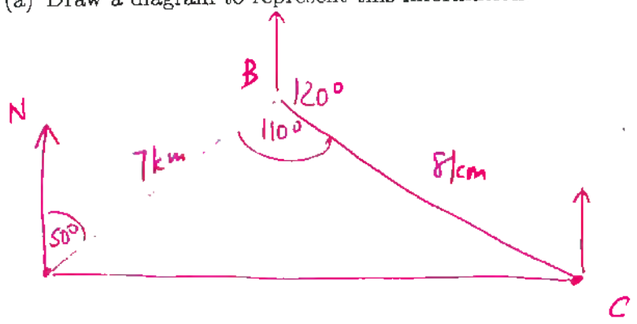
(b) What is the weight of this minimum spanning tree? 1

10 + 12 + 9 + 12 + 12 + 15 + 28 = 98.

Question 26 (5 marks)

Lieutenant Smith mapped out an orienteering course for the Bravo cadets. He left point A on a bearing of 050° and walked for 7 km and placed a marker B. From point B he then left on a bearing of 120° and walked for 8 km to a point C.

(a) Draw a diagram to represent this information. 1



(b) Find the distance from point C to point A, to 1 decimal place. 2

$AC^2 = 7^2 + 8^2 - 2 \times 7 \times 8 \times \cos 110°$ ✓

$= 151.306\ldots$

$AC \doteq 12.3$ km (1 dp) ✓

(c) What is the bearing of C from A? 2

$\frac{\sin A}{8} = \frac{\sin 110°}{12.3}$

$A = 38°$

Bearing $= 38 + 50$

$= 88°$.

Question 27 (4 marks)

Alice has 3 'large' glasses of wine over two and a half hours. A 'large' glass of wine is 1·5 standard drinks and she weighs 53 kg. The formula to calculate her Blood Alcohol Content is:

$$BAC_{\text{Female}} \quad \frac{10N - 7{\cdot}5H}{5{\cdot}5M}$$

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

(a) Calculate Alice's Blood Alcohol Content after two and a half hours. 2

$BAC = \frac{10 \times 3 \times 1{\cdot}5 - 7{\cdot}5 \times 2{\cdot}5}{5{\cdot}5 \times 53}$ ✓

$= \frac{45 - 18{\cdot}75}{5{\cdot}5 \times 53}$

$= 0{\cdot}09$ ✓

(b) If Alice has no more alcohol, determine how much longer she must wait until her Blood Alcohol Content returns to zero. 2

$45 - 7{\cdot}5H = 0$.

$H = \frac{45}{7{\cdot}5}$

$= 6$ hrs ✓

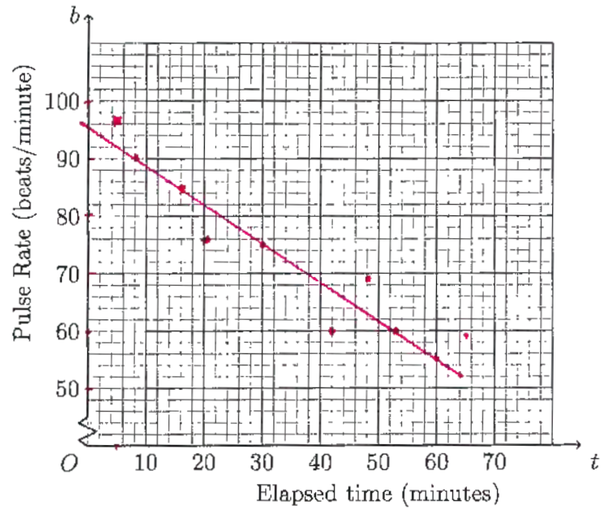
So $3\frac{1}{2}$ hours more until her BAC returns to zero. ✓

Question 28 (5 marks)

Harry measures his pulse rate at various intervals while watching his football team play in the grand-final. This information is recorded in the table below.

Elapsed time t minutes	5	8	16	20	30	42	48	53	60	65
Pulse Rate b beats/minute	97	90	85	76	75	60	69	60	55	59

(a) Draw a scatterplot and line of best fit on the graph below. **2**



(b) Write an equation for line of best fit. **1**

$m = \frac{90-62}{10-50}$ (30, 76) So $76 = -\frac{7}{10} \times 30 + b \rightarrow b = 97$

$= \frac{28}{-40} = -0.7$ $y = -0.7x + 97$ ✓

(c) Calculate the value of the correlation coefficient, correct to 1 decimal place. **2**

-0.9.

Question 29 (2 marks) **2**

Oliver has a credit card with no annual fee, although it charges 19·9% p.a. with interest calculated and added daily on all purchases from the date of purchase. Oliver used his credit card to buy a new TV for \$1190 on the 17th July. Calculate how much will he need to repay on the 10th August so that he has a zero balance on his card.

17-31] 25 days
1-10]

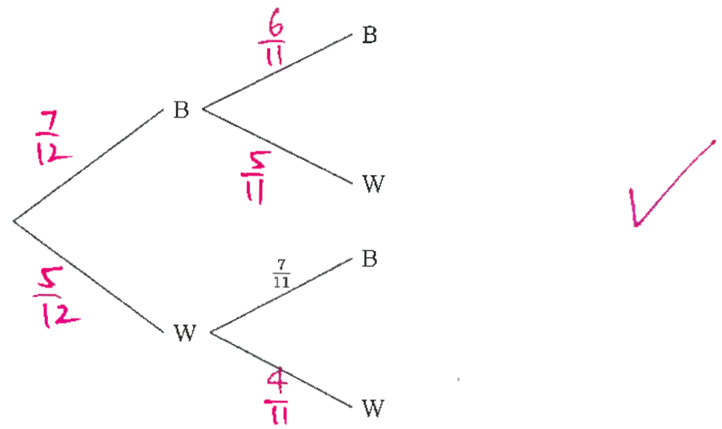
Interest $= 1190(1.0005452)^{25}$ ✓

$= 1206.326\ldots$

So needs to pay back \$1206.33 ✓

Question 30 (3 marks) **3**

A bag contains 7 black balls and 5 white balls. Two balls are selected at random without replacement. A partially completed tree diagram is shown below.



✓

Complete the tree diagram and calculate the probability of selecting two balls of different colours.

P(different colours) = P(BW) + P(WB)

$= \frac{7}{12} \times \frac{5}{11} + \frac{5}{12} \times \frac{7}{11}$

$= \frac{70}{132}$

$= \frac{35}{66}$.

Question 31 (2 marks)

The stem and leaf plot below shows the number of goals scored by the football teams in the A-League across the 2018/2019 season.

3	1	8	9		
4	0	1	2	7	9
5	4	9			

(a) Find the median number of goals scored. 1

41.5 .

(b) Describe the shape of the distribution. 1

symmetrical .

Question 32 (3 marks) 3

Richard is considering purchasing a new refrigerator and has narrowed down his choice to two options:

Electrodux: 3 star energy rating of 394 kWh/year

Kevinator: $4\frac{1}{2}$ star energy rating of 310 kWh/year

How much would Richard save in electricity in one year by purchasing the more efficient refrigerator? You can assume that electricity charges will remain constant at 28.5 c/kWh.

394 − 310 = 84

84 × 0.285 = $23.94 .

Question 33 (3 marks)

The maximum daily temperatures during the summer months in Mount Isa are recorded. These maximum temperatures are normally distributed with a mean of 33·8°C and a standard deviation of 4·1°C.

(a) What temperature has a z-score of -1? **1**

$33 \cdot 8 - 4 \cdot 1 = 29 \cdot 7°C$ ✓

(b) What percentage of summer days in Mount Isa would you expect to be between 29·7°C and 42·0°C? **2**

$+2 - 33 \cdot 8 = 8 \cdot 2$ i.e. $-1 \leq z \leq 2$.

$100\% - 16\% - 2 \cdot 5\% = 81 \cdot 5\%$

Question 34 (2 marks) **2**

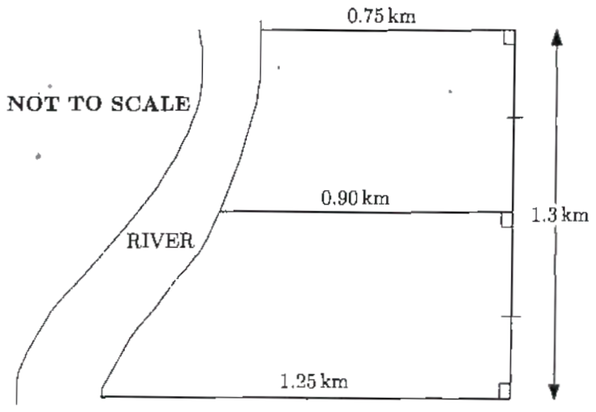
A new start-up company purchases \$24 500 worth of office equipment. It is depreciated using the declining balance method at a rate of 18% per annum. Calculate the value of the equipment after 3 years.

$245000 \times (1 - 18\%)^3$ ✓

$= \$13508 \cdot 52$ ✓

Question 35 (4 marks)

The diagram below represents a property that borders a river.



(a) Use two applications of the trapezoidal rule to estimate the area of the property. **2**

$A = \frac{0 \cdot 65}{2}(1 \cdot 25 + 0 \cdot 9) + \frac{0 \cdot 65}{2}(0 \cdot 9 + 0 \cdot 75)$ ✓

$= 1 \cdot 235 \text{ km}^2$ ✓

(b) Annual rates payable to the local council are charged at the rate of 0.125 cents per square metre. Calculate the annual rates due for this property. **2**

$1 \cdot 235 \times 1000^2 \times 0 \cdot 125$ ✓

$= 1 \cdot 235 \times 1000 \times \$1 \cdot 25$

$= \$1543 \cdot 75$ ✓

Question 36 (4 marks)

The number of seats in a row at a cinema varies inversely with the width of each seat. The present configuration has 42 seats in a row, each of width 47 cm, and this uses up all of the allowed space to comply with safety regulations. The owners of the cinema are considering a refurbishment.

(a) How many seats of width 52 cm can be installed? **2**

$s \propto \frac{1}{w}$

$s = \frac{k}{w}$

$42 = \frac{k}{47}$

$k = 42 \times 47$

$= 1974$

$S = \frac{1974}{52}$

$= 37.96$

so 37 seats

(b) If only 34 seats are required in each row, what is the maximum width of each seat? **2**

$34 = \frac{1974}{w}$

$w = 58.06$

$\doteq 58\text{cm}$

Question 37 (6 marks)

A surfboard manufacturer has initial costs of \$42 500 to set up the factory to produce the surfboards. After the initial set-up costs, every 20 surfboards produced cost a further \$2500. The surfboards are sold to retail outlets for \$465 each.

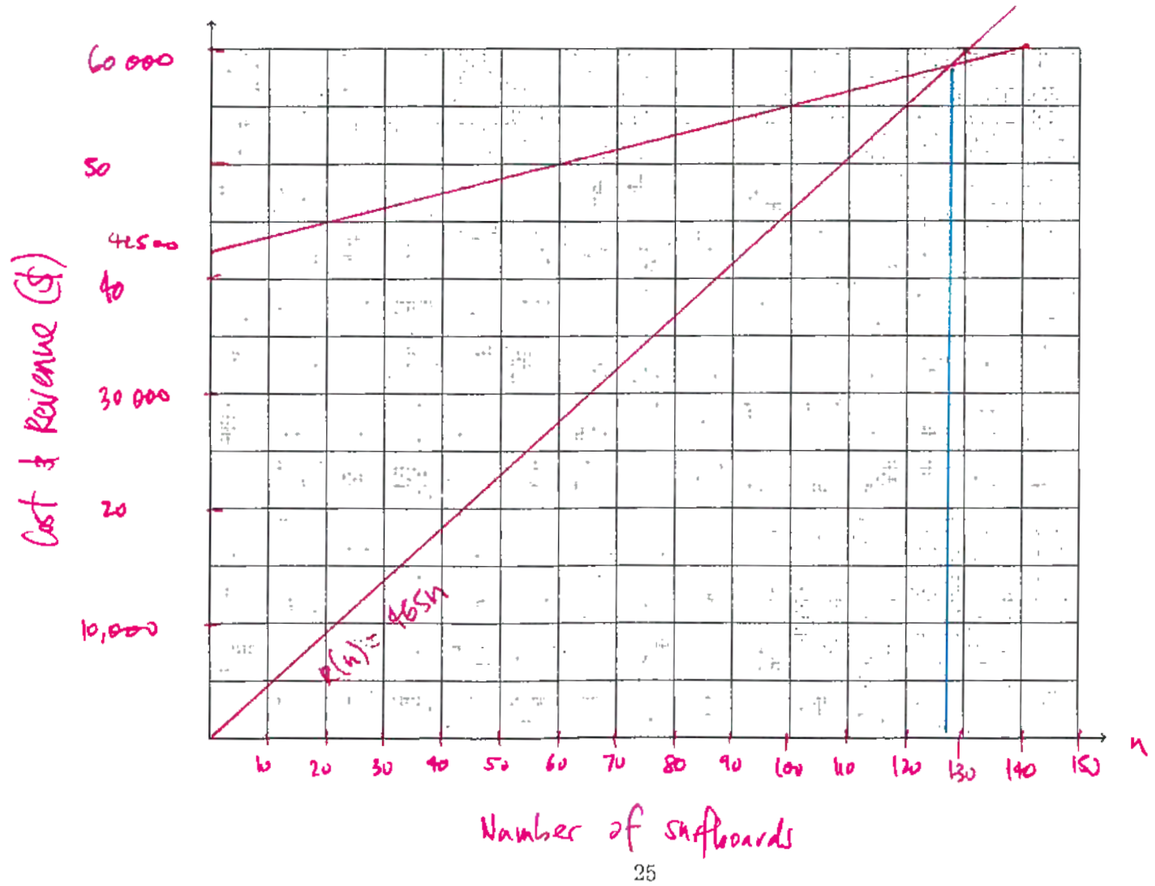
(a) Write down the cost of production function $C(n)$, and the revenue function $R(n)$, where n is the number of surfboards manufactured or sold respectively. **2**

$C(n) = 42500 + \frac{2500n}{20}$ ✓

$= 42500 + 125n$ ✓

$R(n) = 465n$

(b) Graph $C(n)$ and $R(n)$ below on the same set of axes for $0 \quad n \leq 300$. Ensure that your axes are marked and labelled properly. **3**



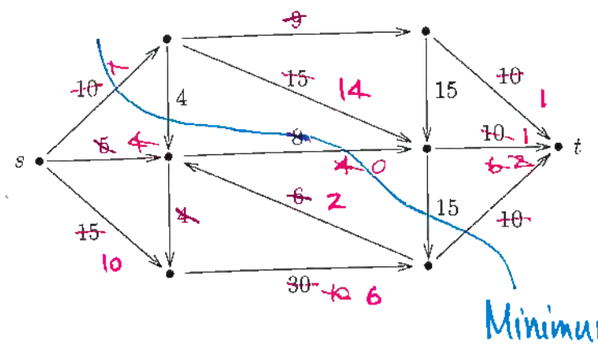
Question 37 (continued)

(c) Find the number of surfboards that must be sold in order to break-even. 1

≈ 125

Question 38 (3 marks)

The diagram below shows a weighted network.



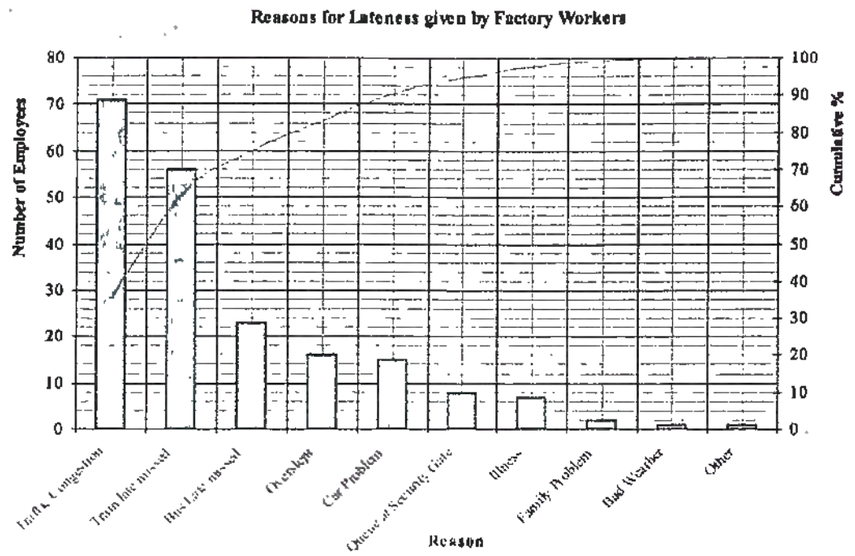
(a) Find the maximum flow in the network. 2

10 + 9 + 4 + 4 + 1 = 28

(b) Hence find the minimum cut for the network. 1

Question 39 (2 marks)

A random sample of 200 factory workers was conducted to find out the reasons why workers were late for work. The results are represented in the Pareto Chart below.



(a) What percentage of latecomers blamed traffic congestion? 1

$\frac{71}{200} = 35.5\%$

(b) List the main causes that account for 80% of the reasons. 1

- Traffic
- Train late
- Bus late

Question 40 (3 marks)

The table below shows the future value of an annuity of \$1 for varying interest rates and time periods. Contributions are made at the beginning of each time period.

n	1%	2%	3%	4%	5%
1	1.0100	1.0200	1.0300	1.0400	1.0500
2	2.0301	2.0604	2.0909	2.1216	2.1525
3	3.0604	3.1216	3.1836	3.2465	3.3101
4	4.1010	4.2040	4.3091	4.4163	4.5256
5	5.1520	5.3081	5.4684	5.6330	5.8019
6	6.2135	6.4343	6.6625	6.8983	7.1420
7	7.2857	7.5830	7.8923	8.2142	8.5491
8	8.3685	8.7546	9.1591	9.5828	10.0265
9	9.4622	9.9497	10.4639	11.0061	11.5779
10	10.5668	11.1687	11.8078	12.4864	13.2068
11	11.6825	12.4121	13.1920	14.0258	14.9171
12	12.8093	13.6803	14.6178	15.6268	16.7130

(a) Lachlan invests \$500 at the start of each year for 12 years at an interest rate of 5% p.a. 1
Calculate the future value of Lachlan's investment after 12 years.

$500 \times 16.7130 = \$8356.50$

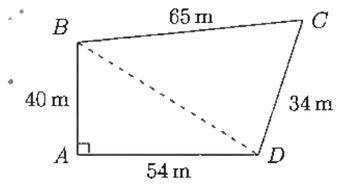
(b) Hugo is planning to buy a new car in 3 years time and he wants to save \$8000 in that time. He intends to make regular quarterly payments into an account that earns 4% p.a. compounded quarterly. What is the minimum quarterly payment into the account, to the nearest dollar, that Hugo needs to make in order to have saved \$8000? Support your answer with calculations. 2

$\frac{8000}{12.8093} = \$625$.

$r = 4 \div 4$
$= 1\%$ per qtr.

Question 41 (5 marks) 5

The quadrilateral $ABCD$ represents a block of land, where AB 40 m, BC 65 m, CD 34 m, AD 54 m and $\angle BAD$ is 90°. This information is shown in the diagram below.



Find the area of the land.

$BD^2 = 40^2 + 54^2$
$= 4516$
$BD \doteq 67.2$m.

$\angle C = \cos^{-1}\left(\frac{65^2 + 34^2 - (40^2 + 54^2)}{2 \times 65 \times 34}\right)$
$= 78.71^0$

Area $= \frac{1}{2} \times 40 \times 54 + \frac{1}{2} \times 34 \times 65 \times \sin 78.71$
$\doteq 2164 m^2$

End of Paper