NAME: _____

Blacktown Boys' High School

Year 12 2022

Trial Examination

Mathematics Standard 2

General Instructions

- Reading time – 10 minutes
- Working time – 2 hours and 30 minutes
- Write using black pen
- Calculators approved by NESA may be used
- A reference sheet is provided for this paper
- In Questions in Section II, show all relevant mathematical reasoning and/or calculations

Total marks: 100

Section I – 15 marks (pages 3-8)

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

Section II – 85 marks (pages 10-28)

- Attempt Questions 16 – 39
- Allow about 2 hours and 5 minutes for this section

Assessor: Mrs.Chhabra

Students are advised that this is a trial examination only and cannot in any way guarantee the content or format of the 2022 Higher School Certificate Examination.

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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.

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1 Jack was rolling an unbiased die. He rolled a 5 followed by a 2.
How would you describe the probability of Jack rolling an even number on the next roll of the die?

A. Likely

B. Certain

C. Even

D. Unlikely

2 A cube has side length of $8.4\ cm$. What is the surface area of this cube?

A. $28.8\ cm^2$

B. $423.36\ cm^2$

C. $282.24\ cm^2$

D. $592.704\ cm^2$

3 Melissa flies out of Brisbane at 11am on Sunday and arrives in Brussels 26 hours later. If Brussels is 9 hours behind Brisbane, find the time in Brussels when Melissa arrives?

A. 9 pm Sunday

B. 9 pm Monday

C. 1 pm Monday

D. 4 am Monday

4 A taxi number plate begins with a letter T and is followed by 4 digits. Each digit can be one of the numbers 0,1,2,3,4,5,6,7,8 or 9. How many different number plates of this type are there?

A. $10 \times 9 \times 8 \times 7$

B. $10 \times 10 \times 10 \times 10$

C. $26 \times 10 \times 9 \times 8 \times 7$

D. $26 \times 10 \times 10 \times 10 \times 10$

5 Mr Johnson gave a maths test. The results are listed below:

Females						Males					
			9	7	0	9					
8	8	6	4	3	1	2	3	5	7	8	
	8	7	4	2	2	1	1	6	6	7	9
8	7	4	3	1	3	1	2	3			

The difference in the median for the females and males is:

A. 2

B. 3

C. 4

D. 5

6 A high school has 130 students in each year group from Year 7 to Year 12. A survey is to be conducted to determine the average number of hours studied per week by students at the school. Which of the following would provide the most representative sample for the survey?

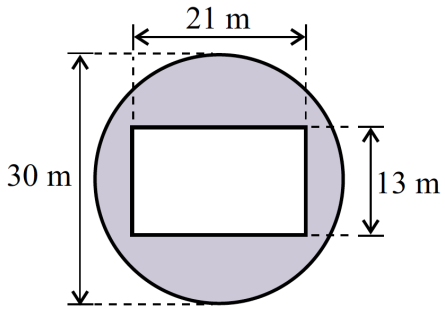
A. Random sample

B. Stratified sample

C. Systematic sample

D. Census

7 A circular grass field has a diameter of 30 metres. There is a concrete rectangle in the middle with a length of 21 metres and a width of 13 metres, as shown in the diagram below.



Which of the following would correctly calculate the area of the grass, in square metres, as shaded in the diagram?

A. $Area = 2 \times \pi \times \left(\frac{30}{2}\right) - 21 \times 13$

B. $Area = 2 \times \pi \times (30) - 21 \times 13$

C. $Area = \pi \times \left(\frac{30}{2}\right)^2 - 21 \times 13$

D $Area = \pi \times 30^2 - 21 \times 13$

8 A train trip costs $ 6.80 including 10% GST.
What is the train trip's price before GST, correct to the nearest cent?

A. $6.18

B. $6.70

C. $5.90

D. $7.48

9 Samuel measured his height to be 173 cm, correct to the nearest centimetre.
What is the percentage error in his measurement?

A. $\pm 0.26\%$

B. $\pm 0.29\%$

C. $\pm 0.0029\%$

D. $\pm 0.0026\%$

10 A bank charges 19.99% p.a. interest on credit cards. What is the daily interest rate assuming not a leap year?

A. 0.7688 %

B. 0.3844 %

C. 1.6658 %

D. 0.0548 %

11 Tara made two errors in her solution to the following equation:

$$\frac{-2x}{x-4} = -7$$

Line 1 …$-2x = -7(x-4)$

Line 2 …$-2x = -7x - 28$

Line 3 …$-5x = -28$

Line 4 …$x = \frac{28}{5}$

Which two lines do not follow correctly from the previous line?

A. $Lines\ 1\ and\ 2$

B. $Lines\ 1\ and\ 3$

C. $Lines\ 1\ and\ 4$

D. $Lines\ 2\ and\ 3$

12 The population (P) of a town grows exponentially according to the function

$$P = 10000(1.06)^t$$

where *t* is the number of years after the start of 2014.

The population at the start of 2021 is closest to

A. 40240

B. 42410

C. 15037

D. 12625

13 The kinetic energy, K (j) of a particle of mass M (kg), with a velocity of V (m/s) is given by:

$$K = \frac{1}{2}MV^2$$

Calculate the value of K, if M = 30kg and V=22 m/s

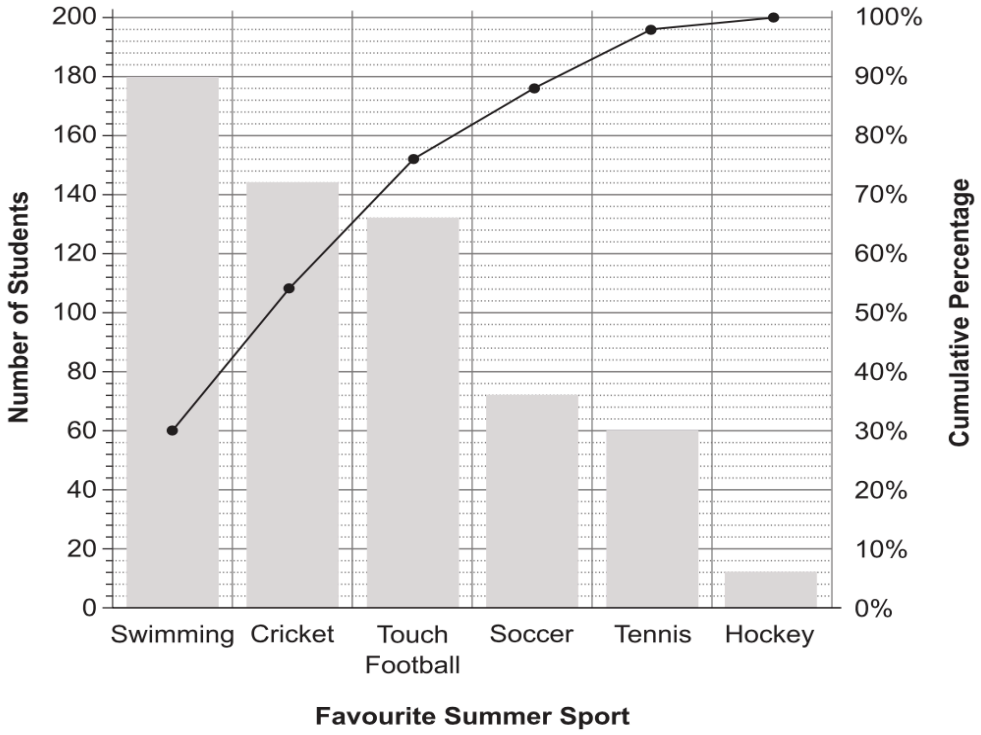
A. 330 j

B. 7260 j

C. 9900 j

D. 29040 j

14 A high school conducted a survey in which they asked their students "What was their favourite sport". The pareto chart below shows the data collected.



What percentage of students chose soccer as their favourite sport?

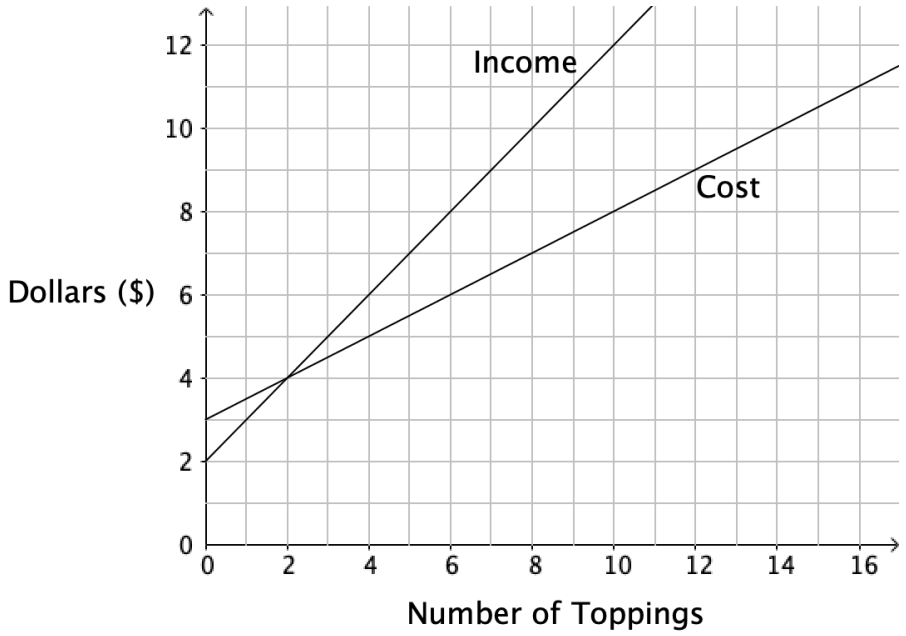
A. 10%

B. 12%

C. 36%

D. 72%

15 The graph below shows the cost of making pizzas depending on the number of toppings and the amount of income made from their sale.



How many toppings need to be sold to break even?

A. 0

B. 2

C. 5

D. 8

End of Section I

Mathematics Standard 2

Section II Answer Booklet

85 marks
Attempt Questions 16 - 39
Allow about 2 hours and 5 minutes for this section

Instructions

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

Question 16 (5 marks)

The table below shows the repayment per $1000 on a monthly reducible loan.

Term in Years	7%	7.25%	7.5%	7.75%	8%
5	19.8012	19.9194	20.0379	20.1570	20.2765
10	11.6108	11.7401	11.8702	12.0011	12.1328
15	8.9883	9.1286	9.2701	9.4128	9.5566
20	7.7530	7.9036	8.0559	8.2095	8.3644
25	7.0678	7.2281	7.3899	7.5533	7.7182
30	6.6530	6.8218	6.9921	7.1641	7.3377

a) Use the table above to find the monthly repayment per $1000 on a loan borrowed at 7% for 20 years. **1**

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b) Calculate the monthly repayment on a loan of $70000 at 7% over 20 years. **2**

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c) Hence, calculate the total amount repaid over the term of the loan in part (b)? **1**

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d) Determine how much interest was paid after the loan in part (b) was fully paid? **1**

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Question 17 (4 marks)

The formula for the volume of a cone is

$$V = \frac{1}{3}\pi r^2 h$$

Where V is the volume, h is the height and r is the radius.

a) Show that the radius of the cone is **2**

$$r = \sqrt{\frac{3V}{\pi h}}$$

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b) Calculate the radius of the base of a cone that is $20cm$ high and has a volume of $200cm^3$, correct to 2 decimal places. **2**

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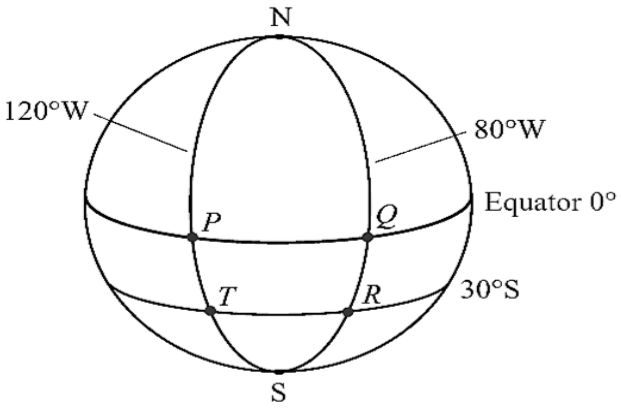
Question 18 (2 marks)

Use the diagram below to name the points with these position coordinates **2**



a) $30°S, 120°W$ ……

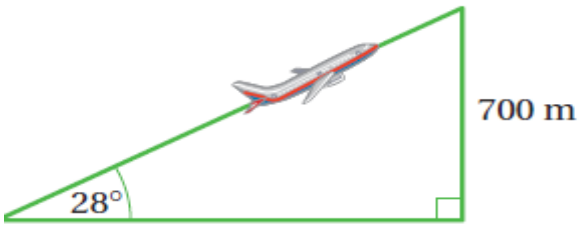
b) $0°, 80°W$ ……

c) $30°S, 80°W$ ……

d) $0°, 120°W$ ……

Question 19 (2 marks)

An aeroplane climbs at an angle of 28° to the horizontal. Find to the nearest metre the distance travelled along its flight path while rising 700m vertically. Express your answer to the nearest metre. **2**



NOT TO SCALE

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Question 20 (3 marks)

Two painters each provide a quote for painting an area of 1500 square metres. **3**

Painter A: charges $90 per 25 square metres.
Painter B: charges $80 per hour and bases his quote on painting 20 square metres per hour.

How much will be saved by choosing the cheaper quote? Justify your answer using mathematical reasoning and /or calculations.

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Question 21 (3 marks)

A bag contains 14 black jellybeans and 11 red jellybeans. Salina selects two jellybeans from the bag and does not replace the first jellybean in the bag. **3**
By drawing a probability tree diagram, or otherwise, find the probability that Salina selects two black jellybeans.

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Question 22 (2 marks)

Solve the following pair of equations systematically. **2**

$$2x - 3y = 3$$
$$y = 2x - 5$$

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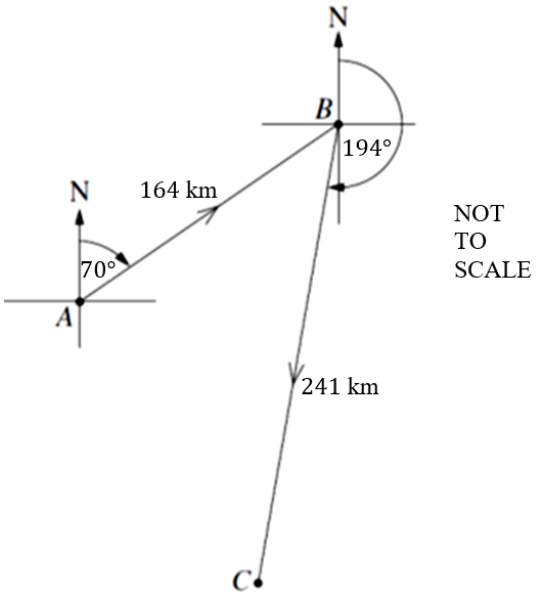
Question 23 (7 marks)

Manavdeep leaves island *A* in a boat and sails 164 km on a bearing of 070° to island *B*. He then sails on a bearing of 194° for 241 km to island *C*, as shown in the diagram.



a) Show that the size of $\angle ABC = 56°$. **1**

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b) Using the cosine rule, find the distance from A to C. Give your answer correct to the nearest whole number. **2**

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Question 21 continues on the next page

c) Using the sine rule, calculate $\angle BCA$ to the nearest degree. **2**

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d) What is the bearing of A from C to the nearest degree? **2**

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Question 24 (2 marks)

Jonas is a real estate agent. He earns \$600 per week plus commission on any sales he makes. His commission is calculated using the schedule below. **2**

Value of Sale	Commission
Less than \$260,000	4%
\$260,001 - \$ 520,000	\$10,400 plus 2% of each dollar over \$260,000
Over \$520,000	\$15,600 plus 1.5% of each dollar over \$520,000

Last week, Jonas sold a block of land for \$ 900,000. Calculate Jonas' income for that week.

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Question 25 (5 marks)

The cost of gas is determined using the table below:

Usage Charge	First 3000 MJ	\$0.05280 per MJ
	Additional MJ over 3000	\$ 0.04620 per MJ

a) Maria used 7000MJ of gas in this period. What is the charge? **2**

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b) Maria has decided to reduce her energy bills. She has a target of \$200 for gas. What is the maximum number of MJ she is allowed in this period? Answer correct to the nearest megajoule. **3**

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Question 26 (2 marks)

Jimmy needs \$1000 in 5 years' time. He is going to invest some money today in an account earning 3% per annum compounded annually. He will make no further deposits or withdrawals. **2**

How much money he needs to invest today so that he has \$1000 at the end of 5 years at 3% p.a compounded annually.

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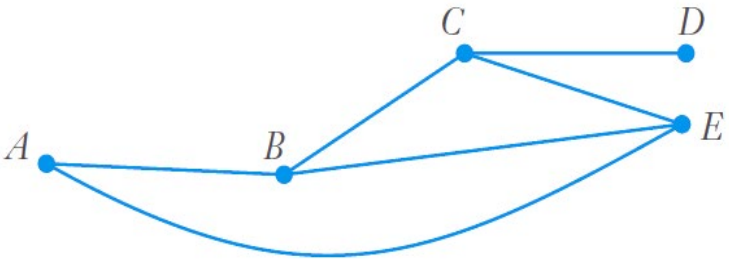
Question 27 (3 marks)

Five towns are connected by the network diagram below.



a) State the vertex with an even degree. **1**

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b) Show that the sum of degrees is equal to twice the number of edges. **2**

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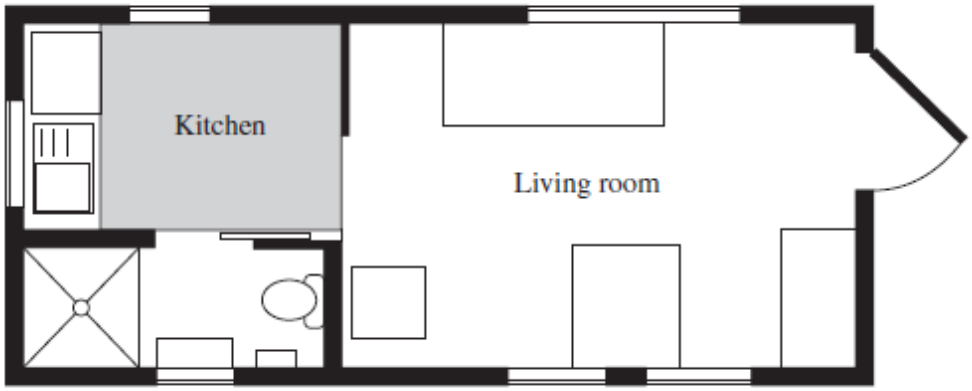
Question 28 (4 marks)

The plan of a lower level of a small house is shown.

Scale: 1 cm = 0.8 m



a) How many windows are shown in the plan? **1**

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b) What is the actual perimeter of the kitchen shown in the plan? **1**

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c) Nikhil plans to cover the kitchen area with tiles measuring $300\ mm \times 300\ mm$. How many tiles are required? **2**

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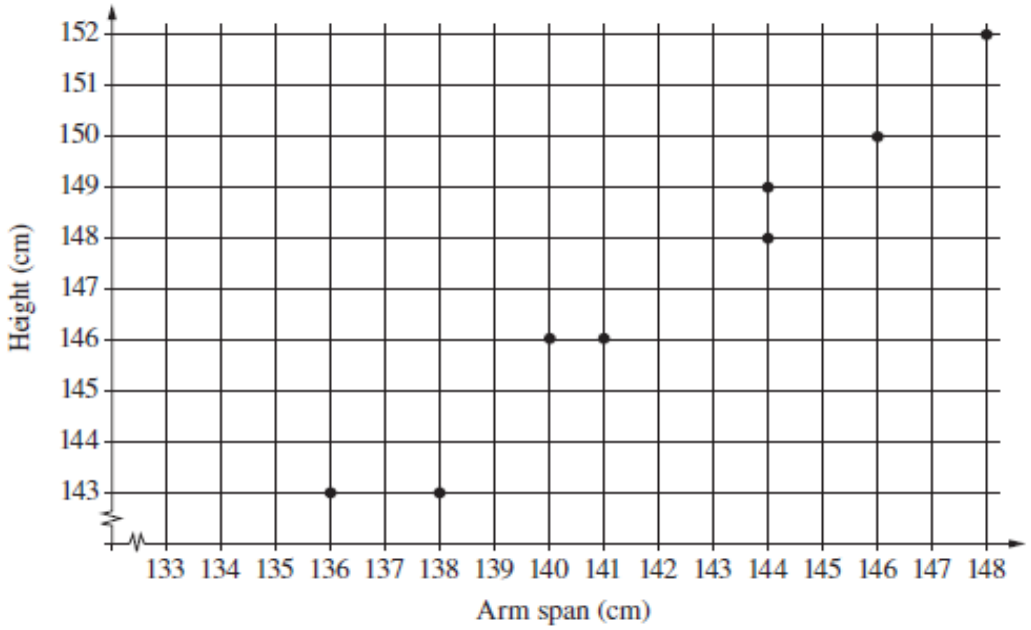
Question 29 (5 marks)

A set of bivariate data is collected by measuring the height and arm span of eight children. The graph shows a scatterplot of these measurements.



a) On the graph, draw a line of best fit by eye. **1**

b) Tim is a child from the class who was absent when the measurements were taken. He has an arm span of 145 cm. Using your line of best fit from part (a), estimate Tim's height. **1**

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c) Calculate the value of Pearson's correlation coefficient, correct to four decimal places. **2**

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d) Describe the strength of association between height and arm span. **1**

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Question 30 (6 marks)

Stephanie works part time in a medical centre part and receives a yearly salary of $34479. She also receives an income of $1950 per year from babysitting. Her total deductions are $1570. During the year she paid tax instalments of $3950.

a) Find Stephanie's taxable income. **1**

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b) Using the tax table given below, find the income tax payable. **2**

Taxable income	*Tax on this income*
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

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c) Calculate the Medicare levy that Stephanie needs to pay. **1**

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d) Find Stephanie's tax refund. **2**

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Question 31 (5 marks)

An object is thrown in the air. It takes 5 seconds for it to reach the ground. The height of the object is given by the formula:

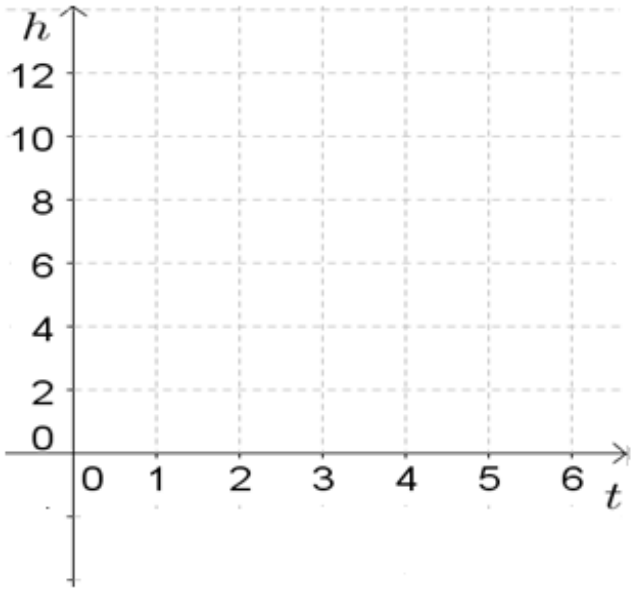
$$h = -t^2 + 4t + 5$$

where h is the height and t is time in seconds.

a) Complete the following table of values. **1**

t	0	1	2	3	4	5
h						

b) Draw the graph of $h = -t^2 + 4t + 5$ on the number plane below. **1**



c) What is the maximum height reached by the object? **1**

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d) When is the maximum height reached? **1**

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e) What was the initial height of the object? **1**

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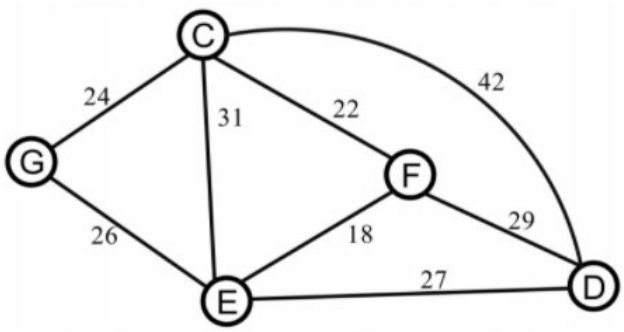
Questions 32(3 marks)

There are five towns that are connected by a series of roads. The distance between each town is shown on the network diagram below:



(a) A funding program is introduced to re-seal some of the roads. **2**
Draw a minimum spanning tree so that it is possible to travel between any two towns (not necessarily directly) along a newly sealed road.

(b) What is the minimum length of road that would need to be re-sealed? **1**

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Question 33 (4 marks)

Jacob makes an initial deposit of $ 70000 on an investment, earning an interest rate of 0.5% per month. An initial amount of $800 is made every month.
The amount in the account can be determined by using the recurrence relation

$$A_n = A_{n-1}(1.005) + 800$$

a) Use the recurrence relation to find the amount of money in the account after the third deposit. **2**

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b) Calculate the amount of interest earned in the first three months. **2**

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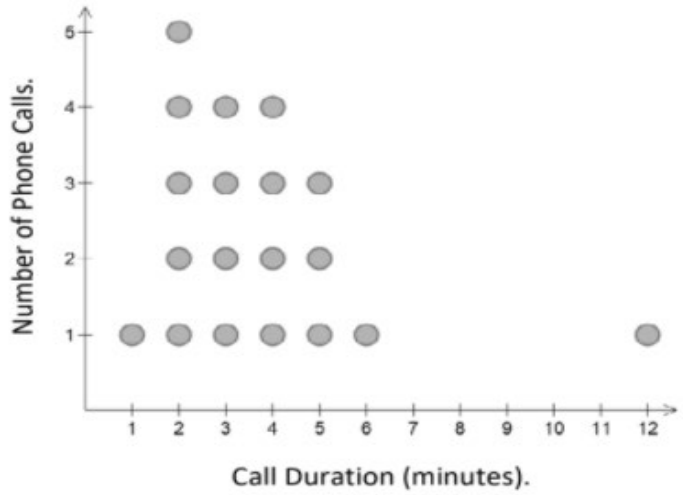
Question 34 (4 marks)

David recorded the duration of his phone calls (in minutes) over a day.
The results are shown on the dot plot.



a) What was the interquartile range of David's calls? **2**

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b) Justify, using calculations, that David's twelve-minute call was an outlier. **2**

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Question 35 (2 marks)

Josephine measures her mass to be 50kg.
On Saturday night she had 4 standard drinks in $2\frac{1}{2}$ hours.
The formula below can be used to estimate the BAC (Blood Alcohol Content) for females:

$$BAC_{female} = \frac{10N - 7.5H}{5.5M}$$

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

a) Show that Josephine's BAC was less than 0.08 after her last drink. **1**

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b) $$Time = \frac{BAC}{0.015}$$ **1**

The formula given above can be used to determine the number of hours required after a person stops consuming alcohol, for their BAC to reach zero. How many hours would Josephine require?

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Question 36 (3 marks)

A table of future value interest factors for an annuity of $1 is shown below

Period	2%	2.50%	3%	3.50%	4%	4.50%	5%	5.50%
1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2	2.020	2.025	2.030	2.035	2.040	2.045	2.050	2.055
3	3.060	3.075	3.090	3.106	3.121	3.137	3.152	3.168
4	4.121	4.152	4.183	4.214	4.246	4.278	4.310	4.342
5	5.204	5.256	5.309	5.362	5.416	5.470	5.525	5.581
6	6.308	6.387	6.468	6.550	6.633	6.716	6.801	6.888
7	7.434	7.547	7.662	7.779	7.898	8.019	8.142	8.266
8	8.583	8.736	8.892	9.051	9.214	9.380	9.549	9.721
9	9.754	9.954	10.159	10.368	10.582	10.802	11.026	11.256

a) Find the future value of an annuity with a contribution of $1500 per quarter for 24 months at 8% per annum compounded quarterly. **1**

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b) Calculate the interest earned on this annuity. **1**

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c) Find the contribution to be made at the end of each year , for 4 years that will give a future value of $4500 if the annuity earns 4.5% compounded annually. **1**

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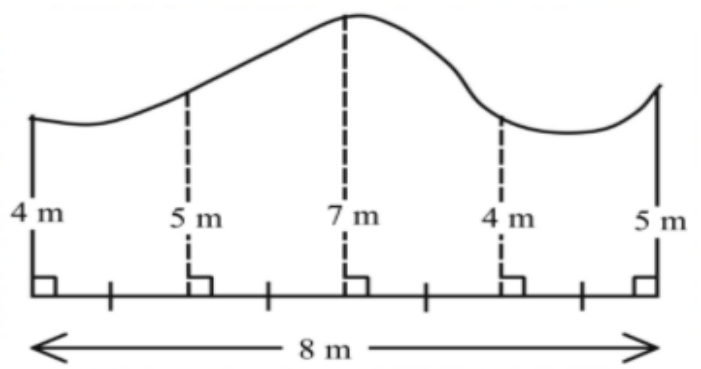
Question 37 (3 marks)

A swimming pool has three straight sides and one which is curved. It is 1.5 metres deep at all points.



Manjit takes measurements shown of the pool in preparation for filling it with water.

a) Use the trapezoidal rule four times to estimate the area of the base of the pool. **2**

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b) Using the fact that $1m^3$ holds 1000 litres of water, how many litres of water will be needed to fill the pool? **1**

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Question 38 (2 marks)

A preschool centre pays \$210 to hire a bus for an excursion. Let *C* be the cost per person and *N* be the number of people going on the excursion. **2**

Write an equation connecting *C* and *N,* if the cost per person is \$2.10. Hence, determine the number of people who travelled on the bus if the centre paid \$315.

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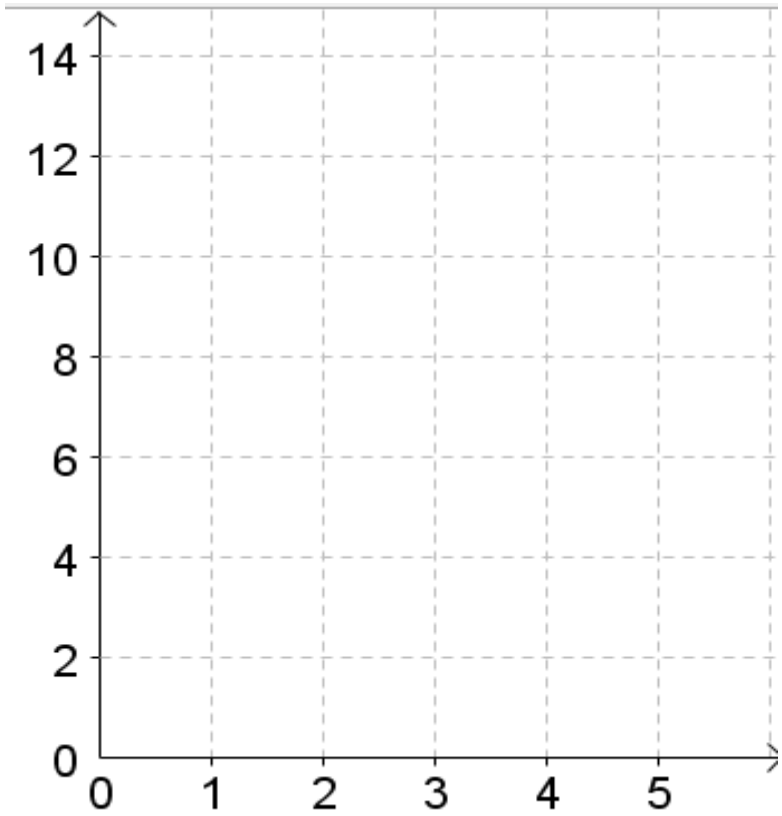
Question 39 (4 marks)

The table below shows the speed v in km/s of a plane at time t seconds

Time *(t)*	1	2	3	4	5
Speed *(v)*	2.5	4	5.5	7	8.5

a) Draw a number plane with $t(\text{time})$ as the horizontal axis and v (speed) as the vertical axis. Plot the points and join them to make a straight line. **2**



b) Determine the equation of the line in the form $y = mx + c$. **2**

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End of paper

NAME: Solutions

Blacktown Boys' High School

Year 12 2022

Trial Examination

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- Working time – 2 hours and 30 minutes
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Section I – 15 marks (pages 3-8)

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- Allow about 25 minutes for this section

Section II – 85 marks (pages 10-28)

- Attempt Questions 16 – 39
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Assessor: Mrs.Chhabra

Section I

15 marks
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B. Certain

(C.) Even

D. Unlikely

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C. 1 pm Monday

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	8	7	4	2	2	1	1	6	6	7	9
8	7	4	3	1	3	1	2	3			

The difference in the median for the females and males is:

A. 2

B. 3

C. 4

D. 5

6 A high school has 130 students in each year group from Year 7 to Year 12. A survey is to be conducted to determine the average number of hours studied per week by students at the school. Which of the following would provide the most representative sample for the survey?

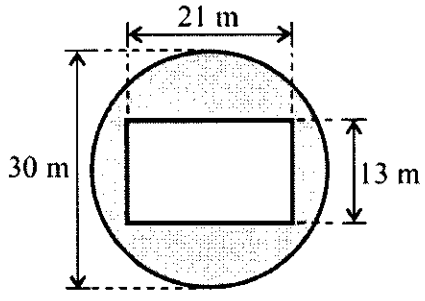
A. Random sample

B. Stratified sample

C. Systematic sample

D. Census

7 A circular grass field has a diameter of 30 metres. There is a concrete rectangle in the middle with a length of 21 metres and a width of 13 metres, as shown in the diagram below.



Which of the following would correctly calculate the area of the grass, in square metres, as shaded in the diagram?

A. $Area = 2 \times \pi \times \left(\frac{30}{2}\right) - 21 \times 13$

B. $Area = 2 \times \pi \times (30) - 21 \times 13$

C. $Area = \pi \times \left(\frac{30}{2}\right)^2 - 21 \times 13$

D $Area = \pi \times 30^2 - 21 \times 13$

8 A train trip costs $ 6.80 including 10% GST.
What is the train trip's price before GST, correct to the nearest cent?

A. $6.18

B. $6.70

C. $5.90

D. $7.48

9 Samuel measured his height to be 173 cm, correct to the nearest centimetre.
What is the percentage error in his measurement?

A. $\pm$ 0.26%

B. $\pm$ 0.29%

C. $\pm$ 0.0029%

D. $\pm$ 0.0026%

10 A bank charges 19.99% p.a. interest on credit cards. What is the daily interest rate assuming not a leap year?

A. 0.7688 %

B. 0.3844 %

C. 1.6658 %

(D.) 0.0548 %

11 Tara made two errors in her solution to the following equation:

$$\frac{-2x}{x-4} = -7$$

Line 1 $\ldots -2x = -7(x-4)$

Line 2 $\ldots -2x = -7x - 28$

Line 3 $\ldots -5x = -28$

Line 4 $\ldots x = \frac{28}{5}$

Which two lines do not follow correctly from the previous line?

A. *Lines* 1 *and* 2

B. *Lines* 1 *and* 3

C. *Lines* 1 *and* 4

(D) *Lines* 2 *and* 3

12 The population (P) of a town grows exponentially according to the function

$$P = 10000(1.06)^t$$

where t is the number of years after the start of 2014.

The population at the start of 2021 is closest to

A. 40240

B. 42410

(C.) 15037

D. 12625

13 The kinetic energy, K (j) of a particle of mass M (kg), with a velocity of V (m/s) is given by:

$$K = \frac{1}{2}MV^2$$

Calculate the value of K, if M = 30kg and V=22 m/s

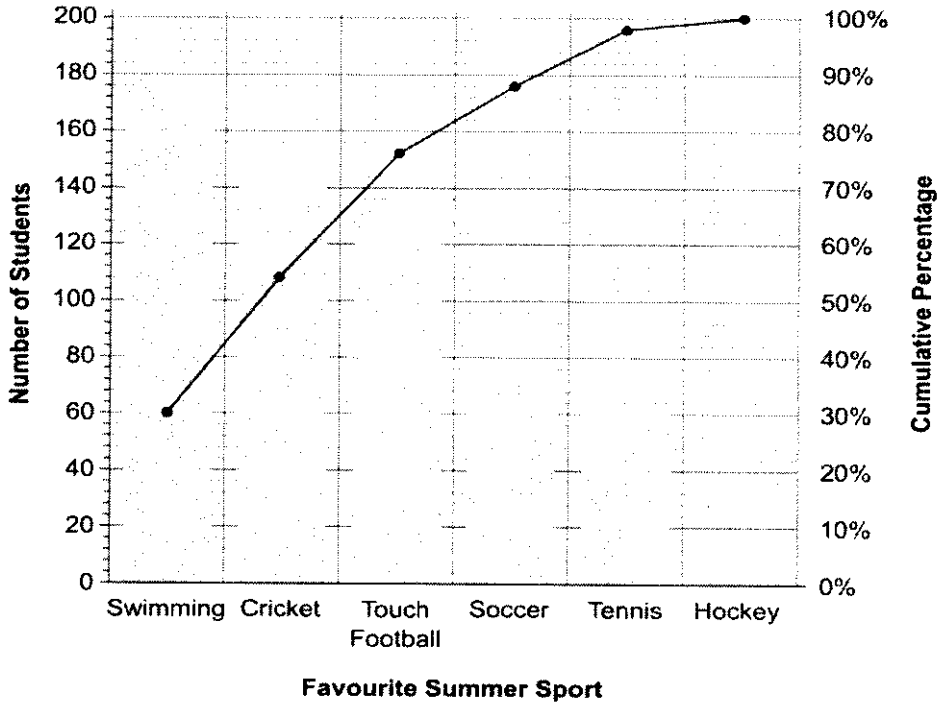
A. 330 j

(B.) 7260 j

C. 9900 j

D. 29040 j

14 A high school conducted a survey in which they asked their students "What was their favourite sport". The pareto chart below shows the data collected.



What percentage of students chose soccer as their favourite sport?

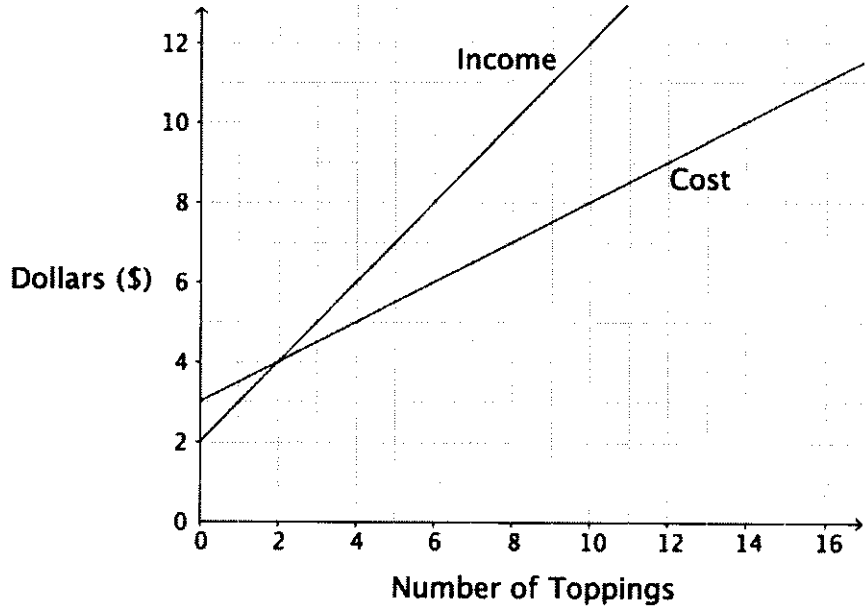
A. 10%

(B.) 12%

C. 36%

D. 72%

15 The graph below shows the cost of making pizzas depending on the number of toppings and the amount of income made from their sale.



How many toppings need to be sold to break even?

A. 0

B. 2

C. 5

D. 8

End of Section I

Mathematics Standard 2

Section II Answer Booklet

85 marks
Attempt Questions 16 - 39
Allow about 2 hours and 5 minutes for this section

Instructions

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

Question 16 (5 marks)

The table below shows the repayment per $1000 on a monthly reducible loan.

Term in Years	7%	7.25%	7.5%	7.75%	8%
5	19.8012	19.9194	20.0379	20.1570	20.2765
10	11.6108	11.7401	11.8702	12.0011	12.1328
15	8.9883	9.1286	9.2701	9.4128	9.5566
20	7.7530	7.9036	8.0559	8.2095	8.3644
25	7.0678	7.2281	7.3899	7.5533	7.7182
30	6.6530	6.8218	6.9921	7.1641	7.3377

a) Use the table above to find the monthly repayment per $1000 on a loan borrowed at 7% for 20 years. **1**

7.7530 ✓

b) Calculate the monthly repayment on a loan of $70000 at 7% over 20 years. **2**

70×7.7530 ✓

$= 542.71$ ✓

c) Hence, calculate the total amount repaid over the term of the loan in part (b)? **1**

$542.71 \times 20 \times 12$

$= 130250.4$ ✓

d) Determine how much interest was paid after the loan in part (b) was fully paid? **1**

$130250.4 - 70000$

$= \$60250.4$ ✓

Question 17 (4 marks)

The formula for the volume of a cone is

$$V = \frac{1}{3}\pi r^2 h$$

Where V is the volume, h is the height and r is the radius.

a) Show that the radius of the cone is **2**

$$r = \sqrt{\frac{3V}{\pi h}}$$

$3V = \pi r^2 h$ ✓

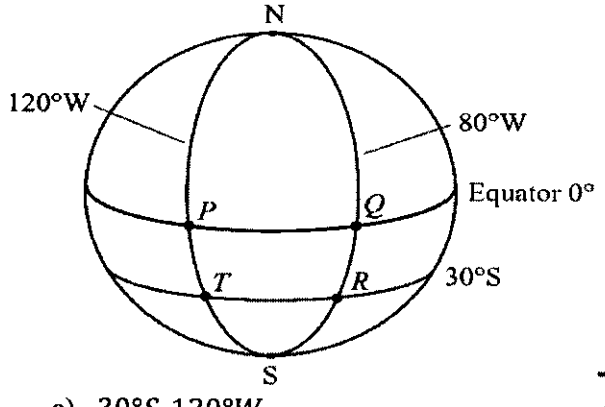
$\sqrt{\frac{3V}{\pi h}} = r$ ✓

b) Calculate the radius of the base of a cone that is $20cm$ high and has a volume of $200cm^3$, correct to 2 decimal places. **2**

$\sqrt{\frac{3 \times 200}{\pi \times 20}} = 3.09$ ✓ ✓

Question 18 (2 marks)

Use the diagram below to name the points with these position coordinates **2**



a) $30°S, 120°W$ T ✓

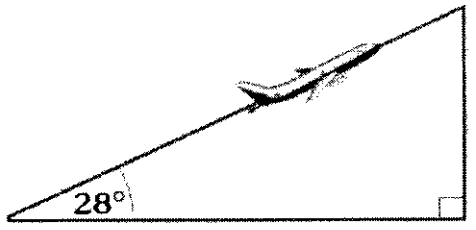
b) $0°, 80°W$ Q

c) $30°S, 80°W$ R ✓

d) $0°, 120°W$ P

Question 19 (2 marks)

An aeroplane climbs at an angle of 28° to the horizontal. Find to the nearest metre the distance travelled along its flight path while rising 700m vertically. Express your answer to the nearest metre. **2**



NOT TO SCALE

$\sin 28^\circ = \frac{700}{x}$ ✓

$x = 1491.038$

$= 1491$ ✓

Question 20 (3 marks)

Two painters each provide a quote for painting an area of 1500 square metres. **3**

Painter A: charges $90 per 25 square metres.
Painter B: charges $80 per hour and bases his quote on painting 20 square metres per hour.

How much will be saved by choosing the cheaper quote? Justify your answer using mathematical reasoning and /or calculations.

Cost painter A $= \frac{1500}{25} = 60$

$= 60 \times 90 = \$5400$ ✓

Cost painter B $= \frac{1500}{20} = 75$

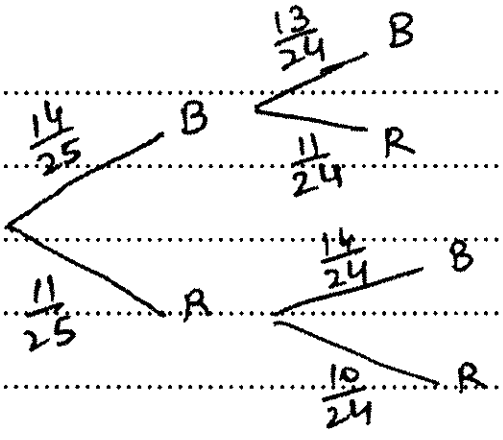
$= 75 \times 80 = \$6000$ ✓

Saving $= \$600$ ✓

Question 21 (3 marks)

A bag contains 14 black jellybeans and 11 red jellybeans. Salina selects two jellybeans from the bag and does not replace the first jellybean in the bag. 3

By drawing a probability tree diagram, or otherwise, find the probability that Salina selects two black jellybeans.



1 mark - some progress

2 mark - most probabilities correct on branches

3 mark - correct soln

$P(BB) = \frac{14}{25} \times \frac{13}{24} = \frac{91}{300}$

Question 22 (2 marks)

Solve the following pair of equations systematically. 2

$$2x - 3y = 3$$
$$y = 2x - 5$$

$2x - 3(2x-5) = 3$

$2x - 6x + 15 = 3$

$-4x = -12$

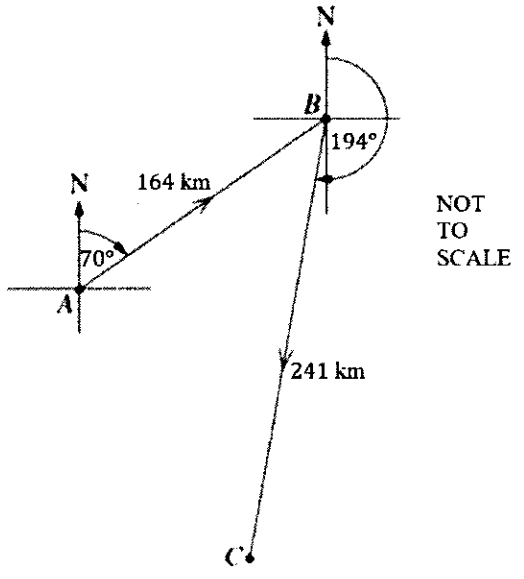
$x = 3$ ✓

$y = 2x - 5$

$y = 1$ ✓

Question 23 (7 marks)

Manavdeep leaves island A in a boat and sails 164 km on a bearing of 070° to island B. He then sails on a bearing of 194° for 241 km to island C, as shown in the diagram.



a) Show that the size of $\angle ABC = 56°$. **1**

$194 - 180 = 14°$

$70° - 14° = 56°$ ✓

b) Using the cosine rule, find the distance from A to C. Give your answer correct to the nearest whole number. **2**

$AC = \sqrt{164^2 + 241^2 - 2 \times 164 \times 241 \times \cos 56°}$

$= 201.9255$

$= 202$ ✓

Question 21 continues on the next page

c) Using the sine rule, calculate $\angle BCA$ to the nearest degree. **2**

$\frac{\sin A}{164} = \frac{\sin 56^\circ}{202}$ ✓

$A = \sin^{-1}\left(\frac{164 \times \sin 56^\circ}{202}\right) = 42.305$

$= 42^\circ 18' 18.82''$

$= 42^\circ$

d) What is the bearing of A from C to the nearest degree? **2**

$360^\circ - (42^\circ - 14^\circ)$ ✓

$= 332^\circ$ ✓

Question 24 (2 marks)

Jonas is a real estate agent. He earns \$600 per week plus commission on any sales he makes. His commission is calculated using the schedule below. **2**

Value of Sale	Commission
Less than \$260,000	4%
\$260,001 - \$ 520,000	\$10,400 plus 2% of each dollar over \$260,000
Over \$520,000	\$15,600 plus 1.5% of each dollar over \$520,000

Last week, Jonas sold a block of land for \$ 900,000. Calculate Jonas' income for that week.

$15600 + 1.5\%\,(900000 - 520000)$

$= 21300$ ✓

Income $= 600 + 21300$

$= 21900$ ✓

Question 25 (5 marks)

The cost of gas is determined using the table below:

Usage Charge	First 3000 MJ	\$0.05280 per MJ
	Additional MJ over 3000	\$ 0.04620 per MJ

a) Maria used 7000MJ of gas in this period. What is the charge? **2**

$3000 \times 0.5280 + 4000 \times 0.4620$ ✓

$= 343.20$ ✓

b) Maria has decided to reduce her energy bills. She has a target of \$200 for gas. What is the maximum number of MJ she is allowed in this period? Answer correct to the nearest megajoule. **3**

$3000 \times 0.05280 = 158.40$ ✓

$158.40 + x \times 0.04620 = 200$

$x = \frac{41.620}{0.04620}$

$= 900$ MJ ✓

max usage = 3900 MJ ✓

Question 26 (2 marks)

Jimmy needs \$1000 in 5 years time. He is going to invest some money today in an account earning 3% per annum compounded annually. He will make no further deposits or withdrawals. **2**

How much money he needs to invest today so that he has \$1000 at the end of 5 years at 3% p.a compounded annually.

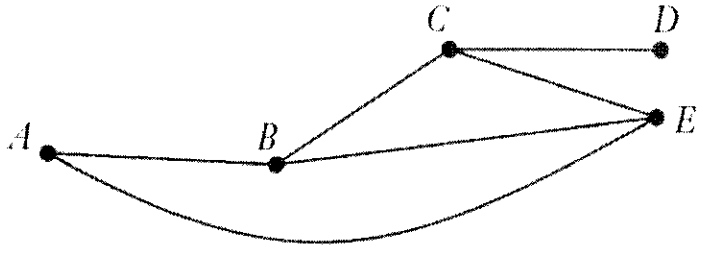
$A = P(1+r)^n$

$\frac{1000}{(1+3\%)^5} = P$ ✓

$P = 862.608$ ✓

Question 27 (3 marks)

Five towns are connected by the network diagram below.



a) State the vertex with an even degree. **1**

A

b) Show that the sum of degrees is equal to twice the number of edges. **2**

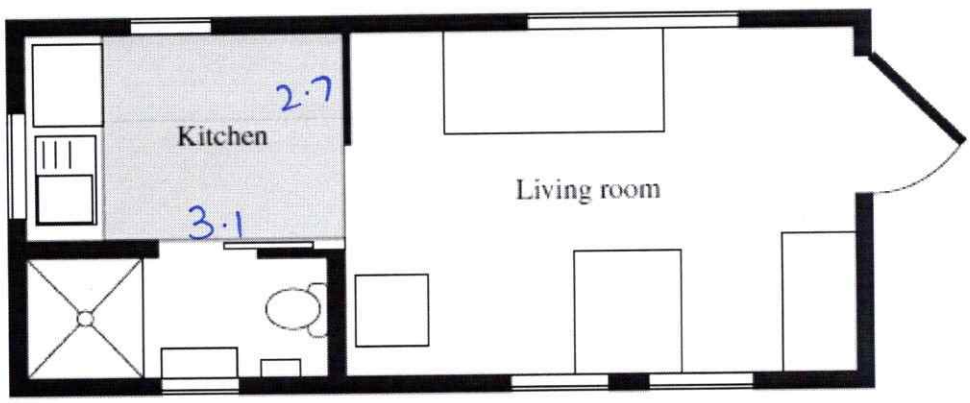
Edges = 6 ✓

Degree = $2+3+3+1+3=12$ ✓

Question 28 (4 marks)

The plan of a lower level of a small house is shown.

Scale: 1 cm = 0.8 m



a) How many windows are shown in the plan? **1**

6 ✓

b) What is the actual perimeter of the kitchen shown in the plan? **1**

$3.1 \times 2 + 2.7 \times 2 = 11.6$

$11.6 \times 0.8 = 9.28\,m$ ✓

c) Nikhil plans to cover the kitchen area with tiles measuring $300\,mm \times 300\,mm$. How many tiles are required? **2**

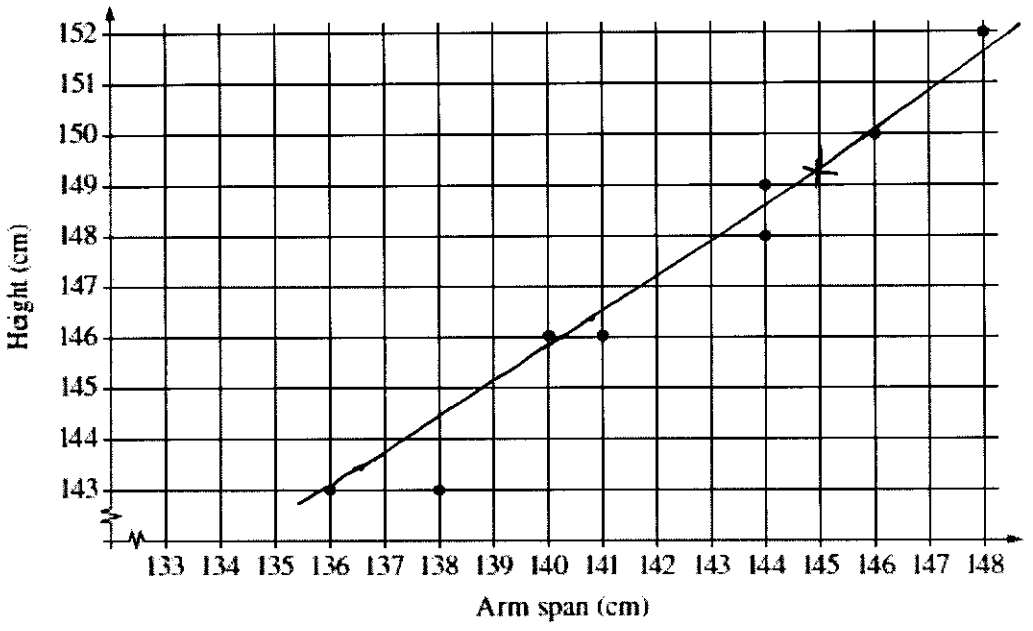
2.48×2.16

$0.09\,m$ — ✓

$\frac{5.3568}{0.09} = 60$

Question 29 (5 marks)

A set of bivariate data is collected by measuring the height and arm span of eight children. The graph shows a scatterplot of these measurements.



a) On the graph, draw a line of best fit by eye. **1**

b) Tim is a child from the class who was absent when the measurements were taken. He has an arm span of 145 cm. Using your line of best fit from part (a), estimate Tim's height. **1**

149.5

c) Calculate the value of Pearson's correlation coefficient, correct to four decimal places. **2**

Armspan	136	138	140	141	144	144	146	148
Height	143	143	146	146	148	149	150	152

$r = 0.98467$ ✓

$r = 0.9847$ ✓

d) Describe the strength of association between height and arm span. **1**

positive association

Question 30 (6 marks)

Stephanie works part time in a medical centre part and receives a yearly salary of $34479. She also receives an income of $1950 per year from babysitting. Her total deductions are $1570. During the year she paid tax instalments of $3950.

a) Find Stephanie's taxable income. **1**

34479 + 1950 - 1570

= 34859

b) Using the tax table given below, find the income tax payable. **2**

Taxable income	*Tax on this income*
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

0.19 (34859 - 18200) ✓

= 3165.21 ✓

c) Calculate the Medicare levy that Stephanie needs to pay. **1**

697.18 ✓

d) Find Stephanie's tax refund. **2**

3165.21 + 697.18 = 3862.39 ✓

Refund = 3950 - 3862.39 = $87.61 ✓

Question 31 (5 marks)

An object is thrown in the air. It takes 5 seconds for it to reach the ground. The height of the object is given by the formula:

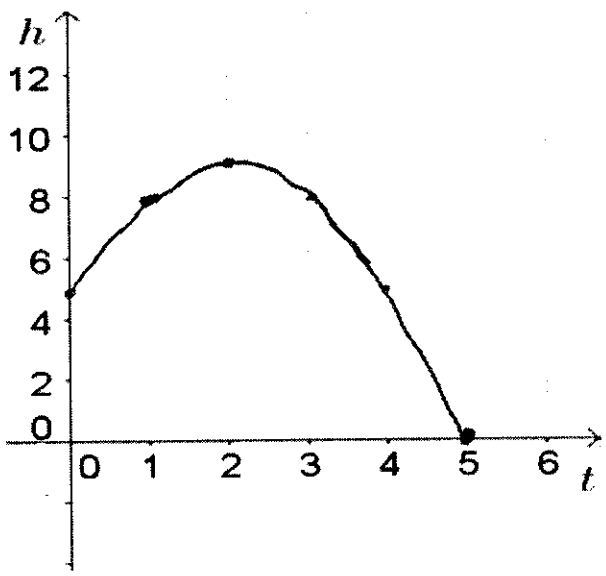
$$h = -t^2 + 4t + 5$$

where h is the height and t is time in seconds.

a) Complete the following table of values. **1**

t	0	1	2	3	4	5
h	5	8	9	8	5	0

b) Draw the graph of $h = -t^2 + 4t + 5$ on the number plane below. **1**



c) What is the maximum height reached by the object? **1**

9

d) When is the maximum height reached? **1**

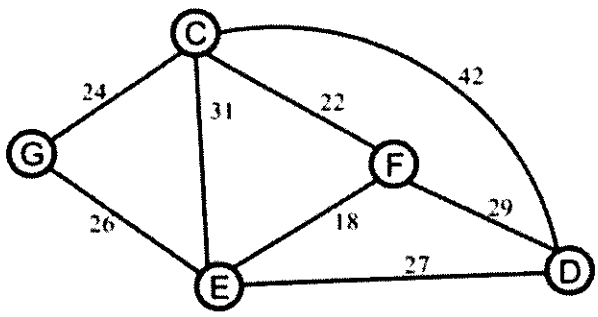
t = 2 sec.

e) What was the initial height of the object? **1**

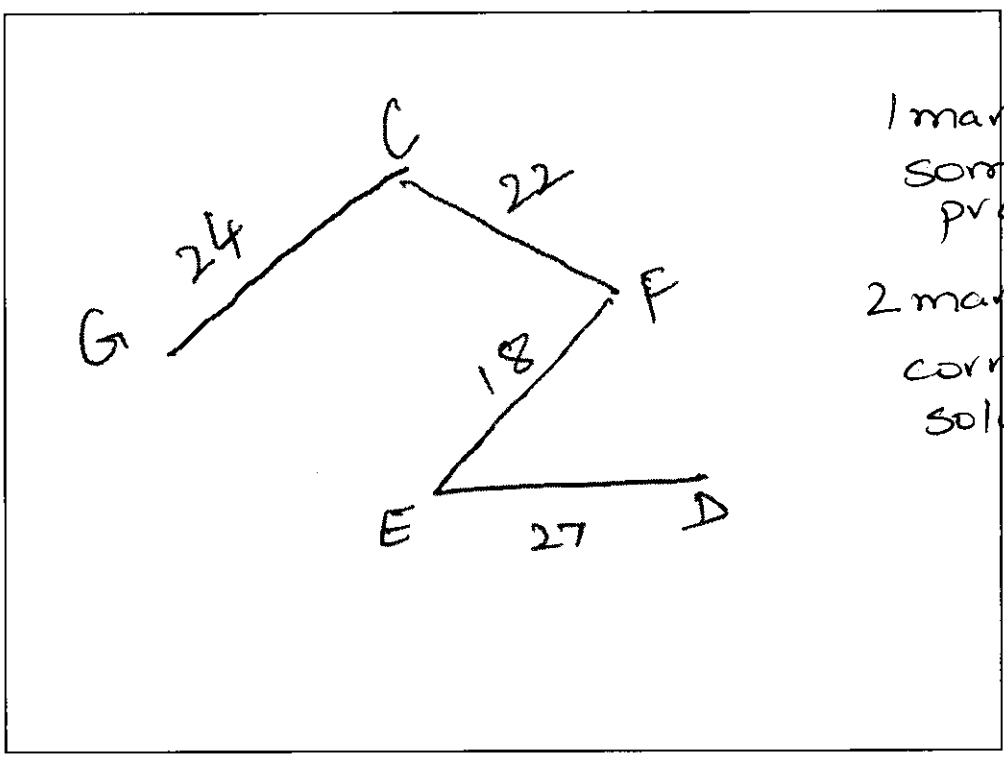
5

Questions 32(3 marks)

There are five towns that are connected by a series of roads. The distance between each town is shown on the network diagram below:



(a) A funding program is introduced to re-seal some of the roads. **2**
Draw a minimum spanning tree so that it is possible to travel between any two towns (not necessarily directly) along a newly sealed road.



1 mark - some progress
2 mark - correct solution

(b) What is the minimum length of road that would need to be re-sealed? **1**

24+22+18+27 = 91

Question 33 (4 marks)

Jacob makes an initial deposit of $ 70000 on an investment, earning an interest rate of 0.5% per month. An initial amount of $800 is made every month.
The amount in the account can be determined by using the recurrence relation

$$A_n = A_{n-1}(1.005) + 800$$

a) Use the recurrence relation to find the amount of money in the account after the third deposit. **2**

$A_1 = 70000(1.005) + 800$

$= 71150$

$A_2 = 71150(1.005) + 800 = 72305.75$

$A_3 = 72305.75(1.005) + 800 = 73467.2788$

1 mark - some progress

2 mark = correct answer

b) Calculate the amount of interest earned in the first three months. **2**

Amount $= 70000 + (800 \times 3)$

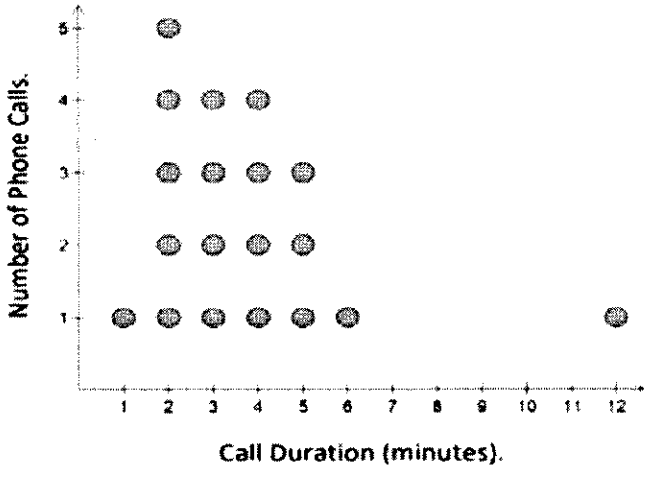
$= 72400$ ✓

Interest $= 73467.2788 - 72400$

$= 1067.2788$ ✓

Question 34 (4 marks)

David recorded the duration of his phone calls (in minutes) over a day.
The results are shown on the dot plot.



a) What was the interquartile range of David's calls? **2**

$Q_2 = 3$

$Q_1 = 2$ ✓ $IQR = 5 - 2$

$Q_3 = 5$ $= 3$ ✓

b) Justify, using calculations, that David's twelve-minute call was an outlier. **2**

$Q_3 + 1.5 \times IQR$

$= 5 + 1.5 \times 3$

$= 9.5$ ✓

$\therefore$ 12 is an outlier ✓

Question 35 (2 marks)

Josephine measures her mass to be 50kg.

On Saturday night she had 4 standard drinks in $2\frac{1}{2}$ hours.

The formula below can be used to estimate the BAC (Blood Alcohol Content) for females:

$$BAC_{female} = \frac{10N - 7.5H}{5.5M}$$

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

a) Show that Josephine's BAC was less than 0.08 after her last drink. **1**

$\frac{10\times4 - 7.5\times2.5}{5.5\times50} = 0.07727$

b) $$Time = \frac{BAC}{0.015}$$ **1**

The formula given above can be used to determine the number of hours required after a person stops consuming alcohol, for their BAC to reach zero. How many hours would Josephine require?

time = 5.1515

Question 36 (3 marks)

A table of future value interest factors for an annuity of $1 is shown below

Period	2%	2.50%	3%	3.50%	4%	4.50%	5%	5.50%
1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2	2.020	2.025	2.030	2.035	2.040	2.045	2.050	2.055
3	3.060	3.075	3.090	3.106	3.121	3.137	3.152	3.168
4	4.121	4.152	4.183	4.214	4.246	4.278	4.310	4.342
5	5.204	5.256	5.309	5.362	5.416	5.470	5.525	5.581
6	6.308	6.387	6.468	6.550	6.633	6.716	6.801	6.888
7	7.434	7.547	7.662	7.779	7.898	8.019	8.142	8.266
8	8.583	8.736	8.892	9.051	9.214	9.380	9.549	9.721
9	9.754	9.954	10.159	10.368	10.582	10.802	11.026	11.256

a) Find the future value of an annuity with a contribution of $1500 per quarter for 24 months at 8% per annum compounded quarterly. **1**

1500 x 8.583

= 12874.5

b) Calculate the interest earned on this annuity. **1**

12874.5 - 1500x8

= 874.5

c) Find the contribution to be made at the end of each year , for 4 years that will give a future value of $4500 if the annuity earns 4.5% compounded annually. **1**

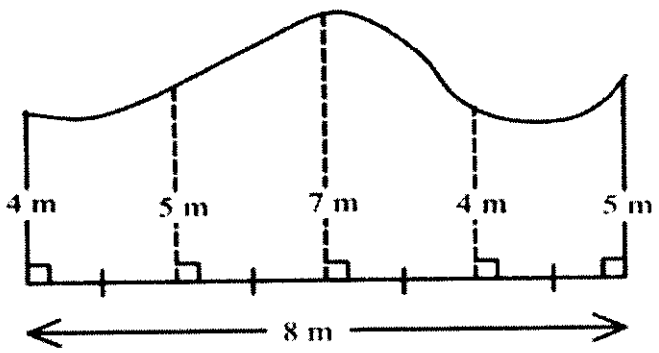
4.278 x Contribution = 4500

Contribution = $\frac{4500}{4.278}$

= 1051.893

Question 37 (3 marks)

A swimming pool has three straight sides and one which is curved. It is 1.5 metres deep at all points.



Manjit takes measurements shown of the pool in preparation for filling it with water.

a) Use the trapezoidal rule four times to estimate the area of the base of the pool. **2**

$A = \frac{2}{2}(4+5)+(5+7)+(7+4)+(4+5)$ ✓

$= 41\,m^2$ ✓

b) Using the fact that $1m^3$ holds 1000 litres of water, how many litres of water will be needed to fill the pool? **1**

$V = 41 \times 1.5$

$= 61.5m^3$

Capacity $= 61.5 \times 1000 = 61500L$

Question 38 (2 marks)

A preschool centre pays \$210 to hire a bus for an excursion. Let C be the cost per person and N be the number of people going on the excursion. **2**

Write an equation connecting C and N, if the cost per person is \$2.10. Hence, determine the number of people who travelled on the bus if the centre paid \$315.

$315 = 210 + 2.10N$ ✓

$315 - 210 = 1N$

2.10

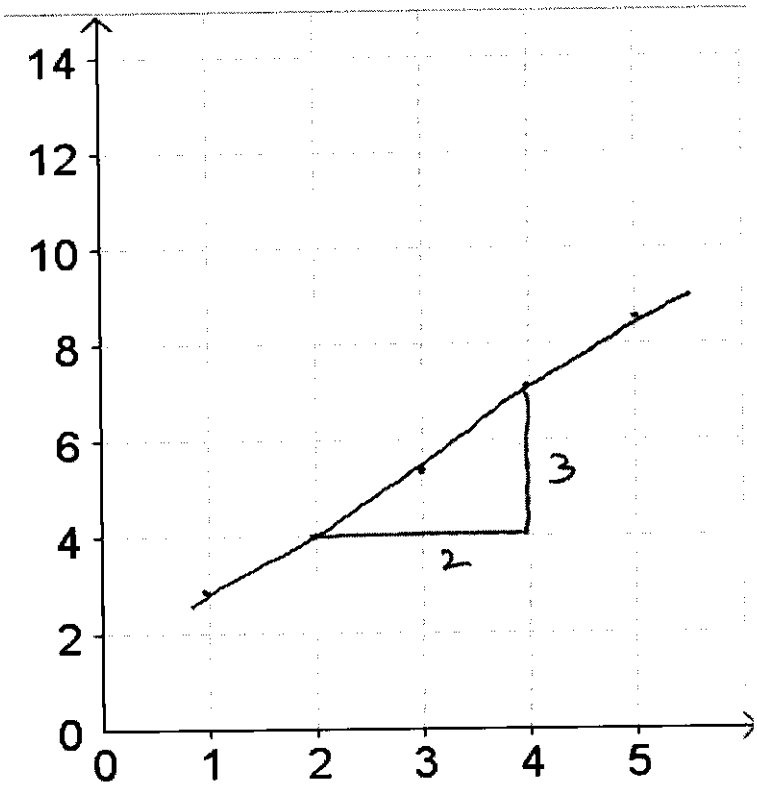
$50 = N$ ✓

Question 39 (4 marks)

The table below shows the speed v in km/s of a plane at time t seconds

Time *(t)*	1	2	3	4	5
Speed *(v)*	2.5	4	5.5	7	8.5

a) Draw a number plane with t(time) as the horizontal axis and v (speed) as the vertical axis. Plot the points and join them to make a straight line. **2**



1 mark – 3 or more points correctly plotted.

2 mark – correct solution

b) Determine the equation of the line in the form $y = mx + c$. **2**

$m = 1.5$ ✓

$y = 1.5x + 1$ ✓

End of paper