Student Number:
Teacher: Mr Singh

St George Girls High School

Mathematics Standard 2

2025 HSC Trial Examination

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 questions in **Section I**, use the Multiple-Choice answer sheet provided
  For questions in **Section II:**
  - Answer the questions in the spaces provided.
  - **Show relevant mathematical reasoning** and/or calculations.
  - **Extra writing space** is provided at the back of this booklet on pages 36-38. If you use this space, clearly indicate which question you are answering.
  - Marks may not be awarded for incomplete or poorly presented solutions or where multiple solutions are provided.

Total marks: 100

Section I – 15 marks (pages 3 to 11)

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

Section II – 85 marks (pages 12 to 35)

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

Section I

15 marks
Attempt Questions 1 – 15.
Allow about **25 minutes** for this section.
Use the **multiple-choice answer sheet** for questions 1 – 15.

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1. It took Bella 3 hours and 20 minutes to travel 180 km from her house to the camping site.

What was Bella's average speed?

(A) 60.00 km/h

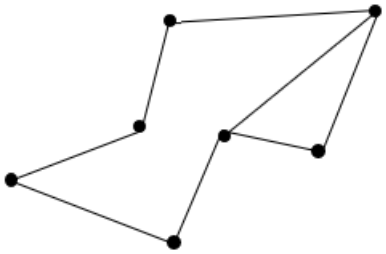
(B) 56.25 km/h

(C) 54.00 km/h

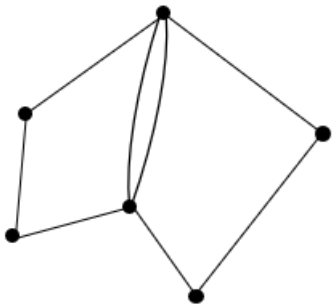
(D) 50.00 km/h

2. Which network is an Eulerian Circuit?

(A)



(B)



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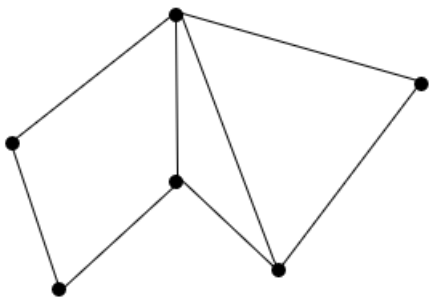

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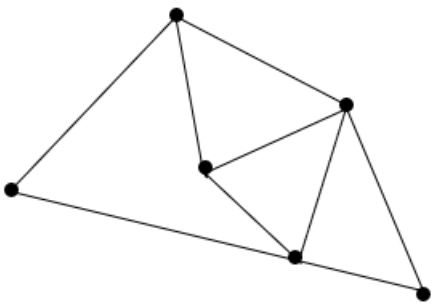
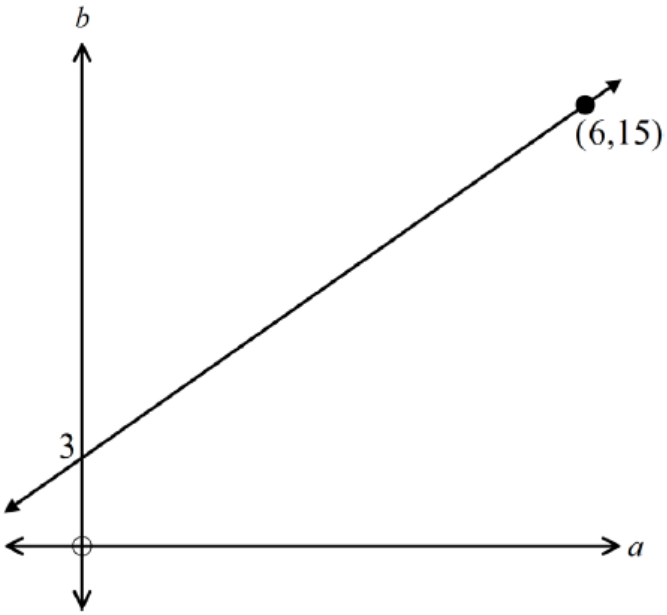


3. Which equation describes the relationship between the two variables a and b?



(A) $b = 2a + 3$

(B) $b = 3a + 2$

(C) $b = 6a + 3$

(D) $b = 6a + 15$

4. Majella stands at the school gate and hands over a questionnaire to every 20th student.

What kind of sampling is she using?

(A) Stratified

(B) Random

(C) Convenient

(D) Systematic

5. Emma measured the diagonal length of the classroom smart board as 1.36 metre, correct to two decimal places.

What is the percentage error in Emma's measurement?

(A) 0.37%

(B) 0.74%

(C) 4.41%

(D) 7.35%

6. Olivia bought a new car three years ago for $35 500 and since then it had depreciated at a rate of 22% p.a using the declining balance method.
What is the current value of the car?

(A) $378.00

(B) $12 070.00

(C) $16 846.60

(D) $21 508.20

7. In a car yard, the ratio of red to white cars is 3:5 and the ratio of red to black 4:3.

What is the ratio of white to black cars?

(A) 1 : 5

(B) 20 : 3

(C) 5 : 1

(D) 20 : 9

8. The weight (w) in kilograms of copper plumbing pipe is directly proportional to the length (d) of the pipe in metres.
A pipe which is 5 metres long, weighs 2.45 kg.
What is the gradient (m) of the direct variation graph $w = md$ for this relationship?

(A) $m = 0.102$

(B) $m = 0.490$

(C) $m = 2.04$

(D) $m = 0.512$

9. Aishani works as a forklift driver and she also operates a crane on a construction site. Her hourly base rate on the jobsite is \$64.50.
When she operates the crane, Aishani is paid a 22% high altitude adversity allowance on top of her normal hourly rate.
What would she be paid for a 40-hour week in which she operated the crane for 18 hours?

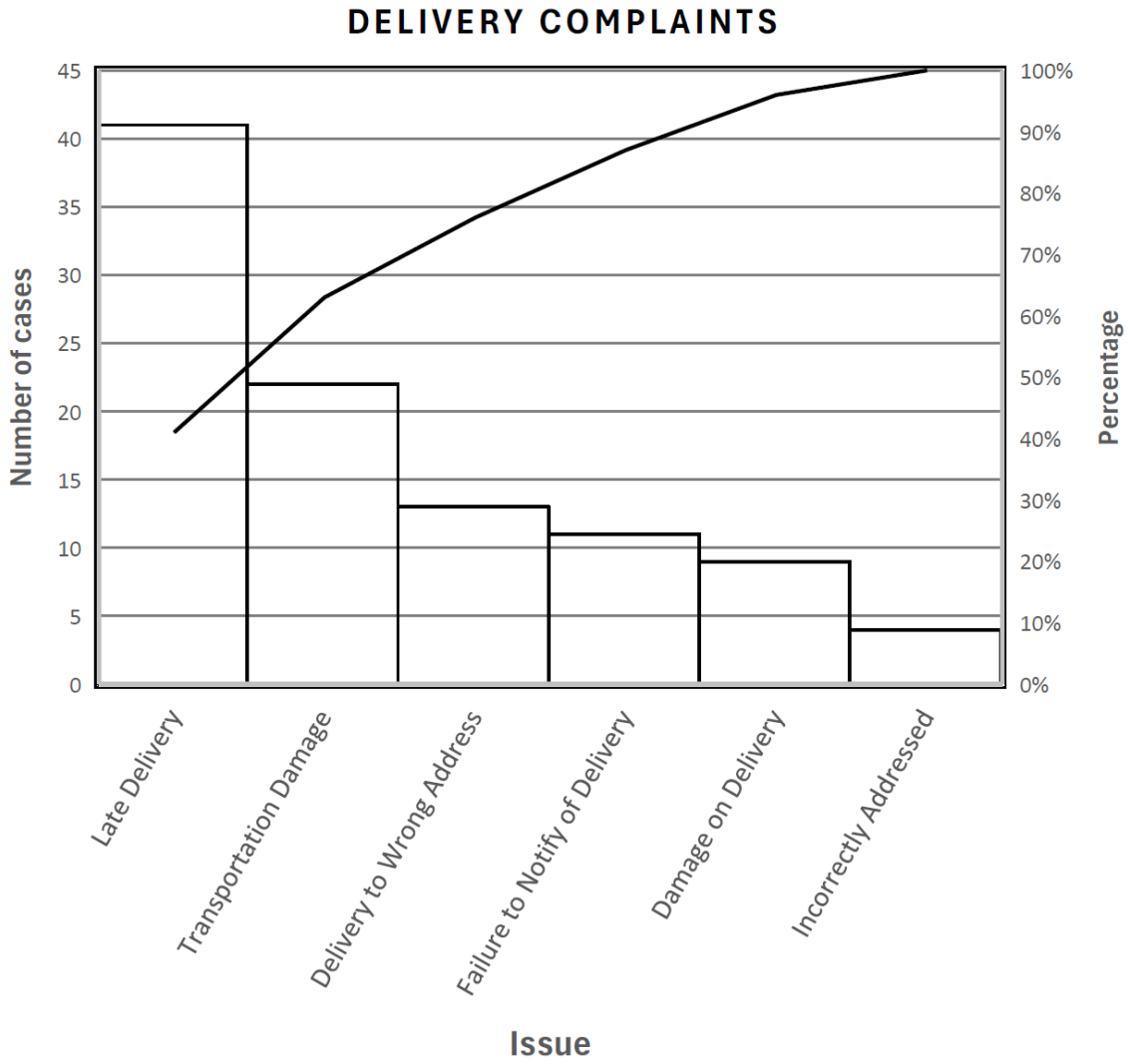
(A) \$255.42

(B) \$1416.42

(C) \$2835.42

(D) \$3996.42

10. The Pareto Chart below looks at the issues an online store had with having its products delivered, based on customer complaints.



Store manager Katrina wants to address only the complaints related to 'Delivery to Wrong Address'. By doing so, what percentage of the total complaints will Katrina address?

(A) 13%

(B) 28%

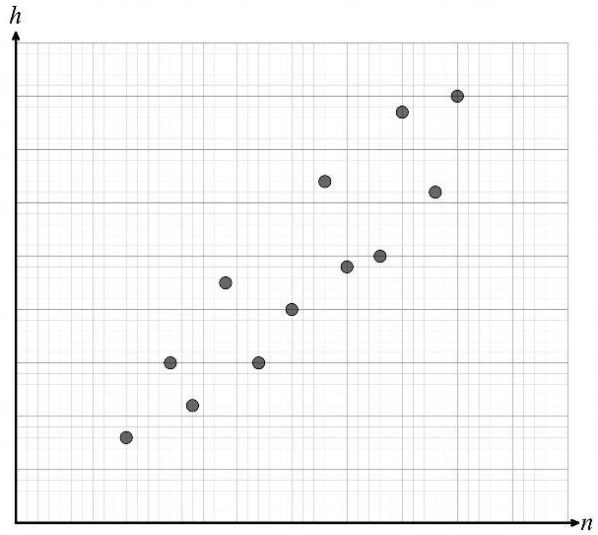
(C) 38%

(D) 78%

11. A researcher calculates the value of Pearson's correlation coefficient is –0.8 for a set of bivariate data that she collected.

Which scatterplot could best represent this data?

(A)



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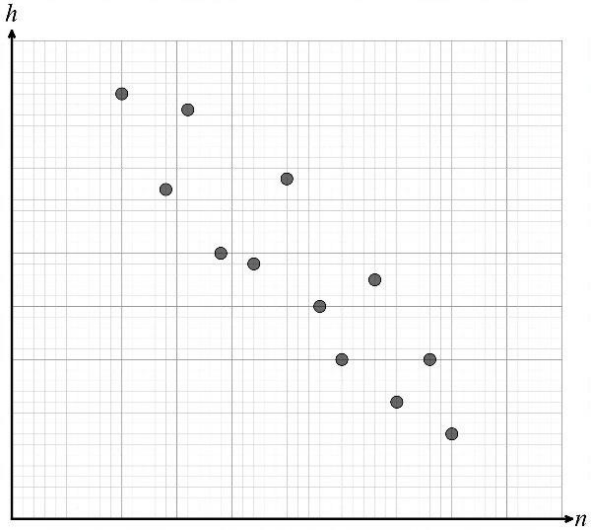

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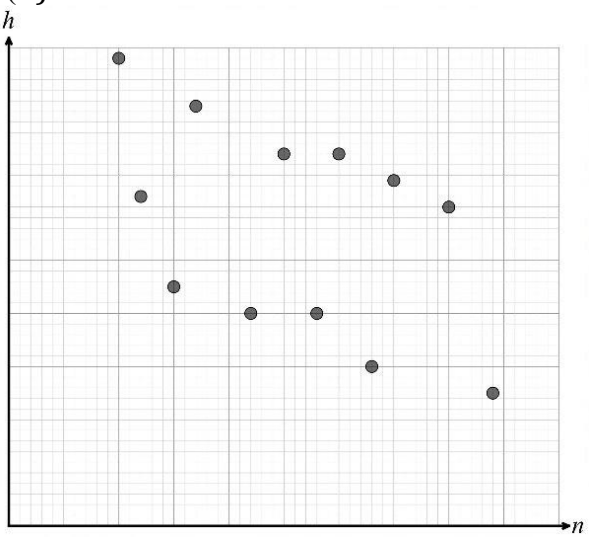
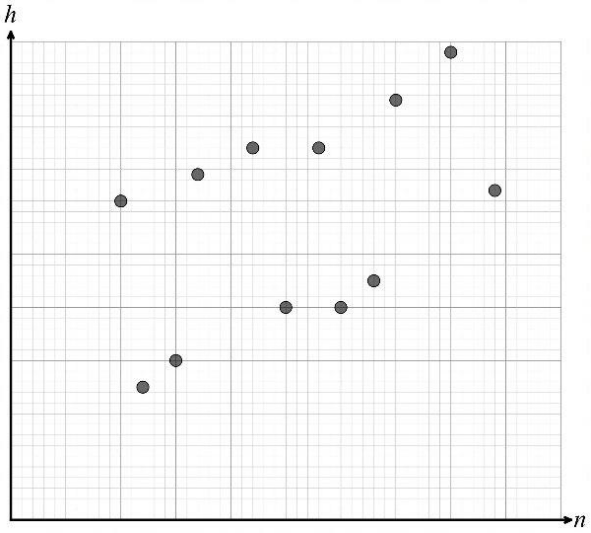


(D)



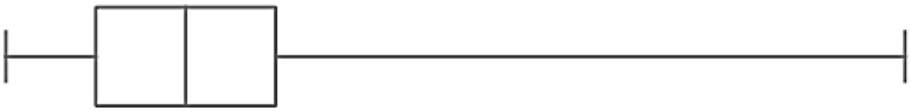
12. The stem-and-leaf plot below shows the distribution of the hourly wages ($) of a manufacturing company.

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

Which of the following box-and-whisker plots may best represent the distribution of their hourly wages?

(A)

(B)



(C)

(D)

13. Alina bought a car with a cash price of $9500 on terms.
She agreed to pay a deposit of $1000 and the remaining amount plus interest over 12 months, in equal instalments.
If simple interest at the rate of 8% p.a. was charged on the remaining amount, how much did Arthur pay each month?

(A) $765.00

(B) $767.13

(C) $855.00

(D) $857.37

14. If the GST increases from 10% to 12%, the price of a textbook rises by $1.44.
What is the original price of the textbook, including GST?

(A) $63.36

(B) $64.80

(C) $72.00

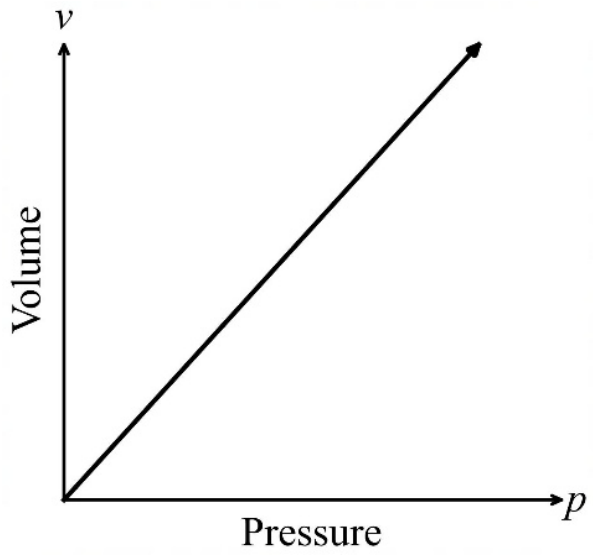
(D) $79.20

15. At a fixed temperature, the relationship between the pressure (p) and volume (v) for a quantity of gas in a container is given by:

$$pv = 100\,.$$

Which of these graphs could represent this relationship?

(A)



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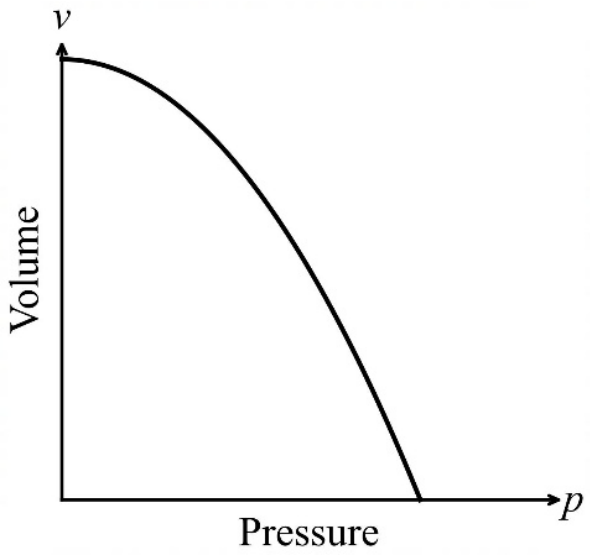
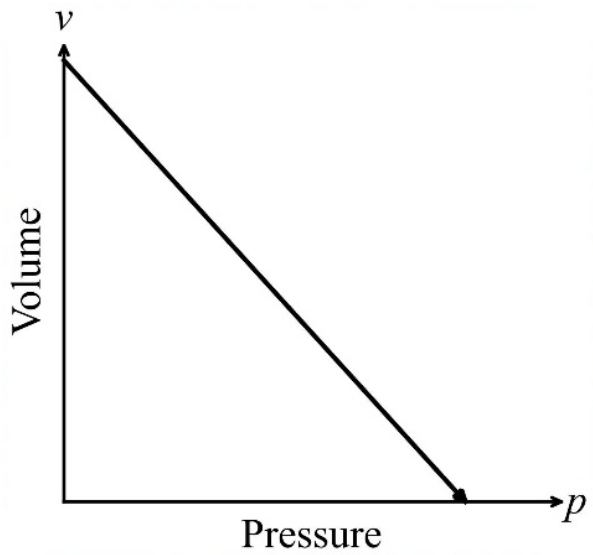
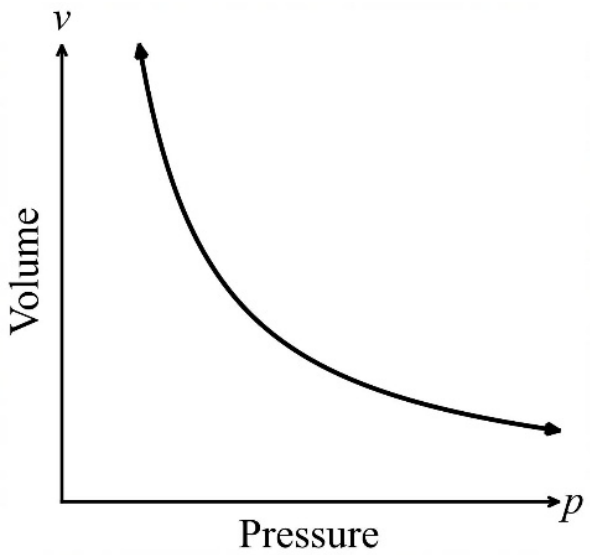


(C)



(D)



END OF SECTION I

Section II

85 marks
Attempt questions 16 - 39
Allow about 2 hours and 5 minutes for this section
Answer each question in the spaces provided.
Your responses should include relevant mathematical reasoning and/or calculations.

Question 16 (2 marks) **Marks**

Solve the following equation $\frac{x}{3} + 2 = 3x$. **2**

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Question 17 (2 marks)

Annie wants to estimate the population of kangaroos in a national park. She captures and tags 50 kangaroos before releasing them back into the park.

A week later, Annie captures a second sample of 40 kangaroos, of which 10 are found to be tagged.

Using this capture-recapture method, what would be Annie's estimate of the total population of kangaroos in the national park.

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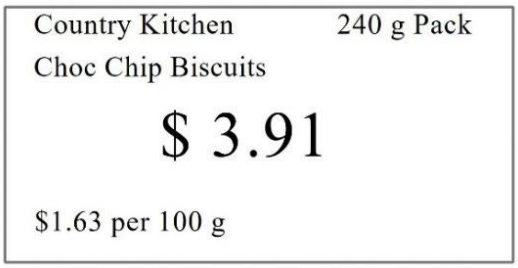
Question 18 (2 marks) **Marks**

The price card from a supermarket for a particular biscuit is shown below.



The biscuits are offered under different specials for one week.

Week 1: Buy two and get one free.

Week 2: A 30% discount on the regular price of the biscuits.

Holly wanted to buy 4 packets of biscuits. Which week offered a better deal for her?

Show mathematical working to justify your answer. **2**

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Question 19 (2 marks)

In 2022 the inflation rate was 4.6%, it rose to 6.5% in 2023, and in 2024 it fell again to 2.3%.

Alexia's basket of weekly groceries cost $250.00 at the start of 2022.

What would the same basket cost at the end of 2024? **2**

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Question 20 (4 marks) **Marks**

Rayani is a real estate agent and she is paid an annual salary of $35 000 plus a commission of 1% on all sales. She is also paid a car allowance of $60 per week. Assuming that there are exactly 52 weeks in a year.

(a) What is Rayani's total yearly income if he sold $12 000 000 worth of property in one year? **2**

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(b) If Rayani has no deductible work-related expenses, use the table given below to calculate the tax payable by her, excluding the Medicare levy. **2**

Taxable income	Tax on this income
0 – $18,200	Nil
$18,201 – $45,000	16 cents for each $1 over $18,200
$45,001 – $135,000	$4,288 plus 30 cents for each $1 over $45,000
$135,001 – $190,000	$31,288 plus 37 cents for each $1 over $135,000
$190,001 and over	$51,638 plus 45 cents for each $1 over $190,000

*Excludes the Medicare levy of 2%

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Question 21 (2 marks) **Marks**

Samia has calculated that, on average, her car consumes 8.5 litres of petrol for every 100 km of travel.

On a recent trip for work, Samia travelled for 4.5 hours at an average speed of 75 km/h.

How many litres (correct to one decimal place) of petrol did Samia's car consume on the trip? **2**

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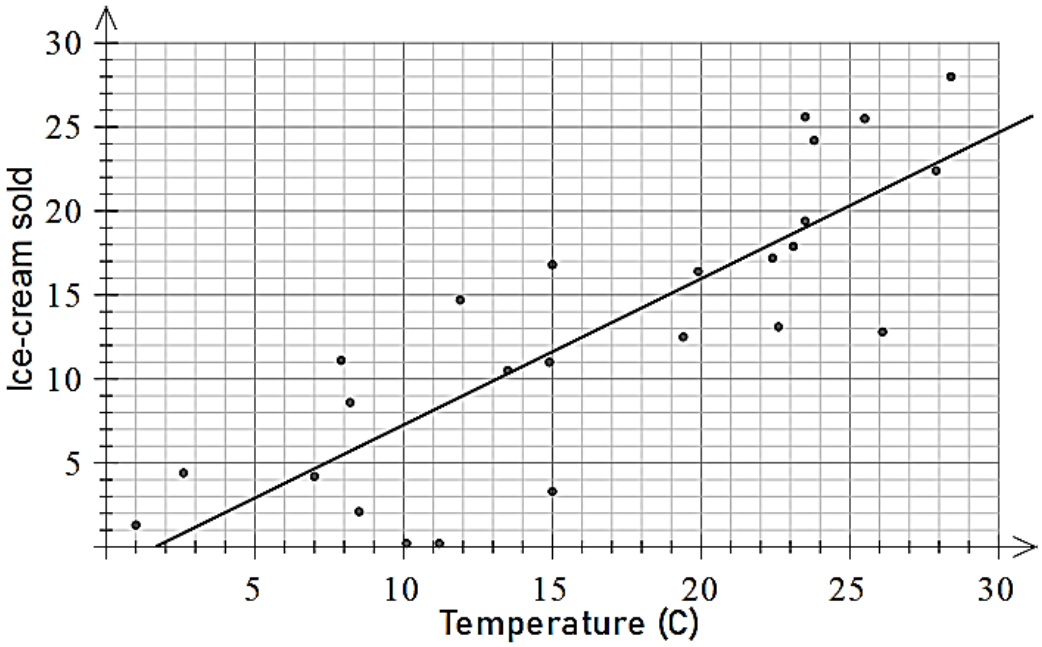
Question 22 (4 marks) **Marks**

The scatterplot below displays the average number of ice-creams sold against the daily temperature (c).

A least squares regression line has been fitted to the scatterplot.



(a) Find the aproximate gradient of the regression line **1**

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(b) Estimate the y-intercept of the regression line. **1**

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(c) What is the equation of the least squares regression line? **1**

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(d) Describe the correlation between the temperature and icecream sold in your own words. **1**

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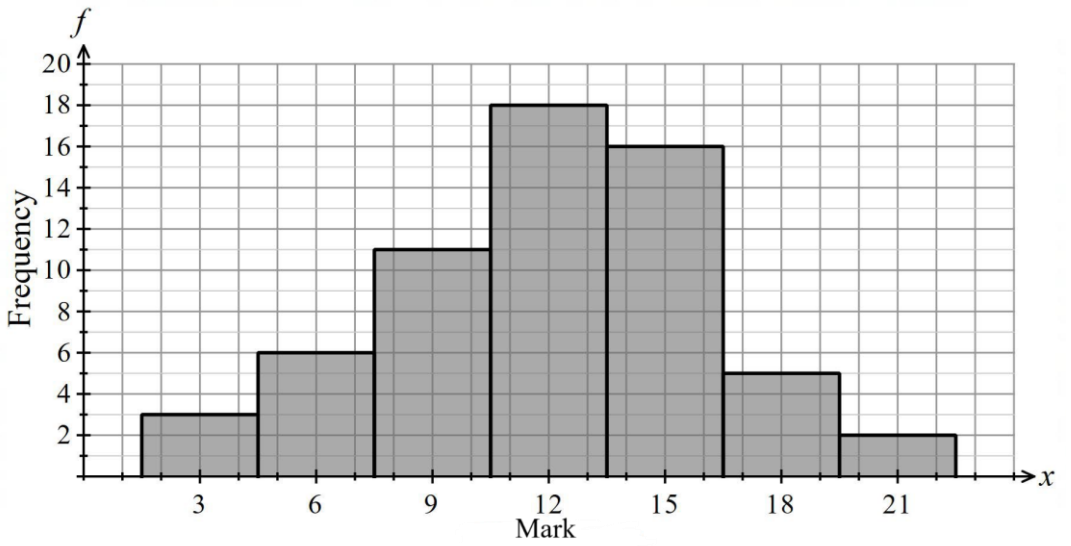
Question 23 (4 marks) **Marks**

The frequency histogram shows marks obtained by students out of 25.



(a) What is the mean of the scores summarised in the histogram? **1**

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(b) What is the median of the scores summarised in the histogram? **1**

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(c) What is the mode of the scores summarised in the histogram? **1**

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(e) Find the lower and upper quartiles of the scores. **1**

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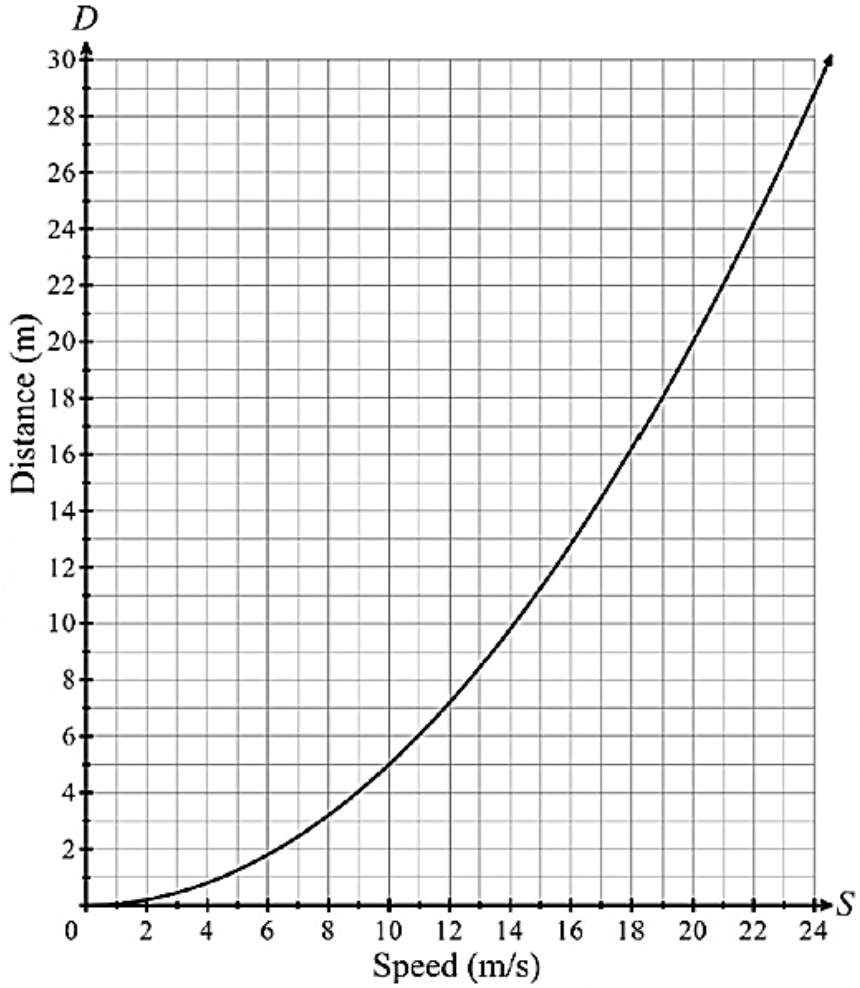
Questions 24 (4 marks) **Marks**

The graph below shows the **breaking distance** (in metres) for a vehicle travelling at increasing speeds (in m/s).



(a) Venice is driving a car at a speed of 11m/s in the school zone. If she takes 0.5 seconds to react to anything on the road before she applies the break, how long will her car travel, during the reaction time? **1**

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(b) What is her breaking distance after she applies the brakes? **1**

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(c) If Venice was driving at 15m/sec instead, how much longer would be her stopping distance, if her reaction time remains the same? **Marks 2**

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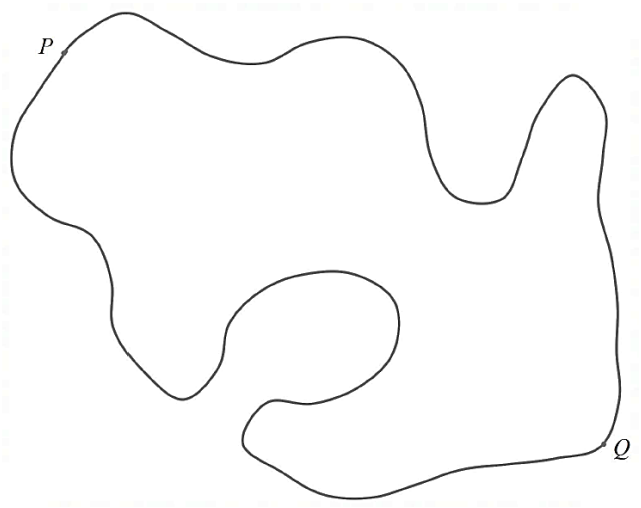
Questions 25 (2 marks)

This map of an island is drawn at a scale of 1 : 200 000.



What is the distance between the points P and Q on the island? **2**

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Questions 26 (4 marks) **Marks**

The Coordinated Universal Time (UTC) of Sydney is +10 hours and the UTC of Vancouver in Canada is -7 hours.

(a) When the time in Vancouver is 4 pm on Friday, what is the time and day in Sydney? **2**

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(b) At 4pm Friday, Monique takes the 16 hour long direct Quantas flight from Vancouver for Sydney. On which day and at what time will Monique's flight reach Sydney? **2**

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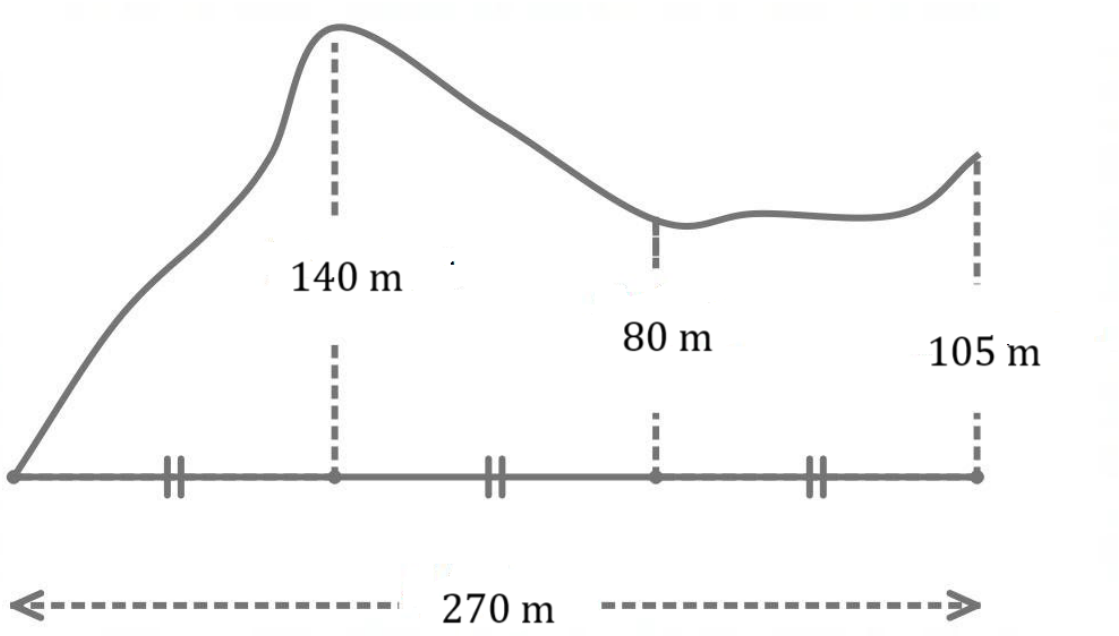
Questions 27 (3 marks) **Marks**

Louise owns a rural block that has one irregular boundary that follows a road, as shown in the diagram below. Offset measurements have been taken at right angles to a straight boundary at regular intervals.



Use three applications of the trapezoidal Rule to find the area of the block. Give your answer in hectares, to the nearest 2 decimal places. **3**

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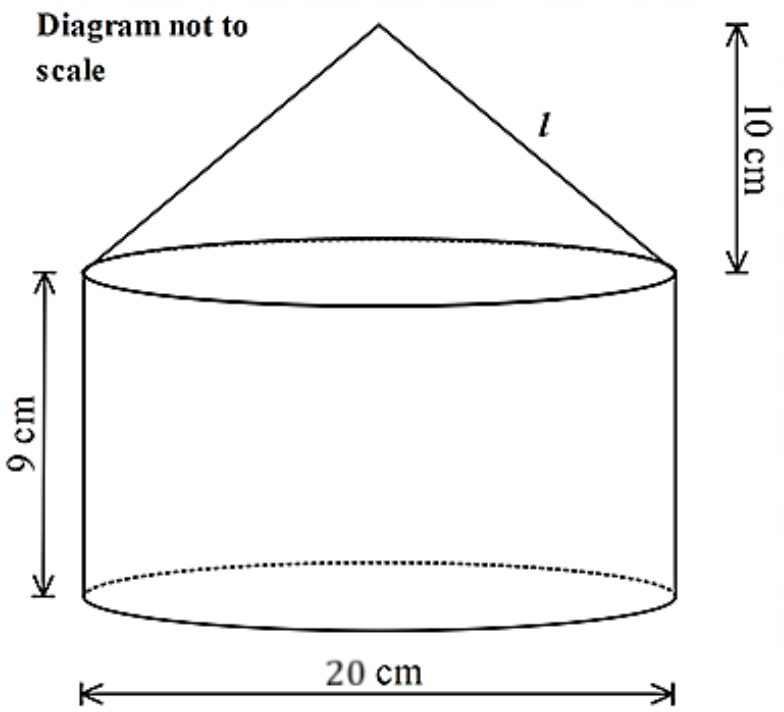
Questions 28 (6 marks) **Marks**

Suzane constructed a cake that has the shape of a cylinder and a cone shaped top. The cylinder has diameter 20 cm and height of 9 cm and the cone has a height of 10 cm.



(a) Calculate the volume of the cake, to the nearest cm^3. **2**

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(b) The conical part of the cake needs to be coated with chocolate. Calculate the surface area of the conical part of the cake that needs to be coated? ($Surface\ area\ of\ a\ cone\ (S)\ = \pi rl$, where l is the slant height of the cone). **2**

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(c) If the chocolate coating needs to be 3 mm thick, calculate the volume of the chocolate that will be used for coating. Give your answer in the nearest mL. **2**

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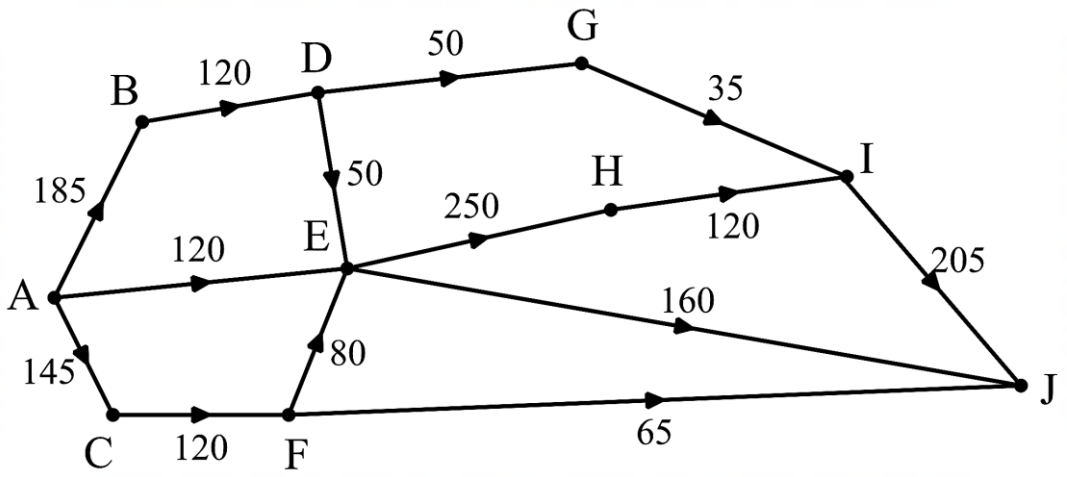
Questions 29 (3 marks) **Marks**

The directed network below shows the water supply route from source A to sink J.



Find the maximum flow of the network by drawing the minimum cut or any other method.

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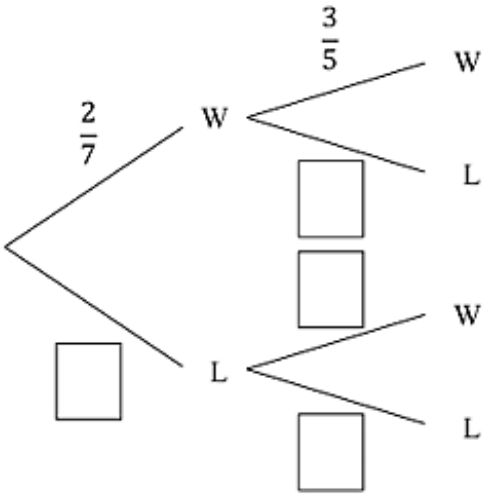
Questions 30 (4 marks) **Marks**

When Nandha plays Loretta at tennis, she wins the first set two out of every seven times they play.

If Nandha wins the first set, she wins the second set three out of every five times, but if she loses the first set, she wins the second set one out of every five times.

(a) Complete the probability tree below. **2**



(b) What is the probability that Nandha loses both sets? **1**

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(c) What is the probability that Nandha will win at least one of the two sets? **1**

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Questions 31 (4 marks) **Marks**

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

Table of future value interest factors

Number of periods	*Interest rate per period (% per period)*			
	2.5%	**3.5**%	**5.5**%	**7**%
6	6.388	6.550	6.888	7.153
12	13.796	14.601	16.386	17.888
18	22.386	24.500	29.481	33.999
24	32.349	36.667	47.538	58.177

Sarah's yearly salary is $125 000, and she wants to contribute part of his salary into an annuity account to save for putting a deposit towards buying her home. The annuity pays interest rate of 5.5% p. a. compounding annually.

(a) If Sarah's goal is to have $300 000 in the annuity account after 6 years, what percentage of her salary should she contribute each year? **3**

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(b) How much interest will Sarah earn as interest on her investment? **1**

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Questions 32 (4 marks) **Marks**

Louise owns 600 shares in Logitec Ltd which she had bought for $9.50 per share last year.

The same shares are currently valued at $14.25 each.

Today Logitec issued a dividend of $2.41 per share.

(a) What is the dividend yield on the shares? **1**

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(b) Louise sold her shares at $14.25 per share and paid a brokerage fee of 0.5% of the sale value. What percentage profit did Louise make on her investment? **3**

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Questions 33 (3 marks) **Marks**

The table below represents a weighted network.

	A	B	C	D	E	F
A		60	55	70		
B	60			45		
C	55			65		70
D	70	45	65		95	50
E				95		40
F			70	50	40	

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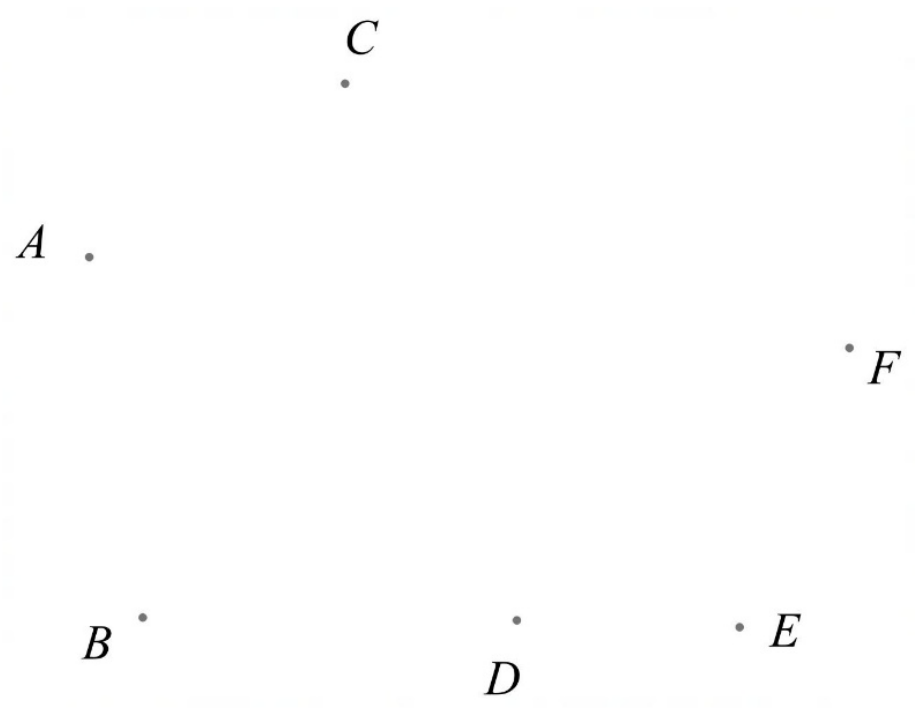
(a) Using the vertices below, draw a diagram of the network. **2**



(b) List the shortest path from A to E and give its length. **1**

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Questions 34 (3 marks) **Marks**

Eleanor borrowed $1 200 and is added at the end of the month before the monthly repayment of $100 is taken off the balance. The table below show the progress of the loan, where 'h' represents the number of months.

h	Balance at Start of Month	Balance after Interest is added	Balance after repayment is made
1	1200.00	1212.00	1112.00
2	1112.00	1123.12	1023.12
3	etc.	etc.	etc.
10	375.5696	379.3253	279.3253
11	279.3253		
12			
13			
14			

(a) What is the rate of interest per month? **1**

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(b) Complete the remaining lines of the table until the loan is repaid and determine the amount of the final repayment and the month in which it will be made. **2**

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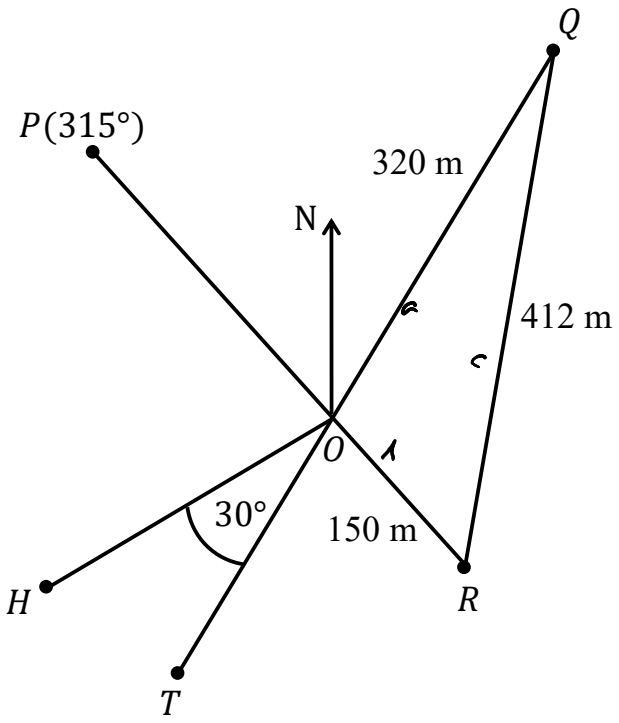
Questions 35 (6 marks) **Marks**

In the diagram, $PQRTH$ are located around the centre O and $\angle TOH = 30°$.

POR and TOQ are straight lines.



(a) Find the size of $\angle QOR$, to the nearest degree. **2**

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(b) Calculate the area of triangle QOR, to the nearest square metres. **1**

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(c) Find the size of $\angle QOP$. **Marks**

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(d) What is the bearing of *H* from *O.* **2**

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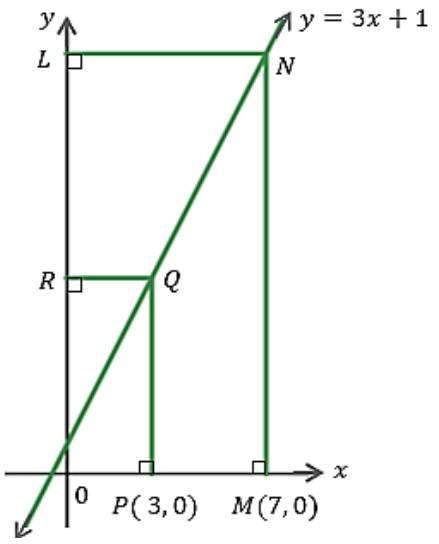
Questions 36 (3 marks)

In the diagram OPQR and OMNL are rectangles.



(a) What is the value of L? **1**

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(b) What is the length of QN? **2**

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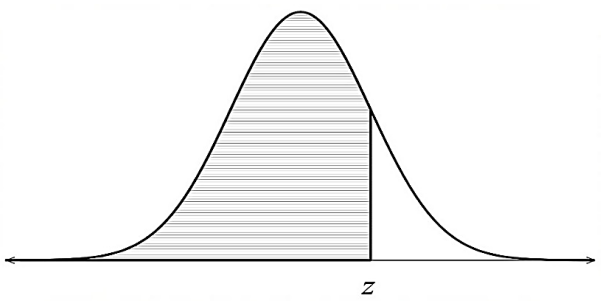
Questions 37 (5 marks) **Marks**

A random variable is normally distributed with a mean of 0 and a standard deviation of 1. The table gives the probability that this random variable lies below z for some positive values of z.

z	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
Probability	0.6915	0.7258	0.7580	0.7881	0.8159	0.8413	0.8643	0.8849	0.9032	0.9192	0.9332

z	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6
Probability	0.9452	0.9554	0.9641	0.9713	0.9773	0.9821	0.9861	0.9893	0.9918	0.9938	0.9953

The probability values given in the above table are represented by the shaded area in the following diagram.



Nicole is a nurse and in her study with 1000 participants found that the circumference of their heads was normally distributed with mean 54.0 cm and standard deviation 1.0 cm.

(a) What is the z-score of the person whose head circumference is 54.5 cm **1**

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(b) What percentage of people are expected to have the head circumference below 54.5 cm? **1**

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(c) By calculating z-scores, find the number of participants whose head circumference was between 53.5 cm and 54.5 cm. **Marks 3**

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Questions 38 (4 marks)

A set of whole number scores has

- an interquartile range = p.
- a lowest quartile $= 2p$.
- 73 as its smallest possible upper outlier score.

What is the highest possible lower outlier score? **4**

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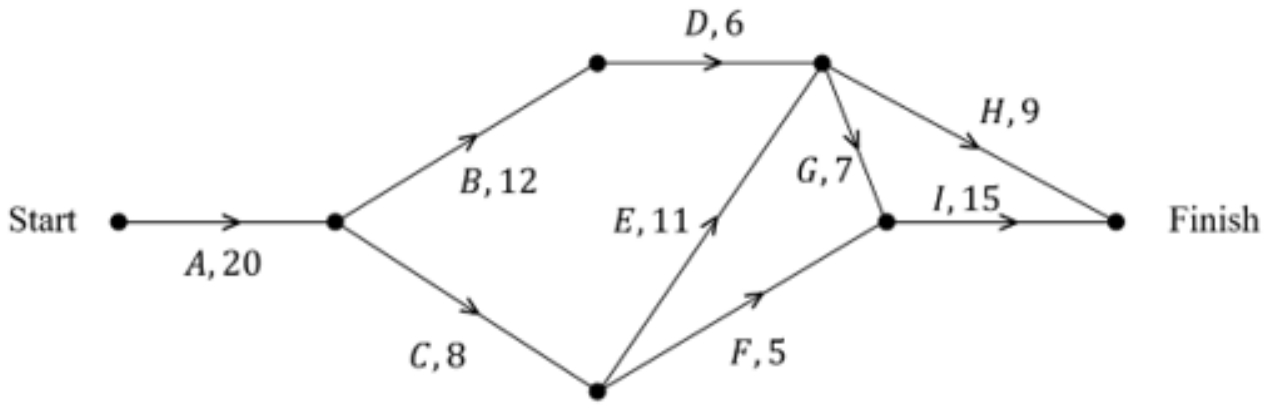
Question 39 (5 marks) **Marks**

A project requires completion of 9 tasks $A,\ B,\ C,\ \ldots,\ I$.

A network diagram for the project giving the duration for each task, in days, is shown.



(a) What is the critical path of the network? **2**

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(b) What is the minimum time required for the project to be completed. **1**

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……

(c) The manager of the project is told that the project has to be completed in 55 days time.

The duration of task *A* cannot be reduced, but any other task can be reduced by employing more workers to do that task.

Nominate a task that could have its duration decreased to meet the maximum completion time of 55 days, and what is the minimum number of days that its duration needs to be reduced to meet this deadline? **2**

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End of Examination

Student Number:
Teacher: Mr Singh

St George Girls High School

Mathematics Standard 2

2025 HSC Trial Examination

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 questions in **Section I**, use the Multiple-Choice answer sheet provided

  For questions in **Section II:**
  - Answer the questions in the spaces provided.
  - **Show relevant mathematical reasoning** and/or calculations.
  - **Extra writing space** is provided at the back of this booklet on pages 36-38. If you use this space, clearly indicate which question you are answering.
  - Marks may not be awarded for incomplete or poorly presented solutions or where multiple solutions are provided.

Total marks: 100

Section I – 15 marks (pages 3 to 11)

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

Section II – 85 marks (pages 12 to 35)

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

Section I

15 marks
Attempt Questions 1 – 15.
Allow about **25 minutes** for this section.
Use the **multiple-choice answer sheet** for questions 1 – 15.

---

1. It took Bella 3 hours and 20 minutes to travel 180 km from her house to the camping site.

What was Bella's average speed?

$180 \div 3.\dot{3}$
$= 54$

(A) 60.00 km/h

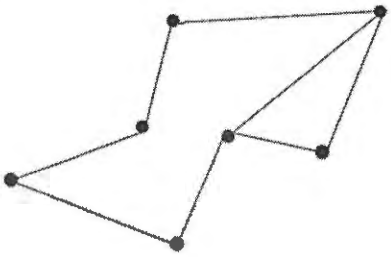
(B) 56.25 km/h

(C) 54.00 km/h

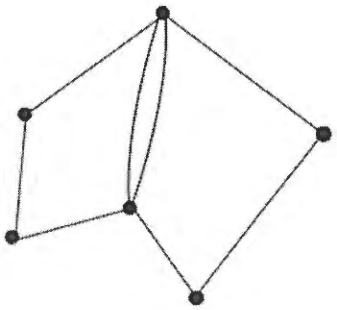
(D) 50.00 km/h

2. Which network is an Eulerian Circuit?

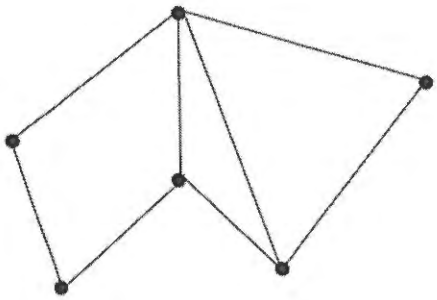
(A)



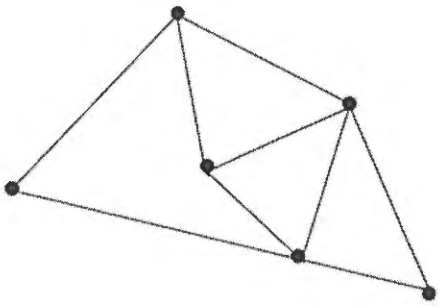
(B)



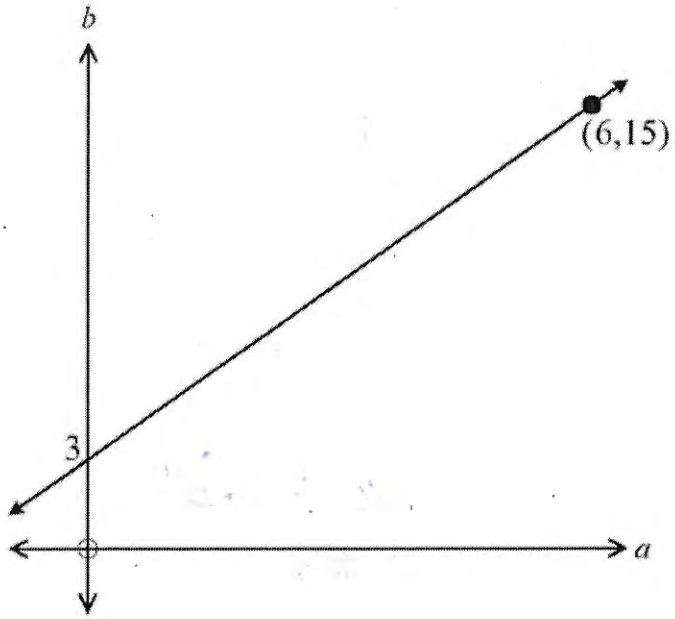
(C)



(D)



3. Which equation describes the relationship between the two variables a and b?



(A) $b = 2a + 3$

(B) $b = 3a + 2$

(C) $b = 6a + 3$

(D) $b = 6a + 15$

$\frac{15-3}{6-0}$

$= \frac{12}{6}$

$= 2$

4. Majella stands at the school gate and hands over a questionnaire to every 20th student.

What kind of sampling is she using?

(A) Stratified

(B) Random

(C) Convenient

(D) Systematic

5. Emma measured the diagonal length of the classroom smart board as 1.36 metre, correct to two decimal places.

What is the percentage error in Emma's measurement?

(A) 0.37%

(B) 0.74%

(C) 4.41%

(D) 7.35%

$\frac{0.005}{1.36} \times 100$

$=$

6. Olivia bought a new car three years ago for \$35 500 and since then it had depreciated at a rate of 22% p.a using the declining balance method.

What is the current value of the car?

(A) \$378.00

(B) \$12 070.00

(C) \$16 846.60

(D) \$21 508.20

$V = 35500 \times 0.78^3$

$= 16846.60$

7. In a car yard, the ratio of red to white cars is 3:5 and the ratio of red to black 4:3.

What is the ratio of white to black cars?

(A) 1 : 5

(B) 20 : 3

(C) 5 : 1

(D) 20 : 9

$R : W : B$

$3_{12} : 5_{20}$

$4_{12} : 3_{9}$

$12 : 20 : 9$

8. The weight (w) in kilograms of copper plumbing pipe is directly proportional to the length (d) of the pipe in metres.

A pipe which is 5 metres long, weighs 2.45 kg.

What is the gradient (m) of the direct variation graph $w = md$ for this relationship?

$w = kd$

$2.45 = k \times 5$

$k = 0.49$

$\therefore w = 0.49 \times d$

(A) $m = 0.102$

(B) $m = 0.490$

(C) $m = 2.04$

(D) $m = 0.512$

9. Aishani works as a forklift driver and she also operates a crane on a construction site. Her hourly base rate on the jobsite is \$64.50.

When she operates the crane, Aishani is paid a 22% high altitude adversity allowance on top of her normal hourly rate.

What would she be paid for a 40-hour week in which she operated the crane for 18 hours?

$= 18 \times 64.50 \times 1.22 + 22 \times 64.5$

$= 1416.42 + 1419$

$= 2835.42$

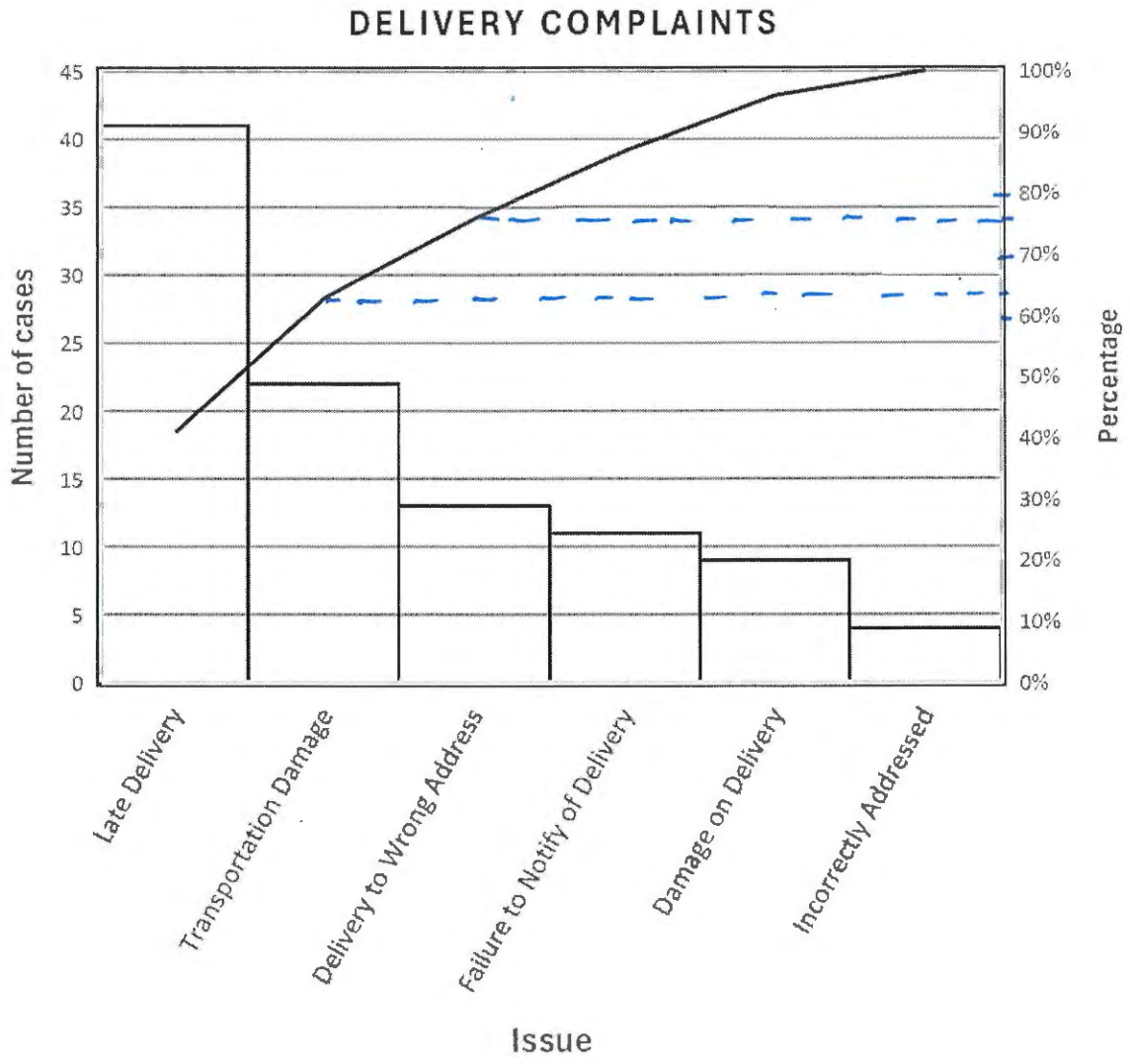
(A) \$255.42

(B) \$1416.42

(C) \$2835.42

(D) \$3996.42

10. The Pareto Chart below looks at the issues an online store had with having its products delivered, based on customer complaints.



Store manager Katrina wants to address only the complaints related to 'Delivery to Wrong Address'. By doing so, what percentage of the total complaints will Katrina address?

$76 - 64 \div 12$

(A) 13%

(B) 28%

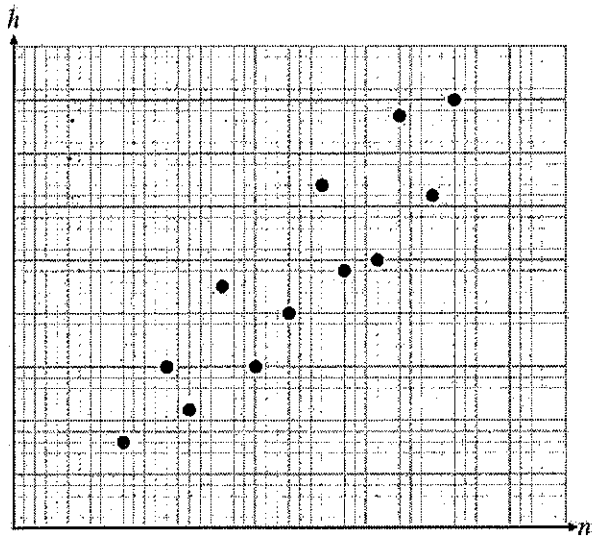
(C) 38%

(D) 78%

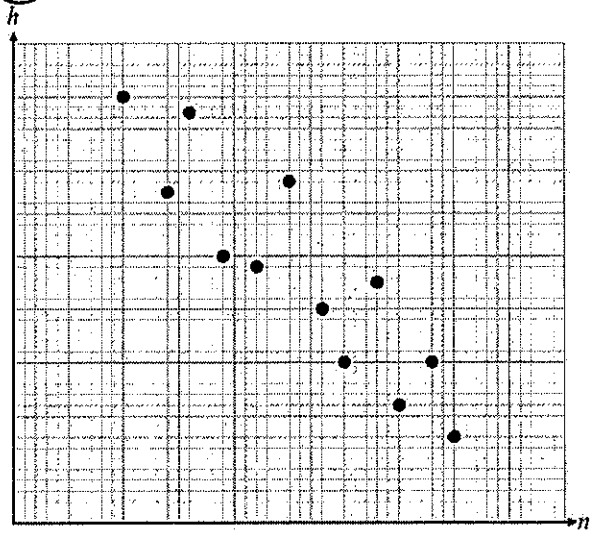
11. A researcher calculates the value of Pearson's correlation coefficient is –0.8 for a set of bivariate data that she collected.

Which scatterplot could best represent this data?

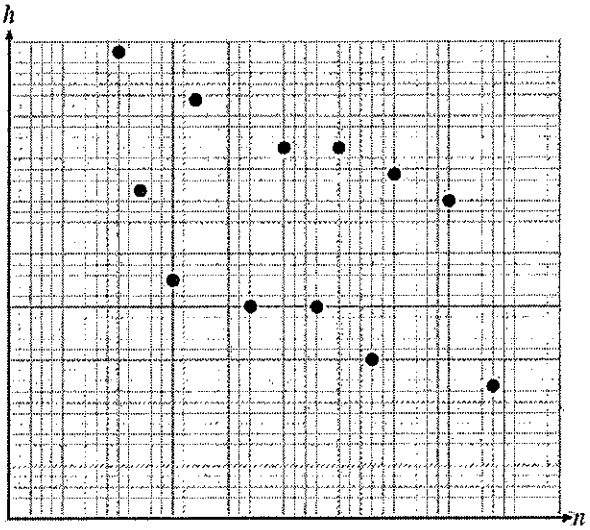
(A)



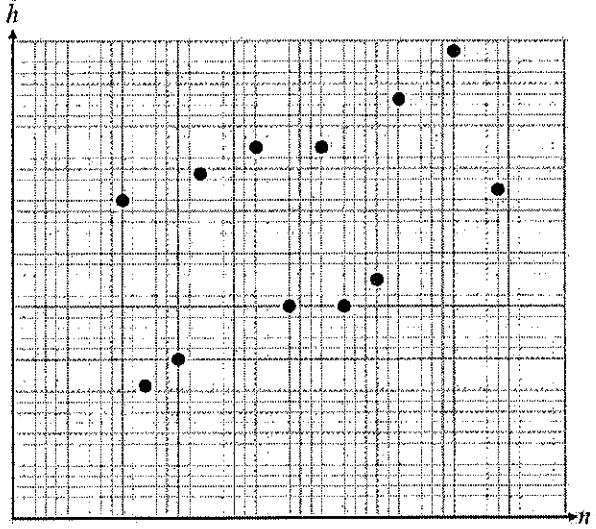
(B)



(C)



(D)



12. The stem-and-leaf plot below shows the distribution of the hourly wages ($) of a manufacturing company.

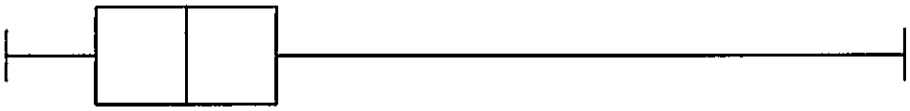
4	0 0 2 2 2 4 8 8 8
5	0 0 1 5 6 6 8 9 9
6	3 6 7 8
7	1
8	3 7
9	6

40 48 55.5 66 96
8 7.5 10.5 30

Which of the following box-and-whisker plots may best represent the distribution of their hourly wages?

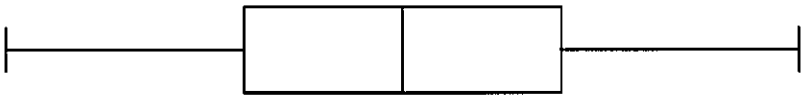
(A)

(B)



(C)

(D)



13. Alina bought a car with a cash price of \$9500 on terms.

She agreed to pay a deposit of \$1000 and the remaining amount plus interest over 12 months, in equal instalments.

If simple interest at the rate of 8% p.a. was charged on the remaining amount, how much did Arthur pay each month?

(A) \$765.00

(B) \$767.13

(C) \$855.00

(D) \$857.37

$$= \frac{1.08\,(9500-1000)}{12}$$

$$= \$765$$

14. If the GST increases from 10% to 12%, the price of a textbook rises by \$1.44.

What is the original price of the textbook, including GST?

(A) \$63.36

(B) \$64.80

(C) \$72.00

(D) \$79.20

$2\% = 1.14$

$1\% = 0.72$

$100\% = \$72$ (without GST)

$110\% = \$79.2$ } difference

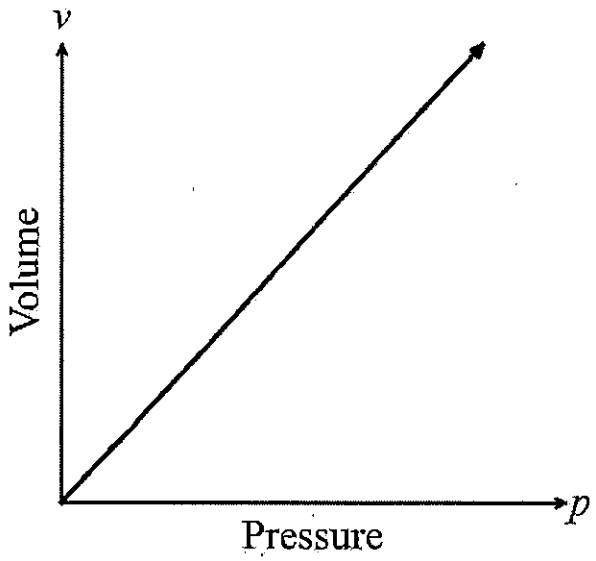
$112\% = \$80.64$ } $= \$1.44$

15. At a fixed temperature, the relationship between the pressure (p) and volume (v) for a quantity of gas in a container is given by:

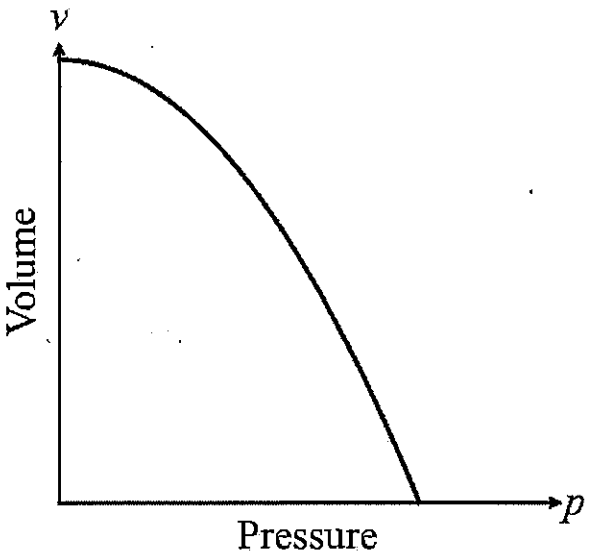
$$pv = 100\,.$$

Which of these graphs could represent this relationship?

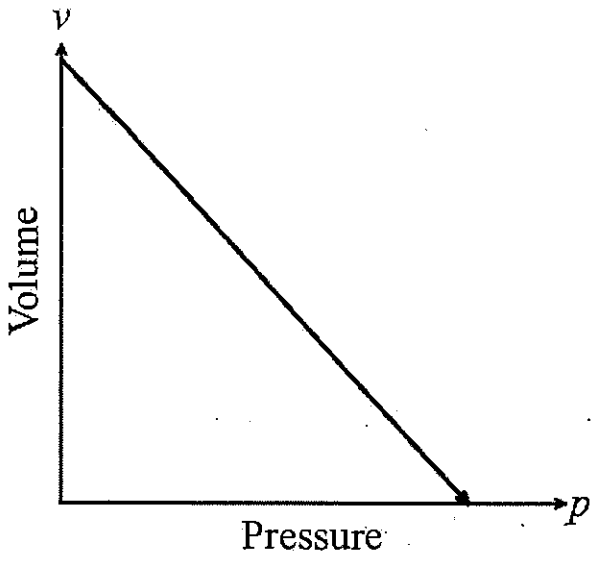
(A)



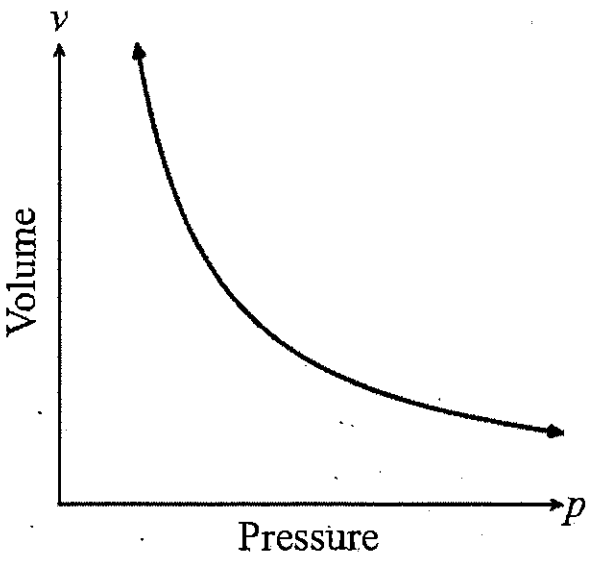
(B)



(C)



(D)



END OF SECTION I

Section II

85 marks
Attempt questions 16 - 39
Allow about 2 hours and 5 minutes for this section
Answer each question in the spaces provided.
Your responses should include relevant mathematical reasoning and/or calculations.

Question 16 (2 marks) **Marks**

Solve the following equation $\frac{x}{3} + 2 = 3x$. **2**

$3x - \frac{x}{3} = 2$

$\frac{9x}{3} - \frac{x}{3} = 2$

$\frac{8x}{3} = 2$

$8x = 6$

$x = \frac{6}{8}$ or $\frac{3}{4}$

Question 17 (2 marks)

Annie wants to estimate the population of kangaroos in a national park. She captures and tags 50 kangaroos before releasing them back into the park.

A week later, Annie captures a second sample of 40 kangaroos, of which 10 are found to be tagged.

Using this capture-recapture method, what would be Annie's estimate of the total population of kangaroos in the national park. **2**

÷ 10 of the 40 were tagged.
÷ 1
× 50 of the whole. $\frac{40 \times 50}{10}$
= 200 kangaroos in total

Question 18 (2 marks) **Marks**

The price card from a supermarket for a particular biscuit is shown below.

Country Kitchen	240 g Pack
Choc Chip Biscuits	
$ 3.91	
$1.63 per 100 g	

The biscuits are offered under different specials for one week.

Week 1: Buy two and get one free.

Week 2: A 30% discount on the regular price of the biscuits.

Holly wanted to buy 4 packets of biscuits. Which week offered a better deal for her?

Show mathematical working to justify your answer. **2**

W1 ⇒ $3.91 \times 2 + 3.91$

$= 7.82 + 3.91$

$= \$11.73$

W2 ⇒ $3.91 \times 4 \times 0.7$

$= \$10.95$

∴ week 2 offered better deal.

Question 19 (2 marks)

In 2022 the inflation rate was 4.6%, it rose to 6.5% in 2023, and in 2024 it fell again to 2.3%.

Alexia's basket of weekly groceries cost $250.00 at the start of 2022.

What would the same basket cost at the end of 2024? **2**

$250 \times 1.046 \times 1.065 \times 1.023$

$= \$284.90$

Question 20 (4 marks) **Marks**

Rayani is a real estate agent and she is paid an annual salary of $35 000 plus a commission of 1% on all sales. She is also paid a car allowance of $60 per week. Assuming that there are exactly 52 weeks in a year.

(a) What is Rayani's total yearly income if he sold $12 000 000 worth of property in one year? **2**

Income $= 35000 + 60 \times 52 \times + 1\% \text{ of } 12000000$
$= 35000 + 3120 + 120000$
$= \$158120$

(b) If Rayani has no deductible work-related expenses, use the table given below to calculate the tax payable by her, excluding the Medicare levy. **2**

Taxable income	Tax on this income
0 – $18,200	Nil
$18,201 – $45,000	16 cents for each $1 over $18,200
$45,001 – $135,000	$4,288 plus 30 cents for each $1 over $45,000
$135,001 – $190,000	$31,288 plus 37 cents for each $1 over $135,000
$190,001 and over	$51,638 plus 45 cents for each $1 over $190,000

*Excludes the Medicare levy of 2%

$Tax = 31288 + 0.37(158120 - 135000)$
$= 31288 + 0.37 \times 23120$
$= \$8554.4 + 31288$
$= \$39842.4$

Question 21 (2 marks) **Marks**

Samia has calculated that, on average, her car consumes 8.5 litres of petrol for every 100 km of travel.

On a recent trip for work, Samia travelled for 4.5 hours at an average speed of 75 km/h.

How many litres (correct to one decimal place) of petrol did Samia's car consume on the trip? **2**

$4.5 \times 75 = 337.5$ km

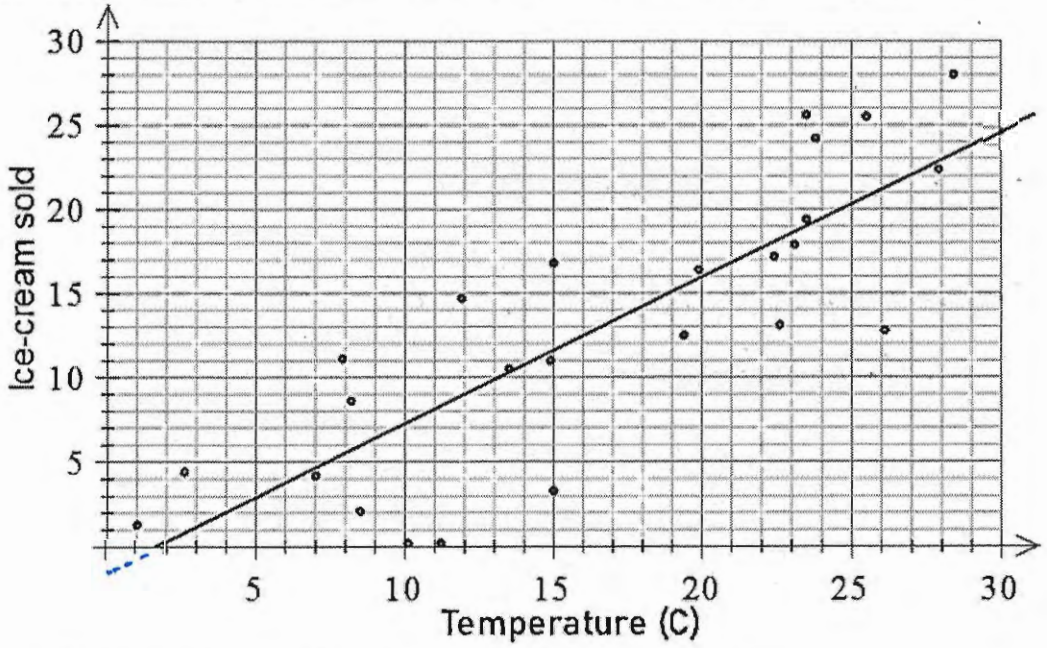
8.5×3.375 (lots of hundred)

$= 28.7$ Litres.

Question 22 (4 marks) **Marks**

The scatterplot below displays the average number of ice-creams sold against the daily temperature (c).

A least squares regression line has been fitted to the scatterplot.



(a) Find the aproximate gradient of the regression line **1**

$m = \frac{25-0}{30-2}$ OR $m = \frac{16-9}{20-12}$

$= \frac{25}{28} \doteq 89$ $= \frac{7}{8} \doteq 0.88$

(b) Estimate the y-intercept of the regression line. **1**

-2 or -1.5

(c) What is the equation of the least squares regression line? **1**

$\text{Icecream sold} = \frac{25}{28} \times C - 2$

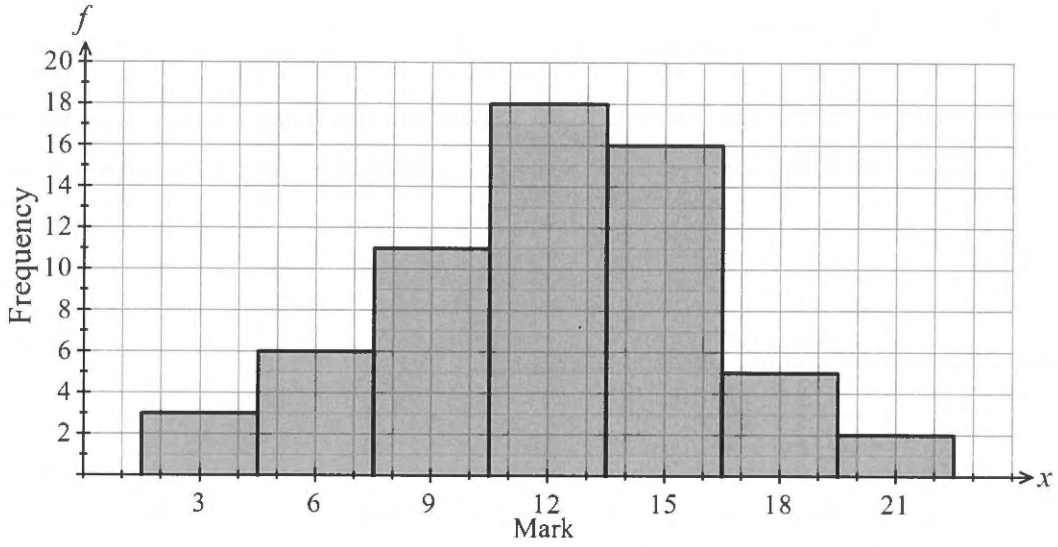
(d) Describe the correlation between the temperature and icecream sold in your own words. **1**

There is a high positive correlation between temperature and number of ice-cream sold.

$r \doteq 81.5$

Question 23 (4 marks) **Marks**

The frequency histogram shows marks obtained by students out of 25.



Mark	f	
3	3	
4	6	
5	11	
6	18	
7	16	
8	5	
9	2	

(a) What is the mean of the scores summarised in the histogram? **1**

$\bar{x} = 6$

(b) What is the median of the scores summarised in the histogram? **1**

Median = 6

(c) What is the mode of the scores summarised in the histogram? **1**

Mode = 6

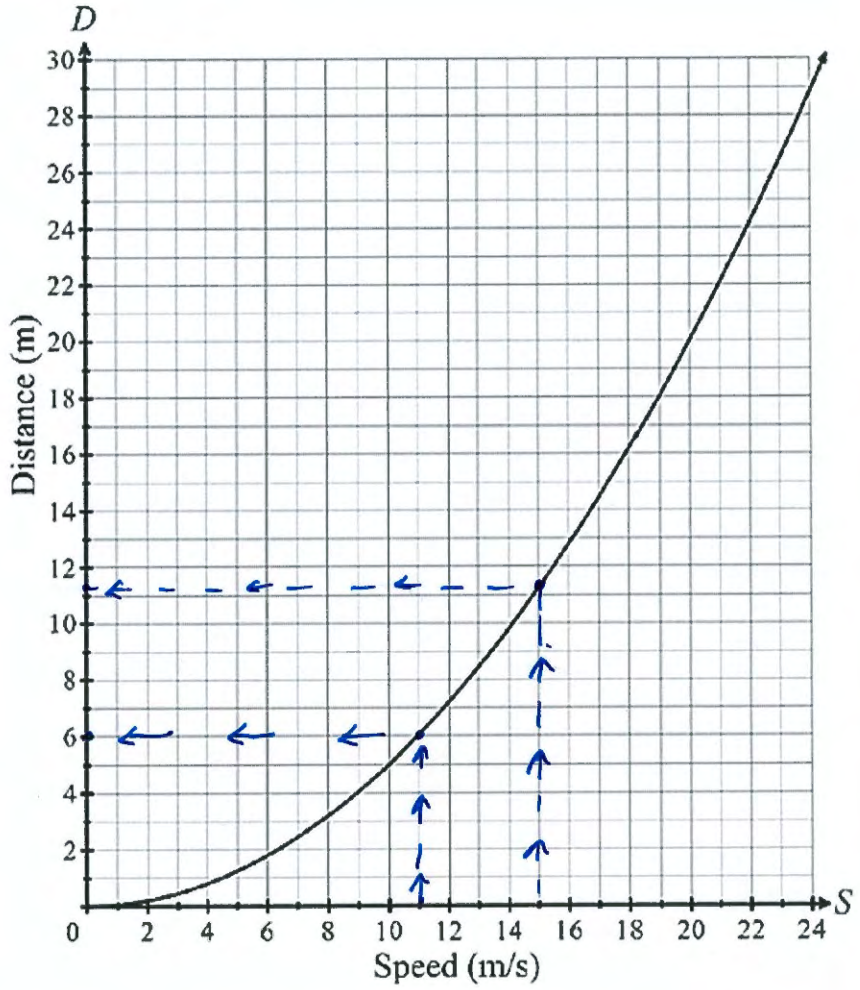
(e) Find the lower and upper quartiles of the scores. **1**

$Q1 = 5$

$Q3 = 7$

Questions 24 (4 marks) **Marks**

The graph below shows the **breaking distance** (in metres) for a vehicle travelling at increasing speeds (in m/s).



(a) Venice is driving a car at a speed of 11m/s in the school zone. If she takes 0.5 seconds to react to anything on the road before she applies the break, how long will her car travel, during the reaction time? **1**

reaction distance = 0.5 × 11

= 5.5m

(b) What is her breaking distance after she applies the brakes? **1**

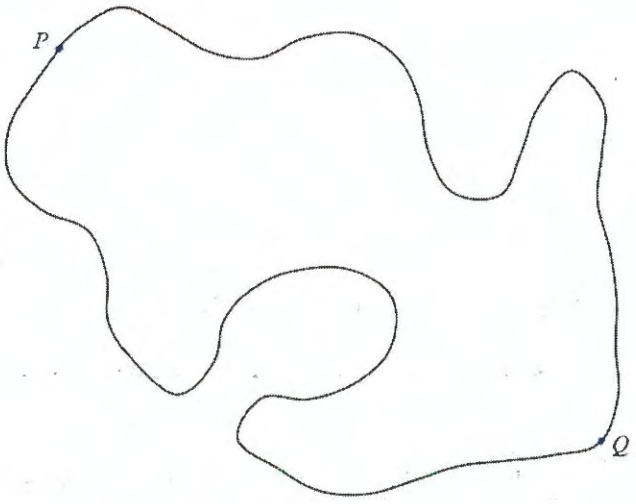
6m

(c) If Venice was driving at 15m/sec instead, how much longer would be her stopping distance, if her reaction time remains the same? **Marks** **2**

at 15 m/s stopping distance
= breaking distance + reaction distance
= 11.2 m + 0.5 × 15
= 11.2 + 7.5
= 18.7 m.
difference between 11 & 15 m/s in stopping distance.
= 18.7 − 11.5
= 7.2 m

Questions 25 (2 marks)

This map of an island is drawn at a scale of 1 : 200 000.



What is the distance between the points P and Q on the island? **2**

9 cm × 200000
= 1800000 cm
= 18000 m
= 18 km.

Questions 26 (4 marks) **Marks**

The Coordinated Universal Time (UTC) of Sydney is +10 hours and the UTC of Vancouver in Canada is -7 hours.

(a) When the time in Vancouver is 4 pm on Friday, what is the time and day in Sydney? **2**

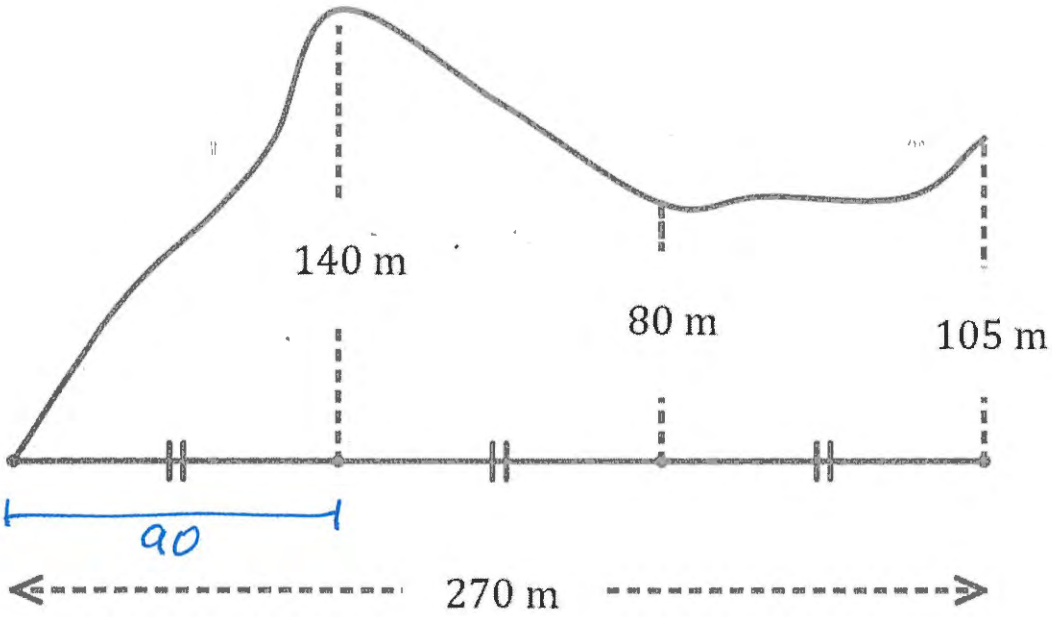
Vancouver is 17 hours (10+7) behind Sydney.
∴ Sydney time = 4 Pm or 16:00 + 17
= 33 (means next day)
− 24
09 am Saturday.

(b) At 4pm Friday, Monique takes the 16 hour long direct Quantas flight from Vancouver for Sydney. On which day and at what time will Monique's flight reach Sydney? **2**

9 am saturday + 16 hrs.
= 25 (which means next day)
−24
01 or 1 am on Sunday.

Questions 27 (3 marks) **Marks**

Louise owns a rural block that has one irregular boundary that follows a road, as shown in the diagram below. Offset measurements have been taken at right angles to a straight boundary at regular intervals.



Use three applications of the trapezoidal Rule to find the area of the block. Give your answer in hectares, to the nearest 2 decimal places. **3**

$A \doteq \left(\frac{0+140}{2}\right)\times 90 + \left(\frac{140+80}{2}\right)\times 90 + \left(\frac{80+105}{2}\right)\times 90$

$\doteq 6300 + 9900 + 8325$

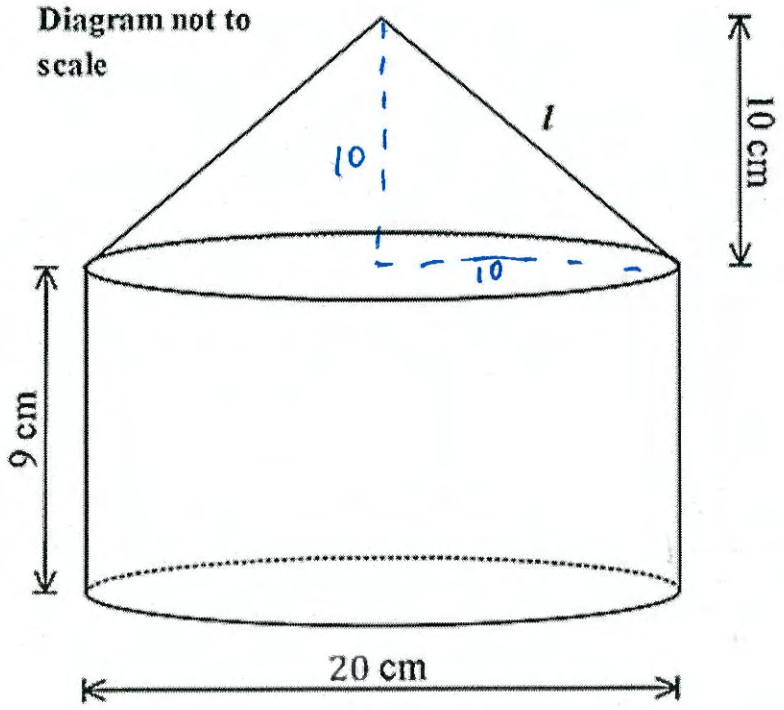
$\doteq 24525$

$\doteq 10000$

$\doteq 2.45$ ha.

Questions 28 (6 marks) **Marks**

Suzane constructed a cake that has the shape of a cylinder and a cone shaped top. The cylinder has diameter 20 cm and height of 9 cm and the cone has a height of 10 cm.



(a) Calculate the volume of the cake, to the nearest cm^3. **2**

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

$= \pi \times 10^2 \times 9 + \frac{1}{3} \times \pi \times 10^2 \times 10$

$= 900\pi + \frac{1000}{3}\pi \quad cm^3$

$= 3874.63 \ cm^3$

$= 3875 \ cm^3$

(b) The conical part of the cake needs to be coated with chocolate. Calculate the surface area of the conical part of the cake that needs to be coated?

(*Surface area of a cone* $(S) = \pi rl$, where l is the slant height of the cone). **2**

$SA = \pi r l$ $\quad l = \sqrt{10^2 + 10^2}$

$= \pi \times 10 \times \sqrt{200}$ $\quad = \sqrt{200}$

$\doteq 444.29\ cm^2$

(c) If the chocolate coating needs to be 3 mm thick, calculate the volume of the chocolate that will be used for coating. Give your answer in the nearest mL. **2**

$V =$ Cross-section Area $\times h$

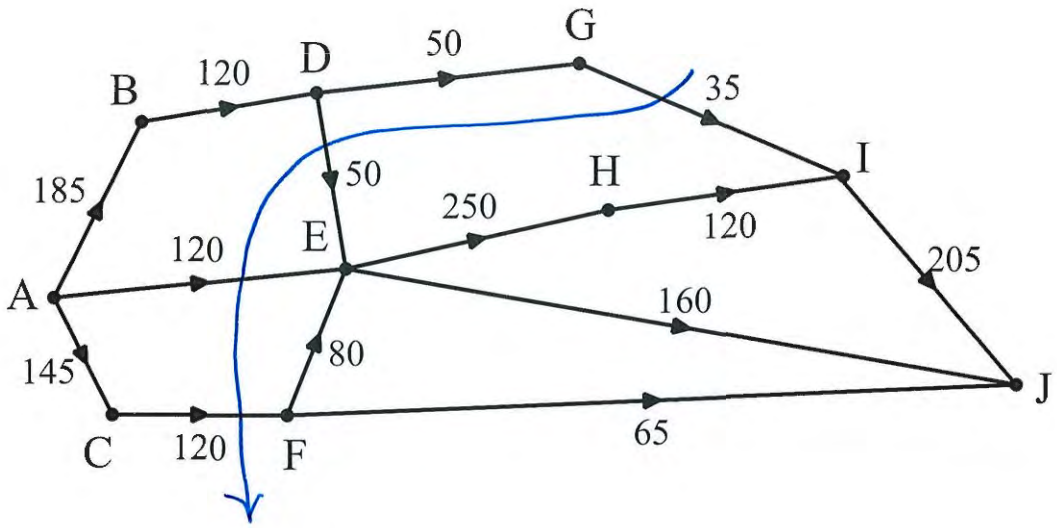
$= 10 \times \pi \times \sqrt{200}\ cm^2 \times 0.3\ cm$ $\quad (3mm = 0.3\ cm)$

$= 133.286\ cm^3$

$= 133\ mL$

Questions 29 (3 marks) **Marks**

The directed network below shows the water supply route from source A to sink J.



Find the maximum flow of the network by drawing the minimum cut or any other method. **3**

35 + 50 + 120 + 120

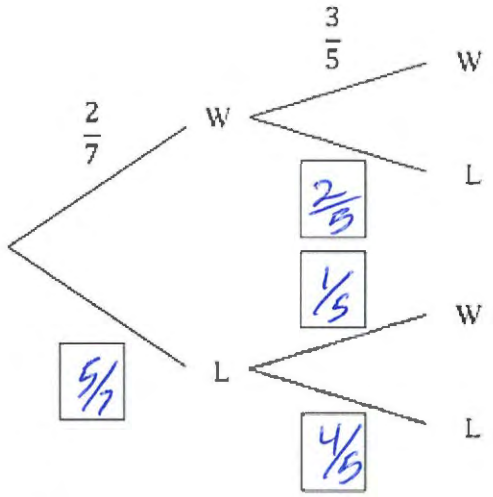
= 325 is the maximum flow

Questions 30 (4 marks) **Marks**

When Nandha plays Loretta at tennis, she wins the first set two out of every seven times they play.

If Nandha wins the first set, she wins the second set three out of every five times, but if she loses the first set, she wins the second set one out of every five times.

(a) Complete the probability tree below. **2**



(b) What is the probability that Nandha loses both sets? **1**

$P(LL) = \frac{5}{7} \times \frac{4}{5}$

$= \frac{20}{35}$

$= 4/7$

(c) What is the probability that Nandha will win at least one of the two sets? **1**

$P(\text{win at least one}) = 1 - P(LL)$

$= 1 - 4/7$

$= 3/7$

Questions 31 (4 marks) **Marks**

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

Table of future value interest factors

Number of periods	*Interest rate per period (% per period)*			
	2.5%	**3.5%**	**5.5%**	**7%**
6	6.388	6.550	6.888	7.153
12	13.796	14.601	16.386	17.888
18	22.386	24.500	29.481	33.999
24	32.349	36.667	47.538	58.177

Sarah's yearly salary is $125 000, and she wants to contribute part of his salary into an annuity account to save for putting a deposit towards buying her home. The annuity pays interest rate of 5.5% p. a. compounding annually.

(a) If Sarah's goal is to have $300 000 in the annuity account after 6 years, what percentage of her salary should she contribute each year? **3**

FV interest factor = 6.888

∴ $6.888 is the FV of $1 annuity

÷ → ∴ $1

× → ∴ 300000 is the FV of $\frac{1}{6.888} \times 300000$

$= \$43554.$

$\frac{43554}{125000} \doteqdot 34.84\%$

(b) How much interest will Sarah earn as interest on her investment? **1**

$300000 - (43554 \times 6)$

$= \$38\,675.96$ interest.

Questions 32 (4 marks) **Marks**

Louise owns 600 shares in Logitec Ltd which she had bought for \$9.50 per share last year.

The same shares are currently valued at \$14.25 each.

Today Logitec issued a dividend of \$2.41 per share.

(a) What is the dividend yield on the shares? **1**

Yeild = $\frac{\text{dividend}}{\text{market value}}$

$= \frac{2.41}{14.25}$

$\doteq 16.91\%$

(b) Louise sold her shares at \$14.25 per share and paid a brokerage fee of 0.5% of the sale value. What percentage profit did Louise make on her investment? **3**

Selling Price $= 14.25 \times 600$

$= \$8550$

brokerage fee $= 0.5\%$ $\therefore$ income is 99.5%.

8550×0.995

$= \$8507.25$

cost of shares $= 600 \times 9.50$

$= \$5700$

Profit $= (8507.25 - 5700) + 2.41 \times 600$ (dividend)

$= 2807.25 + 1446$

$= 4253.25$

% return $= \frac{4253.25}{5700}$

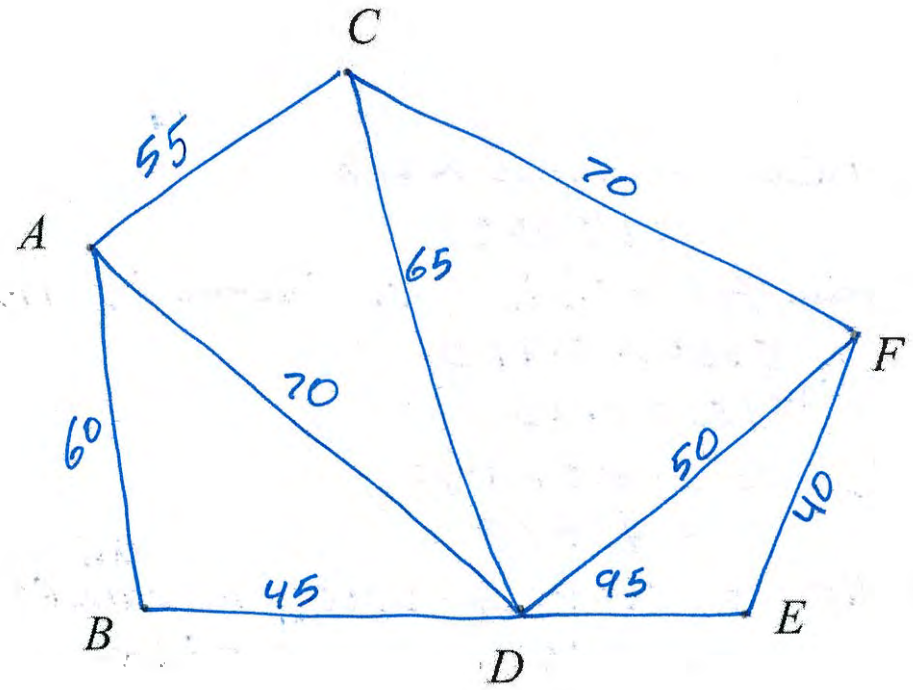
$\doteq 74.62\%$

Questions 33 (3 marks) **Marks**

The table below represents a weighted network.

	A	B	C	D	E	F
A		60	55	70		
B	60			45		
C	55			65		70
D	70	45	65		95	50
E				95		40
F			70	50	40	

(a) Using the vertices below, draw a diagram of the network. **2**



(b) List the shortest path from A to E and give its length. **1**

160 ADFE or ADE

Questions 34 (3 marks) **Marks**

Eleanor borrowed $1 200 and is added at the end of the month before the monthly repayment of $100 is taken off the balance. The table below show the progress of the loan, where 'h' represents the number of months.

h	Balance at Start of Month	Balance after Interest is added	Balance after repayment is made
1	1200.00	1212.00	1112.00
2	1112.00	1123.12	1023.12
3	etc.	etc.	etc.
10	375.5696	379.3253	279.3253
11	279.3253	282.1186	182.1186
12	182.1186	183.9397	83.9397
13	83.9397	84.7791	
14			

(a) What is the rate of interest per month? **1**

1% per month

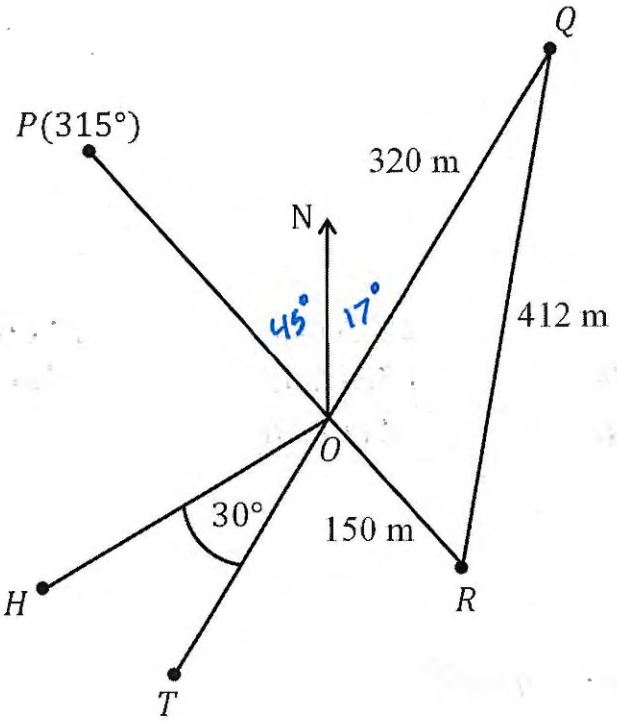
(b) Complete the remaining lines of the table until the loan is repaid and determine the amount of the final repayment and the month in which it will be made. **2**

final payment in the 13th month = $84.78

Questions 35 (6 marks) **Marks**

In the diagram, $PQRTH$ are located around the centre O and $\angle TOH = 30°$.

POR and TOQ are straight lines.



(a) Find the size of $\angle QOR$, to the nearest degree. **2**

$\cos(\angle QOR) = \frac{320^2 + 150^2 - 412^2}{2 \times 320 \times 150}$

$\angle QOR = \cos^{-1}(\quad)$

$= 117.8478...°$

$\doteq 118°$

(b) Calculate the area of triangle QOR, to the nearest square metres. **1**

Area of $\triangle QOR = \frac{1}{2} \times 320 \times 150 \times \sin 118°$

$= 21191\ m^2$ (rounded 118° used)

or

$21221\ m^2$ (exact value of angle used)

(c) Find the size of $\angle QOP$. **Marks**

$\angle QOP = 180^\circ - 118^\circ$ **1**

$= 62^\circ$

(d) What is the bearing of H from O. **2**

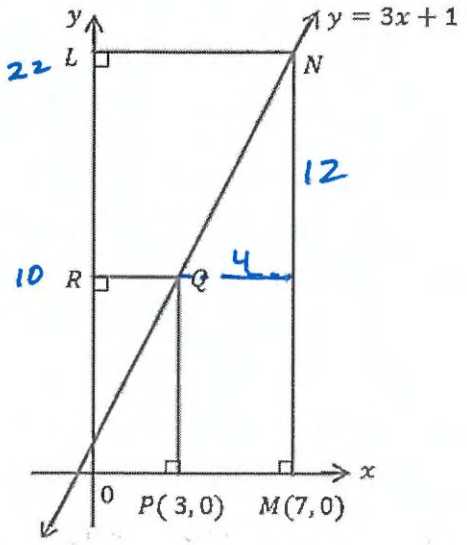
$\angle QON = 17^\circ$ $(360 - 315 = 45^\circ)$

O to $H = 17^\circ + 180^\circ + 30^\circ$

$= 227^\circ$

Questions 36 (3 marks)

In the diagram OPQR and OMNL are rectangles.



(a) What is the value of L? **1**

$L = 3 \times 7 + 1$

$= 22$

(b) What is the length of QN? **2**

$R = 9 + 1$
$= 10$

$LR = 12$

$QN = \sqrt{12^2 + 4^2}$

$= \sqrt{160}$

$= 12.6491...$

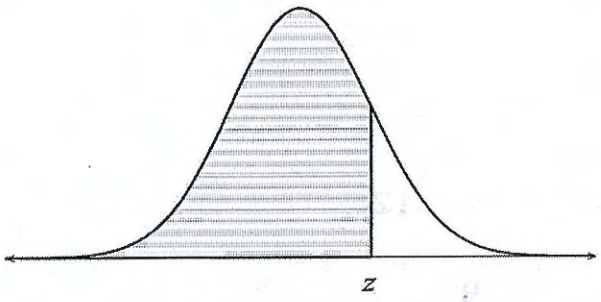
Questions 37 (5 marks) **Marks**

A random variable is normally distributed with a mean of 0 and a standard deviation of 1. The table gives the probability that this random variable lies below z for some positive values of z.

z	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
Probability	0.6915	0.7258	0.7580	0.7881	0.8159	0.8413	0.8643	0.8849	0.9032	0.9192	0.9332

z	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6
Probability	0.9452	0.9554	0.9641	0.9713	0.9773	0.9821	0.9861	0.9893	0.9918	0.9938	0.9953

The probability values given in the above table are represented by the shaded area in the following diagram.



Nicole is a nurse and in her study with 1000 participants found that the circumference of their heads was normally distributed with mean 54.0 cm and standard deviation 1.0 cm.

(a) What is the z-score of the person whose head circumference is 54.5 cm **1**

z score of 54.5 cm $= \frac{54.5 - 54}{1}$

$= +0.5$

(b) What percentage of people are expected to have the head circumference below 54.5 cm? **1**

69.15 % (from table)

(c) By calculating z-scores, find the number of participants whose head circumference was between 53.5 cm and 54.5 cm. **Marks 3**

Z score of 53.5cm = $\frac{53.5-54}{1}$

$= -0.5$

above 0.5 Z-score or 54.5cm = $1 - 69.15$

$= 30.85\%$

∴ below −0.5 Z-score or 53.5cm = 30.85%

∴ between −0.5 (53.5cm) & +0.5 (54.5cm)

$= 0.6915 - 0.3085$

$= 0.3830$ or 38.30%

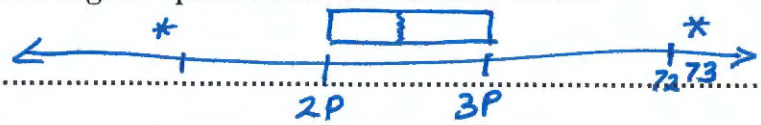
∴ $0.3830 \times 1000 = 383$ people between 53.5 & 54.5

Questions 38 (4 marks)

A set of whole number scores has

- an interquartile range = p.
- a lowest quartile = $2p$.
- 73 as its smallest possible upper outlier score.

What is the highest possible lower outlier score? **4**



72 is not an outlier (whole score) since 73 is.

∴ $3P + 1.5P = 72$

$4.5P = 72$

$P = 16$, $2P = 32$ & $3P = 48$

∴ $1.5 \times 16 = 24$

∴ largest possible lower outlier $< 32 - 24$

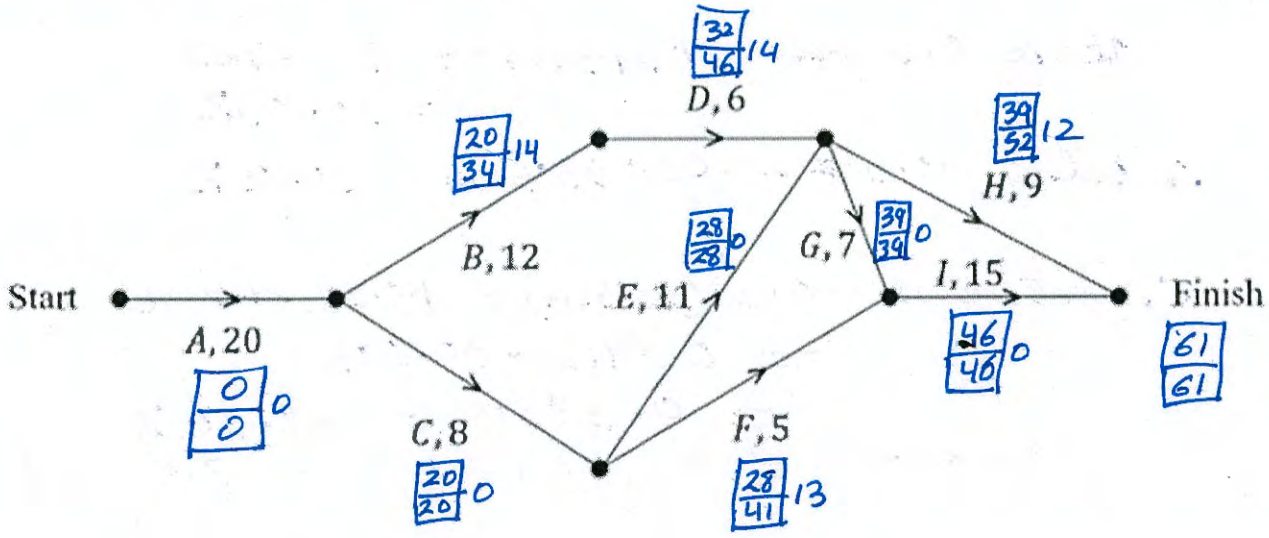
outlier < 8

∴ highest possible lower outlier = 7

Question 39 (5 marks) **Marks**

A project requires completion of 9 tasks A, B, C, . . ., I.

A network diagram for the project giving the duration for each task, in days, is shown.



(a) What is the critical path of the network? **2**

A C E G I

(b) What is the minimum time required for the project to be completed. **1**

61

(c) The manager of the project is told that the project has to be completed in 55 days time.

The duration of task *A* cannot be reduced, but any other task can be reduced by employing more workers to do that task.

Nominate a task that could have its duration decreased to meet the maximum completion time of 55 days, and what is the minimum number of days that its duration needs to be reduced to meet this deadline? **2**

61 − 55 = 6 days.
∴ 6 days must be reduced on the critical path by adding extra labour & without affecting other or getting affected by others.
∴ best place is I

End of Examination