2023 **Year 12 Trial Examination**

Mathematics Standard 2

07/08/2023

General Instructions
- Reading time – 10 minutes
- Working time – 2 hours and 30 minutes
- Write using blue or black pen
- Calculators approved by NESA may be used
- A reference sheet is provided
- For questions in Section II, show relevant mathematical reasoning and/or calculations
- No white-out may be used

Total Marks: 100

Section I - 15 marks (pages 3 – 10)
- Attempt Questions 1 – 15
- Allow about 25 minutes for this section

Section II - 85 marks (pages 11 – 48)
- Attempt Questions 16 – 38
- Allow about 2 hours and 5 minutes for this section

This question paper must not be removed from the examination room

This assessment task constitutes 40% of the course.
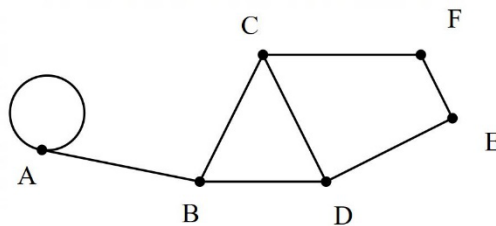
15 marks
Attempt Questions 1–15
Allow about 25 minutes for this section

Use the multiple-choice answer sheet for Questions 1–15.

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1 Calculate the degree of vertex A.

(A) 3

(B) 4

(C) 5

(D) 6

2 Which of the following best describes the distribution of the boxplot?
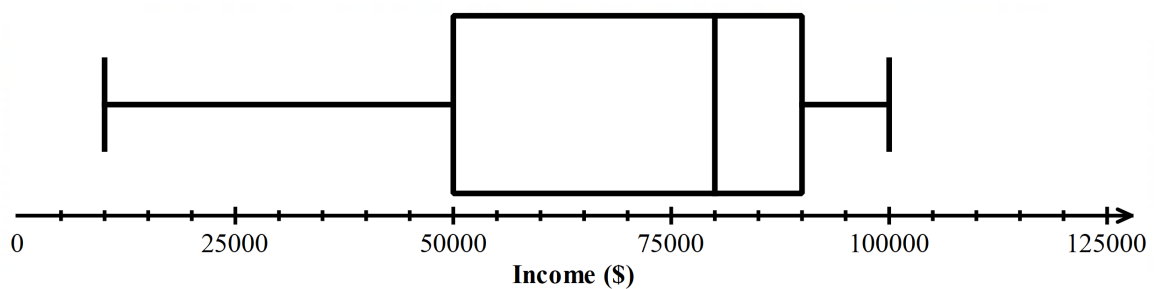
(A) Positively skewed

(B) Negatively skewed

(C) Bimodal

(D) Symmetrical

3   What is the true bearing of A from O?
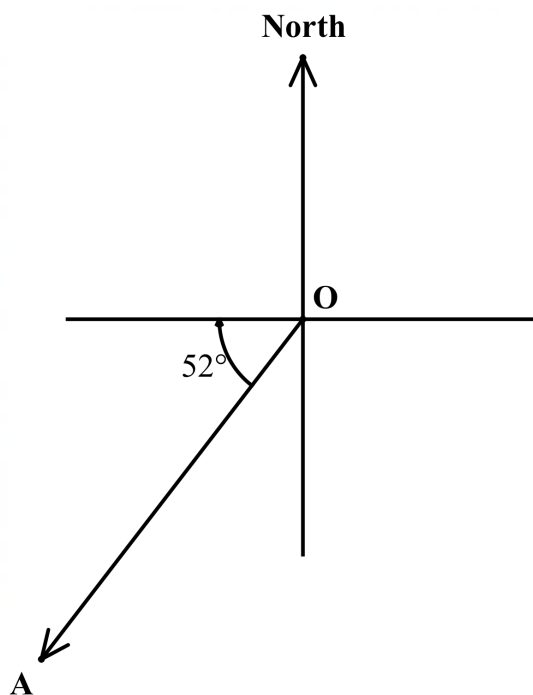
(A)   38°

(B)   52°

(C)   142°

(D)   218°

4   A factory produces a type of concrete mix made with gravel, cement, and water. The amount of gravel, cement and water are in the ratio of 7 : 4 : 3 respectively.

In a small bag of concrete mix, there are 6 kg of cement.

Calculate the weight of the concrete mix.

(A)   14 kg

(B)   21 kg

(C)   24 kg

(D)   28 kg

5 The perimeter of the rectangle and the square below are the same.

15 cm

11 cm

x cm
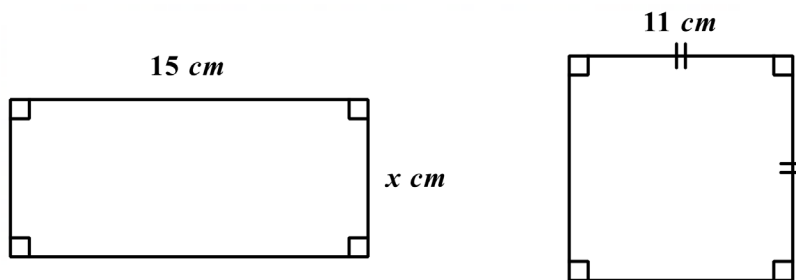
Calculate the value of x.

(A) 4 cm

(B) 7 cm

(C) 8 cm

(D) 14 cm

6 A cylindrical water tank initially contains 850 L of water. During a very rainy day, the tank collected water at a rate of 2 L per minute.

Let V be the volume of the water in the tank in litres and t be the time per minute after it starts raining.

Which linear equation describes this situation?

(A) $V = -2t + 850$

(B) $V = 2t + 850$

(C) $V = -2t - 850$

(D) $V = 2t - 850$

7 A boat was initially purchased for $42,900 and is now worth $21,600 after 6 years. Using the straight-line method of depreciation, calculate the annual amount of depreciation.

(A) $3550

(B) $3780

(C) $4260

(D) $10750

8 Jane is trying to estimate the number of trout in a lake.

She captures 150 trout, attaches a tag to each one and releases them back into the lake. Two days later, she goes back and captures 120 trout. She finds that 48 of these have tags attached to them.

Estimate the number of trouts in the lake.

(A) 60

(B) 185

(C) 270

(D) 375

9 A set of data is represented by the cumulative frequency histogram and ogive. Find the median score.
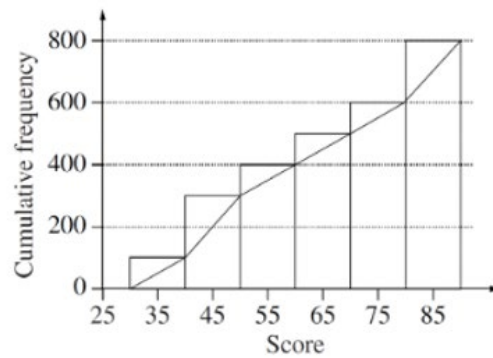
(A) 50

(B) 55

(C) 60

(D) 65

10 Which one of the following equations best represent the graph below?
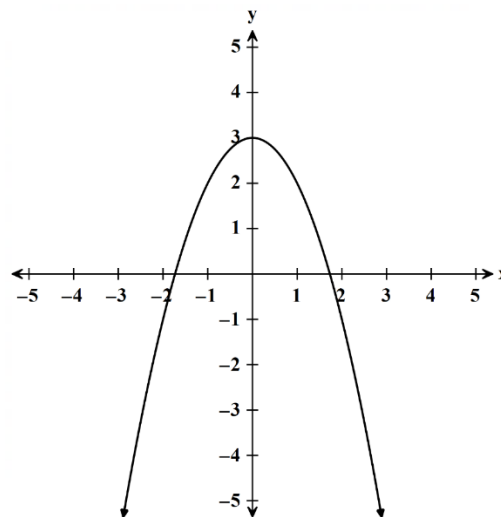
(A) $y = 3 - x^2$

(B) $y = -x^2$

(C) $y = x^2 - 3$

(D) $y = x^2 + 3$

11 The daily wage of Ada is 20% higher than that of Billy, while the daily wage of Billy is 20% lower than that of Christine. It is given that the daily wage of Billy is $480. Calculate the difference between Ada and Christine's daily wage.

(A) $0

(B) $14

(C) $24

(D) $96

12 The heights of Year 12 girls are normally distributed.
Mary is 154 cm with a z-score of -2 and Anne is 181.5 cm with a z-score of 3.

What is the mean height for the Year 12 girls?

(A) 162.25 cm

(B) 165 cm

(C) 167.75 cm

(D) 170.5 cm

13   Tamra is recording the number of koi fish in some ponds. The number of koi fish in the first ten ponds are given below.

$$3 \quad 4 \quad 5 \quad 6 \quad 2 \quad 4 \quad 3 \quad 7 \quad 3 \quad 6$$

The 11th pond has 4 koi fish.

Which of the following statements is true when the 11th pond is included?

(A)   The mode will decrease

(B)   The mean will increase

(C)   The median will decrease

(D)   The median will stay the same

14   Tim deposited $5000 into a savings account that offers an interest rate of 5.55% per annum earning compound interest calculated monthly.

Let R_n be the recurrence relation that models the balance of Tim's savings account after n months.

This recurrence relation is:

(A) $R_0 = 5000, \quad R_{n+1} = 1.004625 \times R_n$

(B) $R_0 = 5000, \quad R_{n+1} = 1.04625 \times R_n$

(C) $R_0 = 5000, \quad R_{n+1} = 1.0555 \times R_n$

(D) $R_0 = 5000, \quad R_{n+1} = 1.555 \times R_n$

15 Rearrange the following equation so that g is the subject.

$$\frac{1}{f} + \frac{2}{g} = \frac{5}{h}$$

(A) $g = \dfrac{2hf}{5f-h}$

(B) $g = \dfrac{2hf}{5f+h}$

(C) $g = \dfrac{5f-h}{2hf}$

(D) $g = \dfrac{5f+h}{2hf}$

End of Section I

Section II

In Questions 16 - 38, your response should include relevant mathematical reasoning and/or calculations.

Question 16 (2 marks)

A real estate agent's commission for selling houses is 2% for the first $800 000 of the sale price and 1.5% for any amount over $800 000.

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Calculate the commission earned in selling a house for $1 500 000.

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Question 17 (3 marks)

Greg is 40 years old and likes to keep fit by exercising.

(a) The maximum recommended heart rate (beats per minute) is calculated using the following formula:

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$$\text{Maximum heart rate} = 220 - \text{age in years}$$

Calculate Greg's maximum recommended heart rate.

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Question 17 (continued)

(b) Greg has been advised he will get the most benefit from his exercise if his heart rate is between 60% and 80% of his maximum recommended heart rate. **2**

Between what two heart rates to the nearest whole number should Greg be aiming for to get the most benefit from his exercises?

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End of Question 17

Question 18 (3 marks)

Kayleen leaves Sydney (UTC +10) at 4 pm Friday, flying to San Francisco (UTC -8).

(a)   What is the time and day in San Francisco when Kayleen leaves Sydney?   **2**

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(b)   The flight time is 16 hours. What is the day and time in San Francisco when she arrives?   **1**

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Question 19 (4 marks)

Stephanie borrowed $675 000 to buy an apartment. The interest rate is 6.00% per annum, compounding monthly. The repayments were set by the bank at $4048 per month for 30 years.

The loan balance sheet below shows the interest charged and the balance owing for the first 3 months.

Month	Principal at the start of the month	Monthly interest	Monthly repayment	Balance at the end of month
1	$675 000	$3375	$4048	$674 327
2	$674 327	$3371.64	$4048	A
3	A	B	$4048	C

(a) Find the values of A, B and C. Round to the nearest cent where appropriate. **2**

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(b) What is the total amount that has to be paid for this loan over the 30 years? **1**

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(c) Hence, calculate the interests charged on this loan. **1**

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Question 20 (4 marks)

The weighted network below shows the distance, in kilometres, between five towns labelled A, B, C, D and E.
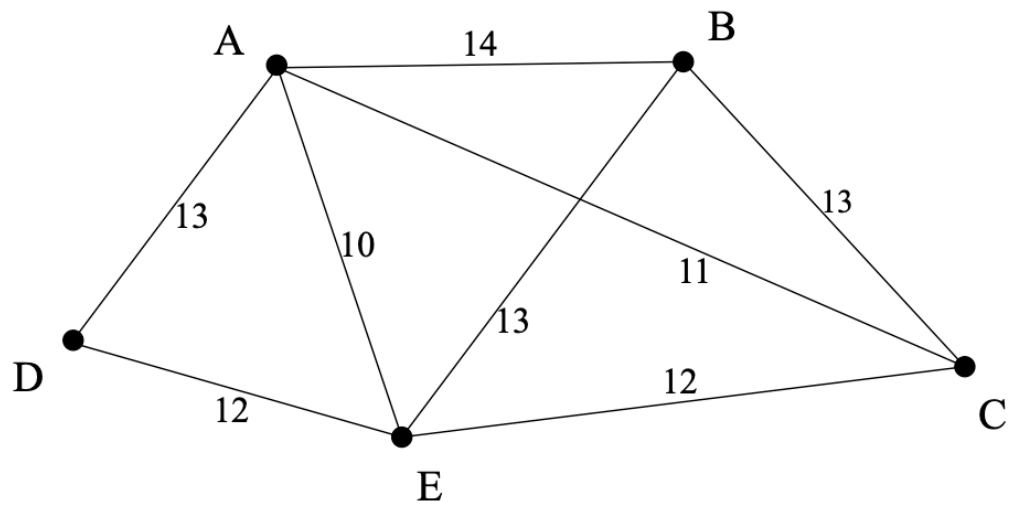
(a) Represent the given network by completing the table below.　　　　**2**

Towns	A	B	C	D	E
A	-	14			
B		-			
C			-		
D				-	
E					-

Question 20 continues on the page 17

Question 20 (continued)

(b) A tourist wishes to visit each town. Draw a minimum spanning tree which will allow   **2**
for this AND determine its length.

A .

.B

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D

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C

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E
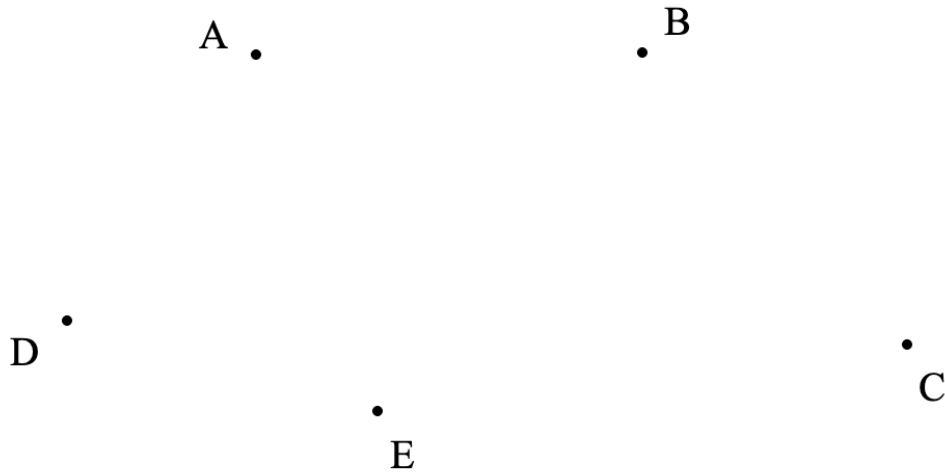
Length of minimum spanning tree = _____

End of Question 20

Question 21 (3 marks)

320 students sat a Math exam. Each student received a score out of 100. **3**

The overall scores were normally distributed with a mean score of 65 and a standard deviation of 6.5.

Only the students who scored above 78 received a faculty merit.

Calculate how many students received a faculty merit.

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Question 22 (4 marks)

Future value of $1 invested

Interest rate per period

Period	2%	3%	4%	5%	6%	7%	8%
1	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	2.0200	2.0300	2.0400	2.0500	2.0600	2.0700	2.0800
3	3.0604	3.0909	3.1216	3.1525	3.1836	3.2149	3.2464
4	4.1216	4.1836	4.2465	4.3101	4.3746	4.4399	4.5061
5	5.2040	5.3091	5.4163	5.5256	5.6371	5.7507	5.8666
6	6.3081	6.4684	6.6330	6.8019	6.9753	7.1533	7.3359
8	8.5830	8.8923	9.2142	9.5491	9.8975	10.2598	10.6366

(a) Use the future value factor table above to find the future value of an annuity of $1650 invested every 6 months for 2 years at an interest rate of 8% p.a. **2**

(b) Hence, calculate the amount of interest earned on the investment. **2**

Question 23 (4 marks)

The following stem-and-leaf plot shows the scores of 16 students who took a science test.

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2 | 1
3 | 0
4 |
5 | 4   5   6   7   8   9
6 | k   9
7 | 1   3   5   6   9
8 | 0
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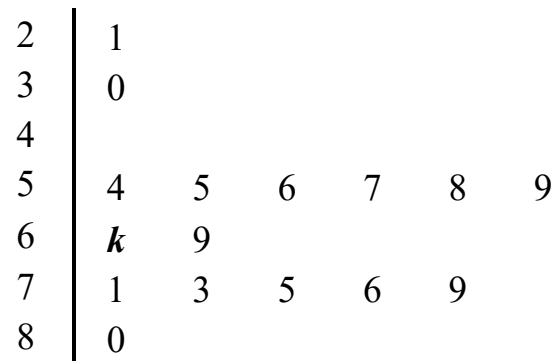
(a)   If the median mark is 62, find the value of k **1**

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(b)   Show that 21 is an outlier.   **2**

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(c)   Hence, explain why the mean may not be the appropriate measure of central tendency   **1**
        to use to summarise the results of this Science test.

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Question 24 (2 marks)

Marco owns 1000 Woolworths Group shares, valuing at $38.98 each. He received a total dividend of $950. Calculate the dividend yield. Correct your answer to 2 decimal places.

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Question 25 (3 marks)

An observer on top of a building 66 metres high, finds the angle of elevation to the top of a taller building to be 34°. The angle of depression to the foot of the same building is 51°. If the buildings are on the same ground level, find the height of the taller building. Correct your answer to the nearest metre.   **3**

Diagram not to scale

66 *m*

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Question 26 (4 marks)

A box containing 80 paper clips, some of which are grey, some are yellow, and the rest are blue.

The probability of drawing a grey clip is $\frac{1}{5}$ and the probability of drawing a yellow clip is $\frac{1}{4}$.

(a)   Find the number of blue paper clips in the box.   **2**

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(b)   Let x be the number of blue paper clips removed from the box so that the probability   **2**
of drawing a blue clip from the box becomes $\frac{7}{25}$.

Find the number of blue paper clips removed from the box.

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Question 27 (4 marks)

(a) Find the area of the following quadrilateral pond *ABCD*, to one decimal place. **2**

Diagram not to scale

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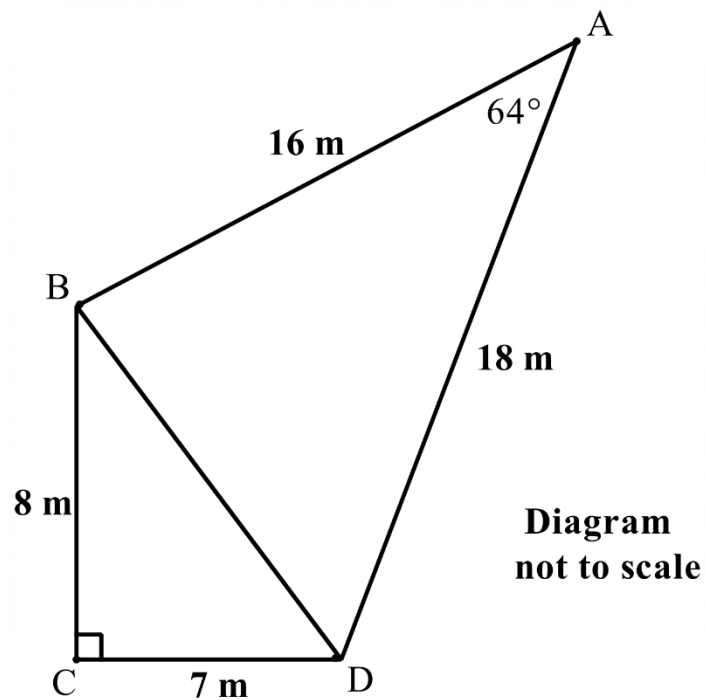
(b) If the depth of this pond is 2.5 m, calculate how much water is in this pond, correct to the nearest litre. **2**

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Question 28 (4 marks)

Janet makes hand-painted cards which she sells online. She bought a batch of cards with a fixed cost of $80 plus $3 per card, and she sells the card for $7 each.

Let x be the number of painted cards sold.

(a) Write two linear equations representing cost (C) and revenue (R).   **2**

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(b) If Janet made $200 of profit, calculate the number of painted cards sold.   **2**

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Question 29 (3 marks)

The scaled plan for a villa is shown below on a 0.5 cm by 0.5 cm grid. **3**
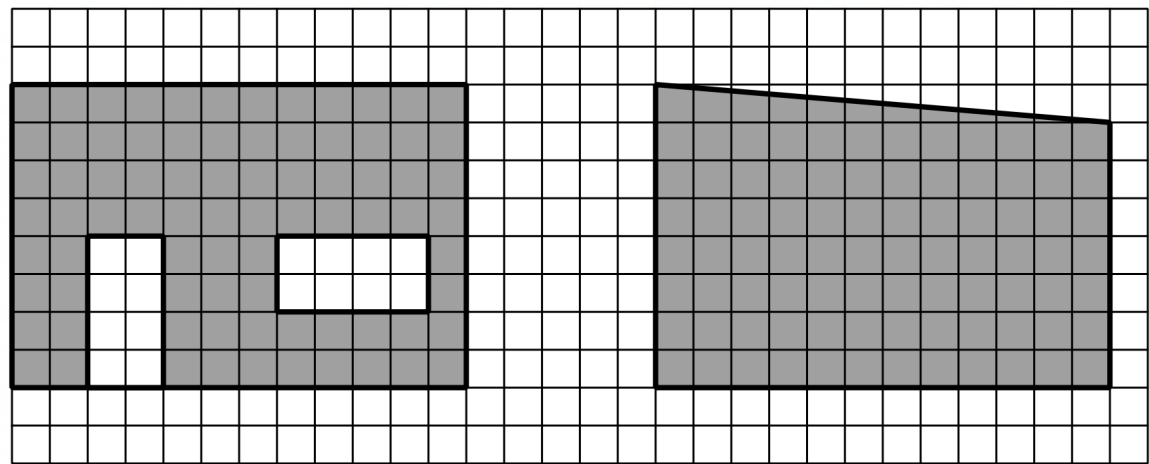
Front wall   **Side wall**

Scale 1 cm : 80 cm

A painter is assigned the job to paint the front and the two side walls of the villa **(not including the doors and windows)**. How many litres of paint are required to paint the front and the two side walls? It is known that 1L of paint covers $6.5m^2$.

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End of Booklet 1

Question 30 (4 marks)

A series of pipelines is installed to drain stormwater from a holiday park. The capacity of these pipes, in litres per minute, is shown in the directed network below.

When considering the possible flow of stormwater through this network, many different cuts can be made.

(a) Determine the capacity of Cut 1, shown below. **1**

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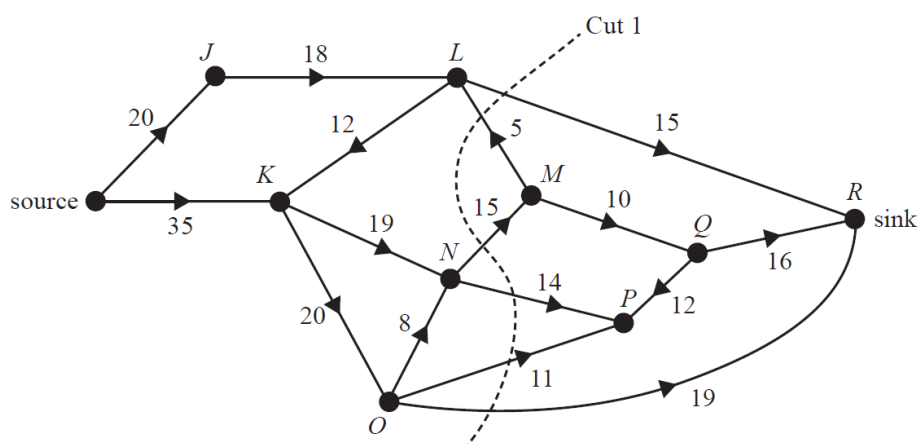
(b) Show that the maximum flow for the network above is 44 litres per minute. **1**

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(c) Determine which pipe should have its capacity increased to cause the largest increase in flow from source to sink, and by how much? **2**

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Question 31 (2 marks)

The table gives the present value interest factor for an annuity of $1 per month, for various interest rates (R) and number of months (N).   **2**

Table of present value interest factors.					
N \\ R	Interest rate per month				
	0.75%	0.8%	0.85%	0.9%	0.95%
70	54.30462	53.43960	52.59397	51.76724	50.95891
71	54.89293	54.00754	53.14226	52.29657	51.46995
72	55.47685	54.57097	53.68593	52.82118	51.97618
73	56.05643	55.12993	54.22502	53.34111	52.47764
74	56.63169	55.68446	54.75957	53.85641	52.97438

Tony uses this table to calculate his monthly car loan repayment. His loan is $26 000 and will be paid in equal monthly repayments over 6 years. The interest rate on his loan is 10.2% per annum.

Calculate the amount of each monthly repayment.

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Question 32 (3 marks)

A rock is thrown upward and away from the top of a cliff. The height, h metres above the sea level, of the rock at time, t seconds, is given by the equation

$$h = -30t^2 + 102t + 240$$

The graph of this relationship is shown.
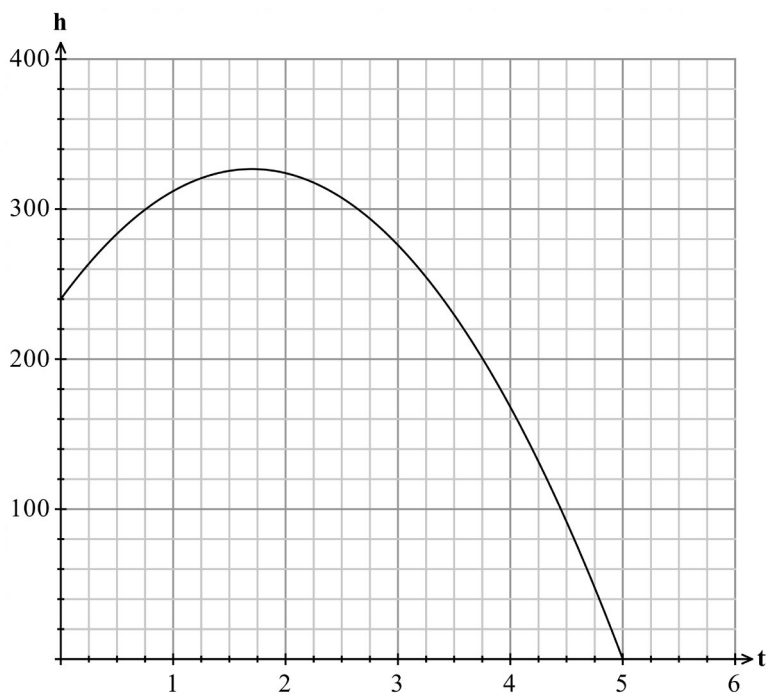
(a) State the initial height of the rock.   **1**

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(b) What does the value of time, $t = 5$ represent on the graph?   **1**

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(c) The rock reaches its maximum height after 1.7 seconds. Find the maximum height   **1**
reached by the rock.

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- 30 -

Question 33 (4 marks)

A big concert is to be organised by an event planning company. Ten activities have been identified for this project. The activity network given below shows the activities and their completion times in weeks.
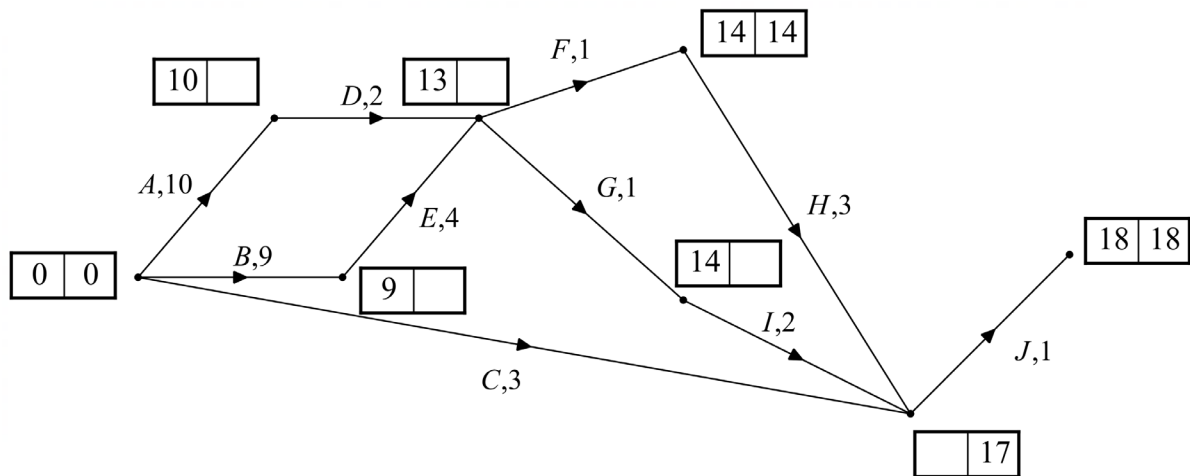
(a) Complete the missing EST and LST for the activity diagram above.　**2**

(b) Determine the minimum time, in weeks, to complete this project.　**1**

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(c) Determine the float time, in weeks for activity C.　**1**

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Question 34 (8 marks)

The table below shows observations of the area of Arctic Sea ice from 1980 to 2020.

Years from 1980	0	5	10	15	20	25	30	35	40
Area of Arctic Sea ice (Million km²)	7.54	6.49	6.04	6.03	5.76	5.32	4.62	4.43	3.82

(a) Calculate the value of the Pearson's correlation coefficient (r) to the nearest 3 decimal places.   **1**

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(b) Interpret the value of the correlation coefficient in terms of its strength and direction of the correlation between the years and the area of Arctic Sea ice.   **2**

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Question **34** (continued)

The graph below shows the relationship between the year and the area of Arctic Sea ice, as well as a regression line.

Years from 1980
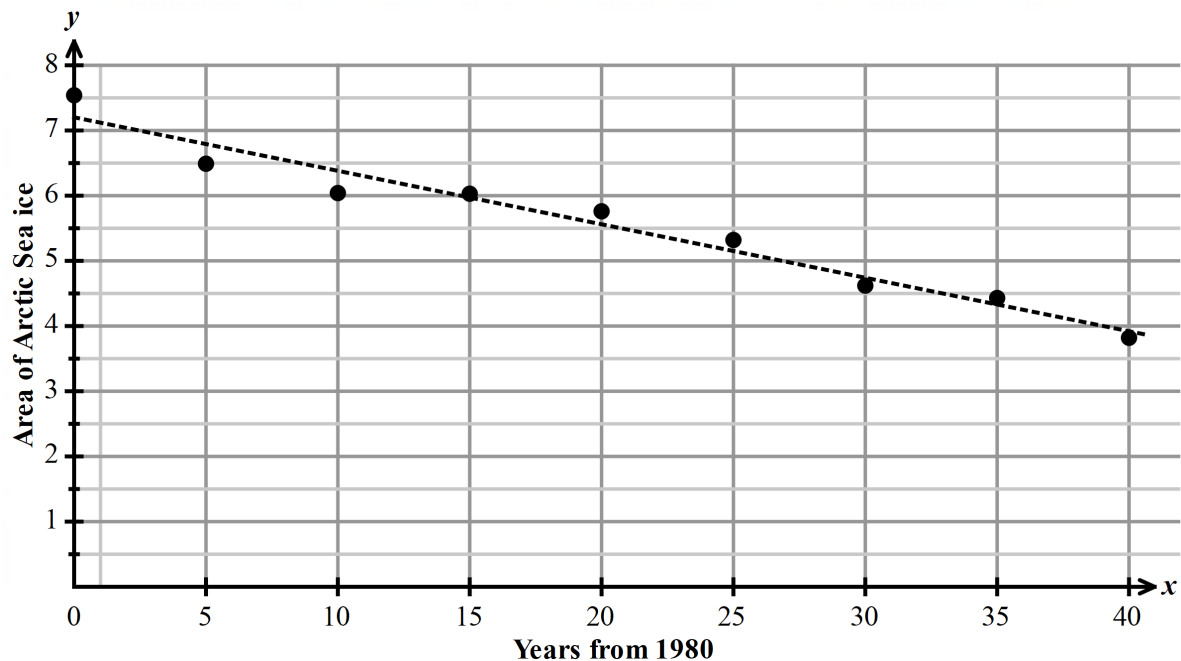
The equation of the regression line is $y = 7.202 - 0.082x$.

(c) Interpret the value of the gradient of the regression line in the context of the data provided.

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(d) Using the regression line equation, predict the first year that the area of Arctic Sea ice will be less than 1 million km².

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Please turn over

Question **34** (continued)

(e) Discuss the reliability of the prediction made in **part (d).** Give two reasons for your answer.

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End of Question 34

Question 35 (4 marks)

During a game of golf, Salena hits a ball twice, from A to B and then from B to C.
The path of the ball after each hit is shown in the diagram below.
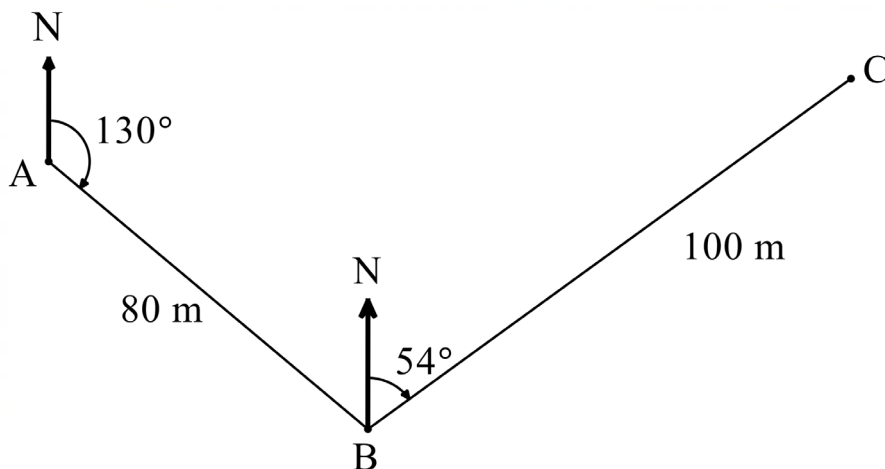
Diagram not to scale

After Salena's first hit, the ball travelled 80 m on a bearing of 130° from point A to point B.
After Salena's second hit, the ball travelled 100 m on a bearing of 054° from point B to point C.

(a) Another ball is hit and travels directly from A to C. Calculate the distance travelled by this ball. Correct your answer to the nearest metre.   **2**

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(b) Hence, calculate the bearing of C from A, giving your answer correct to the nearest degree.   **2**

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Question 36 (3 marks)

Barry owns a rectangular paddock with a perimeter of 128 metres. He wants to install fences around it, so his cattle do not run away.

Let the length of the paddock be l and the width be w. So that $l + w = 64$.
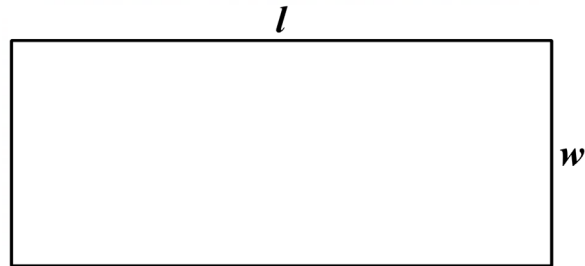
(a) Show that the area, A, in square metres of the rectangular paddock is given by

$$A = 64w - w^2$$

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(b) The graph of $A = 64w - w^2$ is shown below. **2**
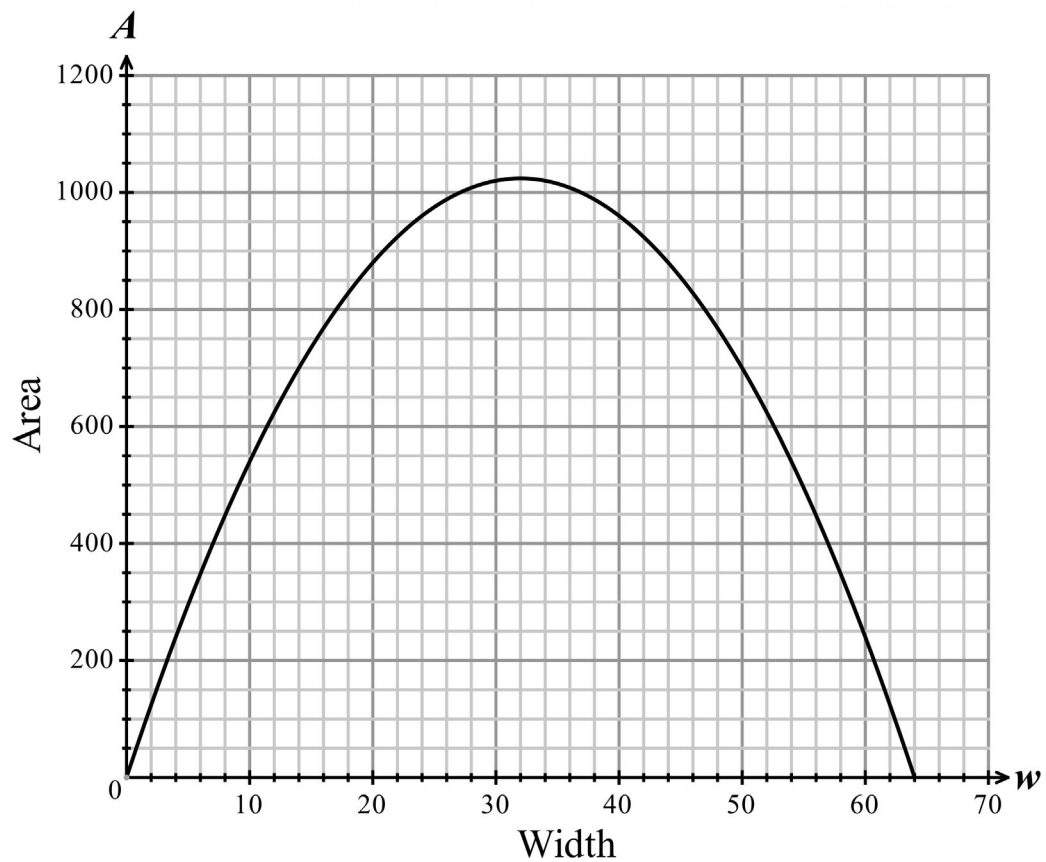
Barry wants to maximise the area of his paddock.

Hence, using the graph above, find the dimension of his paddock so that the area is as large as possible.

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End of Question 36

Question 37 (4 marks)

The company Kookaburra manufactures sporting equipment, specilaisng in hockey sticks and tennis racquets

Let x be the number of hockey sticks that are manufactured each month.
Let y be the number of tennis racquets that are manufactured each month.

(a) Each month, a total of 480 pieces of sporting equipment are manufactured. The company manufactures twice as many hockey sticks than tennis racquets. **2**

Formulate two equations that represent the information above.

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(b) Sketch the two equations on the following axis. **2**
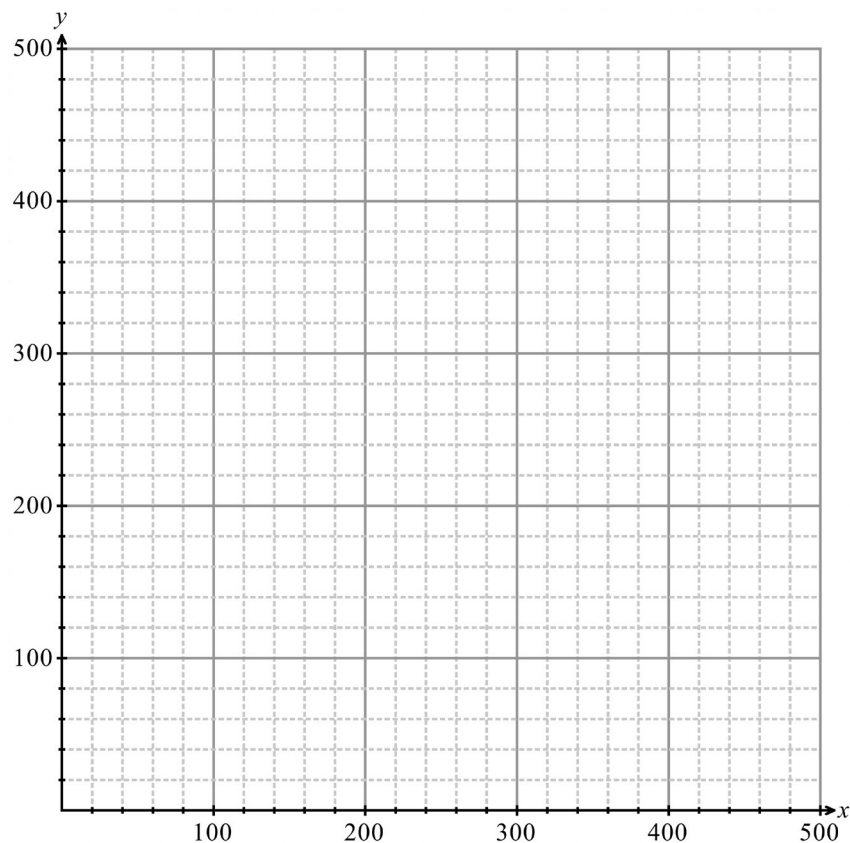
(c) Using your graph above, or otherwise. Calculate the number of hockey sticks and tennis racquets the company produced. **2**

Number of hockey sticks:_____

Number of tennis racquets: _____

Question 38 (4 marks)

The table below gives the probability of z-scores from a set of normally distributed data.

z	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2
Probability	0.0228	0.668	0.1587	0.3085	0.5	0.6915	0.8413	0.9332	0.9772

The probabilities given in the table above for different values of z are represented by the shaded area in the following diagram.
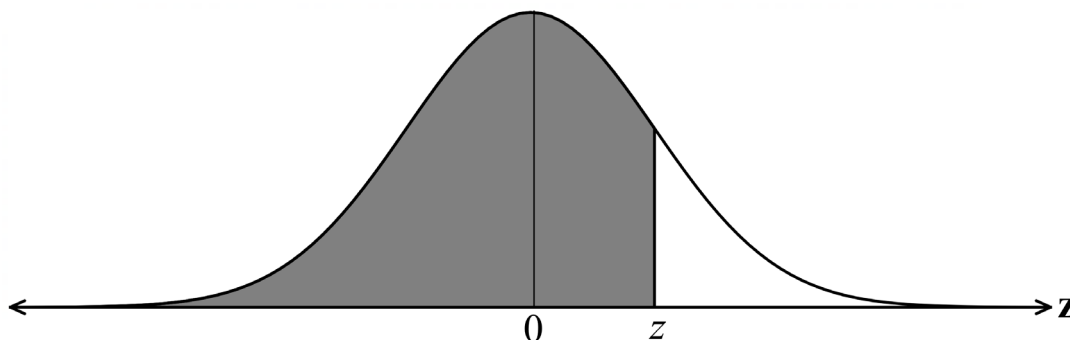
A machine is designed to manufacture sheets of metal, each 24.0 cm in length. A sample of the metal sheets shows that their lengths are normally distributed with a mean of 24.2 cm and a standard deviation of 0.2 cm.

(a) What is the probability that the length of a sheet of metal is less than 24.5 cm?   **2**

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(b) On average, a machine produces 5000 sheets of metal a day. If sheets of metal are   **2**
rejected when they are less than 23.8 cm or greater than 24.5 cm, calculate the number of metal sheets rejected in a day.

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End of Examination

2023 HSC Trial Mathematics Standard 2
Marking Guidelines and Markers Feedback

Section I

Multiple-choice Answer Key

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

Markers feedback:

The following multiple-choice questions were done well by most of the cohort:

> Q1, Q3 to Q7

The following multiple-choice questions were done well by about 55% to 65% of the cohort:

> Q8 to Q10, Q12, Q13

The following multiple-choice questions were done well by about 25% to 40% of the cohort:

> Q2, Q11, Q14, Q15

Section II

Question 16

Criteria	Marks
• Provides correct solution	**2**
• Shows correct calculations	**1**

Sample answer:

$$2\% \times 800000 + 700000 \times 1.5\%$$
$$= \$26\,500$$

Markers feedback:

This question was done well by students.

Question 17 (a)

Criteria	Marks
• Provides correct solution	**1**

Sample answer:

$$220 - 40 = 180 \text{ bpm}$$

Markers feedback:

This question was done well by students.

Question 17 (b)

Criteria	Marks
• Provides correct solution	**2**
• Shows correct calculations	**1**

Sample answer:

$$60\% \times 180 = 108$$

$$80\% \times 180 = 144$$

$$\therefore \quad 108 - 144 \text{ bpm}$$

Markers feedback:

This question was done well by students.

Question 18 (a)

Criteria	Marks
• Correct answers on time and day.	**2**
• One mark for either one of time or day.	**1**

Sample answer:

10 pm, Thursday.

Markers feedback:

Students did well on this question. Only small percentage of students made both mistakes.

Question 18 (b)

Criteria	Marks
• Correct answer on both day and time	1

Sample answer:

2 pm, Friday

Markers feedback:

Small number of students gave wrong answers.

Question 19 (a)

Criteria	Marks
• **Correct values on A, B and C**	**2**
• **1 mark awarded to either 2 out of 3.**	**1**

Sample answer:

$A = 674327 + 3371.64 - 4048 = 673650.64$

$B = 673650.64 \times \frac{6}{12}\% = 3368.25$

$C = 673650.64 + 3368.25 - 4048 = 672970.89$

Markers feedback:

Small number of students made careless mistakes on calculations.

Question 19 (b)

Criteria	Marks
• Correct answer	1

Sample answer:

$4048 \times 360 = 1457280$

Markers feedback:

Small number of students did not convert 30 years to 360 months.

Question 19 (c)

Criteria	Marks
• Correct answer	1

Sample answer:

$1457280 - 675000$
$= 782280$

Markers feedback:

Wrong answer with ECF (Error carry forward) are given marks to many students.

Question 20 (a)

Criteria	Marks
• Correctly completed the table	2
• Partly wrong on weighted network	1

Sample answer:

Towns	A	B	C	D	E
A	-	14	11	13	10
B	14	-	13	0	13
C	11	13	-	0	12
D	13	0	0	-	12
E	10	13	12	12	.-

Markers feedback:

Small number of students filled in wrong figures on both columns and rows B and C.

Question 20 (b)

Criteria	Marks
• Correct answers on minimum spanning tree and its length.	**2**
• Either one of the answers is correct.	**1**

Sample answer:
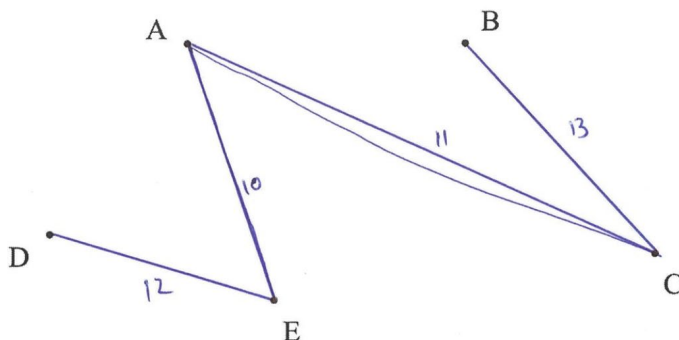
Length of minimum spanning tree = _____ 46 _____

Markers feedback:

Most students did well.

Question 21

Criteria	Marks
• All Z-scores, 2.5% of standard normal distribution and number of students are correct	**3**
• Either 2 out of three are correct	**2**
• One correct answer	**1**

Sample answer:

$$z = \frac{7.8 - 6.5}{6.5} = 2$$

2.5%

∴ 2.5% × 320 = 8
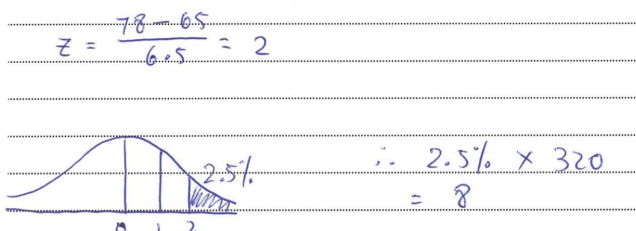
Markers feedback:

Small number of students did not work out Z- scores to show a standard normal distribution correctly.

Question 22 (a)

Criteria	Marks
• Correct percentage from Future value table and answer	**2**
• Pick the right percentage from the given table	**1**

Sample answer:

$1650 \times 4.2465 = 7006.73$

Markers feedback:

Small number of students did not choose the right percentage from the given table.

Question 22 (b)

Criteria	Marks
• Correct working and answer	**2**
• Correct working but the wrong answer	**1**

Sample answer:

$7006.73 - (1650 \times 4) = 406.73$

Markers feedback:

Small number of students did not calculate total amount of annuity.

Question 23 (a)

Criteria	Marks
• Finds the correct answer for k. Both 5 and 65 are acceptable.	1

Sample answer:

$$\frac{59 + x}{2} = 62$$

$$x = 65$$

$$\therefore k = 5$$

Markers feedback:

The question was asking for ONLY the number in the leaf column. A majority of the answers stated 65, rather than just 5.

Question 23 (b)

Criteria	Marks
• Finding the correct quartiles and interquartile range • Stating explicitly that $21 < 27.75$, so 21 is an outlier.	2
• Finding an incorrect IQR and stating 21 is less than the calculated limit $Q_1 - 1.5 \times IQR$	1

Sample answer:

$Q_1 = 55.5$ Lower fence: $55.5 - 1.5 \times 18.5$
$Q_3 = 74$ $= 27.75$
$IQR = 18.5$ Since $21 < 27.75$,
                          21 is an outlier.

Markers feedback:

Students correctly stated that 21 was less than the lower limit, however there were a lot of incorrect answers whilst calculating 1st and 3rd quartile, as well as interquartile range.

Question 23 (c)

Criteria	Marks
• Stating that the mean will be affected by the outlier of 21.	**1**

Sample answer:

Since the mean is affected by outliers, and
21 is an outlier. therefore, the mean is not
the appropriate measure of central tendency.

Markers feedback:

Students mostly answered this correctly stating the effect of the outlier to the mean.

Question 24

Criteria	Marks
• Calculate the cost of dividend per share. • Finding the correct dividend yield.	**2**
• Calculating correct cost dividend per share	**1**

Sample answer:

Dividend per share : $950 \div 1000 = 0.95$

Dividend yield : $\dfrac{0.95}{38.98} \times 100 = 2.44\%$

Markers feedback:

Many answers involved inaccurately dividing 1000 by 950, thus calculating the wrong dividend per share. Students could have also done the following:

$$950 \div (38.98 \times 1000) \times 100$$

Question 25

Criteria	Marks
• Finding the correct value of the height of the triangle (x), using the tan function, or other trigonometric formulas. • Calculated the length y using x and the tan function. • Added height of 66meteres to the correct length of y.	3
• Calculated the correct value of x using the tan function. • Added the height of 66m to the incorrect length of y.	2
• Only calculated the correct value of x using the tan function.	1

Sample answer:
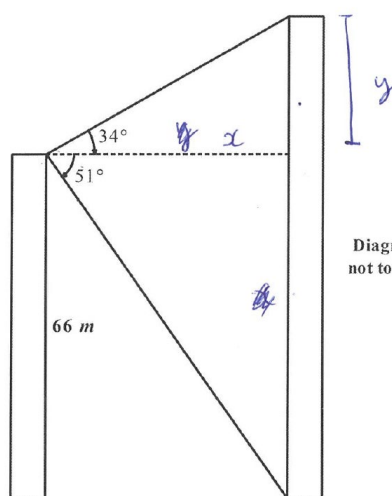
$$\tan 51° = \frac{6.6}{x}$$

$$x = \frac{66}{\tan 51°} = 53.44574\ldots \text{ m}$$

Diagram not to scale

$$\tan 34 = \frac{y}{x}$$

$$y = x \tan 34 = 36.0496\ldots \text{ m}$$

$$\therefore \text{ height of building} = 66 + 36.0496\ldots$$
$$= 102.049\ldots$$
$$= 102 \text{ m}$$

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Markers feedback:

Some answers incorrectly used the cosine and sine rule to determine the height of the building, swapping the hypotenuse and shorter side length. Others incorrectly used the sine rule to determine the length of x, as there was no other angle available to determine x.

Question 26 (a)

Criteria	Marks
• Finding the probability of drawing a blue paperclip • Multiplying the probability by 80.	2
• Find the correct probability of drawing a blue paperclip.	1

Sample answer:

$$P(blue) = 1 - \frac{1}{5} - \frac{1}{4} = \frac{11}{20}$$

$$\therefore \text{ number of paper clips} = \frac{11}{20} \times 80$$

$$= 44$$

Markers feedback:

Majority of answers were correct for this question.

Question 26 (b)

Criteria	Marks
• Stating the correct equation to find the number of blue paper clips • Calculating the correct number of blue paper clips.	2
• Stating an almost correct equation to find the number of blue paper clips.	1

Sample answer:

$$\frac{44 - x}{80 - x} = \frac{7}{25}$$

$$25(44 - x) = 7(80 - x)$$
$$1100 - 25x = 560 - 7x$$
$$18x = 540$$
$$x = 30$$

Markers feedback:

Majority of answers were incorrect. Students subtracted the number of blue clips (x) from the numerator 44 only. They had to subtract the number of blue clips from both the numerator and denominator to obtain the correct equation.

Question 27 (a)

Criteria	Marks
• Finding the total area and rounding the answer to 2 decimal places	**2**
• Find the area of either the triangle correctly	**1**

Sample answer:
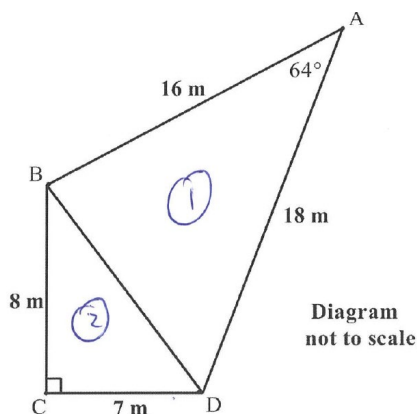
$$① : \frac{1}{2} \times 16 \times 18 \times \sin 64 = 129.426... m^2$$

$$② : \frac{1}{2} \times 8 \times 7 = 28 \ m^2$$

$$\therefore A = 129.426... + 28$$
$$= 157.426... \ m^2$$
$$A = 157 \ m^2$$

Markers feedback:

(a) Most students did very well. losing 1 mark for not rounding correctly.

(b) Common mistake: students don't know how to convert m^3 to Litres.

Note: $1m^3 = 1000L$

Question 27 (b)

Criteria	Marks
• Find the volume and covert m^3 to litres correctly	2
• Find the volume by multiplying the area by 2.5	1

Sample answer:

$$V = 157 \times 2.5$$
$$= 392.5 \, m^3$$
$$= 392500 \, L$$

Markers feedback:

Question 28 (a)

Criteria	Marks
• Both equations correct	2
• Writing one equation correct	1

Sample answer:

$$C = 3x + 80$$
$$R = 7x$$

Markers feedback:

Well done. Some students took R(revenue) as P(Profit) and did

$$R = 7x - (3x + 80)$$

Question 28 (b)

Criteria	Marks
• Right equation and solve the equation correctly	**2**
• Writing the right equation	**1**

Sample answer:

$$P = 7x - 3x - 80$$
$$P = 4x - 80$$

$$4x - 80 = 200$$
$$4x = 280$$
$$x = 70$$

Markers feedback:

Well done.

Some students did not remove the bracket correctly.

Question 29

Criteria	Marks
• Area of both shapes correct using the right scale	**3**
• Find area of one shape correctly with the right scale	**2**
• Using the right scale: can be finding the length correct (e.g. $0.5 \times 12 \times 80cm$) or converting area from cm^2 to m^2 correctly	**1**

Sample answer:
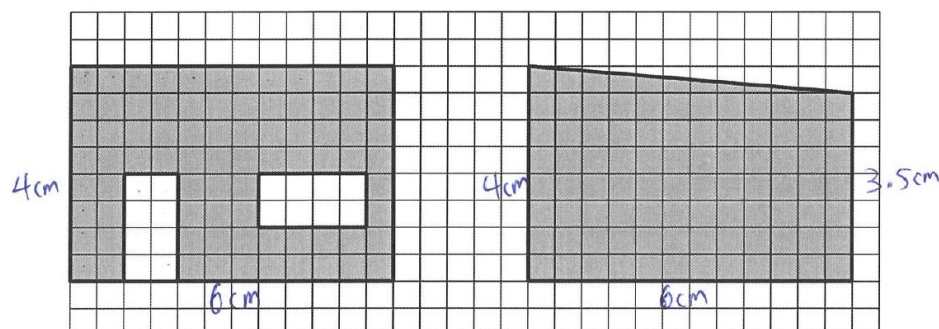
Front wall : $(320 \times 480) - 2(12800)$
$= 128000 \ cm^2$
$= 12.8 \ m^2$

$2 \times$ Side wall : $2 \times \left(\frac{1}{2} \times 480 \times (320 + 280)\right)$
$= 288000 \ cm^2$
$= 28.8 \ m^2$

Total area $= 12.8 m^2 + 28.8 m^2 = 41.6 m^2$

$\therefore \ 41.6 \div 6.5 = 6.4 L$ of paint needed.

Markers feedback:

Poorly done.

Common mistake:

- Using the scale wrong. Take 1 square as 1cm not 0.5 cm.
- Not converting the unit of area correctly. Not cm^2 to m^2 by dividing 100^2

Question 30 (a)

Criteria	Marks
• Correct answer	1
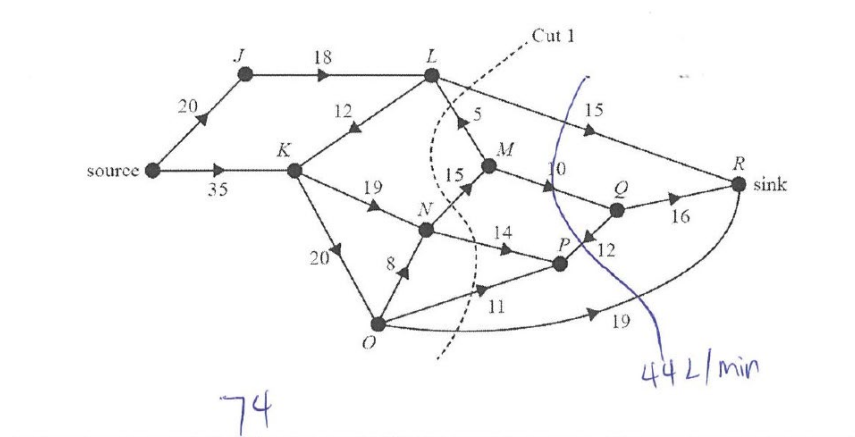
Sample answer:

Markers feedback:

Question was done well. Student can correctly identify the flow from source to sink.

Question 30 (b)

Criteria	Marks
Correct answer	1

Sample answer:
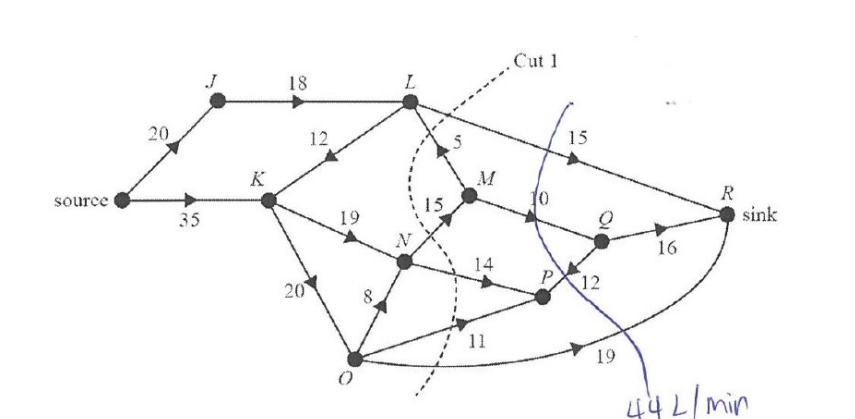
Markers feedback:

Mostly done well. Students needed to show either on the diagram with the minimum cut or clearly identify the weights on the maximum flow to get 1 mark.

Question 30 (c)

Criteria	Marks
Correctly identify the edge and adjusted capacity	**2**
Identify a valid increase of capacity on the minimum cut	**1**

Sample answer:

$$L \rightarrow R \quad \text{increase by at least } \$8$$

Markers feedback:

Poorly attempted. Most students were not able to provide a valid increase in the overall capacity of the maximum flow. Some students provided a possible increase on one of the edges along the maximum flow, however it was not the largest increase possible. Students in this case received 1 mark.

Question 31

Criteria	Marks
• Correct answer with working out	**2**
• Identify the correct factor from the table or equivalent merit	**1**

Sample answer:

$$26000 = R \times 53.68593$$

$$R = \frac{26000}{53.68593}$$

$$= \$484.30$$

Markers feedback:
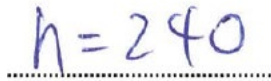
Students must clearly identify the correct factor and used in solving the problem to get one mark. Students who only circled from the table without any relevant working related was not given the mark.

In general, this question was done unexpectedly poorly. Students need to revise more on annuity calculation.

Question 32 (a)

Criteria	Marks
• Correct answer	**1**

Sample answer:

$h = 240$

Markers feedback:

This question was done well.

Question 32 (b)

Criteria	Marks
• Correct answer or equivalent reasoning	**1**

Sample answer:

It represents when the rock lands

Markers feedback:

Students generally understand well in the context of this questions and were able to identify the representation of h = 0 in this context.

Question 32 (c)

Criteria	Marks
• Correct answer (see marker's feedback for marking scheme)	1

Sample answer:

$$h = -30t^2 + 102(1.7) + 240$$
$$= -30(1.7)^2 + 102(1.7) + 240$$
$$h = 326.7\,m$$

Markers feedback:

With the equation given, it is suggested that using algebraic substitution to find the value is more accurate. Students who identified the height graphically must show both vertical and horizontal distance on the diagram to receive 1 mark.

Question 33 (a)

Criteria	Marks
• Correct answers for all values	2
• Correctly identify the values on critical paths or more than half of the values	1

Sample answer:
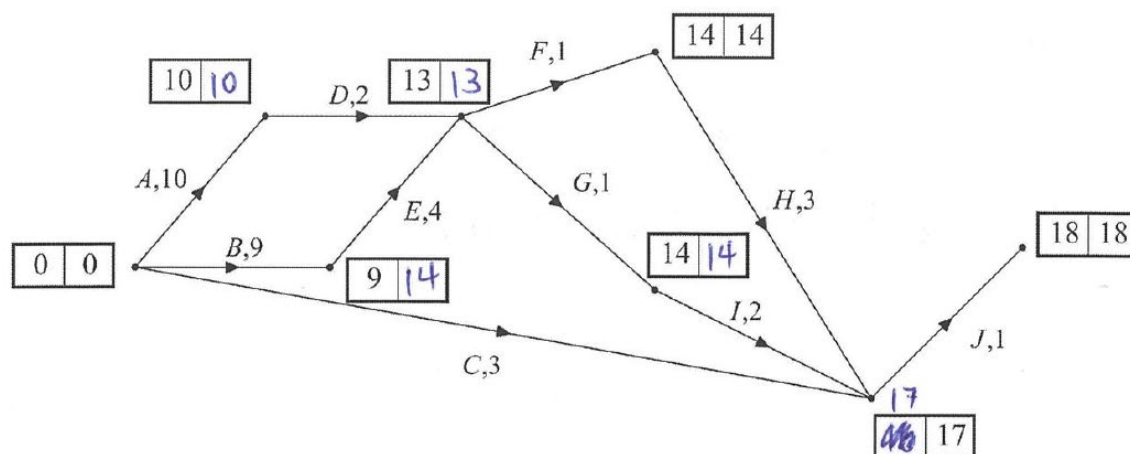
Markers feedback:

Generally done well. Students are weaker in backward scanning compared to forward scanning. More practises must be done prior to HSC.

Question 33 (b)

Criteria	Marks
• Correct answer	**1**

Sample answer:

18 weeks

Markers feedback:

This question was done well.

Question 33 (c)

Criteria	Marks
• Correct answer	**1**

Sample answer:

5 weeks

Markers feedback:

This question was done poorly. Students need to revise the calculation of float time.

Question 34 (a)

Criteria	Marks
• Correct answer	**1**

Sample answer:

$r = -0.979$

Markers feedback:

This question was done well.

Question 34 (b)

Criteria	Marks
• Correctly identify both strength and direction	**2**
• Only identify correctly with one of them	**1**

Sample answer:

This ~~is~~ has a negative strong correlation

Markers feedback:

This question was done well.

Question 34 (c)

Criteria	Marks
• Correct interpretation of the value of gradient in the context	**1**

Sample answer:

the gradient represents that for every year from 1980, the area of Arctic Sea Ice decreases by 0.082 km².

Markers feedback:

Students in general found it challenging to interpret the value of gradient in the context of the question. Only a few related the negative value with the decreasing amount by $0.082 \ km^2$ per year. Some students were confused with the scale on the diagram to every 5 years.

Question 34 (d)

Criteria	Marks
• Find the correct year	**2**
• Find the value of x	**1**

Sample answer:

$$1 = 7.202 - 0.082x$$
$$0.082x = 6.202$$
$$x = 75.634\ldots \qquad \therefore \approx 2056.$$

Markers feedback:

Most of the students can solve linear equation to find the value of x to the nearest whole number. However, some of them were not answering to the question by leaving x as the answer. Students must show the year number to get full marks.

Question 34 (e)

Criteria	Marks
• Provide two valid reasons	**2**
• Provide one valid reason	**1**

Sample answer:

The prediction is not reliable because it is an extrapolation and ice do not decrease in a linear manner.

Markers feedback:

The prediction should not be reliable. Students need to be able to identify the prediction done in part d was an example of extrapolation. Students who provided reasons equivalent to the definition of extrapolation received 1 mark. Students who provided valid reasons to explain the unreliability of the prediction received 1 mark.

Question 35 (a)

Criteria	Marks
• Applying the cosine rule to find the correct answer	**2**
• Find $\angle ABC = 104°$	**1**

Sample answer:
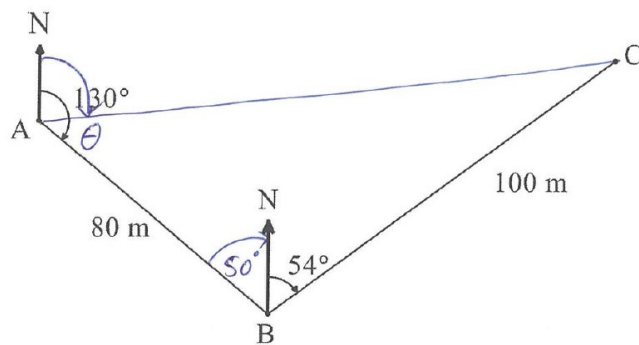
$$AC = \sqrt{80^2 + 100^2 - 2(80)(100)\cos 104°}$$
$$= 142.375\ldots\ m$$
$$= 142m$$

Markers feedback:

Almost every student recognised that in order to find AC, they will have to apply the cosine rule. However, many were not able to find the value of $\angle ABC$.

Question 35 (b)

Criteria	Marks
• Calculate the correct bearing of C from A	**2**
• Find the value of $\angle BAC$	**1**

Sample answer:

$$\cos\theta = \frac{80^2 + 142^2 - 100^2}{2(80)(142)}$$

$$\theta \approx 43.193...^\circ$$

$$\therefore \text{Bearing C from A} : \quad 130 - \theta$$
$$\approx 86.806...$$
$$\approx 87^\circ$$

Markers feedback:

The most common error was that student found $\angle ACB$ instead of $\angle BAC$. For students who correctly calculated the value of $\angle BAC$, they forgot to minus $\angle BAC$ from 130°.

Question 36 (a)

Criteria	Marks
• Show that $A = 64w - w^2$	**1**

Sample answer:

$$l + w = 64$$
$$l = 64 - w$$

$$A = w(64 - w)$$
$$= 64w - w^2$$

Markers feedback:

This question had a very low success rate. Many students did not that they have to make l the subject and then use the area formula of a rectangle to show that $A = 64w - w^2$.

Question 36 (b)

Criteria	Marks
• Find the correct value for width and the length of the rectangle	**2**
• Find the correct value for the width or the length of the rectangle	**1**

Sample answer:

$$W = 32 \quad , \quad l = 64 - 32$$
$$= 32$$

Markers feedback:

Many students were only able to get 1 out of 2 marks because they forgot to find the value of the length. The question asked for the dimensions of the rectangle, not the width and the area.

Question 37 (a)

Criteria	Marks
• Correctly formulate both equations	**2**
• Correctly formulate one out the two equations	**1**

Sample answer:

$$x + y = 480$$
$$x = 2y$$

Markers feedback:

Many students were only able to formulate one equation.

Question 37 (b)

Criteria	Marks
• Sketch both lines correctly	**2**
• Sketch one of the lines correctly	**1**

Sample answer:
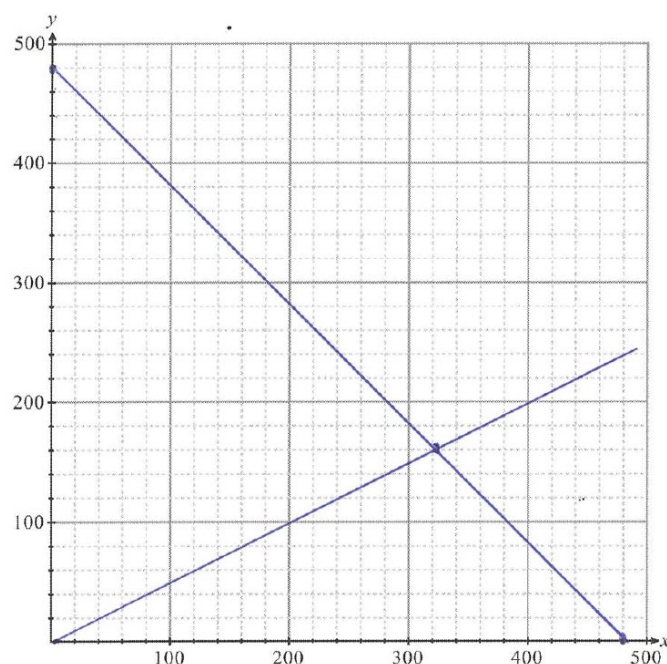
Markers feedback:

Very few students were able to sketch both lines correctly because they weren't able to formulate both equations in part (a).

Question 37 (c)

Criteria	Marks
• Find the correct value for both sporting equipment	**2**
• Find the correct value for one of the sporting equipment	**1**

Sample answer:

Number of hockey sticks: _____320_____

Number of tennis racquets: _____160_____

Markers feedback:

The question was done well by most students.

Question 38 (a)

Criteria	Marks
• Provides the correct solution	**2**
• Find the correct z-score	**1**

Sample answer:

$$z = \frac{24.5 - 24.2}{0.2} = 1.5$$

$$\therefore \ 93.32\%$$

Markers feedback:

Most students were able to find the correct z-score but failed to use the table to provide the correct solution. If z-scores are not integers, the empirical rule cannot be applied to find the probability because the Normal Distribution is not linear.

Question 38 (b)

Criteria	Marks
• Provides the correct solution	**2**
• Find the probability for $P(z < -2)$ or $P(z > 1.5)$	**1**

Sample answer:

$$z = \frac{23.8 - 24.2}{0.2} = -2 \quad ; \quad z = \frac{24.5 - 24.2}{0.2} = 1.5$$

$$P(z < -2) = 0.0228 \quad ; \quad P(z > 1.5) = 1 - 0.9332$$
$$= 0.0668$$

$$\therefore \ (0.0228 + 0.0668) \times 5000 = 448$$

Markers feedback:

Students were awarded a mark if they found the $P(z < -2) = 2.5\%$ using the empirical rule. Students again assume that $P(z > 1.5) = 9.25\%$, but since the Normal Distribution is not linear the table must be used to find the correct probabilities.