HORNSBY GIRLS HIGH SCHOOL

Mathematics Standard 2

Year 12 Higher School Certificate Trial
Assessment 4 Term 3 2025

STUDENT NUMBER:_____

General Instructions:

- Reading time – 10 minutes
- Working time – 2 hours and 30 minutes
- Write using black pen
- Calculators approved by NESA may be used
- For questions in Section II, show relevant mathematical reasoning and/or calculations

Total Marks: 100

Section I – 15 marks (pages 2–9)

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

Section II – 85 marks (pages 10–32)

- Attempt Questions 16–41
- Allow about 2 hour and 5 minutes for this section

Outcomes assessed: MS11-1, MS11-2, MS11-3, MS11-4, MS11-5, MS11-6, MS11-7, MS11-8, MS11-10, MS2-12-1, MS2-12-2, MS2-12-3, MS2-12-4, MS2-12-5, MS2-12-6, MS2-12-7, MS2-12-8, MS2-12-10

This assessment task constitutes 30% of the Higher School Certificate Course School Assessment

Section I

15 Marks
Attempt Questions 1-15
Circle the best answer on the Multiple-Choice Answer Sheet provided
Allow about 25 minutes for this section

1. Which of the following beverages is the cheapest per mL?

   A) Coffee at $3.50 for 500 mL

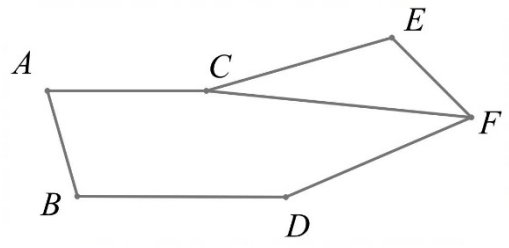
   B) Juice at $4.00 for 1 L

   C) Milk at $2.00 for 250 mL

   D) Lemonade at $1.80 for 300 mL

2. Which of the networks below has two vertices of degree 4?

A.



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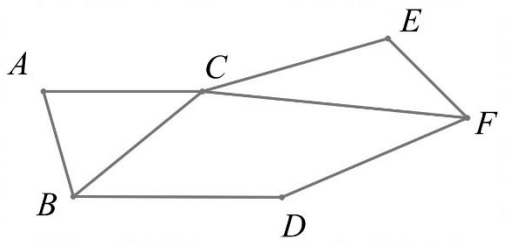

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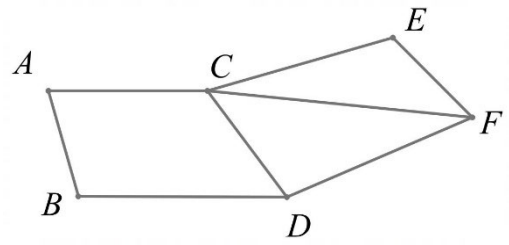

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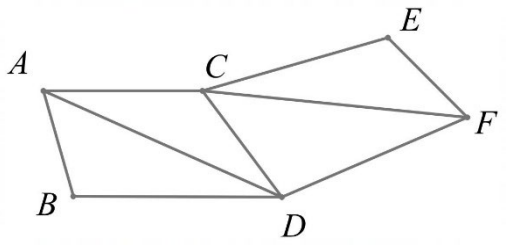


3. A student measured the length of a field as 84.0 metres, correct to one decimal place. The percentage error in the student's measurement is:

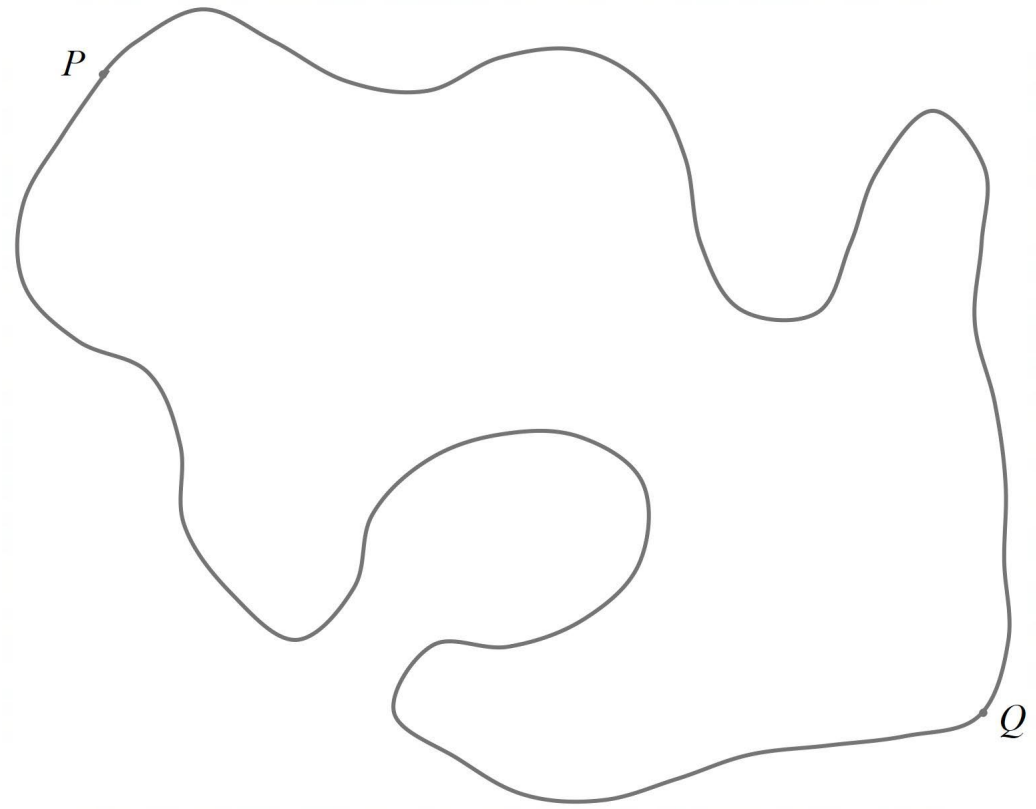
A) 0.0595%

B) 0.1190%

C) 0.595%

D) 1.19%

4. This map of an island is drawn at a scale of 1 : 200 000.
The distance between the points P and Q is closest to which value below?



A) 28.8 km

B) 288 km

C) 2 880 km

D) 28 800 km

5. Which true bearing is the same as southeast?

A) 045°

B) 135°

C) 315°

D) 360°

6. The Coordinated Universal Time (UTC) of Sydney is +10 hours and the UTC of Tijuana is – 8 hours.

When the time in Tijuana is 4 pm, Friday, what is the time in Sydney?

A) 10:00 am, Saturday

B) 6:00 pm, Friday

C) 2:00 am, Saturday

D) 10:00 pm, Friday

7. The weight (w) of a steel cable is directly proportional to the length (l) of the cable.

A cable which is 25 metres long, weighs 245 kg.

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

Answers are given to three significant figures.

A) $m = 0.102$

B) $m = 9.80$

C) $m = 10.2$

D) $m = 980$

8. Three years ago, a laptop was bought for \$1 899. Since then, it has depreciated by 24% each year, based on the declining-balance method.

What is the total depreciation of the laptop over the three years, to the nearest dollar?

A) \$532

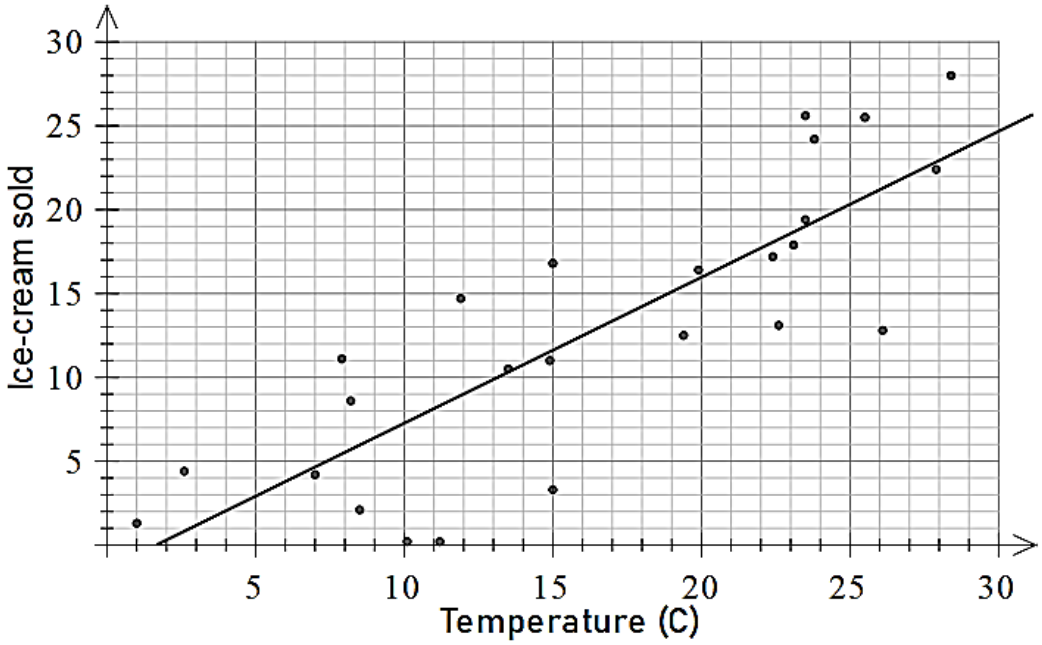
B) \$834

C) \$1065

D) \$1367

9. 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.



What is the equation of the least squares regression line closest to?

A) $Ice\ cream = -1.333 + 0.867 \times Temperature$

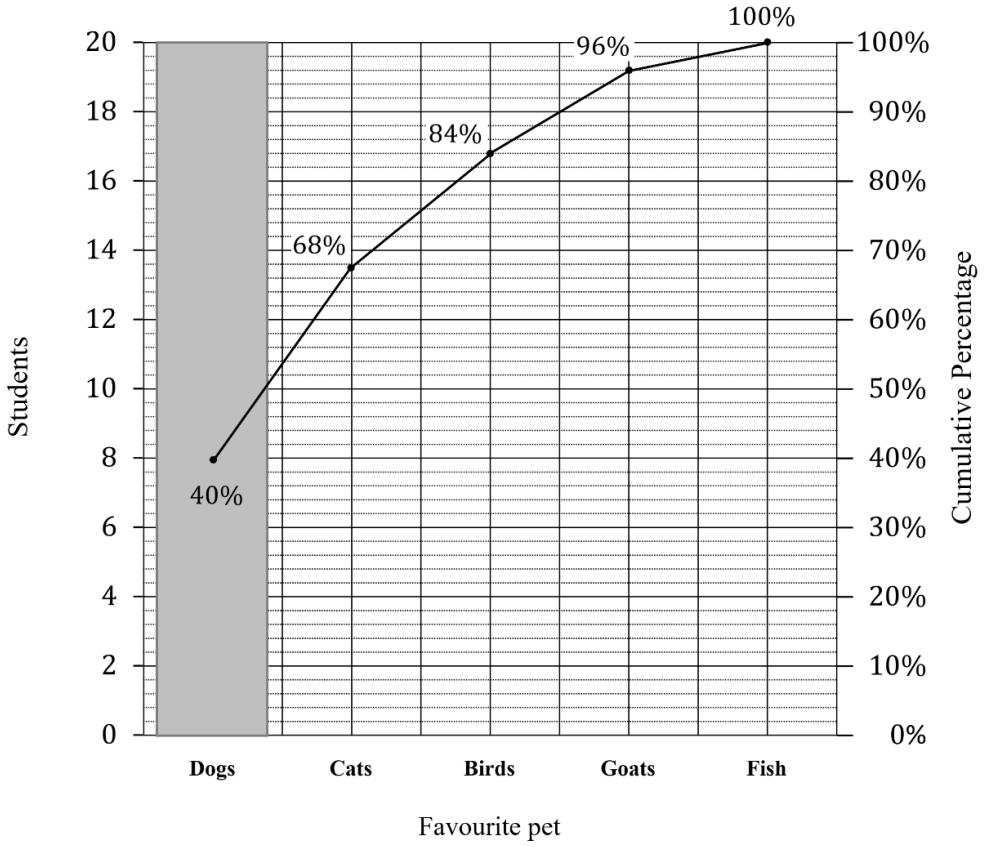
B) $Ice\ cream = -7.077 + 1.154 \times Temperature$

C) $Temperature = -1.333 + 0.867 \times Ice\ cream$

D) $Temperature = -0.867 + 1.333 \times Ice\ cream$

10. A teacher asked fifty students to identify their favourite type of pet.

A partially completed Pareto chart shows some of the data collected.



How many students chose cats as their favourite pet?

A) 12 students

B) 14 students

C) 28 students

D) 34 students

11. Re-write the formula $e = \frac{f - 2g}{h}$, with f as the subject.

A) $f = eh + 2g$

B) $f = eh - 2g$

C) $f = eh + 2gh$

D) $f = \frac{eh+g}{2}$

12. Tony took out a reducing balance loan of $800 000, with interest calculated monthly.

The balance of the loan, in dollars, after n months, T_n, can be modelled by the recurrence relation:

$$T_0 = 800\,000, \qquad T_{n+1} = 1.0054T_n - 5003$$

The interest rate, per annum, for this loan is:

A) 0.45%

B) 4.5%

C) 5.4%

D) 6.48%

13. The diameter of a circle is measured to be 12 centimetres, correct to the nearest centimetre.

What is the difference between the lower and upper bounds for the area of the circle?

A) 3.14 cm^2

B) 9.4 cm^2

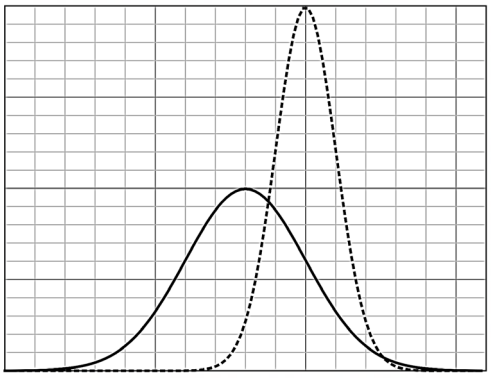
C) 18.8 cm^2

D) 37.7 cm^2

14. Let X be a normal distribution with mean of 80 and a standard deviation of 20. Let Y be a normal distribution with mean of 100 and standard deviation of 10.

Which diagram below best represents the normal distribution for X and Y, plotted on the same set of axes?

A.



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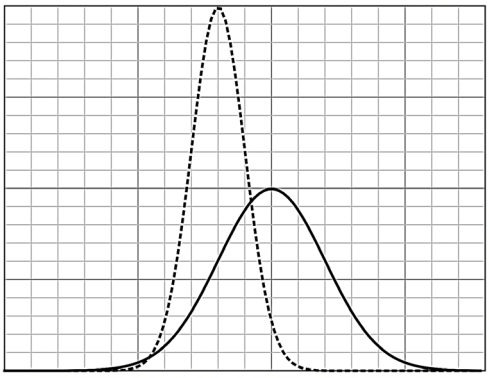

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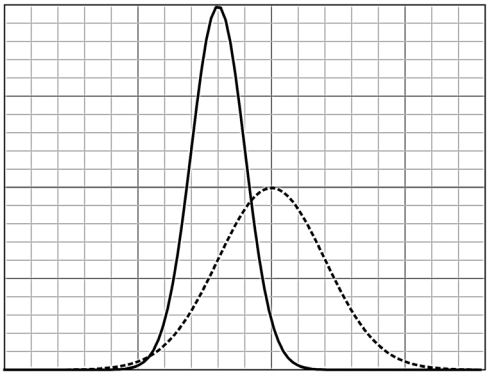

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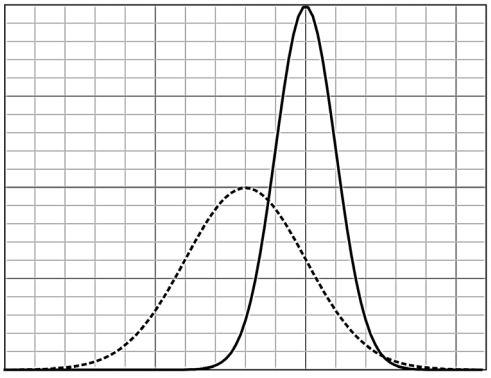

15. Nine unbiased dice, each with faces numbered $1, 2, 3, 4, 5, 6$, are rolled.

Which one of the expressions below represents the probability of a 6 appearing on at least one of the dice?

A) $1 - \left(\frac{5}{6}\right)^9$

B) $1 - \left(\frac{1}{6}\right)^9$

C) $9 \times \left(\frac{1}{6}\right)$

D) $\left(\frac{1}{6}\right)^9$

END OF MULTIPLE CHOICE

Section II

85 Marks
Attempt Questions 16-41
Write answers in the spaces provided
Allow about 2 hours and 5 minutes for this section

Question 16 (2 marks)

After school, Sasha likes to make a snack by mixing raisins and nuts in the ratio of 3: 5. When she checked the cupboard today, there were only 60 g of raisins and 75 g of nuts left. Determine the maximum weight of the snack Sasha can make while still maintaining the ratio 3: 5? **2**

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Question 17 (2 marks)

Peter has calculated that, on average, his car consumes 1.5 litres of petrol for every 12.6 km of travel. **2**

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

How many litres of petrol did Peter's car consume on the trip?

Answer correct to one decimal place.

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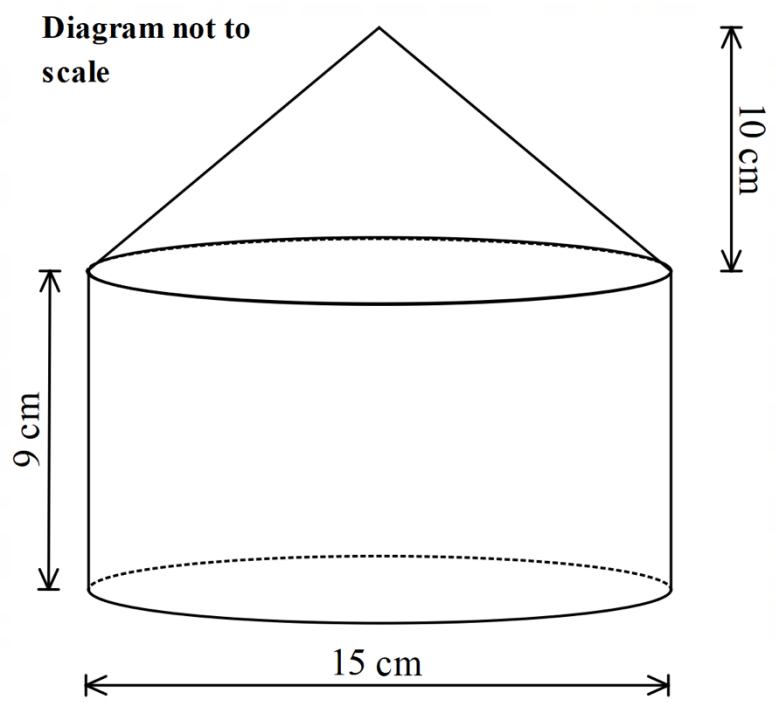
Question 18 (3 marks)

A cake is created using a cylinder and a cone shaped top. The cylinder has diameter 15 cm and height of 9 cm and the cone has a height of 10 cm. **3**



Calculate the surface area of the cake that is to be covered in icing, correct to the nearest cm^2.

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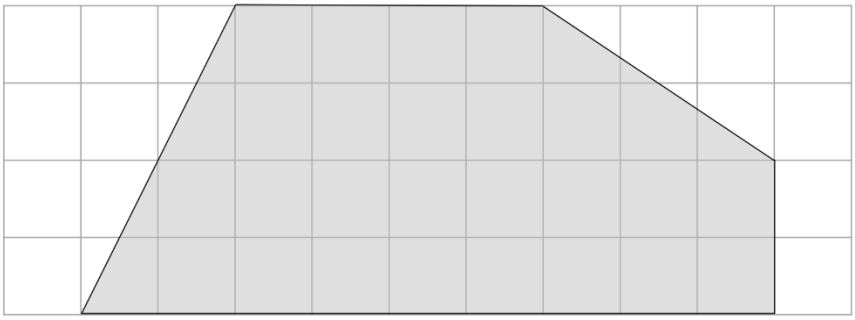
Question 19 (3 marks)

The scale diagram shows a garden bed, which is to be covered with mulch to a depth of 30 centimetres. Each square on the grid has a side length of 5 metres. **3**



Find the volume of mulch that will be needed to cover the garden bed, in cubic metres correct to 1 decimal place

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Question 20 (2 marks)

Jordan is saving up for a model of car which currently has a purchase price of $34 000. In two years' time he will have saved $20 000, and will take out a loan for the balance of the purchase price. **2**

Due to inflation, the purchase price of that model of car is expected to increase by 4% each year.

How much money will he need to borrow in two years' time to buy the car?

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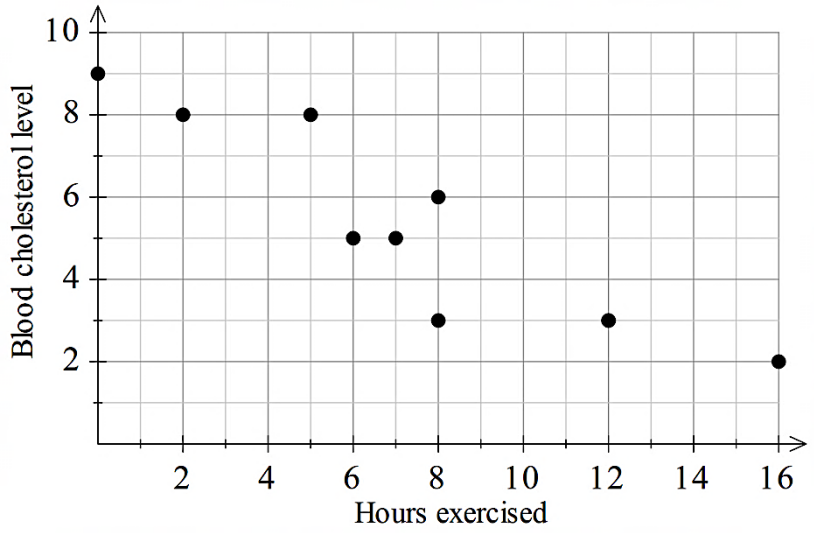
Question 21 (4 marks)

A set of bivariate data is collected by measuring the blood choloestrol level and hours exercised of nine adults. The graph shows a scatterplot of the results.



(a) Calculate the Pearson's correlation coefficient for the data, correct to two decimal places. **1**

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(b) Identify the direction and the strength of the linear association between blood cholesterol level and hours exercised. **1**

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(c) The equation of the least-squares regression line is shown. **2**

$$Blood\ Cholesterol\ Level = -0.4679(Hours\ exercised) + 8.7717$$

An adult's blood cholesterol level is at 4.

Calculate the amount of hours exercised for this adult using the equation of the least squares regression line. Correct to the nearest 2 decimal places.

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Question 22 (2 marks)

The table shows the income tax rates for the 2025-2026 financial year. **2**

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

For the 2025-2026 financial year, Amani has a taxable income of $126 250.

During the year she paid $1130 per fortnight in Pay As You Go (PAYG) tax.

Calculate Amani's tax refund, ignoring the Medicare levy.

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Question 23 (2 marks)

Find the value of x if: **2**

$$3(3x-5)-4x=10$$

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Question 24 (3 marks)

Hayley owns 1 600 shares in Logistics Ltd which are currently valued at $4.23 each.
Today Logistics issued a dividend of $0.81 per share.

(a) What is the current value of her shares? **1**

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(b) Hayley paid $6 240 in total for the shares a year ago.
What is the percentage profit she would make today based on the purchase price? **1**

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(c) What is the dividend yield of these shares? **1**

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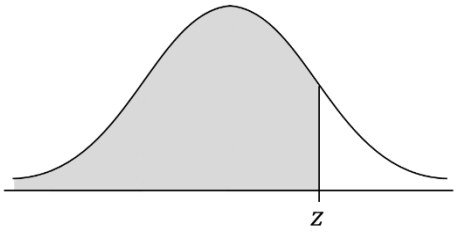
Question 25 (2 marks)

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 from some positive values of z.

z	2.20	2.21	2.22	2.23	2.24	2.25	2.26	2.27	2.28	2.29
Probability	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890

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



A pizza restaurant delivers pizzas to their customers' homes. The restaurant finds that the time taken from when the customer makes the order online until the pizza arrives at their home is normally distributed with a mean of 30 minutes and a standard deviation of 8 minutes.

What percentage of customers must wait for more than 48 minutes for their pizza to arrive? **2**
Answer as a percentage correct to one decimal place.

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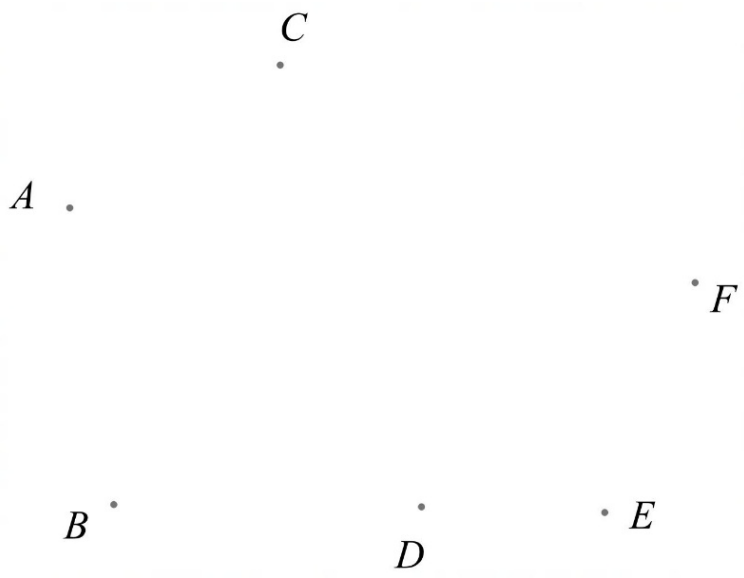
Question 26 (4 marks)

The table below represents a weighted network.

	A	B	C	D	E	F
A		50	40	70		
B	50			35		
C	40			75		75
D	70	35	75			50
E						40
F			75	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. **2**

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Question 27 (4 marks)

A piece of wire 20 cm long is bent into a rectangle.

Let one side of the rectangle be x cm long.

(a) Show that the area, A, can be expressed by $A = 10x - x^2$ **2**

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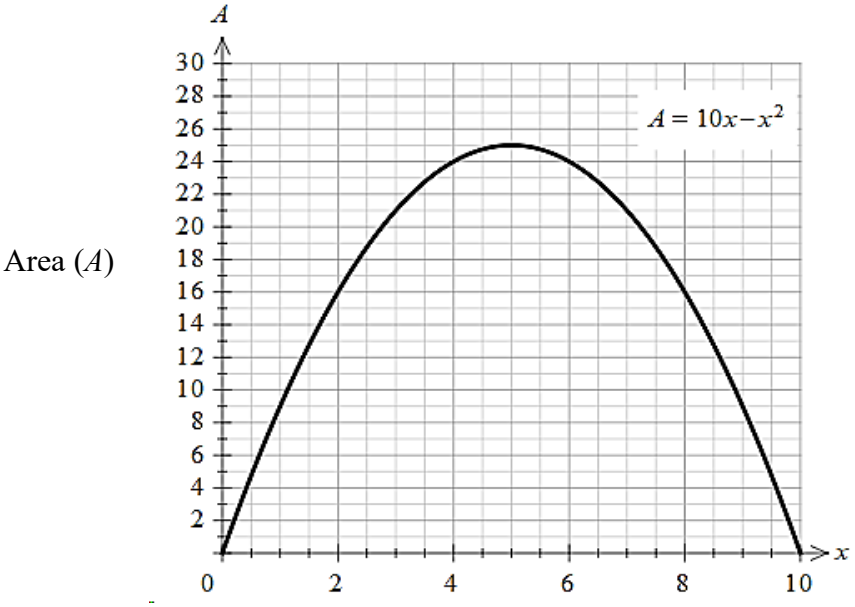
(b) The graph of A is shown below. **1**



Using the graph, or otherwise, what are the value(s) of x when the area is 16 cm^2?

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(c) Using the graph, or otherwise, what are the dimensions of the rectangle when the area is at its maximum. **1**

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Question 28 (4 marks)

Two families are purchasing tickets for a theme park online.

The first family purchased 2 adult and 3 student tickets for a total of $190.

If one adult ticket costs $\$\boldsymbol{x}$ and one student ticket costs $\$\boldsymbol{y}$. Then the following equation can be formed for the first family:

$$2x + 3y = 190$$

The second family purchased 5 adult and 2 student tickets for a total of $310

(a) What is the equation formed for the second family? **1**

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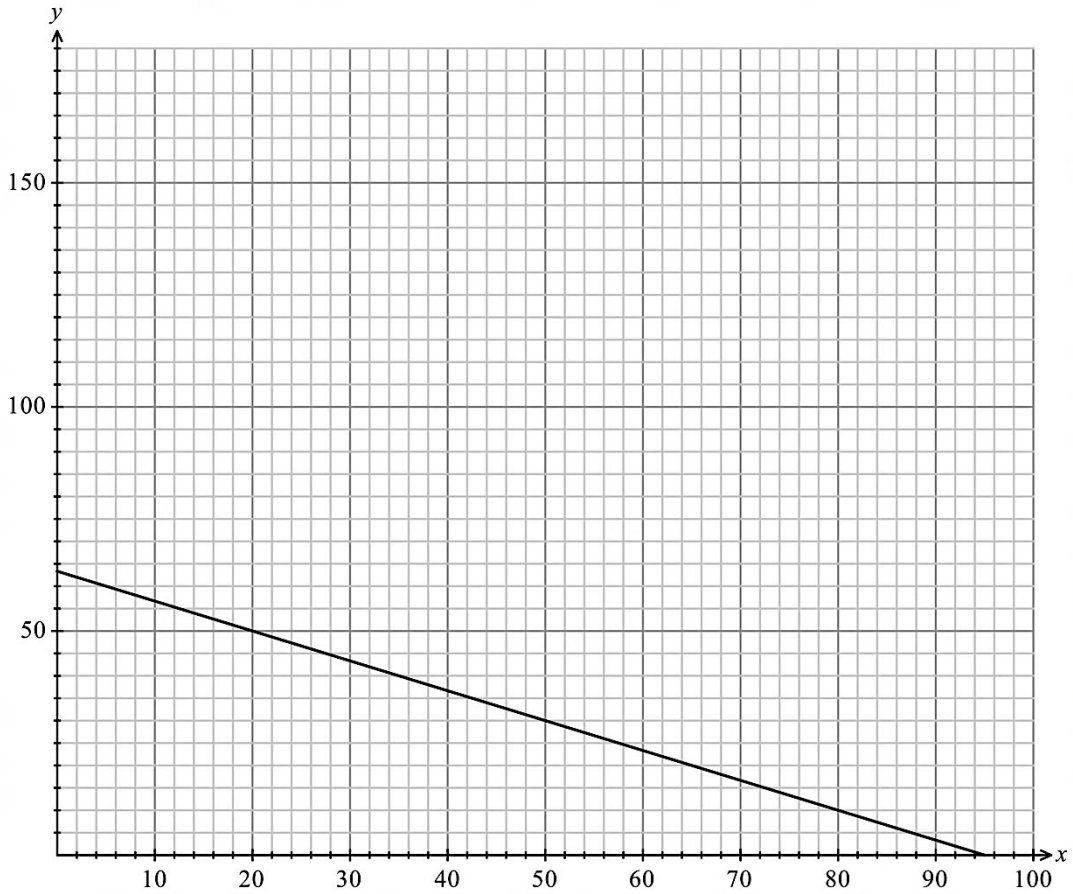
(b) The graph for the first family is sketched on the grid below. **1**

Using your equation from (a), graph the equation of the second family on the same grid.



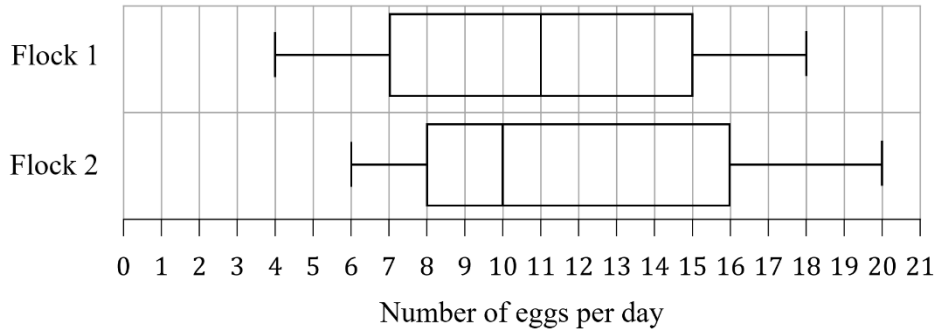
(c) What is the cost of one adult and one child ticket? **2**

Cost of one adult ticket = _____

Cost of one student ticket = _____

Question 29 (3 marks)

A farmer has two flocks of chickens. The number of eggs they laid each day during the year was counted, with the data shown in a parallel box-plot. **3**



Compare the two datasets by examining the skewness of the distributions, and the measures of central tendency and spread.

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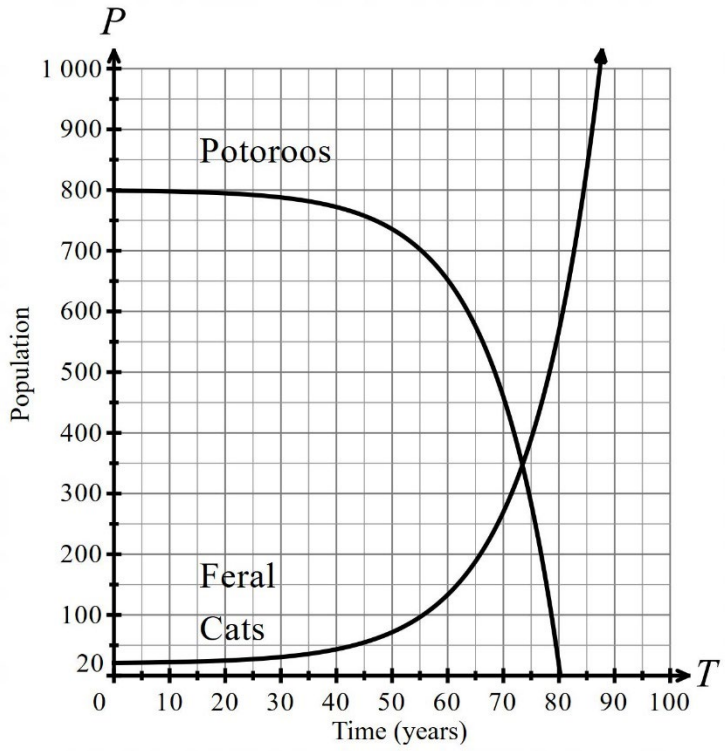
Question 30 (4 marks)

A conservation area has a fenced section which has been used to release 800 Potoroos. The area also has an estimated 20 feral cats.

An environmentalist models the populations of both groups over the next 100 years if the cats were not removed.

The graph shows the results of the model.



Note: The cats kill and eat other creatures as well as Potoroos, so their population can still rise, even when the number of Potoroos decreases.

(a) After how many years are the two populations equal in size (nearest 5 years)? **1**

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(b) In the year when there are 100 feral cats, how many Potoroos remain? **1**

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(c) Compare the populations in (b) to those 10 years later and describe the way that the two populations change from 70 years onwards. **2**

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Question 31 (4 marks)

Natalie and Donovan each inherit \$100 000 and open separate bank accounts each earning 7.2% per annum, compounding monthly.

Natalie decides to withdraw \$500 at the end of each month. The amount in Natalie's bank account immediately after the nth withdrawal can be determined using the recurrence relation:

$$A_n = A_{n-1} \times 1.006 - 500, \text{ where } n = 1,\ 2,\ 3, \ldots$$
$$\text{and } A_0 = 100\ 000.$$

Donovan decides to leave all his money in the bank to earn as much interest as possible.

At the end of the first three months, just after Natalie's third withdrawal, how much higher is Donovan's bank balance than Natalie's? **4**

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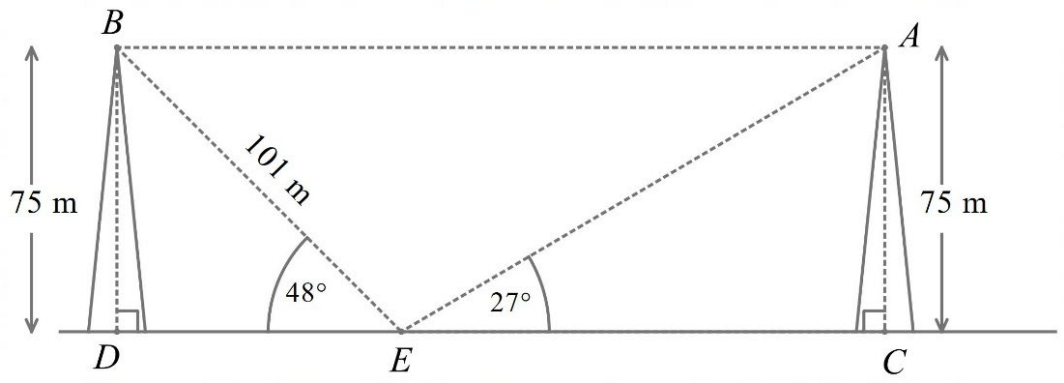
Question 32 (3 marks)

Two towers *BD* and *AC* stand on level ground.

Both towers are 75 m tall. From *E*, a point between the towers, Elana has measured the angles of elevation *A* and *B* to be 27º and 48º respectively.



Elana also used trigonometry to calculate the distance *BE* to be 101 m.

The information above is shown on the diagram.

(a) Using trigonometry, calculate the distance *AE,* to the nearest whole metre. **1**

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(b) Using Sine Rule, calculate the distance *AB*, to one decimal place. **2**

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Question 33 (3 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

(a) Sally's yearly salary is $160 000, and she wants to contribute part of her salary into an annuity account with an interest rate of 7% p.a. compounding annually. **2**

If Sally's goal is to have $500 000 in the annuity account after 18 years, what percentage of her salary should he contribute each year?

Give your answer to two decimal places.

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(b) Jacob wants to have $500 000 in his investment account after 18 years. He decides to deposit a single sum of money now, rather than making regular contributions towards an annuity. **1**

The investment account earns interest at a rate of 7% per annum, compounding yearly.

Calculate the amount Jacob needs to invest now to achieve his goal.

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Question 34 (4 marks)

Students at Alphabeta Secondary College sit exams in three subjects - Science, English and Mathematics. The table below gives the mean and standard deviation on these tests.

	Mean	Standard Deviation
Science Test	66.5	11.2
English Test	55.8	10.8
Maths Test	45.6	9.6

The results of Amber and Bianca, two students who sat the tests, are given in the table below.

Student	Science Mark	English Mark	Maths Mark
Amber	80	70	55
Bianca	70	78	65

(a) Convert Amber's three marks into *z*-scores and determine on which test she performed best relative to the other candidates. **2**

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(b) Determine which of the six results scored by the two students was the lowest overall result relative to all the candidates who sat the tests. **2**

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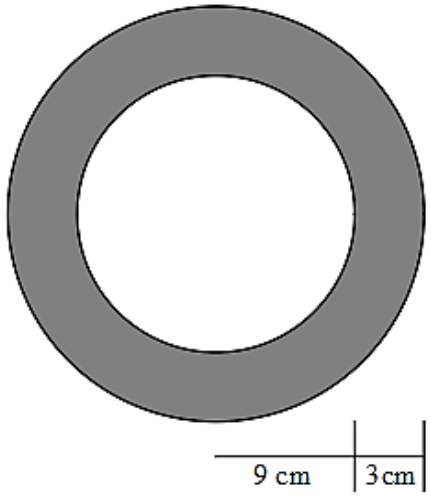
Question 35 (3 marks)

The figure below shows a circular dartboard with two circles sharing the same centre with radii of 12 cm and 9 cm respectively. **3**



Two darts are thrown and hit the dartboard.

Is the probability higher if both darts land in the shaded region, or if only one dart lands in the shaded region and the other in the inner white region?

Justify your answer with relevant calculations.

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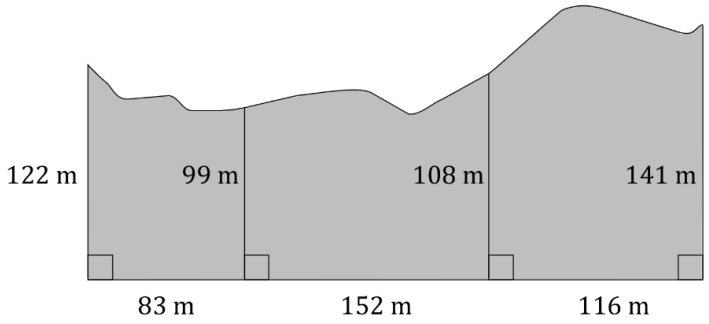
Question 36 (5 marks)

The area of a paddock is to be estimated. Due to thick spiky weeds through parts of the paddock, the surveyors are only able to find the following measurements.



NOT TO SCALE

(a) Use three applications of the trapezoidal rule to estimate the area of the paddock, in hectares correct to one decimal place. (1 hectare $= 10\,000\ \text{m}^2$.) **2**

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(b) The owner hires a crop duster to spread a mixture of herbicide and fertiliser evenly over the paddock to help control the weeds and encourage grass growth. The mixture needs to be applied at a rate of forty-five litres per hectare. **1**

How much mixture is needed for the paddock, in litres correct to one decimal place?

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(c) A thunderstorm over the paddock sees the whole paddock receive 8 millimetres of rain. **2**

How much rain fell onto the paddock, correct to the nearest kilolitre?

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Question 37 (4 marks)

A baker makes and sells x loaves of their sourdough bread each day, for \$8 per loaf, with a revenue function of $y = 8x$.

Each day the baker has fixed expenses of \$150, plus it costs an extra \$2 per loaf in ingredients and electricity.

(a) What is the cost function? **1**

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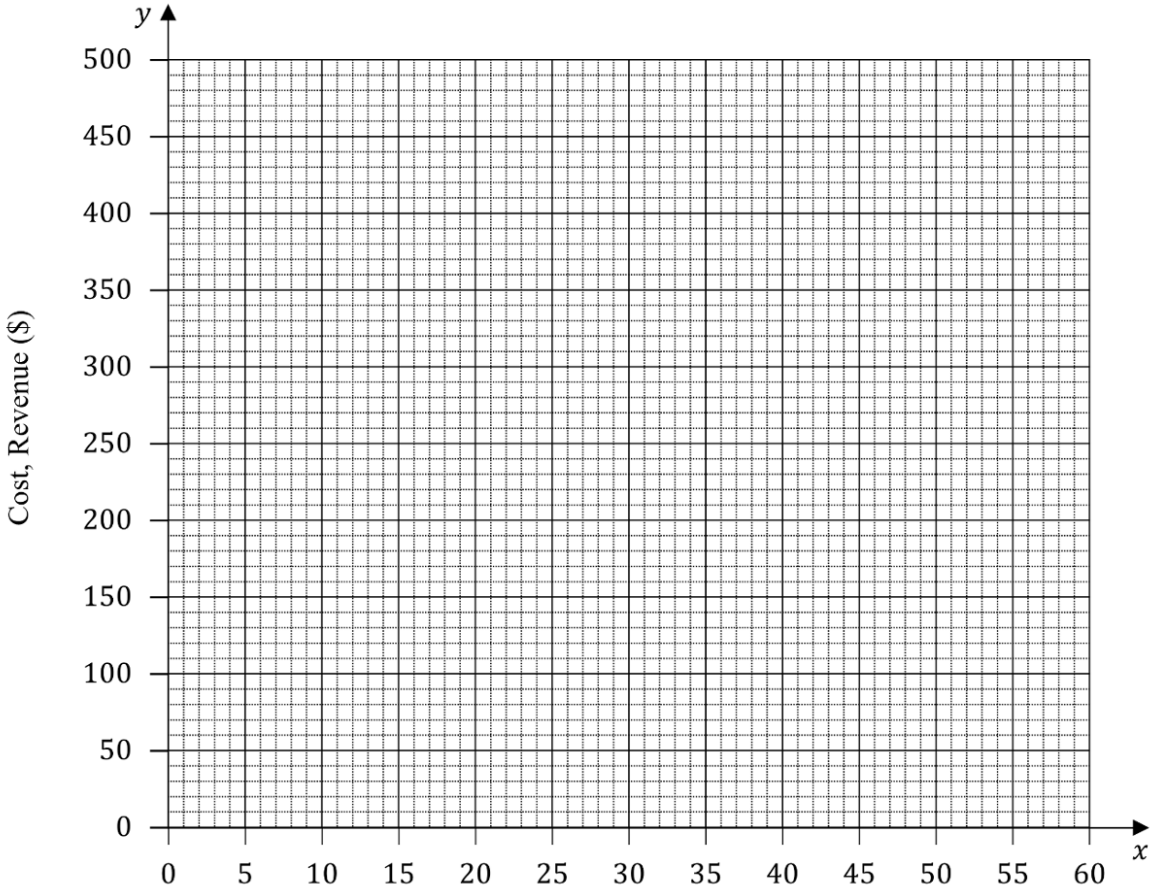
(b) Graph the revenue function and your cost function, from (a), on the grid below. **2**



(c) How many loaves of bread does the baker need to bake and sell to make a profit of \$150 for their day's work? **1**

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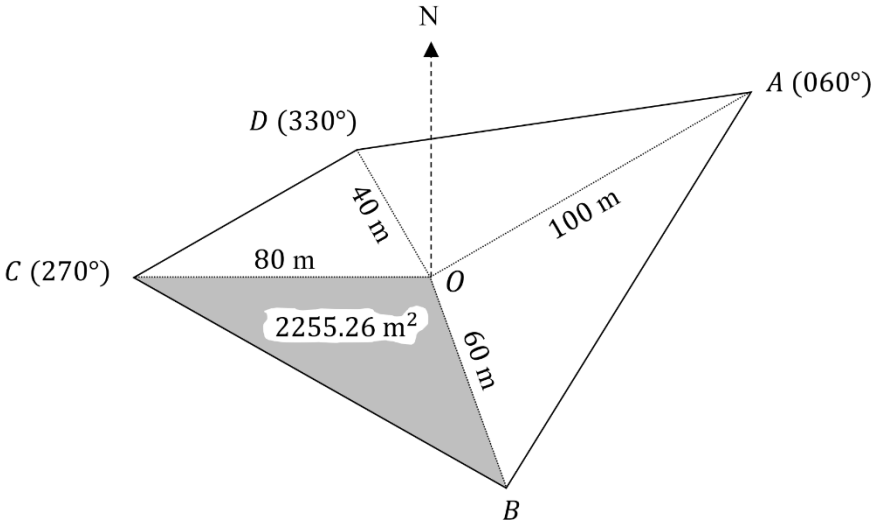
Question 38 (4 marks)

Part of a compass radial survey shows the position of four corners of a block of land, A, B, C and D, in relation to a point O.



The area of triangle BOC is $2255.26\ \text{m}^2$, and the angle COB is obtuse.

(a) By first using the area of triangle BOC to find the obtuse angle COB, or otherwise, find the bearing of B from O. **3**

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(b) Find the length of BC, correct to the nearest metre. **1**

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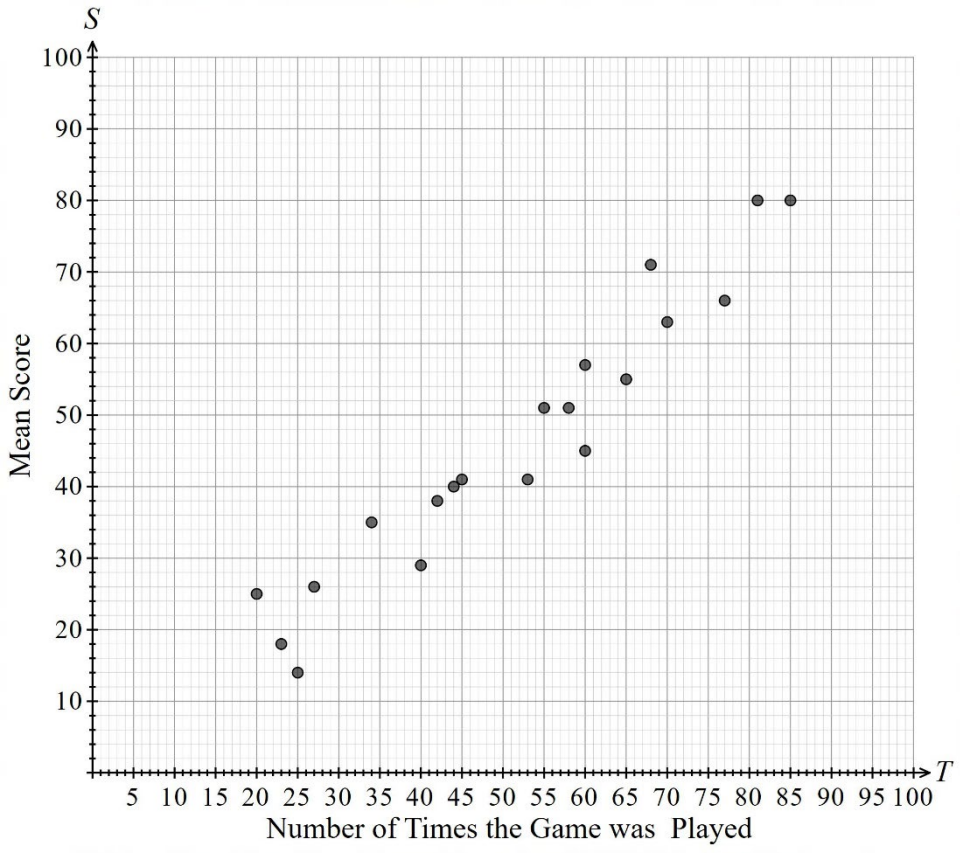
Question 39 (3 marks)

The scatterplot below compares the number of times that 20 gamers had played the game *SimuLife* with the mean score they achieved on playing the game.



When the least-squares regression line is found, the two variables are found to be in direct variation and that the line also passes through the point A (50, 45).

(a) Find the equation of the least-squares regression line and draw it on the scatterplot above. **2**

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(b) Estimate the average score of a gamer who had played 96 games. **1**

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Question 40 (3 marks)

Roco has a credit card with the following conditions:

- There is no interest-free period
- Interest is charged at the end of each month at 19.99% per annum, compounding daily, from the purchase date (included) to the last day of the month (included).

Roco's credit card statement for March is shown, with some figures missing.

Statement period: 1 March to 31 March

Date	Details	Amount ($)
1 March	Opening balance	0.00
19 March	Car repairs	1200.00
27 March	Trailer hire	110.00
31 March	Interest charged	***
31 March	Closing balance	***

Minimum payment: ***

The minimum payment was calculated as 2.5% of the closing balance on 31 March.

Once Roco makes the minimum monthly payment on April 1, what will his balance be? **3**

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Question 41 (5 marks)

An athlete can find their maximum heart rate using the formula:

Maximum heart rate in beats per minute (bpm) = 220 – age in years.

The table below indicates how different heart rates fit into a training regime for athletes.

Target Zone	Percentage of Maximum Heart Rate	Description and Purpose
5	90% – 100%	Elite – Competition and top-level training
4	80% – 90%	Training – Develop endurance and performance
3	70% – 80%	Fitness – Develop aerobic fitness
2	60% – 70%	Weight Loss – Begin to burn fat
1	50% – 60%	Recovery – Warm up and cool down

While exercising, Michael and Kerrie check their heart rates.

Kerrie, who is 50 years old, counts 92 heart beats in 40 seconds and completes a quick calculation to find her heart rate in bpm.

Michael, who is 18 years old, has a smartwatch which shows that his current heart rate is 150 bpm and tracks it as it changes.

(a) Determine at what percentage of their maximum heart rate each of them is exercising and in which Target Zone they are exercising. **3**

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(b) Find the minimum change in his heart rate that Michael must achieve if he wants to exercise in the same Target Zone as Kerrie. **2**

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END OF EXAMINATION

HORNSBY GIRLS HIGH SCHOOL

Mathematics Standard 2

Year 12 Higher School Certificate Trial Assessment 4 Term 3 2025

STUDENT NUMBER: Solutions

General Instructions:

- Reading time – 10 minutes
- Working time – 2 hours and 30 minutes
- Write using black pen
- Calculators approved by NESA may be used
- For questions in Section II, show relevant mathematical reasoning and/or calculations

Total Marks: 100

Section I – 15 marks (pages 2–9)

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

Section II – 85 marks (pages 10–32)

- Attempt Questions 16–41
- Allow about 2 hour and 5 minutes for this section

Outcomes assessed: MS11-1, MS11-2, MS11-3, MS11-4, MS11-5, MS11-6, MS11-7, MS11-8, MS11-10, MS2-12-1, MS2-12-2, MS2-12-3, MS2-12-4, MS2-12-5, MS2-12-6, MS2-12-7, MS2-12-8, MS2-12-10

This assessment task constitutes 30% of the Higher School Certificate Course School Assessment

Section I

15 Marks
Attempt Questions 1-15
Circle the best answer on the Multiple-Choice Answer Sheet provided
Allow about 25 minutes for this section

1. Which of the following beverages is the cheapest per mL?

A) Coffee at \$3.50 for 500 mL $\frac{3.5}{500} = 0.007$

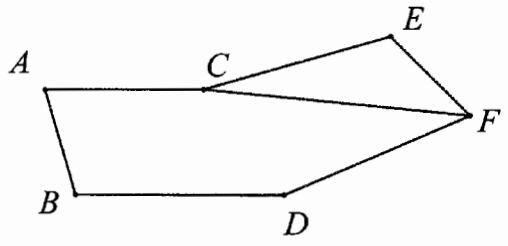
B) Juice at \$4.00 for 1 L $\frac{4}{1000} = 0.004$

C) Milk at \$2.00 for 250 mL $\frac{2}{250} = 0.008$

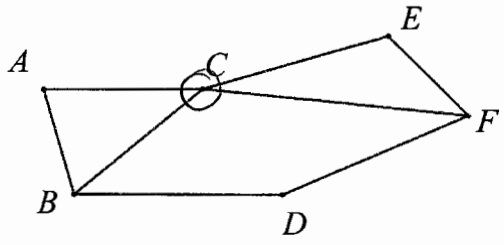
D) Lemonade at \$1.80 for 300 mL $\frac{1.8}{300} = 0.006$

2. Which of the networks below has two vertices of degree 4?

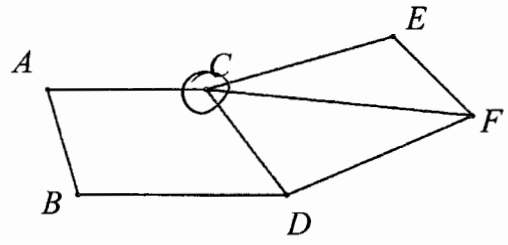
A.



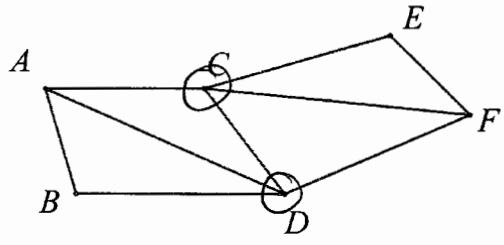
B.



C.



D.



3. A student measured the length of a field as 84.0 metres, correct to one decimal place.
The percentage error in the student's measurement is:

A) 0.0595%

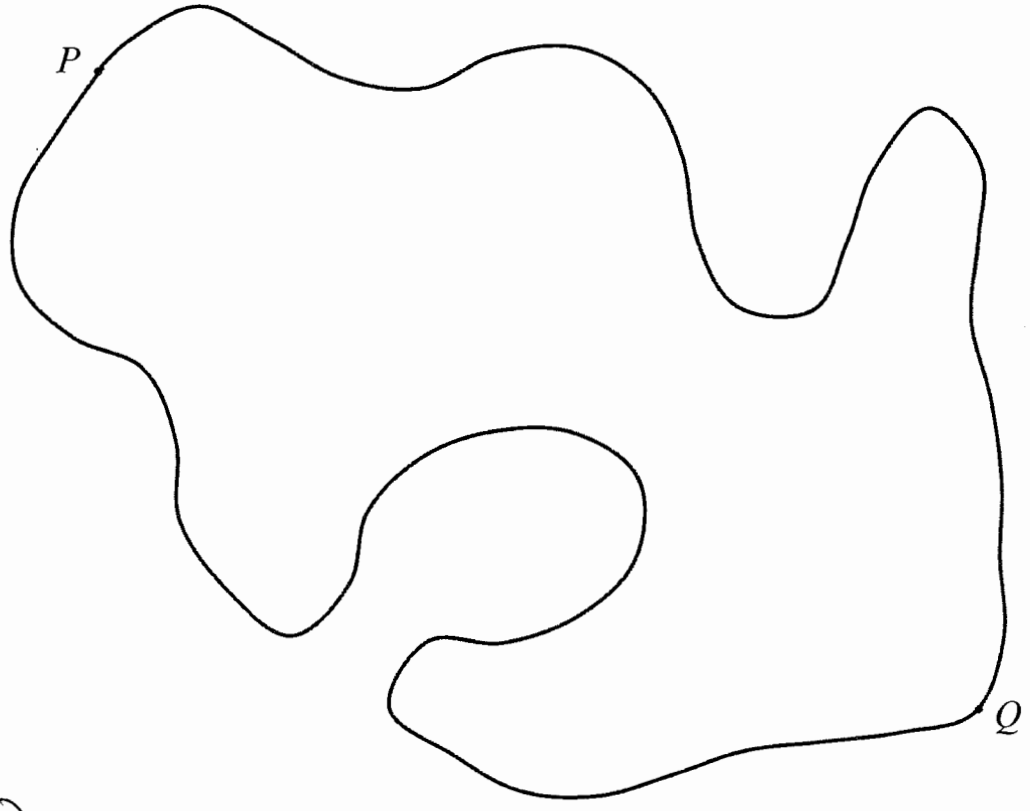
$\frac{0.05}{84} \times 100$

B) 0.1190%

C) 0.595%

D) 1.19%

4. This map of an island is drawn at a scale of 1 : 200 000.
The distance between the points P and Q is closest to which value below?



A) 28.8 km

B) 288 km

C) 2 880 km

D) 28 800 km

Measuring from P to Q = 144mm
Actual distance = 144 x 200000
= 28800000 ÷ 10 ÷ 100 ÷ 1000

5. Which true bearing is the same as southeast?

A) 045°

B) 135°

C) 315°

D) 360°

6. The Coordinated Universal Time (UTC) of Sydney is +10 hours and the UTC of Tijuana is – 8 hours.

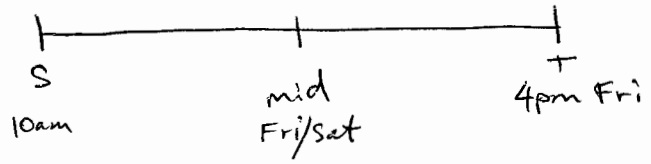
When the time in Tijuana is 4 pm, Friday, what is the time in Sydney?

A) 10:00 am, Saturday

B) 6:00 pm, Friday

C) 2:00 am, Saturday

D) 10:00 pm, Friday



7. The weight (w) of a steel cable is directly proportional to the length (l) of the cable.

A cable which is 25 metres long, weighs 245 kg.

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

Answers are given to three significant figures.

A) $m = 0.102$

B) $m = 9.80$

C) $m = 10.2$

D) $m = 980$

$w = ml$

$245 = 25l$

$\therefore l = \frac{245}{25}$

8. Three years ago, a laptop was bought for \$1 899. Since then, it has depreciated by 24% each year, based on the declining-balance method.

What is the total depreciation of the laptop over the three years, to the nearest dollar?

A) \$532

B) \$834

C) \$1065

D) \$1367

$S = 1899 - (1-0.24)^3$

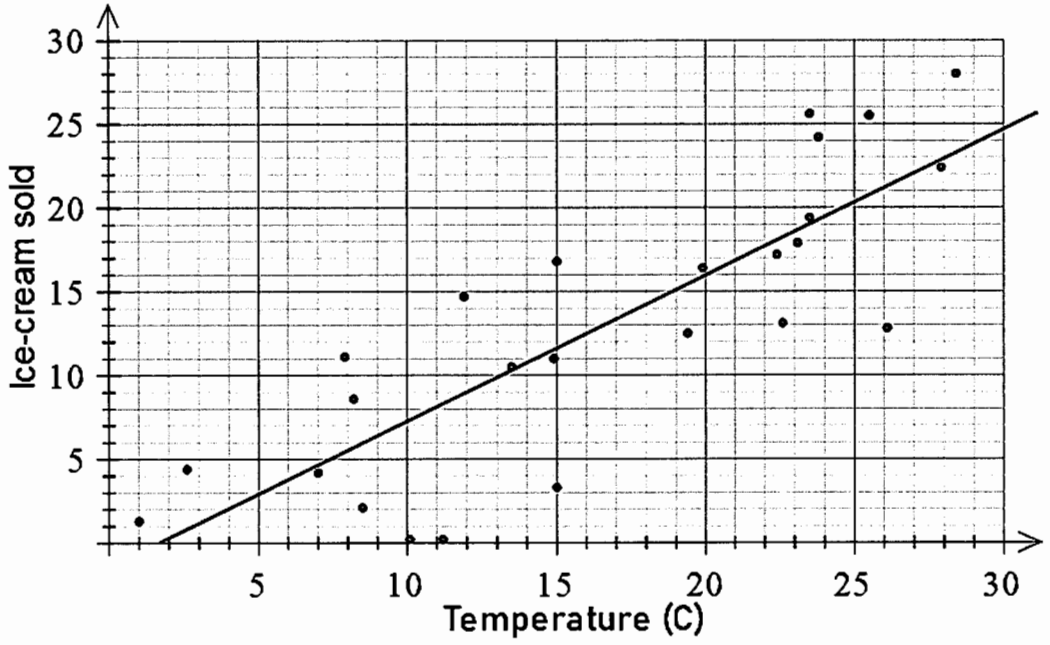
$= \$833.62$

Depreciation $= 1899 - 833.62$

$=$

9. 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.



What is the equation of the least squares regression line closest to?

A) $Ice\ cream = -1.333 + 0.867 \times Temperature$

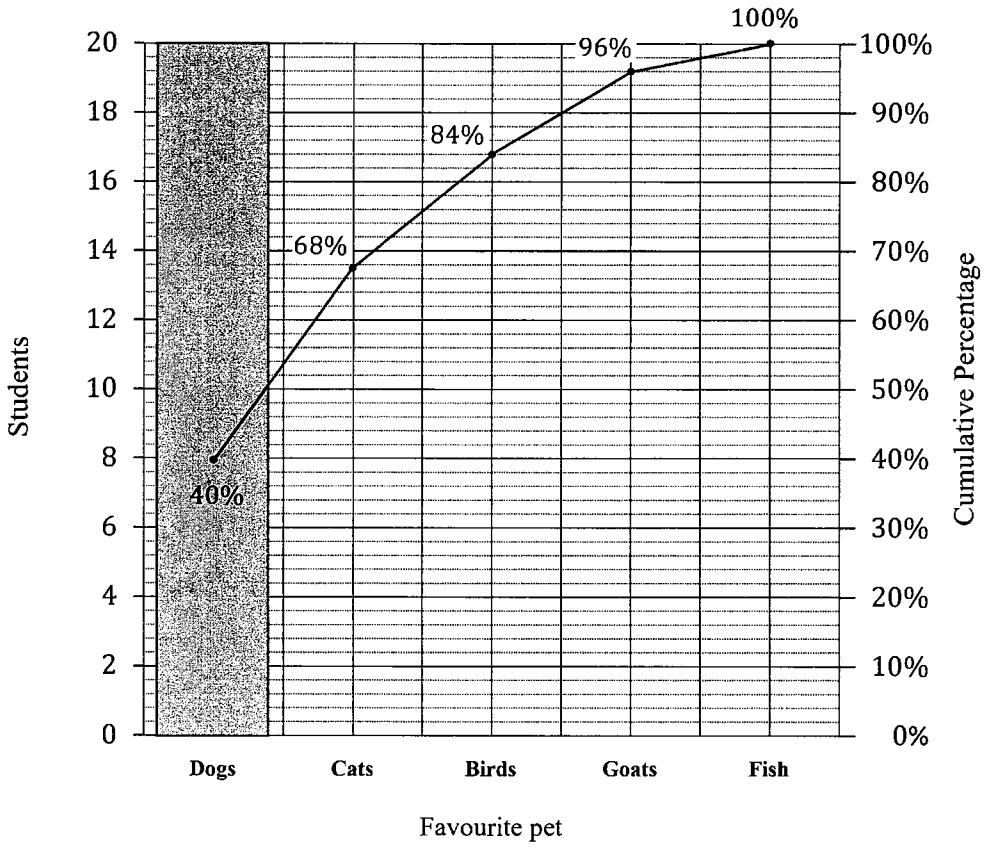
B) $Ice\ cream = -7.077 + 1.154 \times Temperature$

C) $Temperature = -1.333 + 0.867 \times Ice\ cream$

D) $Temperature = -0.867 + 1.333 \times Ice\ cream$

10. A teacher asked fifty students to identify their favourite type of pet.

A partially completed Pareto chart shows some of the data collected.



How many students chose cats as their favourite pet?

A) 12 students

cats = 68% − 40%

= 28%.

B) 14 students

C) 28 students

D) 34 students

11. Re-write the formula $e = \frac{f-2g}{h}$, with f as the subject.

A) $f = eh + 2g$

$eh = f - 2g$

$eh + 2g = f$

B) $f = eh - 2g$

C) $f = eh + 2gh$

D) $f = \frac{eh+g}{2}$

12. Tony took out a reducing balance loan of $800 000, with interest calculated monthly.

The balance of the loan, in dollars, after n months, T_n, can be modelled by the recurrence relation:

$$T_0 = 800\,000, \qquad T_{n+1} = 1.0054T_n - 5003$$

The interest rate, per annum, for this loan is:

A) 0.45%

B) 4.5%

C) 5.4%

D) 6.48%

monthly interest $= 0.0054$

Annual interest $= 0.0054 \times 12$

$= 0.0648$

13. The diameter of a circle is measured to be 12 centimetres, correct to the nearest centimetre.

What is the difference between the lower and upper bounds for the area of the circle?

A) 3.14 cm^2

B) 9.4 cm^2

C) 18.8 cm^2

D) 37.7 cm^2

Lower bound $= \pi \times \left(\frac{11.5}{2}\right)^2 = 103.87\ldots$

Upper bound $= \pi \times \left(\frac{12.5}{2}\right)^2 = 122.72\ldots$

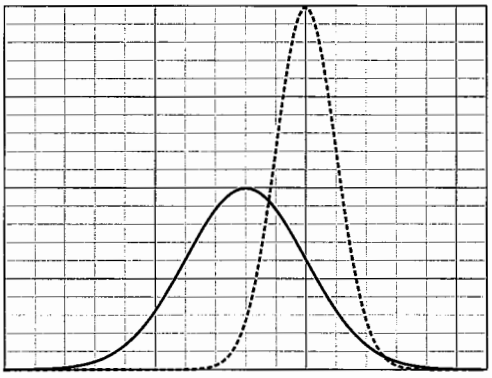
$122.72 - 103.87\ldots$

$=$

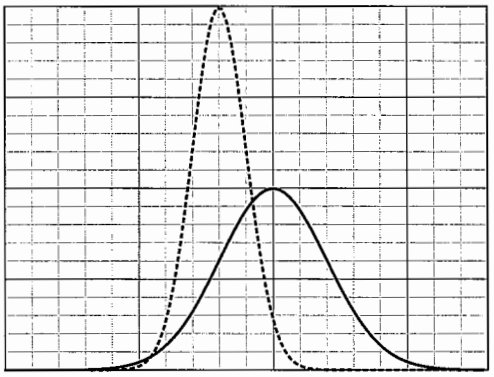
14. Let X be a normal distribution with mean of 80 and a standard deviation of 20. Let Y be a normal distribution with mean of 100 and standard deviation of 10.

Which diagram below best represents the normal distribution for X and Y, plotted on the same set of axes?

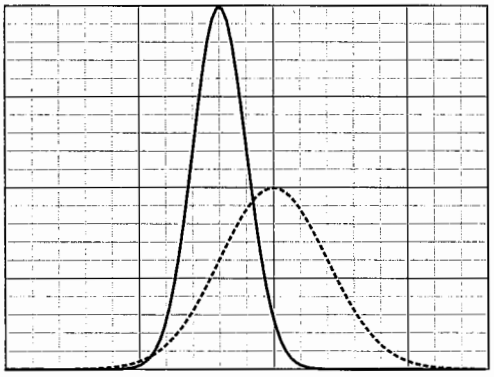
A.



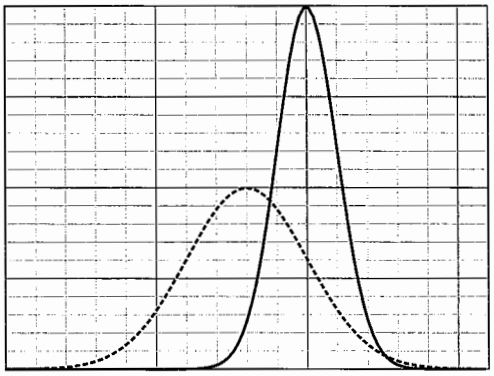
B.



C.



D.



15. Nine unbiased dice, each with faces numbered 1, 2, 3, 4, 5, 6, are rolled.

Which one of the expressions below represents the probability of a 6 appearing on at least one of the dice?

A) $1-\left(\frac{5}{6}\right)^9$

B) $1-\left(\frac{1}{6}\right)^9$

C) $9\times\left(\frac{1}{6}\right)$

D) $\left(\frac{1}{6}\right)^9$

$P(\text{no. 6 on all nine dice})=\left(\frac{5}{6}\right)^9$

$\therefore P(\text{at least one six})=1-$

END OF MULTIPLE CHOICE

HORNSBY GIRLS HIGH SCHOOL

Mathematics Standard 2

Year 12 Higher School Certificate Trial
Assessment 4 Term 3 2025

STUDENT NUMBER: _____

Section I – Multiple Choice Answer Sheet

Allow about 25 minutes for this section

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

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

A ○ B ● C ○ D ○

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

A ● B ✕ C ○ D ○

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

A ✕ B ● (correct) C ○ D ○

1.	A ○	B ●	C ○	D ○
2.	A ○	B ○	C ○	D ●
3.	A ●	B ○	C ○	D ○
4.	A ●	B ○	C ○	D ○
5.	A ○	B ●	C ○	D ○
6.	A ●	B ○	C ○	D ○
7.	A ○	B ●	C ○	D ○
8.	A ○	B ○	C ●	D ○
9.	A ●	B ○	C ○	D ○
10.	A ○	B ●	C ○	D ○
11.	A ●	B ○	C ○	D ○
12.	A ○	B ○	C ○	D ●
13.	A ○	B ○	C ●	D ○
14.	A ○	B ○	C ○	D ●
15.	A ●	B ○	C ○	D ○

Section II

85 Marks
Attempt Questions 16-41
Write answers in the spaces provided
Allow about 2 hours and 5 minutes for this section

Question 16 (2 marks)

After school, Sasha likes to make a snack by mixing raisins and nuts in the ratio of 3: 5. When she checked the cupboard today, there were only 60 g of raisins and 75 g of nuts left. Determine the maximum weight of the snack Sasha can make while still maintaining the ratio 3: 5? **2**

60g ÷ 3 = 20g Raisins = 1 part
20g x 5 = 100g nut
∴ Not enough nuts
75g ÷ 5 = 15g nuts = 1 part
15x3 = 45g Raisins
∴ Enough for both
∴ Maximum weight = 75g + 45g = 120g.

Question 17 (2 marks)

Peter has calculated that, on average, his car consumes 1.5 litres of petrol for every 12.6 km of travel. **2**

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

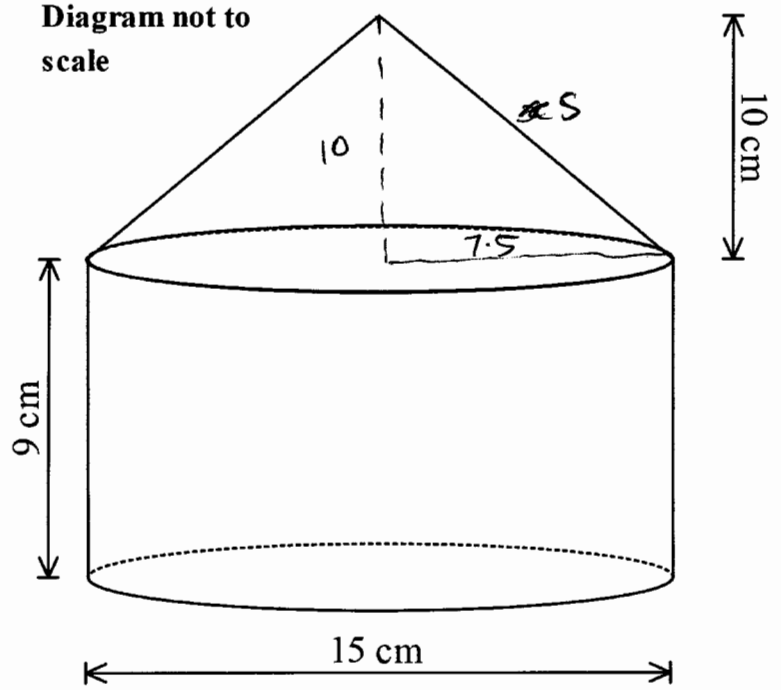
How many litres of petrol did Peter's car consume on the trip?

Answer correct to one decimal place.

Distance travelled = 4.5x75 = 337.5km
Total fuel used = 337.5 ÷ 12.6 x 1.5
= 40.2L (1 decimal place).

Question 18 (3 marks)

A cake is created using a cylinder and a cone shaped top. The cylinder has diameter 15 cm and height of 9 cm and the cone has a height of 10 cm. **3**



Calculate the surface area of the cake that is to be covered in icing, correct to the nearest cm^2.

Slant height $= \sqrt{10^2 + 7.5^2}$

$= 12.5\text{cm} \quad (s > 0)$

$\therefore$ total surface area $= 2\pi rh + \pi rs$

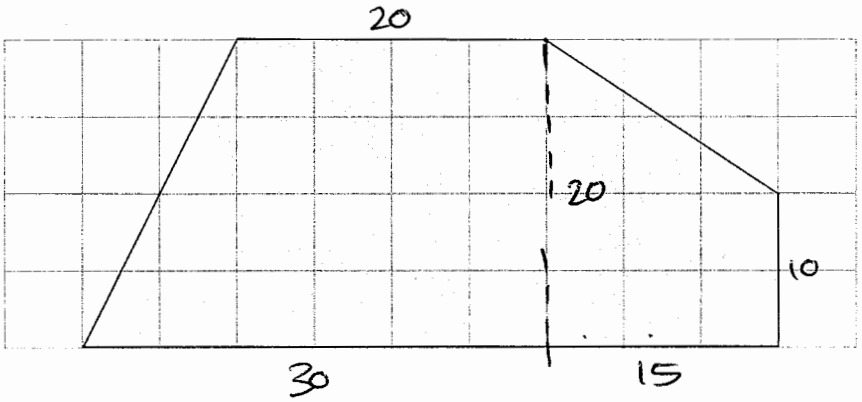
$= 2 \times \pi \times 7.5 \times 9 + \pi \times 7.5 \times 12.5$

$= 718.6393195$

$= 719\text{cm}^3$ (nearest cm).

Question 19 (3 marks)

The scale diagram shows a garden bed, which is to be covered with mulch to a depth of 30 centimetres. Each square on the grid has a side length of 5 metres. **3**



Find the volume of mulch that will be needed to cover the garden bed, in cubic metres correct to 1 decimal place

$A = \frac{1}{2} \times 20(20+30) + \frac{1}{2} \times 15(10+20)$

$= 500 + 225$

$= 725 m^2$

$\therefore$ Volume $= 725 \times 0.3$

$= 217.5 m^3$

Question 20 (2 marks)

Jordan is saving up for a model of car which currently has a purchase price of $34 000. In two years' time he will have saved $20 000, and will take out a loan for the balance of the purchase price. **2**

Due to inflation, the purchase price of that model of car is expected to increase by 4% each year.

How much money will he need to borrow in two years' time to buy the car?

Cost $= 34000(1.04)^2$

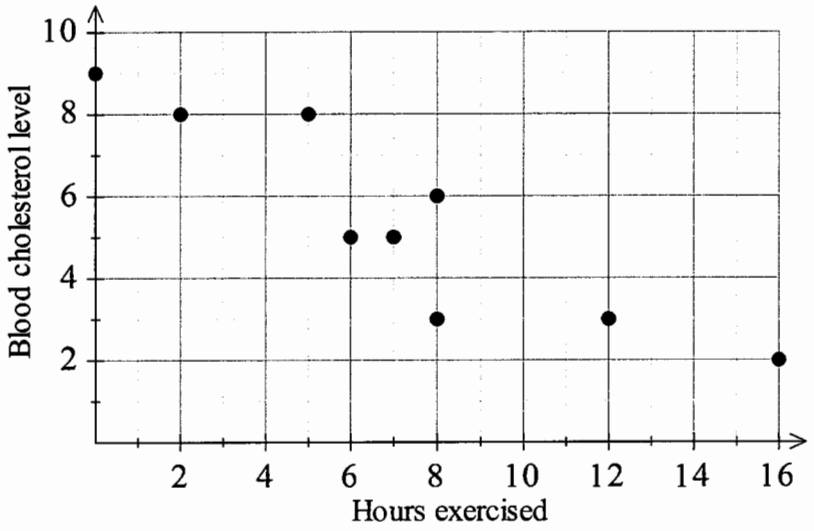
$= \$36774.40$

Needs to borrow $= 36774.40 - 20000$

$= \$16774.40$

Question 21 (4 marks)

A set of bivariate data is collected by measuring the blood choloestrol level and hours exercised of nine adults. The graph shows a scatterplot of the results.



(a) Calculate the Pearson's correlation coefficient for the data, correct to two decimal places. **1**

$r = -0.90259416$

$= -0.90$

(b) Identify the direction and the strength of the linear association between blood cholesterol level and hours exercised. **1**

Strong negative association

(c) The equation of the least-squares regression line is shown. **2**

$$\textit{Blood Cholesterol Level} = -0.4679(\textit{Hours exercised}) + 8.7717$$

An adult's blood cholesterol level is at 4.

Calculate the amount of hours exercised for this adult using the equation of the least squares regression line. Correct to the nearest 2 decimal places.

$4 = -0.4679(h) + 8.7717$

$-4.7717 = -0.4679h$

$\therefore h = \frac{-4.7717}{-0.4679}$

$= 10.19814926$

$= 10.20$ (2 decimal places)

Question 22 (2 marks)

The table shows the income tax rates for the 2025-2026 financial year. **2**

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

For the 2025-2026 financial year, Amani has a taxable income of $126 250.

During the year she paid $1130 per fortnight in Pay As You Go (PAYG) tax.

Calculate Amani's tax refund, ignoring the Medicare levy.

Tax payable $= 4288 + 0{\cdot}3(126250 - 45000)$

$= \$28663$

$\therefore$ Tax refund $= 26 \times 1130 - 28663$

$= \$717$

Question 23 (2 marks)

Find the value of x if: **2**

$$3(3x-5)-4x=10$$

$9x - 15 - 4x = 10$

$5x - 15 = 10$

$5x = 25$

$x = 5$

Question 24 (3 marks)

Hayley owns 1 600 shares in Logistics Ltd which are currently valued at $4.23 each.

Today Logistics issued a dividend of $0.81 per share.

(a) What is the current value of her shares? **1**

current value = 1600×4.23

$= \$6768$

(b) Hayley paid $6 240 in total for the shares a year ago. **1**

What is the percentage profit she would make today based on the purchase price?

$6768 - 6240 = \$528$

$\therefore$ % profit $= \frac{528}{6240} \times 100$

$= 8.46\%$ (2 d.p.)

(c) What is the dividend yield of these shares? **1**

$\text{Yield} = \frac{0.81}{4.23} \times 100$

$= 19.15\%$

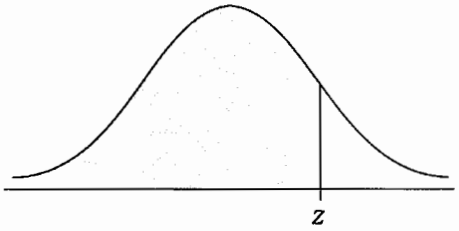
Question 25 (2 marks)

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 from some positive values of z.

z	2.20	2.21	2.22	2.23	2.24	2.25	2.26	2.27	2.28	2.29
Probability	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890

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



A pizza restaurant delivers pizzas to their customers' homes. The restaurant finds that the time taken from when the customer makes the order online until the pizza arrives at their home is normally distributed with a mean of 30 minutes and a standard deviation of 8 minutes.

What percentage of customers must wait for more than 48 minutes for their pizza to arrive? **2**

Answer as a percentage correct to one decimal place.

$48 \text{ min} = 30 + 18$

$= \bar{x} + \frac{18}{8}s$

$= \bar{x} + 2.25s$

$z_{48} = \frac{48-30}{8}$

$= 2.25$

$P(z > 2.25) = 1 - P(z < 2.25)$

$= 1 - 0.9878$

$= 0.0122$

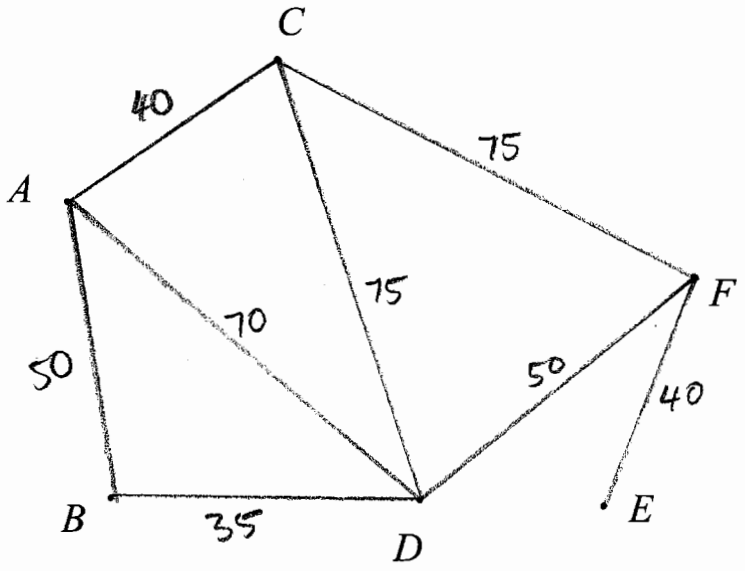
$= 1.22\%$

Question 26 (4 marks)

The table below represents a weighted network.

	A	B	C	D	E	F
A		50	40	70		
B	50			35		
C	40			75		75
D	70	35	75			50
E						40
F			75	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. **2**

Shortest path = A - C - F - E

which has a length = 40 + 75 + 40

= 155

Question 27 (4 marks)

A piece of wire 20 cm long is bent into a rectangle.

Let one side of the rectangle be x cm long.

(a) Show that the area, A, can be expressed by $A = 10x - x^2$ **2**

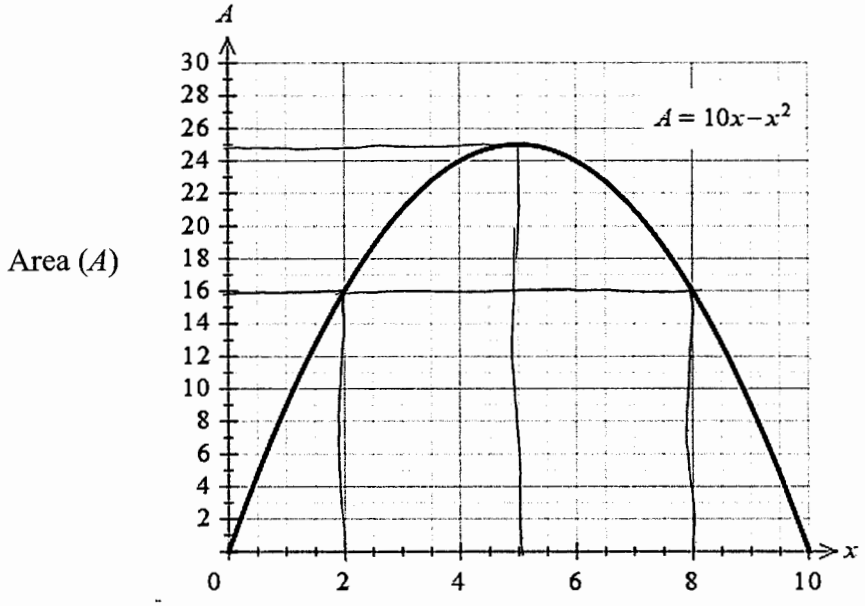
$P = 2l + 2w$ → $A = xy$

$20 = 2x + 2y$ $A = x(10-x)$

$10 = x + y$ $A = 10x - x^2$

$y = 10 - x$

(b) The graph of A is shown below. **1**



Using the graph, or otherwise, what are the value(s) of x when the area is 16 cm^2?

When $x = 2$ and $x = 8$

(c) Using the graph, or otherwise, what are the dimensions of the rectangle when the area is at its maximum. **1**

$x = 5$ $A = xy$

$A = 10x - x^2$ $25 = 5y$

$= 10(5) - 5^2$ $\therefore y = 5$

$= 50 - 25 = 25$ $\therefore$ width = 5cm, length = 5cm.

Question 28 (4 marks)

Two families are purchasing tickets for a theme park online.

The first family purchased 2 adult and 3 student tickets for a total of \$190.

If one adult ticket costs $\$x$ and one student ticket costs $\$y$. Then the following equation can be formed for the first family:

$$2x+3y=190$$

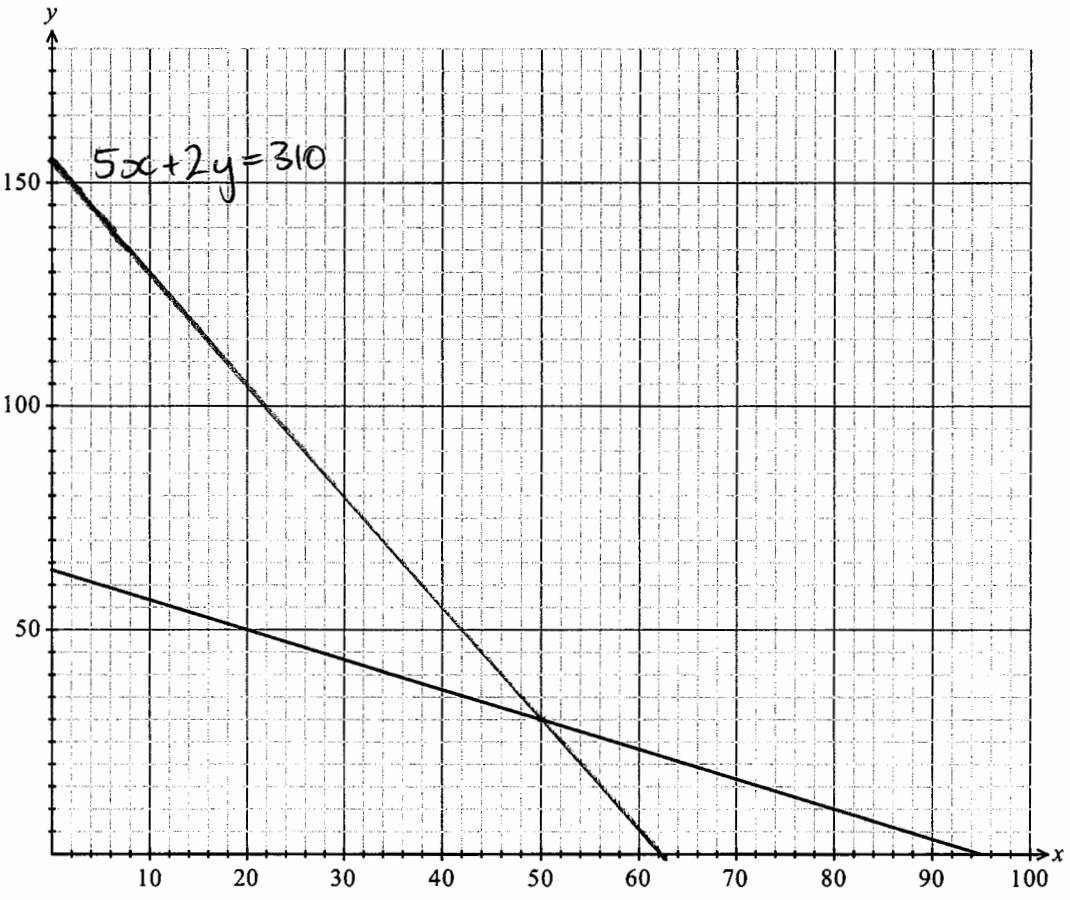
The second family purchased 5 adult and 2 student tickets for a total of \$310

(a) What is the equation formed for the second family? **1**

$5x+2y=310$

(b) The graph for the first family is sketched on the grid below. **1**

Using your equation from (a), graph the equation of the second family on the same grid.



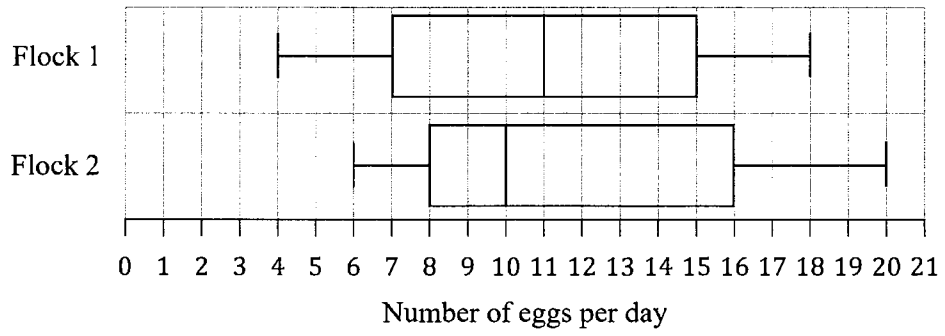
(c) What is the cost of one adult and one child ticket? **2**

Cost of one adult ticket = \$50

Cost of one student ticket = \$30

Question 29 (3 marks)

A farmer has two flocks of chickens. The number of eggs they laid each day during the year was counted, with the data shown in a parallel box-plot. **3**



Compare the two datasets by examining the skewness of the distributions, and the measures of central tendency and spread.

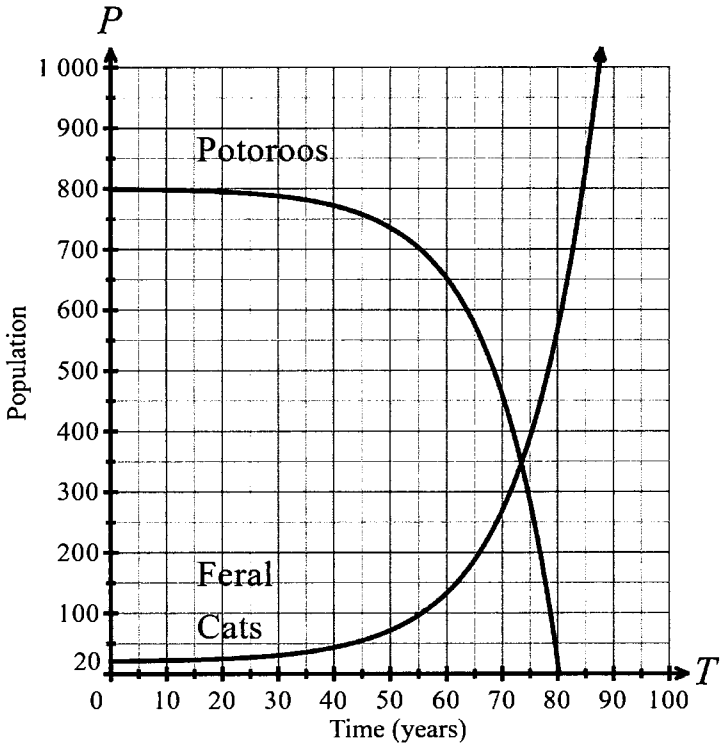
Flock 2 is positively skewed while flock 1 is more symmetrical. The median of flock 1 is higher than flock 2 although the range of each flock is equal.

Question 30 (4 marks)

A conservation area has a fenced section which has been used to release 800 Potoroos. The area also has an estimated 20 feral cats.

An environmentalist models the populations of both groups over the next 100 years if the cats were not removed.

The graph shows the results of the model.



Note: The cats kill and eat other creatures as well as Potoroos, so their population can still rise, even when the number of Potoroos decreases.

(a) After how many years are the two populations equal in size (nearest 5 years)? **1**

approximately 75 years

(b) In the year when there are 100 feral cats, how many Potoroos remain? **1**

100 Potoroos remain

(c) Compare the populations in (b) to those 10 years later and describe the way that the two populations change from 70 years onwards. **2**

10 years later cats population has grown to 200 while Potoroos have declined to about 575. Based on the population of cats, it's expected that Potoroos will be extinct after 80 years.

~ 21 ~

Question 31 (4 marks)

Natalie and Donovan each inherit \$100 000 and open separate bank accounts each earning 7.2% per annum, compounding monthly.

Natalie decides to withdraw \$500 at the end of each month. The amount in Natalie's bank account immediately after the nth withdrawal can be determined using the recurrence relation:

$$A_n = A_{n-1} \times 1.006 - 500, \text{ where } n = 1, 2, 3, \ldots$$
$$\text{and } A_0 = 100\,000.$$

Donovan decides to leave all his money in the bank to earn as much interest as possible.

At the end of the first three months, just after Natalie's third withdrawal, how much higher is Donovan's bank balance than Natalie's? **4**

$0.072 \div 12 = 0.6\%$

Donovan

$FV = 100000 \times (1.006)^3$

$= \$101810.82$

Natalie

$A_1 = 100000 \times 1.006 - 500$

$= \$100100$

$A_2 = 100100 \times 1.006 - 500$

$= \$100200.60$

$A_3 = 100200.60 \times 1.006 - 500$

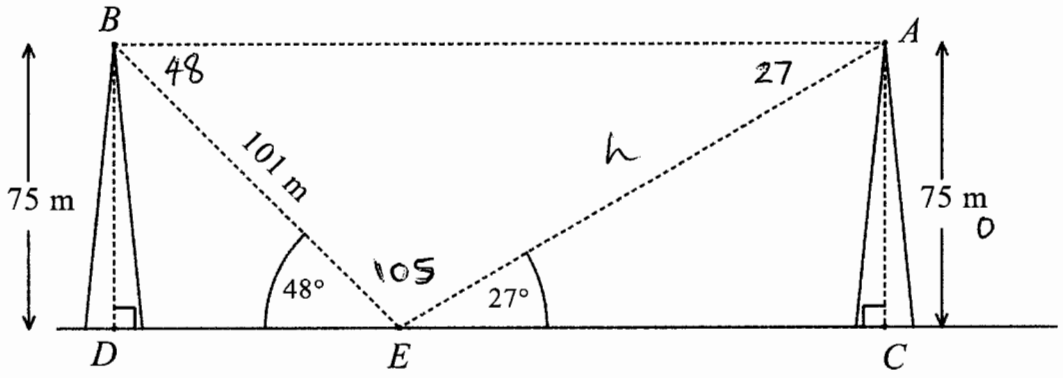
$= \$100301.80$

$\therefore$ Donovan has \$1509.02 more then Natile in his bank account.

Question 32 (3 marks)

Two towers *BD* and *AC* stand on level ground.

Both towers are 75 m tall. From *E*, a point between the towers, Elana has measured the angles of elevation *A* and *B* to be 27° and 48° respectively.



Elana also used trigonometry to calculate the distance *BE* to be 101 m.

The information above is shown on the diagram.

(a) Using trigonometry, calculate the distance *AE,* to the nearest whole metre. **1**

$\sin\theta = \frac{O}{H}$

$\sin 27 = \frac{75}{AE}$

$AE = \frac{75}{\sin 27}$

$= 165.2016948 = 165\text{m}$

(b) Using Sine Rule, calculate the distance *AB*, to one decimal place. **2**

$\frac{a}{\sin A} = \frac{b}{\sin B}$

$\frac{AB}{\sin 105} = \frac{101}{\sin 27}$

$AB = \frac{101 \sin 105}{\sin 27}$

$= 214.89107 92$

$= 214.9$

Question 33 (3 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

(a) Sally's yearly salary is $160 000, and she wants to contribute part of her salary into an annuity account with an interest rate of 7% p. a. compounding annually. **2**

If Sally's goal is to have $500 000 in the annuity account after 18 years, what percentage of her salary shouldshe contribute each year?

Give your answer to two decimal places.

$500000 = PMT \times 33.999$

$PMT = \frac{500000}{33.999}$

$= \$14706.32$

$\%$ of salary $= \frac{14706.32}{160000} \times 100$

$= 9.19\%$

(b) Jacob wants to have $500 000 in his investment account after 18 years. He decides to deposit a single sum of money now, rather than making regular contributions towards an annuity. **1**

The investment account earns interest at a rate of 7% per annum, compounding yearly.

Calculate the amount Jacob needs to invest now to achieve his goal.

$PV = \frac{500000}{(1+0.07)^{18}}$

$= \$147931.96$

Question 34 (4 marks)

Students at Alphabeta Secondary College sit exams in three subjects - Science, English and Mathematics. The table below gives the mean and standard deviation on these tests.

	Mean	Standard Deviation
Science Test	66.5	11.2
English Test	55.8	10.8
Maths Test	45.6	9.6

The results of Amber and Bianca, two students who sat the tests, are given in the table below.

Student	Science Mark	English Mark	Maths Mark
Amber	80	70	55
Bianca	70	78	65

(a) Convert Amber's three marks into z-scores and determine on which test she performed best relative to the other candidates. **2**

$z_{science} = \frac{80-66.5}{11.2} = 1.2054...$

$z_{english} = \frac{70-55.8}{10.8} = 1.3148...$

$z_{maths} = \frac{55-45.6}{9.6} = 0.9792...$

$\therefore$ Ambers English result was her best.

(b) Determine which of the six results scored by the two students was the lowest overall result relative to all the candidates who sat the tests. **2**

Bianca: $z_{science} = \frac{70-66.5}{11.2} = 0.3125...$

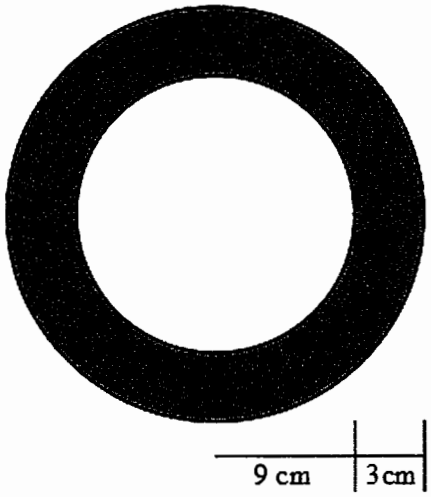
$z_{english} = \frac{78-55.8}{10.8} = 2.0556$

$z_{maths} = \frac{85-45.6}{9.6} = 2.0208...$

$\therefore$ The lowest result overall was Bianca's science result.

Question 35 (3 marks)

The figure below shows a circular dartboard with two circles sharing the same centre with radii of 12 cm and 9 cm respectively. **3**



Two darts are thrown and hit the dartboard.

Is the probability higher if both darts land in the shaded region, or if only one dart lands in the shaded region and the other in the inner white region?

Justify your answer with relevant calculations.

total area $= \pi r^2$ not shaded area $= \pi r^2$

$= \pi \times 12^2$ $= \pi \times 9^2$

$= 144\pi$ $= 81\pi$

Shaded area $= 144\pi - 81\pi$

$= 63\pi$

Probability of two darts $= \frac{63\pi}{144\pi} \times \frac{63\pi}{144\pi} = \frac{7}{16}$

Probability of one dart $= 2\left(\frac{63\pi}{144\pi} \times \frac{81\pi}{144\pi}\right) = \frac{63}{128}$

$\frac{63}{128} > \frac{7}{16}$ thus probability is higher if only one dart lands in shaded region.

Question 36 (5 marks)

The area of a paddock is to be estimated. Due to thick spiky weeds through parts of the paddock, the surveyors are only able to find the following measurements.

NOT TO SCALE

(a) Use three applications of the trapezoidal rule to estimate the area of the paddock, in hectares correct to one decimal place. (1 hectare = 10 000 m^2.) **2**

$A = \frac{83}{2}(122+99) + \frac{152}{2}(99+108) + \frac{116}{2}(108+141)$

$= 39345.5 m^2 \div 10000$

$= 3.9 ha$

(b) The owner hires a crop duster to spread a mixture of herbicide and fertiliser evenly over the paddock to help control the weeds and encourage grass growth. The mixture needs to be applied at a rate of forty-five litres per hectare. **1**

How much mixture is needed for the paddock, in litres correct to one decimal place?

$V = 3.9 \times 45$

$= 175.5 L$

(c) A thunderstorm over the paddock sees the whole paddock receive 8 millimetres of rain. **2**

How much rain fell onto the paddock, correct to the nearest kilolitre?

$8 = 0.008 m$ $V = 39345.5 \times 0.008$

$= 315 kL$

Question 37 (4 marks)

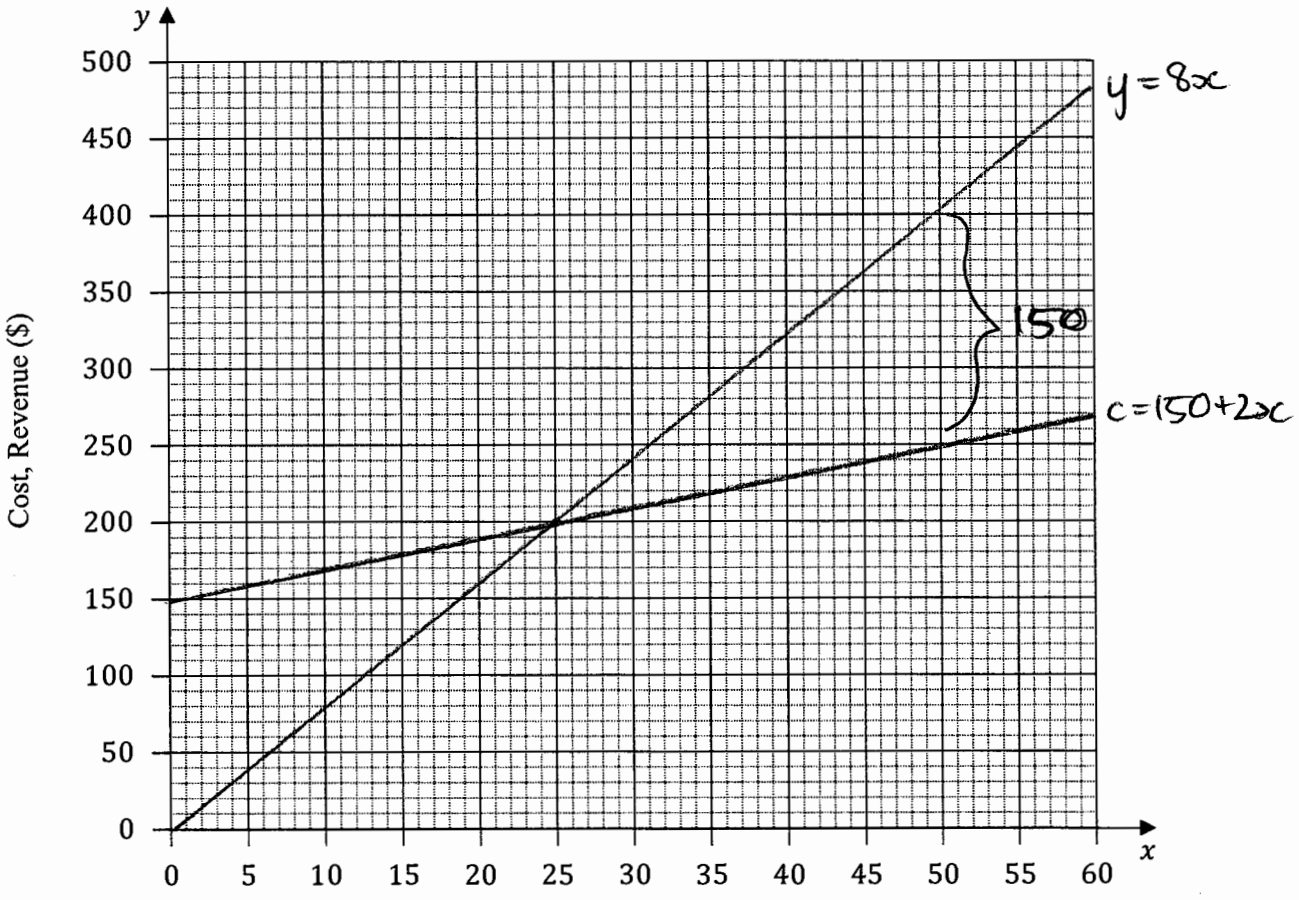
A baker makes and sells x loaves of their sourdough bread each day, for \$8 per loaf, with a revenue function of $y = 8x$.

Each day the baker has fixed expenses of \$150, plus it costs an extra \$2 per loaf in ingredients and electricity.

(a) What is the cost function? **1**

$c = 150 + 2x$

(b) Graph the revenue function and your cost function, from (a), on the grid below. **2**

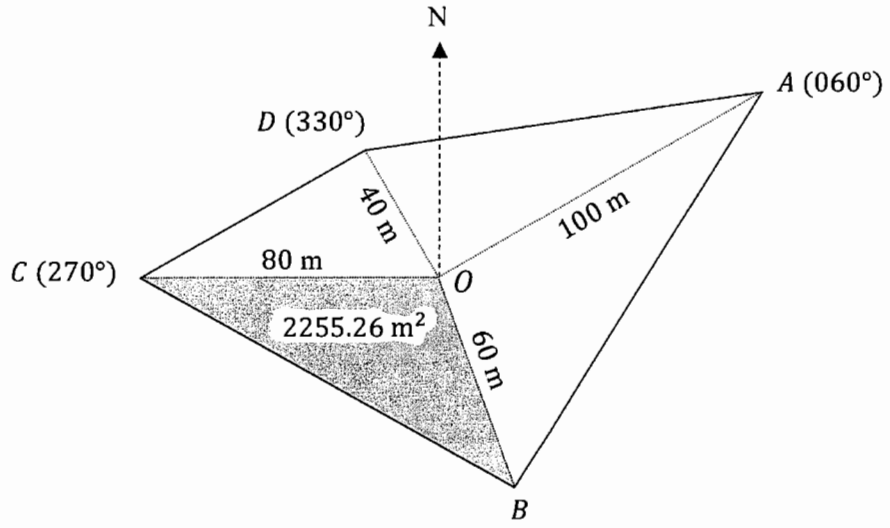


(c) How many loaves of bread does the baker need to bake and sell to make a profit of \$150 for their day's work? **1**

50 loaves.

Question 38 (4 marks)

Part of a compass radial survey shows the position of four corners of a block of land, A, B, C and D, in relation to a point O.



The area of triangle BOC is 2255.26 m^2, and the angle COB is obtuse.

(a) By first using the area of triangle BOC to find the obtuse angle COB, or otherwise, find the bearing of B from O. **3**

$2255.26 = \frac{1}{2} \times 80 \times 60 \times \sin \angle COB$

$2255.26 = 2400 \sin \angle COB$

$\sin \angle COB = 0.939691...$

$\angle COB = 70°$ or $180 - 70 = 110°$

$\therefore \angle COB = 110°$ ($\angle COB$ is obtuse)

∴ Bearing of B from O is $270 - 110 = 160°$

(b) Find the length of BC, correct to the nearest metre. **1**

$BC^2 = 80^2 + 60^2 - 2 \times 80 \times 60 \times \cos 110°$

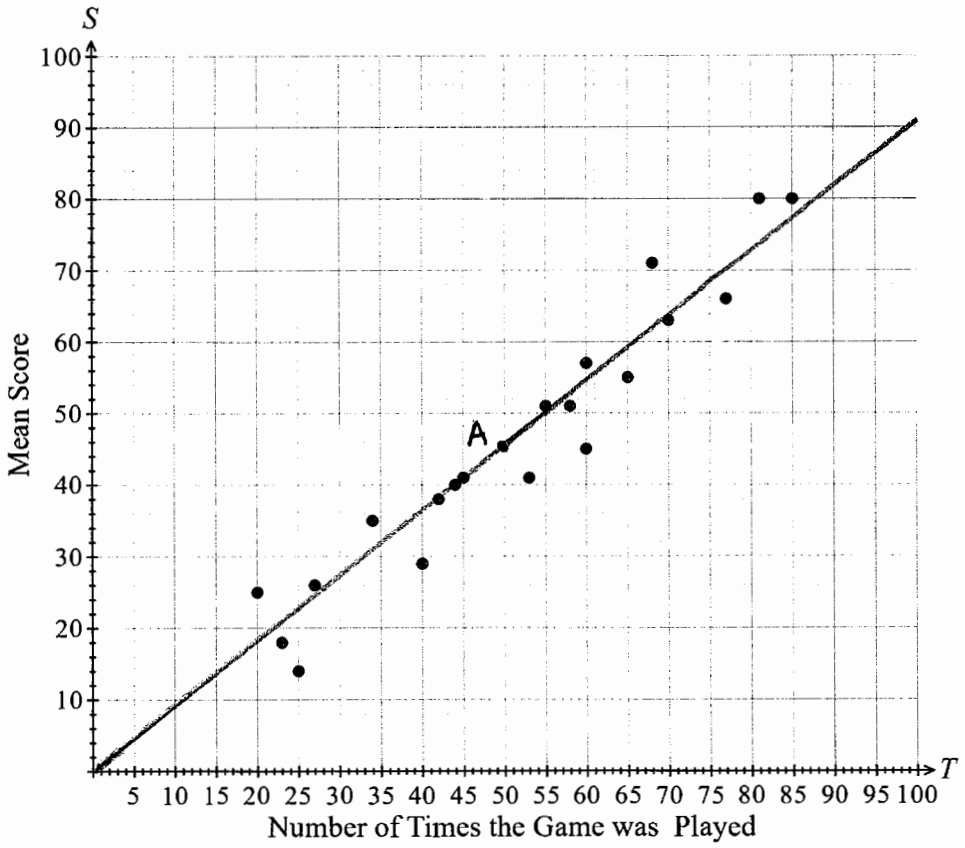
$= 13283.39$

$BC = 115.2536...$

$= 115$ m (nearest m)

Question 39 (3 marks)

The scatterplot below compares the number of times that 20 gamers had played the game *SimuLife* with the mean score they achieved on playing the game.



When the least-squares regression line is found, the two variables are found to be in direct variation and that the line also passes through the point A (50, 45).

(a) Find the equation of the least-squares regression line and draw it on the scatterplot above. **2**

$m = \frac{rise}{run}$

$= \frac{45}{50}$

$= 0.9$

$y = 0.9x$

$\therefore S = 0.9T$

(b) Estimate the average score of a gamer who had played 96 games. **1**

$S = 0.9 \times 96$

$= 86.4$

Question 40 (3 marks)

Roco has a credit card with the following conditions:

- There is no interest-free period
- Interest is charged at the end of each month at 19.99% per annum, compounding daily, from the purchase date (included) to the last day of the month (included).

Roco's credit card statement for March is shown, with some figures missing.

Statement period: 1 March to 31 March

Date	Details	Amount ($)
1 March	Opening balance	0.00
19 March	Car repairs	1200.00
27 March	Trailer hire	110.00
31 March	Interest charged	***
31 March	Closing balance	***

Minimum payment: ***

The minimum payment was calculated as 2.5% of the closing balance on 31 March.

Once Roco makes the minimum monthly payment on April 1, what will his balance be? **3**

→ Repairs accrue interest for 13 days

→ Trailer hire accrues interest for 5 days

Closing balance $= 1200 \times \left(1 + \frac{0.1999}{365}\right)^{13} + 110\left(1 + \frac{0.1999}{365}\right)^{5}$

$= \$1318.87$

Minimum Payment $= 0.025 \times 1318.87$

$= \$32.97$

$\therefore$ Balance $= 1318.87 - 32.97$

$= \$1285.90$

Question 41 (5 marks)

An athlete can find their maximum heart rate using the formula:

Maximum heart rate in beats per minute (bpm) = 220 – age in years.

The table below indicates how different heart rates fit into a training regime for athletes.

Target Zone	Percentage of Maximum Heart Rate	Description and Purpose
5	90% – 100%	Elite – Competition and top-level training
4	80% – 90%	Training – Develop endurance and performance
3	70% – 80%	Fitness – Develop aerobic fitness
2	60% – 70%	Weight Loss – Begin to burn fat
1	50% – 60%	Recovery – Warm up and cool down

While exercising, Michael and Kerrie check their heart rates.

Kerrie, who is 50 years old, counts 92 heart beats in 40 seconds and completes a quick calculation to find her heart rate in bpm.

Michael, who is 18 years old, has a smartwatch which shows that his current heart rate is 150 bpm and tracks it as it changes.

(a) Determine at what percentage of their maximum heart rate each of them is exercising and in which Target Zone they are exercising. **3**

Kerrie's MHR = 220 − 50 = 170 bpm

current = $\frac{92}{40} \times 60 = 138$ bpm

% MHR = $\frac{138}{170} \times 100 = 81.2\%$

∴ Kerrie is in zone 4.

Michael's MHR = 220 − 18 = 202 bpm

current = 150 bpm

% MHR = $\frac{150}{202} \times 100 = 74.3\%$

∴ Michael is in zone 3.

(b) Find the minimum change in his heart rate that Michael must achieve if he wants to exercise in the same Target Zone as Kerrie. **2**

80% of 202 = 162 bpm

∴ Michael needs to increase his heart rate by 12 bpm to achieve zone 4.

END OF EXAMINATION