Diploma Programme
Programme du diplôme
Programa del Diploma

Mathematics: applications and interpretation
Standard level
Paper 2

11 November 2025

Zone A morning | **Zone B** morning | **Zone C** morning

1 hour 30 minutes

Instructions to candidates

- Do not open this examination paper until instructed to do so.
- A graphic display calculator is required for this paper.
- Answer all the questions in the answer booklet provided.
- Unless otherwise stated in the question, all numerical answers should be given exactly or correct to three significant figures.
- A clean copy of the **mathematics: applications and interpretation SL formula booklet** is required for this paper.
- The maximum mark for this examination paper is **[80 marks]**.

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Answer **all** questions in the answer booklet provided. Please start each question on a new page. Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. Solutions found from a graphic display calculator should be supported by suitable working. For example, if graphs are used to find a solution, you should sketch these as part of your answer. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working.

1. [Maximum mark: 15]

A marathon is a race over a distance of $42.19\,\text{km}$.

(a) (i) Write down $42.19\,\text{km}$ correct to the nearest kilometre.

(ii) Find the percentage error if $42.19\,\text{km}$ is rounded to the nearest kilometre. [3]

Rolando and Davi are training to run a marathon. They both start their training in the same week.

Rolando runs $6\,\text{km}$ in the first week, $8\,\text{km}$ in the second week and $10\,\text{km}$ in the third week. In each subsequent week he runs $2\,\text{km}$ further than the previous week.

(b) Find the week during which Rolando runs $42\,\text{km}$. [3]

(c) Find the **total** distance that Rolando runs in the first 10 weeks. [2]

Davi runs $3\,\text{km}$ in the first week. In each subsequent week he runs 20% further than the previous week. These distances form the terms of a geometric sequence.

(d) Find the first week during which Davi runs more than $42\,\text{km}$. [4]

(e) Find the first week that the **total** distance that Davi has run, since the start of training, exceeds $150\,\text{km}$. [3]

2. [Maximum mark: 14]

Aiden works for WoodCraft Wonders, a company that makes wooden letters. He wants to predict the demand for different letters. He thinks that letters earlier in the alphabet are more popular.

Aiden finds that, in the year he was born, his name was the most popular in the United States. From the 10 most popular boys' names, his name was first alphabetically. This data is shown in the following table.

Name	**Popularity**	**Position in the alphabet**
Aiden	1	1
Ethan	2	3
Jacob	3	6
Jayden	4	7
Caden	5	2
Noah	6	9
Jackson	7	5
Jack	8	4
Logan	9	8
Ryan	10	10

Aiden calculates the Spearman's rank correlation coefficient, r_s, for this data.

(a) Find r_s, and use the following table to interpret its value. [4]

$\lvert r_s \rvert$	**Strength**
0.000 to 0.199	Very weak
0.200 to 0.399	Weak
0.400 to 0.599	Moderate
0.600 to 0.799	Strong
0.800 to 1.000	Very strong

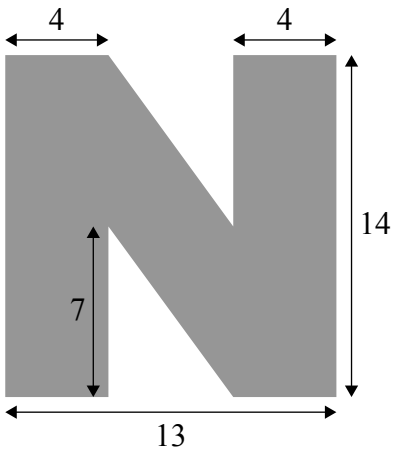
(This question continues on the following page)

(Question 2 continued)

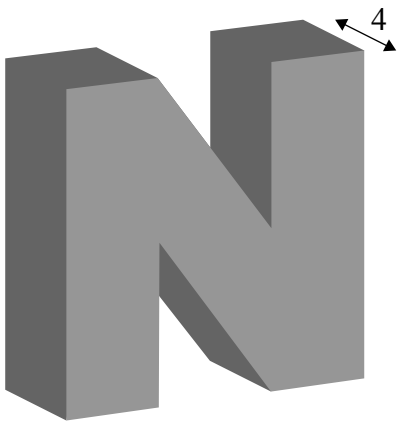
WoodCraft Wonders makes the letter N from a wooden rectangular prism with a depth of $4\,\text{cm}$. The front surface is a rectangle with a base length of $13\,\text{cm}$ and a height of $14\,\text{cm}$. Two identical right-angled triangular prisms are then cut out of the rectangular prism to make the letter N, as shown in the diagram.

diagrams not to scale

Front surface of letter N



Finished letter N



(b) Find the **area** of the front surface of the letter N. [3]

(c) Calculate the **volume** of the finished letter N. [1]

WoodCraft Wonders has two machines that make the wooden letters: Machine A and Machine B. Aiden wants to test if the machines are producing letters of different weights. A sample of wooden letters in the shape of an N are taken from both machines and weighed.

Machine A sample (grams)						
355	342	361	343	328	376	364

Machine B sample (grams)						
338	343	332	358	349	332	324

Aiden assumes the samples came from normally distributed populations with equal variances, and he performs a t-test at the 5% significance level.

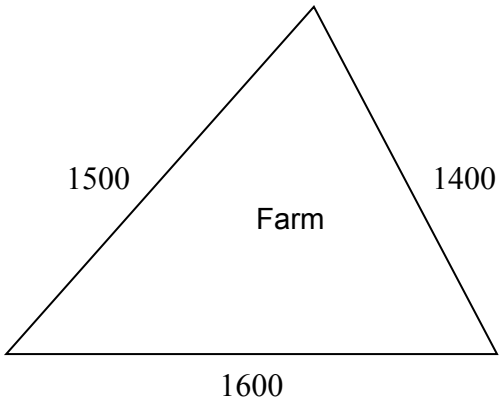
(d) (i) Write down the null hypothesis and the alternative hypothesis.

(ii) Find the p-value for this test.

(iii) Write down the conclusion of the test. Give a reason for your answer. [6]

3. [Maximum mark: 15]

Inola has a triangular-shaped farm with boundaries of length $1600\,\text{m}$, $1500\,\text{m}$ and $1400\,\text{m}$.



(a) Find the area of the farm. Give your answer in the form $a \times 10^k$, where $1 \leq a < 10$ and $k \in \mathbb{Z}$. [6]

Inola's farm has a barn and a farmhouse.

Inola is constructing a $2\,\text{m}$-wide straight path on the level ground between the barn and the farmhouse. The barn is located $300\,\text{m}$ east and $200\,\text{m}$ north of the farmhouse.

(b) Find the distance from the barn to the farmhouse. [2]

The path costs $\$120$ per square metre.

(c) Find the cost, c, of the path, to the nearest dollar. [2]

Inola takes out a loan to pay for supplies to make the path. Inola borrows c dollars for five years, compounded monthly. To repay the loan, she makes a payment of $\$1750$ at the end of each month.

(d) (i) Find the total amount of interest paid.

(ii) Find the nominal annual interest rate of the loan. [5]

4. [Maximum mark: 18]

A particular island is only accessible by road at times when the water level is low enough. Otherwise, the road is underwater.

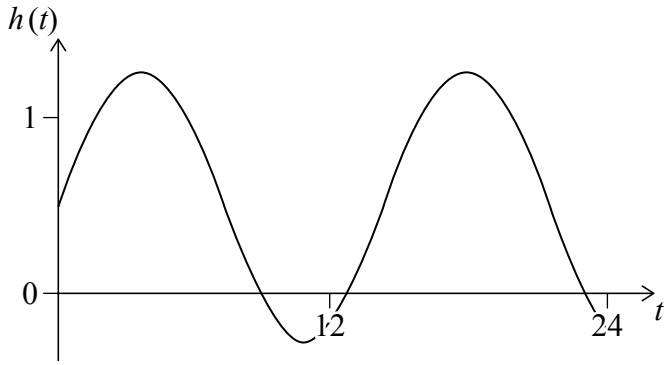
The height of the water above the road, h metres, can be modelled by

$$h(t) = a\sin(bt) + d,$$

where t is time measured in **hours** from $00{:}00$ (midnight) on Tuesday.

The first maximum (high tide) is at $03{:}36$ with a height of $1.26\,\text{m}$, and the first minimum (low tide) occurs at $10{:}48$ with a height of $-0.26\,\text{m}$.

This is shown in the graph.



(a) Find the value of a, given that $a > 0$. [2]

(b) Find the value of d. [2]

(c) Find the period of the function in hours. [3]

(d) Find the equation of the model. [3]

(e) Find the value of $h(t)$ at $02{:}30$. [2]

(f) State the meaning of $h(t) < 0$ in context. [1]

(g) Find the length of time on Tuesday when $h(t) < 0$. [5]

5. [Maximum mark: 18]

Zheng models the height of a section of a rollercoaster.

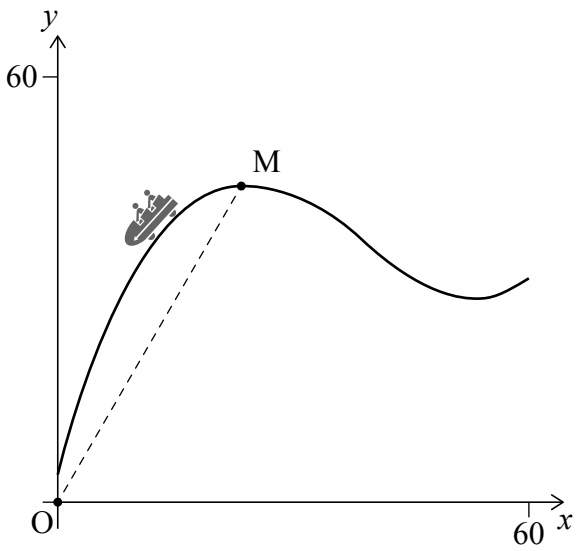
She uses the function

$$f(x) = 0.001x^3 - 0.12x^2 + 4.05x + 3, \text{ for } 0 \le x \le 60,$$

where x is the horizontal distance from the left-hand end of the section and $f(x)$ is the vertical height. Distances are measured in metres.

Zheng's model is shown on the following graph of $y = f(x)$.

diagram not to scale



Point O has coordinates $(0, 0)$.

(a) (i) Write down the definite integral for the exact area between the curve and the x-axis.

(ii) Calculate this area. [4]

A light beam from O passes through the local maximum at point M.

(b) (i) Find the coordinates of M.

(ii) Find the angle of elevation from O to M. [4]

(This question continues on the following page)

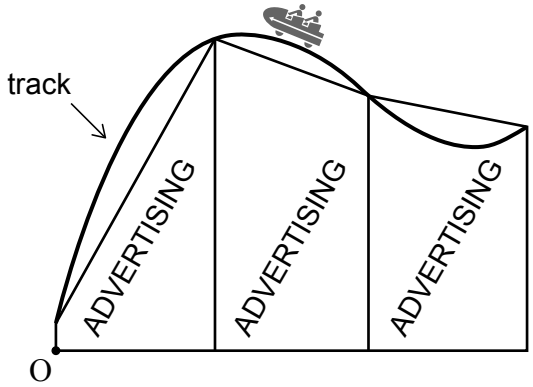
(Question 5 continued)

Zheng wants to place advertising boards in front of this section of the rollercoaster.
At four positions along the rollercoaster track, she records the horizontal distance from O and the vertical height of the track.

Her values are shown in the table and represented on the graph.

x **(horizontal distance)**	0	20	40	60
y **(vertical distance)**	3	44	37	30

diagram not to scale



(c) Find the total area of the advertising boards. [3]

The cost of space on the advertising boards per square metre varies according to the amount purchased.

The **rate of change** in the cost, in dollars ($\$$), for space on the advertising boards can be modelled by the function

$$C'(a) = -0.00292a + 4.71, \text{ for } a > 60,$$

where a is the total square metres purchased.

A company, E-Byte, wishes to advertise its new gaming device. Zheng tells E-Byte it will cost $\$1750$ for $500\,\mathrm{m}^2$ of space on the advertising boards.

(d) Find the cost function $C(a)$. [5]

E-Byte instead wants to purchase the entire space of all three boards.

(e) Using the cost function from part (d), estimate how much this would cost E-Byte. [2]