Diploma Programme
Programme du diplôme
Programa del Diploma

Mathematics: applications and interpretation
Standard level
Paper 2

15 May 2026

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

1 hour 30 minutes

Instructions to students

- 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]**.

2226 – 5219

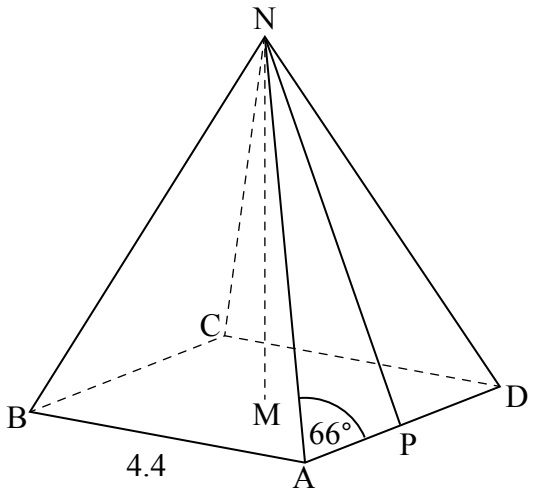
11 pages

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: 14]

A small trophy, in the shape of a solid right-pyramid, $ABCDN$, is made from silver. The base of the pyramid is a square of length $4.4\,\text{cm}$ and angle $N\hat{A}P = 66°$. P is the midpoint of $[AD]$ and $NA = NB = NC = ND$.

diagram not to scale



(a) (i) Write down the length of $[AP]$.

(ii) Find the length of $[NP]$.

(iii) Calculate the area of triangle NDA. [4]

(b) Calculate the total surface area of the pyramid. [2]

N is vertically above M, the centre of the base $ABCD$.

(c) (i) Find the length of $[MN]$.

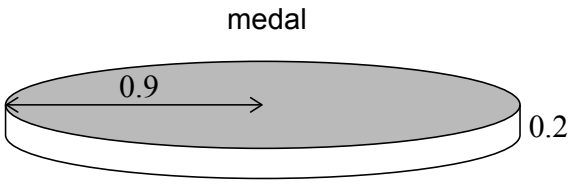
(ii) Hence, calculate the volume of the pyramid. [4]

(This question continues on the following page)

(Question 1 continued)

The silver used to make the pyramid is melted down to make identical medals that are cylindrical in shape. The medals each have a radius of $0.9\,\text{cm}$ and thickness of $0.2\,\text{cm}$.

diagram not to scale



(d) Calculate the maximum number of medals that can be made from the melted silver. [4]

2. [Maximum mark: 15]

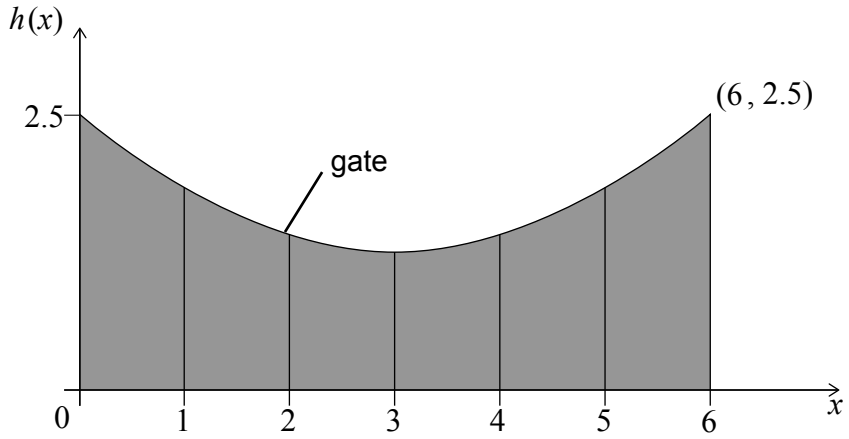
Aisha wants to paint the gate to her house. She only wants to paint the gate on one side.

The gate is $6\,\text{m}$ wide and its height at each side is $2.5\,\text{m}$. The top edge of the gate is in the shape of a parabola and the height, h metres, of the gate is modelled by the equation

$$h(x) = \frac{1}{9}x^2 - \frac{2}{3}x + 2.5, \text{ for } 0 < x < 6,$$

where x is the distance, in metres, from the left side of the gate. This is shown in the following diagram.

diagram not to scale



(a) Find the minimum height of the gate. [2]

$h(x)$ is increasing for $a < x < b$.

(b) Find the value of a and of b. [1]

(This question continues on the following page)

(Question 2 continued)

Aisha uses the trapezoidal rule to find the approximate area of the gate.

She uses $h(x)$ to find the height at $1\,\text{m}$ intervals, and records the results in the following table.

x (m)	0	1	2	3	4	5	6
h (m)	2.5	$\frac{35}{18}$	$\frac{29}{18}$	p	$\frac{29}{18}$	q	2.5

(c) (i) Write down the value of p and of q.

(ii) Calculate the approximate area of the gate using the trapezoidal rule. [5]

Aisha realizes that this approximate area is an overestimate of the area of the gate.

(d) Without calculation, explain why the trapezoidal rule will produce an overestimate in this case. [1]

Aisha then calculates the exact area, A, of the gate, according to her model, $h(x)$.

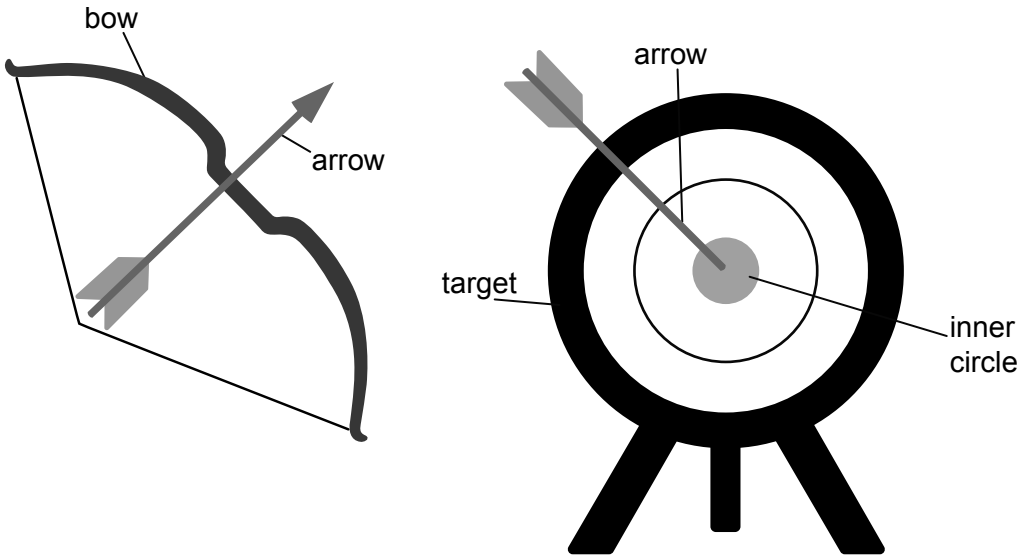
(e) (i) Write down an integral expression for A.

(ii) Calculate the value of A. [4]

(f) Find the absolute percentage error when using the value from part (c)(ii) as an approximation for A. [2]

3. [Maximum mark: 17]

Mores joins an archery club, where he shoots arrows with his bow towards a target.



The probability that he hits the target with his first arrow is 0.34.

If Mores hits the target with his first arrow, the probability that he hits the target with his second arrow is 0.72.

If Mores does **not** hit the target with his first arrow, the probability that he hits the target with his second arrow is 0.68.

(a) Draw and complete a tree diagram to represent all possible outcomes from Mores shooting two arrows. [3]

(b) Find the probability that Mores hits the target **at most once** after shooting two arrows. [3]

(This question continues on the following page)

(Question 3 continued)

Dipali is an expert archer. The probability that his arrow hits the inner circle of the target on any shot is 0.94. The arrow hitting the inner circle on one shot is independent of the arrow hitting the inner circle on any other shot.

Dipali takes 10 shots at the target.

(c) Find the probability that he hits the inner circle exactly 9 times. [2]

(d) Find the probability that he hits the inner circle at least 7 times. [2]

Every year, the archery club holds a competition for new members. Each competitor is allowed to shoot one arrow at the target.

From the club's historical data, it is known that the distances of all arrows from the centre of the target can be modelled by a normal distribution with a mean of $26\,\text{cm}$ and standard deviation of $7\,\text{cm}$.

The target has a radius of $50\,\text{cm}$, and the inner circle has a radius of $10\,\text{cm}$.

A competitor is chosen at random.

(e) Find the probability that this competitor hits the inner circle. [2]

(f) Find the probability that this competitor does **not** hit the target. Give your answer in the form $a \times 10^k$, where $1 \leq a < 10$, $k \in \mathbb{Z}$. [3]

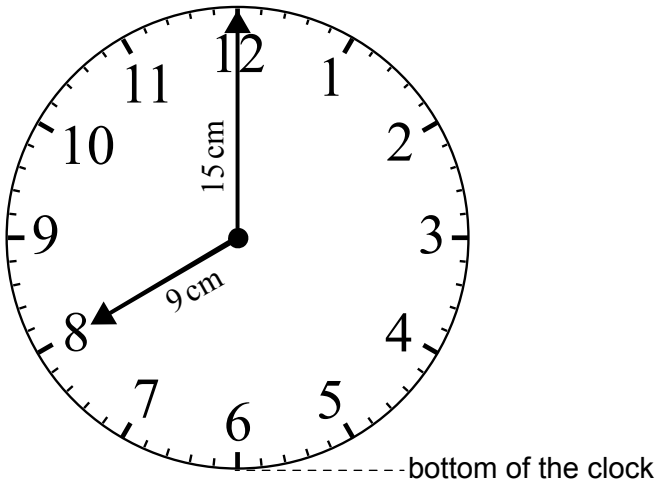
The probability that an arrow hits the target less than $p\,\text{cm}$ from its centre is 0.475.

(g) Find the value for p. [2]

4. [Maximum mark: 14]

The circular face of a wall clock has a diameter of $30\,\text{cm}$. The minute hand of the clock is $15\,\text{cm}$ long and the hour hand is $9\,\text{cm}$ long. The clock is initially set to $8{:}00$. This is shown in the following diagram.

diagram not to scale



(a) Calculate the distance between the endpoints of the two hands of the clock at $8{:}00$. [4]

Both hands of the clock rotate at a constant rate as time passes, to indicate the time at a particular moment. The minute hand makes 1 rotation in 1 hour, while the hour hand makes 1 rotation in 12 hours.

As the minute hand moves, the height of its endpoint, $h(t)$, above the bottom of the clock, can be modelled as the cosine function

$$h(t) = a\cos\left((bt)^\circ\right) + d \text{ where } a,\ b,\ d > 0,$$

where t is the time after $8{:}00$, measured in minutes, and bt is measured in degrees.

(b) Find the value of

(i) a.

(ii) b.

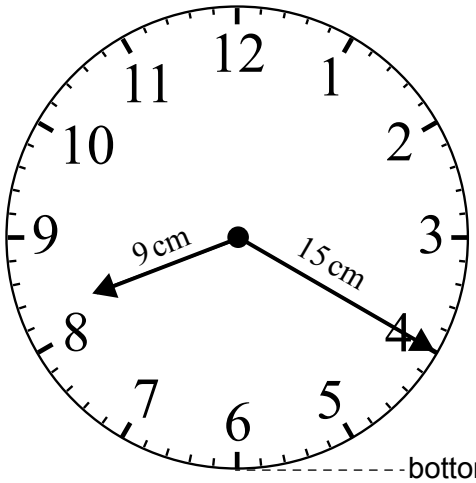
(iii) d. [4]

(This question continues on the following page)

(Question 4 continued)

Later, the clock shows the time $8{:}20$.

diagram not to scale



(c) Use the model, or otherwise, to calculate the height of the endpoint of the minute hand above the bottom of the clock at $8{:}20$. [2]

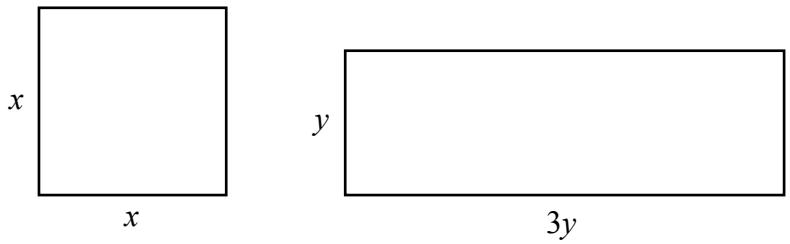
(d) Explain why the distance between the endpoints of the two hands of the clock is greater at $8{:}20$ than at $8{:}00$. [1]

(e) Calculate the difference in height between the endpoints of the two hands of the clock at $8{:}20$. [3]

5. [Maximum mark: 20]

Lisa makes two serving trays from wood. The first tray is a square with each side measuring $x\,\text{cm}$. The second tray is a rectangle, $y\,\text{cm}$ by $3y\,\text{cm}$. The lengths and widths of the trays are integers.

diagram not to scale



Lisa has a plastic strip of length 200 cm. The width of the strip is negligible. After being cut into two pieces, the plastic strip will fit exactly around the perimeters of **both** trays.

(a) Show that the combined area, $A\,\text{cm}^2$, of the two trays can be written as

$$A = 1.75x^2 - 75x + 1875\,.$$ [4]

(b) Given that the combined area of the two trays is $1075\,\text{cm}^2$, find the dimensions of each of the two trays. [4]

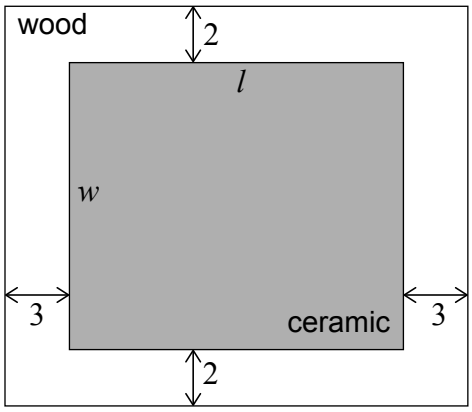
(This question continues on the following page)

(Question 5 continued)

Lisa makes another rectangular tray, using wood and ceramic. The shaded part is made of ceramic and is in the shape of a rectangle, $l\,\text{cm}$ by $w\,\text{cm}$. The part of the tray around the ceramic is made of wood, of $2\,\text{cm}$ width along the sides of length $l\,\text{cm}$ and $3\,\text{cm}$ width along the sides of length $w\,\text{cm}$.

This is shown in the following diagram.

diagram not to scale



(c) The ceramic part of the tray has an area of $150\,\text{cm}^2$.
Write down an **equation**, in terms of l and w, that represents this information. [1]

Lisa wants to minimize the perimeter of the tray.

(d) Find an expression for the perimeter, P, of the entire tray in terms of w only. [4]

(e) (i) Find $\dfrac{\mathrm{d}P}{\mathrm{d}w}$.

(ii) Hence, or otherwise, find the value of w that minimizes P. [5]

(f) Write down the value of l that minimizes P. [1]

(g) Hence, find the dimensions of this tray. [1]