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]**.

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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: 14]

Give your answers to parts (a), (b) and (d) correct to two decimal places.

Suriyana invests GBP $14\,500$ into an account that pays a nominal annual interest rate of $2.3\,\%$, compounded monthly.

(a) Calculate the amount Suriyana will have in her account after three years. [3]

After the initial three years of investment, Suriyana starts making additional monthly payments of GBP 250 into the same account at the end of each month.

(b) Calculate the amount Suriyana will have in her account after two years of making additional monthly payments. [3]

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(Question 1 continued)

After these two years of making additional monthly payments, Suriyana decides to buy a used car. She notices that the costs of the used cars at a particular dealership form an arithmetic sequence. The following table shows the age of a car n and its cost u_n.

Age of car n (years)	**Cost of used car u_n (GBP)**
1	28 492
2	26 616
3	24 740
...	...

(c) (i) Find the formula for the n^{th} term of the sequence in the form $u_n = a + bn$, where $a, b \in \mathbb{Z}$.

$u_n = u_1 + n-1(d)$

(ii) Hence find the cost of a car that is 7 years old.

(iii) Comment on the limitations of the formula found in part (c)(i). [5]

Suriyana buys a used car of the least age possible using only the money from her account.

(d) Find the amount of money Suriyana has remaining in her account after purchasing the car. [3]

2. [Maximum mark: 18]

For her study on fitness levels, Mysha randomly selects a group of participants from her local community. She asks each participant to classify their lifestyle as "active" or "non-active". She then measures the heart rate of each participant after they have run for 10 minutes on a treadmill at a set speed.

The data Mysha collected is shown in the following table.

	Heart rate (beats per minute)							
Active lifestyle	121	115	130	128	110	112	135	127
Non-active lifestyle	133	142	121	140	138	118	124	135

(a) Find the mean and standard deviation for

(i) the active lifestyle participants.

(ii) the non-active lifestyle participants. [4]

(b) Using your values from part (a), compare and contrast the two groups of participants. [2]

Mysha believes that the mean heart rate of active lifestyle participants, μ_A, will be lower than the mean heart rate of non-active lifestyle participants, μ_N. She assumes that the heart rates are normally distributed and performs a one-tailed t-test at the 5% level of significance.

(c) State

(i) the null hypothesis.

(ii) the alternative hypothesis. [2]

(d) Find the p-value for this test. [2]

(e) State the conclusion for this test in context. Justify your answer. [2]

(This question continues on the following page)

(Question 2 continued)

Mysha conducts further analysis on the active lifestyle participants. She asks them to run for 10 minutes on a treadmill at a set speed to determine if there is a relationship between age, x, in years, and heart rate, y, in beats per minute. The data is shown in the following table.

Age (x years)	28	21	25	29	19	18	31	33
Heart rate (y beats per minute)	121	115	130	128	110	112	135	127

Mysha uses linear regression to obtain a model for the data.

(f) (i) Find the equation of the regression line of y on x.

(ii) Find the value of r, the Pearson's product-moment correlation coefficient. [3]

Mysha classifies herself as an active 45-year-old.

(g) (i) Use your regression line to calculate a prediction for Mysha's heart rate after running for 10 minutes on the treadmill at the same set speed.

(ii) State a mathematical reason why this may not be an accurate prediction for Mysha's heart rate. [3]

3. [Maximum mark: 12]

The human body temperature changes during the day, and these changes can be approximately modelled by a sine function.

Tom takes his temperature three times during a day and records the results in the table below.

Time	08:00	13:00	18:00
Body temperature (°C)	36.2	36.6	36.9

Tom decides to model his body temperature, T °C, using an equation of the form $T = a\sin(bt) + c$, where t is the time in hours after $00{:}00$ (midnight).

(a) Given that body temperature, T, has a period of 24 hours, find the value of b. [2]

(b) (i) Use the value of T at $18{:}00$ to show that $36.9 = -a + c$.

(ii) Use the value of T at $13{:}00$ to find a second equation for a and c.

(iii) Hence find the value for a and the value for c. [6]

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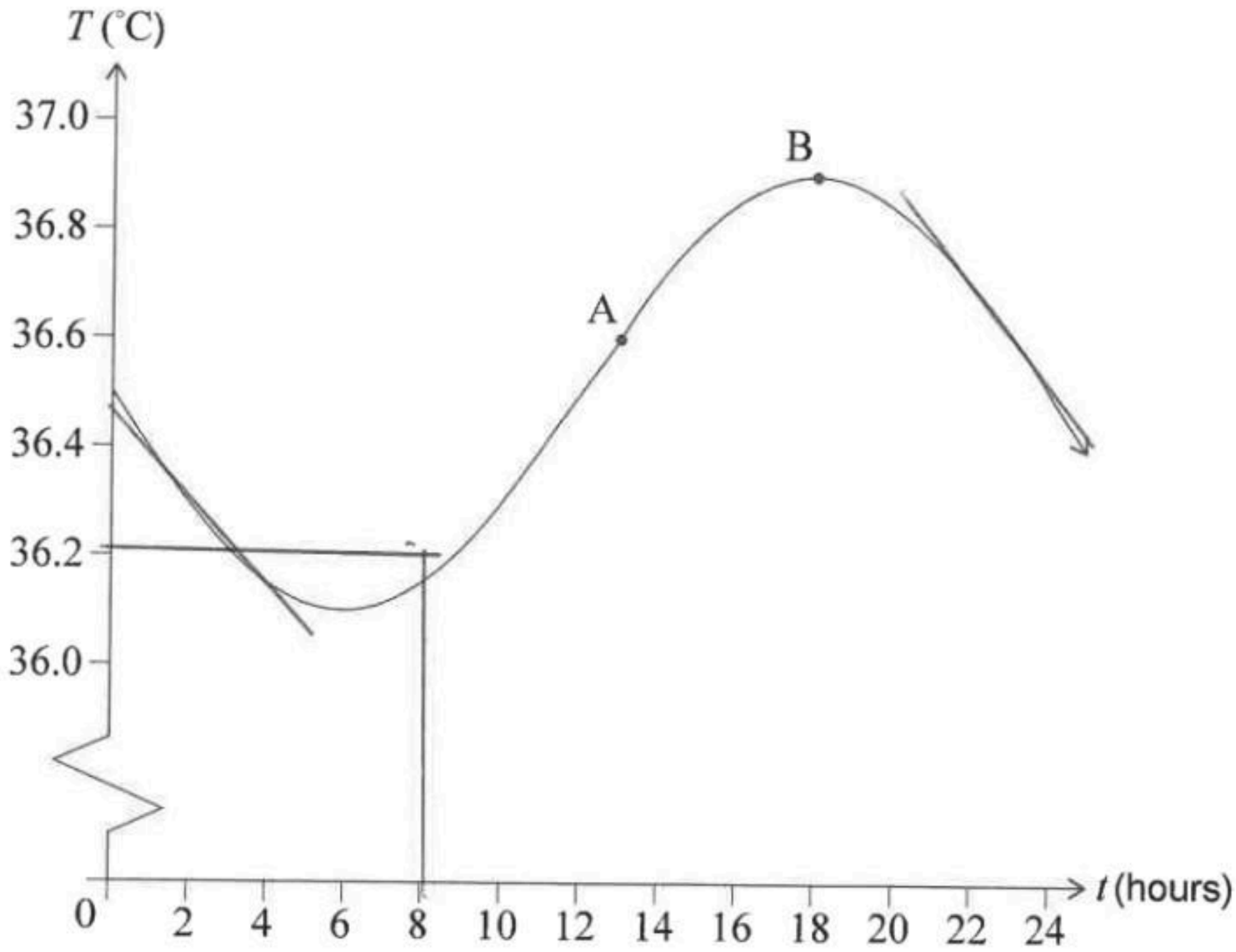
(Question 3 continued)

A graph of Tom's model with the points $A(13, 36.6)$ and $B(18, 36.9)$ is shown in the following diagram.



(c) Determine whether the point $(8, 36.2)$ will be above or below the curve. Justify your answer. [2]

Research indicates that sleep is more likely to occur when the body temperature is decreasing.

(d) Using Tom's model, state the interval(s) during a 24-hour cycle when sleep is more likely to occur, according to this research. [2]

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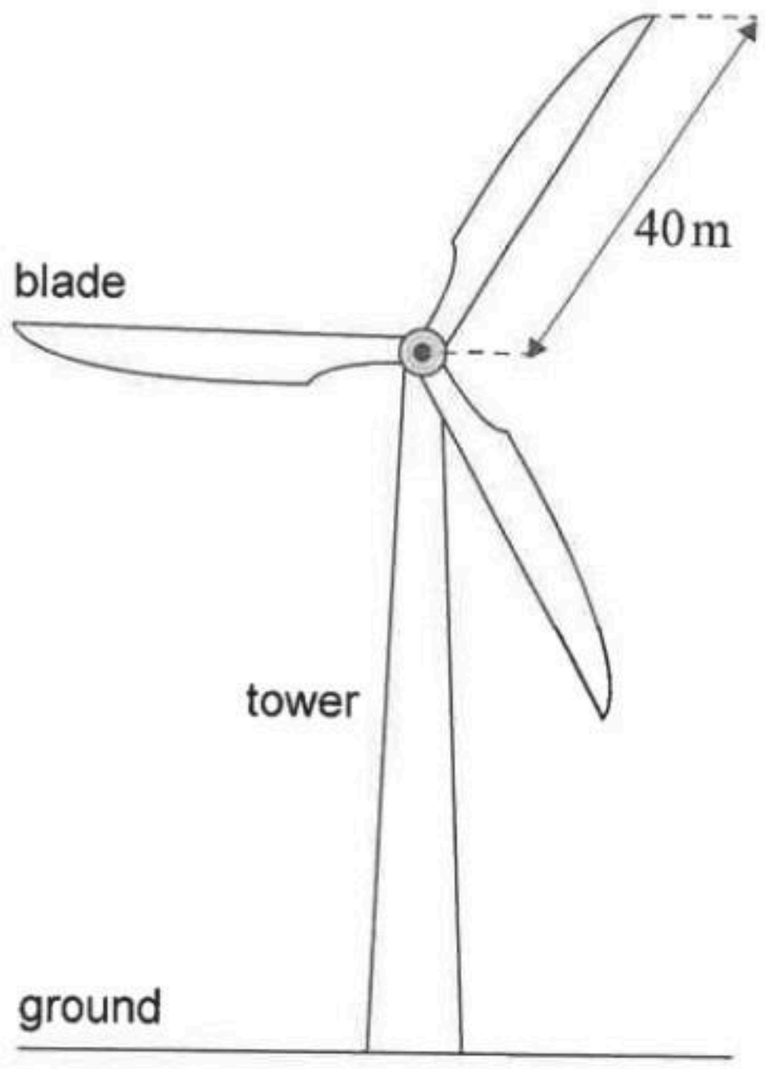
4. [Maximum mark: 17]

A wind turbine is designed so that the rotation of the blades generates power. The turbine consists of a vertical tower and three blades, each of length $40\,\text{m}$. This is shown in the following diagram.



The relative power, P, generated by the wind turbine is modelled by

$$P = 0.245\pi r^2 v^3,$$

where r is the length of the wind turbine blades in metres, and v is the wind speed in metres per second.

(a) Find the relative power, P, generated by the wind turbine with a wind speed of $10\,\text{m s}^{-1}$. Give your answer in the form $a \times 10^k$, where $1 \leq a < 10$ and $k \in \mathbb{Z}$. [3]

(This question continues on the following page)

(Question 4 continued)

The Beaufort scale categorizes wind speeds from calm to hurricane. The following table shows the Beaufort scale categories with their relative descriptions and wind speeds.

Beaufort scale category	Description	Wind speed ($\mathrm{m\,s^{-1}}$)
0	Calm	0.2 or less
1	Light air	0.3 to 1.5
2	Light breeze	1.6 to 3.3
3	Gentle breeze	3.4 to 5.4
4	Moderate breeze	5.5 to 7.9
5	Fresh breeze	8.0 to 10.7
6	Strong breeze	10.8 to 13.8
7	Near gale	13.9 to 17.1
8	Gale	17.2 to 20.7
9	Strong gale	20.8 to 24.4
10	Storm	24.5 to 28.4
11	Violent storm	28.5 to 32.6
12	Hurricane	32.7 or more

In the table the wind speeds are given **correct to one decimal place**.

(b) (i) Show that the minimum possible relative power produced by this wind turbine in a category 6 wind is 1.53×10^6, correct to three significant figures.

(ii) Find the greatest possible difference in relative power produced in category 6 winds. [5]

(This question continues on the following page)

(Question 4 continued)

A second wind turbine can only operate in wind speeds of $3.35 \leq v < 17.15$.

The relative power, P, generated by the second wind turbine can be modelled by

$$P = 4.48v^4 - 236v^3 + 3570v^2 - 8740v - 735,$$

where v is the wind speed in metres per second.

(c) For this second wind turbine,

(i) find $\frac{\mathrm{d}P}{\mathrm{d}v}$.

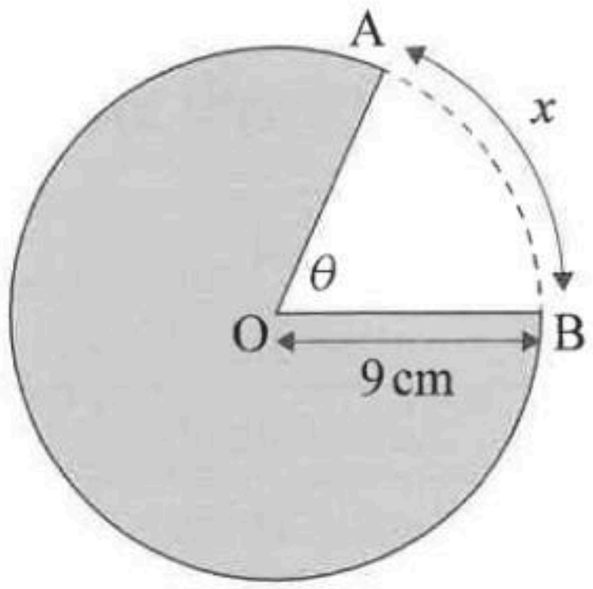
(ii) find the value of v for which $\frac{\mathrm{d}P}{\mathrm{d}v} = 0$.

(iii) state, in context, what this value of v represents. [6]

(d) Find the range of wind speeds that will allow this wind turbine to generate a relative power of at least $90\,000$. Give your answer in the form $a \leq v < b$, where a and b are given correct to two decimal places. [3]

5. [Maximum mark: 19]

A circular disc has radius $9\,\text{cm}$. A sector with an angle of θ degrees is removed from the disc.



(a) Find, in terms of θ,

(i) the arc length, $x\,\text{cm}$, of the sector that has been removed.

(ii) the arc length of the sector that remains. [4]

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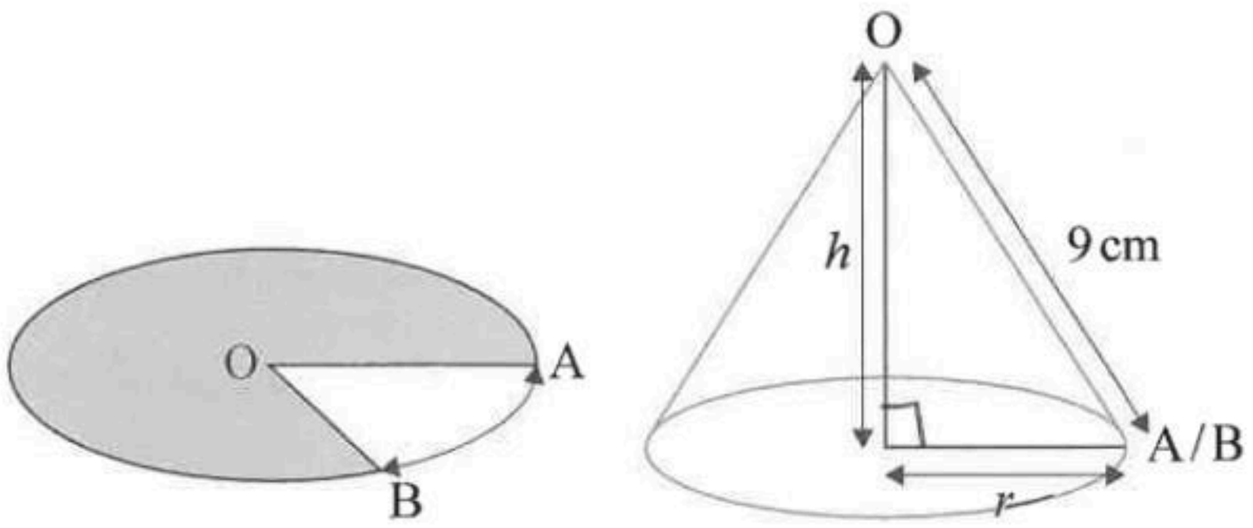
A local ice cream shop makes their cones using circular discs with radius $9\,\text{cm}$. To make the cone, a sector AOB of arc length $x\,\text{cm}$ is removed and the edges OA and OB are connected. This makes a cone with radius $r\,\text{cm}$, height $h\,\text{cm}$ and slant height of $9\,\text{cm}$, as shown in the following diagram.

diagram not to scale



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(b) Using your answer to part (a)(ii), show that $r = 9 - \frac{\theta}{40}$. [2]

(c) Show that the volume of the cone is $V = \frac{1}{3}\pi\left(9-\frac{\theta}{40}\right)^2\sqrt{81-\left(9-\frac{\theta}{40}\right)^2}$. [3]

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(Question 5 continued)

(d) (i) Using your graphic display calculator, find the value of θ that will maximize the volume of the cone.

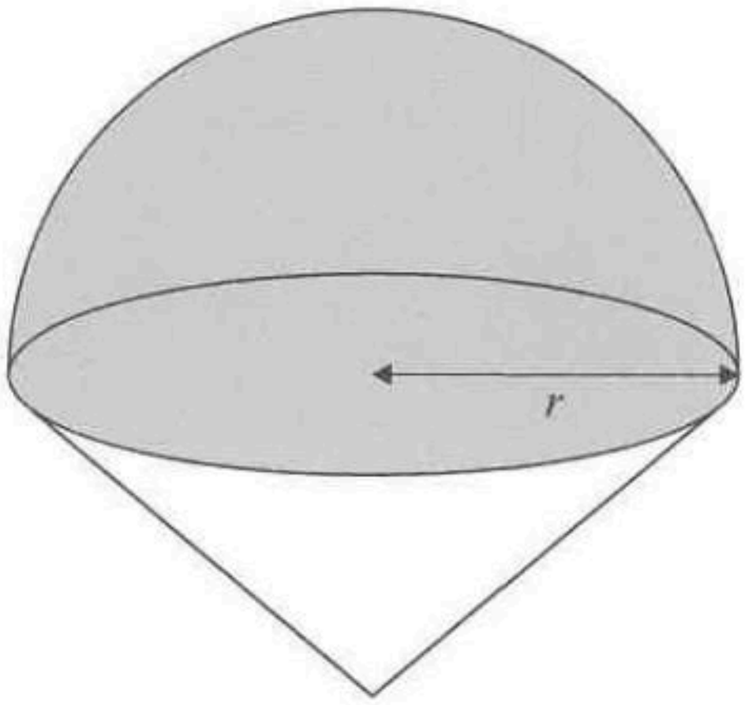
(ii) State the maximum volume of the cone.

(iii) Find the corresponding radius of the cone. [5]

The ice cream shop has an item on its menu called "Ice Cream Delight".

To make the "Ice Cream Delight", the cone with maximum volume is completely filled with ice cream and then a hemisphere of ice cream is added on the top. This is shown in the following diagram.

diagram not to scale



The shop states that more than a litre of ice cream is used in every "Ice Cream Delight"

(Note: $1000\,\text{cm}^3 = 1$ litre).

(e) Determine if the shop's claim is true. [5]