

General Certificate of Education
June 2004
Advanced Subsidiary Examination



APPLYING MATHEMATICS Paper 1

UOM4/1

Monday 24 May 2004 Morning Session

In addition to this paper you will require:

- a clean copy of the Data Sheet (enclosed);
- an 8-page answer book;
- a ruler;
- a graphics calculator.

Time allowed: 1 hour

Instructions

- Use blue or black ink or ball-point pen. Pencil should only be used for drawing.
- Write the information required on the front of your answer book.
- The *Examining Body* for this paper is AQA. The *Paper Reference* is UOM4/1.
- Answer **all** questions.
- All necessary working should be shown; otherwise marks for method may be lost.
- The **final** answer to questions requiring the use of a calculator should normally be given to three significant figures.
- You may **not** refer to the copy of the Data Sheet that was available prior to this examination. A clean copy is available for your use.
- At the end of the examination, remember to hand in your answer book.

Information

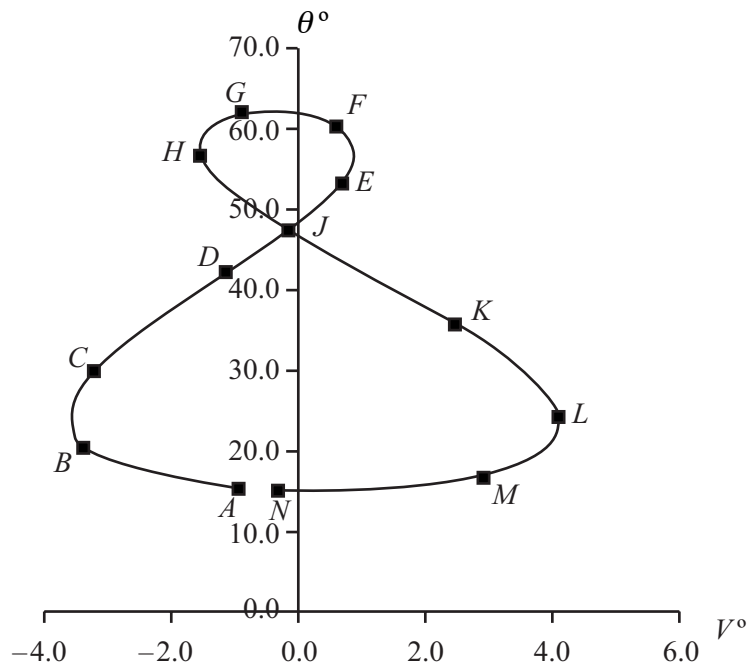
- The maximum mark for this paper is 30.
- Mark allocations are shown in brackets.
- You will be awarded up to 3 marks for your ability to present information accurately using correct notation **and** up to 3 marks for mathematical arguments presented clearly and logically.

Answer **all** questions.

Use **The Analemma** on the Data Sheet.

- 1 The article states that, “The Earth makes a complete revolution in approximately 24 hours”.
- (a) Show clearly why this implies that the Earth “rotates by approximately $\frac{1}{4}^{\circ}$ every minute”. (2 marks)
- (b) State an assumption that has been made in arriving at this conclusion. (1 mark)
- 2 At noon on 30th March, $N = 90$.
- (a) State clearly the time, correct to the nearest minute, that a sundial would be indicating according to the graph in **Figure 3**. (2 marks)
- (b) Show calculations using the formula for the correction, E minutes, to confirm that your answer to part (a) is correct. (3 marks)
- 3 Use the graph in **Figure 3** to give the first date in a year when the Sun is due south at noon. (3 marks)
- 4 The graph of E plotted against N can be obtained by geometric transformation of the graph of the variation, V° , plotted against N .
- State clearly this geometric transformation. (2 marks)
- 5 (a) Find, in the simplest form possible, an expression for θ° at the North Pole. (1 mark)
- (b) Sketch a graph of θ against N , for $0 \leq N \leq 400$, at the North Pole. (3 marks)
- (c) Interpret this graph in terms of daylight at the North Pole over the course of a year. (3 marks)

6 The analemma for the noon Sun at Greenwich is repeated below with each point labelled.



(a) Identify the point corresponding to:

(i) March 31st;

(ii) December 26th.

(2 marks)

(b) On how many days in a year does sundial time correspond with Greenwich mean time? (2 marks)

END OF QUESTIONS

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE