

**Tuesday 17 January 2012 – Morning**

**A2 GCE MATHEMATICS (MEI)**

**4754B** Applications of Advanced Mathematics (C4) Paper B: Comprehension

**QUESTION PAPER**

Candidates answer on the Question Paper.

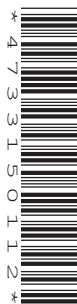
**OCR supplied materials:**

- Insert (inserted)
- MEI Examination Formulae and Tables (MF2)

**Other materials required:**

- Scientific or graphical calculator
- Rough paper

**Duration:** Up to 1 hour



|                       |  |                      |  |
|-----------------------|--|----------------------|--|
| Candidate<br>forename |  | Candidate<br>surname |  |
| Centre number         |  | Candidate number     |  |

**INSTRUCTIONS TO CANDIDATES**

- The Insert will be found in the centre of this document.
- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.
- The insert contains the text for use with the questions.
- You are permitted to use a scientific or graphical calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- You may find it helpful to make notes and do some calculations as you read the passage.
- You are **not** required to hand in these notes with your question paper.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.
- The total number of marks for this paper is **18**.
- This document consists of **8** pages. Any blank pages are indicated.

- 1 In lines 22 and 23 it says “arcs can be added to any regular polygon with an odd number of sides to make a curve of constant width”. State why the method described cannot be applied to a regular polygon with an even number of sides. [1]

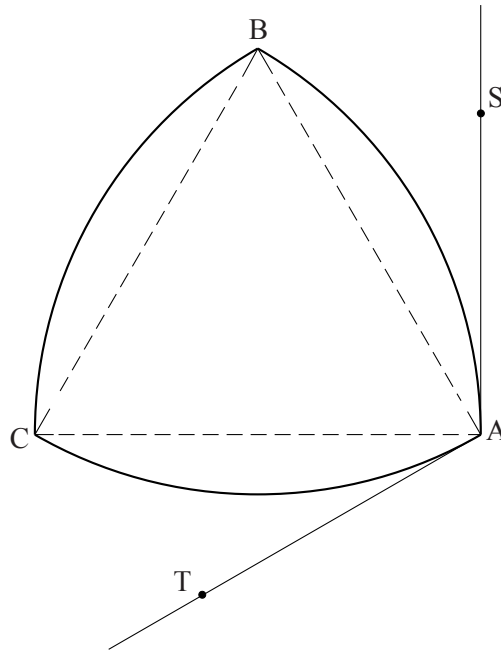
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- 2 (i) On the curve of constant width below, indicate clearly the arcs that were constructed with centre P. [1]
- (ii) Given that this curve has perimeter 70 cm, calculate its width, correct to 3 significant figures. [2]

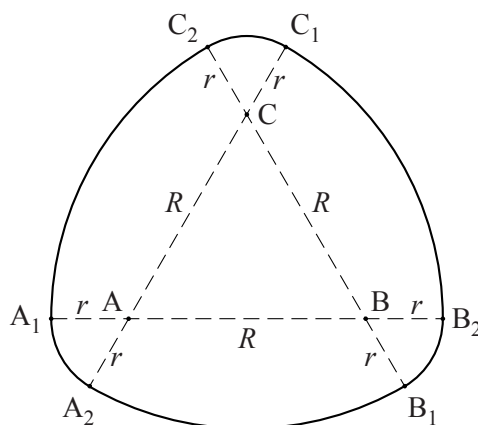
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| 2 (i)  |                                                                                                                         |
| 2 (ii) | <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> |

3

- 3 The diagram below shows two tangents, AS and AT, at vertex A on a Reuleaux triangle. State the angle SAT justifying your answer carefully. [3]



- 4 For the curve in Fig. 7b (copied below) the width,  $l$ , is  $R + 2r$ .



- (i) Prove that the perimeter is  $\pi l$ .

[3]

- (ii) You are given that, in the case where  $r = \frac{R}{2}$ , the area enclosed by this curve is  $R^2 \left( \frac{5\pi - 2\sqrt{3}}{4} \right)$ .

Show that this area falls in the range indicated in lines 28 and 29.

[3]

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| 4 (i)  |  |
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| 4 (ii) |  |
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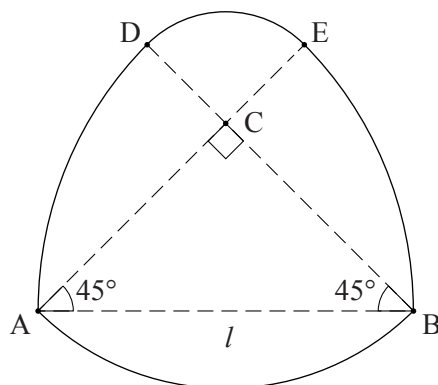
5 Fig. 11b is copied below.

(i) Show that CE has length  $\frac{(2 - \sqrt{2})}{2} l$ . [2]

(ii) Hence show that the square path traced out by point C (see line 67) has side length  $(\sqrt{2} - 1) l$ . [2]

(iii) A square hole of side length 50mm is to be cut in a sheet of plastic, using the method described in lines 69 to 71. Calculate the side length of the square hole needed in the guide plate, giving your answer correct to the nearest millimetre. [1]

5 (i)



5 (ii)

5 (iii)

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