

**ADVANCED SUBSIDIARY GCE  
MATHEMATICS (MEI)**

Concepts for Advanced Mathematics (C2)

**4752**

**QUESTION PAPER**

Candidates answer on the printed answer book.

**OCR supplied materials:**

- Printed answer book 4752
- MEI Examination Formulae and Tables (MF2)

**Other materials required:**

- Scientific or graphical calculator

**Friday 20 May 2011**

**Afternoon**

**Duration:** 1 hour 30 minutes

**INSTRUCTIONS TO CANDIDATES**

These instructions are the same on the printed answer book and the question paper.

- The question paper will be found in the centre of the printed answer book.
- Write your name, centre number and candidate number in the spaces provided on the printed answer book. Please write clearly and in capital letters.
- **Write your answer to each question in the space provided in the printed answer book.** Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- 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**

This information is the same on the printed answer book and the question paper.

- The number of marks is given in brackets [ ] at the end of each question or part question on the 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 **72**.
- The printed answer book consists of **12** pages. The question paper consists of **4** pages. Any blank pages are indicated.

**INSTRUCTION TO EXAMS OFFICER / INVIGILATOR**

- Do not send this question paper for marking; it should be retained in the centre or destroyed.

## Section A (36 marks)

1 Find  $\int_2^5 (2x^3 + 3) dx$ . [3]

2 A sequence is defined by

$$u_1 = 10,$$

$$u_{r+1} = \frac{5}{u_r^2}.$$

Calculate the values of  $u_2$ ,  $u_3$  and  $u_4$ .

What happens to the terms of the sequence as  $r$  tends to infinity? [3]

3 The equation of a curve is  $y = \sqrt{1 + 2x}$ .

(i) Calculate the gradient of the chord joining the points on the curve where  $x = 4$  and  $x = 4.1$ . Give your answer correct to 4 decimal places. [3]

(ii) Showing the points you use, calculate the gradient of another chord of the curve which is a closer approximation to the gradient of the curve when  $x = 4$ . [2]

4 The graph of  $y = ab^x$  passes through the points (1, 6) and (2, 3.6). Find the values of  $a$  and  $b$ . [3]

5 Find the equation of the normal to the curve  $y = 8x^4 + 4$  at the point where  $x = \frac{1}{2}$ . [5]

6 The gradient of a curve is given by  $\frac{dy}{dx} = 6\sqrt{x} - 2$ . Given also that the curve passes through the point (9, 4), find the equation of the curve. [5]

7 Solve the equation  $\tan \theta = 2 \sin \theta$  for  $0^\circ \leq \theta \leq 360^\circ$ . [4]

8 Using logarithms, rearrange  $p = st^n$  to make  $n$  the subject. [3]

9 You are given that

$$\log_a x = \frac{1}{2} \log_a 16 + \log_a 75 - 2 \log_a 5.$$

Find the value of  $x$ . [3]

10 The  $n$ th term,  $t_n$ , of a sequence is given by

$$t_n = \sin(\theta + 180n)^\circ.$$

Express  $t_1$  and  $t_2$  in terms of  $\sin \theta^\circ$ . [2]

**Section B** (36 marks)

- 11** (i) The standard formulae for the volume  $V$  and total surface area  $A$  of a solid cylinder of radius  $r$  and height  $h$  are

$$V = \pi r^2 h \quad \text{and} \quad A = 2\pi r^2 + 2\pi r h.$$

Use these to show that, for a cylinder with  $A = 200$ ,

$$V = 100r - \pi r^3. \quad [4]$$

- (ii) Find  $\frac{dV}{dr}$  and  $\frac{d^2V}{dr^2}$ . [3]

- (iii) Use calculus to find the value of  $r$  that gives a maximum value for  $V$  and hence find this maximum value, giving your answers correct to 3 significant figures. [4]

- 12** Jim and Mary are each planning monthly repayments for money they want to borrow.

- (i) Jim's first payment is £500, and he plans to pay £10 less each month, so that his second payment is £490, his third is £480, and so on.

(A) Calculate his 12th payment. [2]

(B) He plans to make 24 payments altogether. Show that he pays £9240 in total. [2]

- (ii) Mary's first payment is £460 and she plans to pay 2% less each month than the previous month, so that her second payment is £450.80, her third is £441.784, and so on.

(A) Calculate her 12th payment. [2]

(B) Show that Jim's 20th payment is less than Mary's 20th payment but that his 19th is not less than her 19th. [3]

(C) Mary plans to make 24 payments altogether. Calculate how much she pays in total. [2]

(D) How much would Mary's first payment need to be if she wishes to pay 2% less each month as before, but to pay the same in total as Jim, £9240, over the 24 months? [2]

[Question 13 is printed overleaf.]

13 Fig. 13.1 shows a greenhouse which is built against a wall.

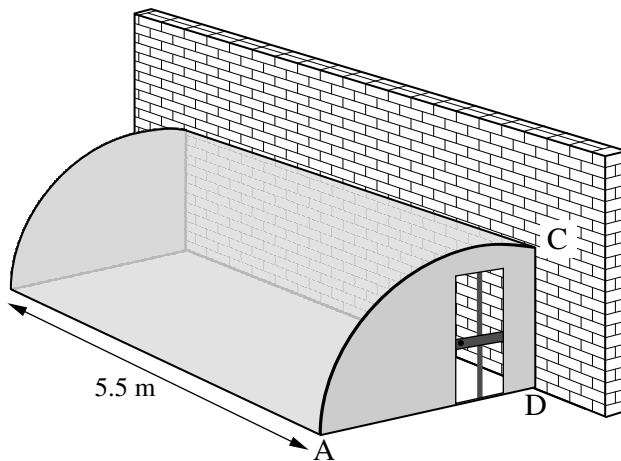


Fig. 13.1

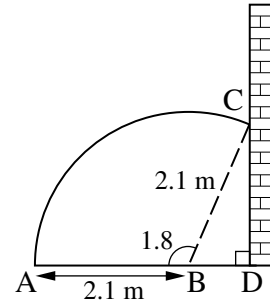


Fig. 13.2

The greenhouse is a prism of length 5.5 m. The curve AC is an arc of a circle with centre B and radius 2.1 m, as shown in Fig. 13.2. The sector angle ABC is 1.8 radians and ABD is a straight line. The curved surface of the greenhouse is covered in polythene.

- (i) Find the length of the arc AC and hence find the area of polythene required for the curved surface of the greenhouse. [4]
- (ii) Calculate the length BD. [3]
- (iii) Calculate the volume of the greenhouse. [5]

**Copyright Information**

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website ([www.ocr.org.uk](http://www.ocr.org.uk)) after the live examination series. If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity. For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.