

## **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

$$\begin{aligned} u_1 &= 10, \\ u_{r+1} &= \frac{5}{u_r^2}. \end{aligned}$$

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]

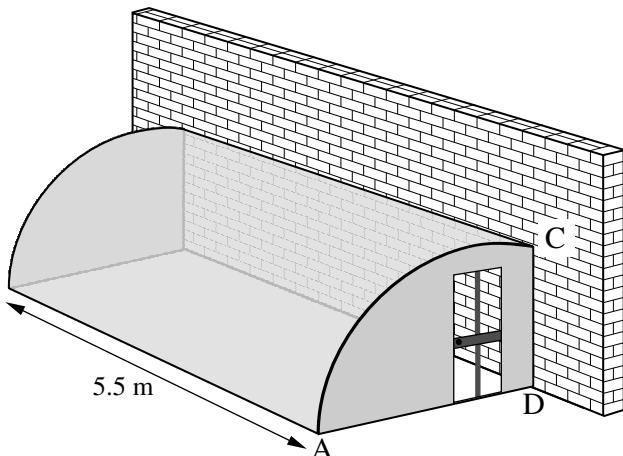
(B) Show that Jim's 20th payment is less than Mary's 20th payment but that his 19th is not less than her 19th. [3]

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

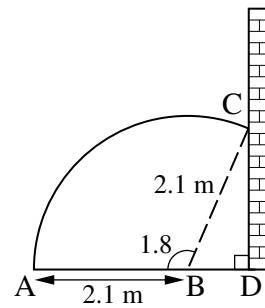
(D) How much would Mary's first payment need to be if she wishes to pay 2% less each month as before, but to pay the same in total as Jim, £9240, over the 24 months? [2]

[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]

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