



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.

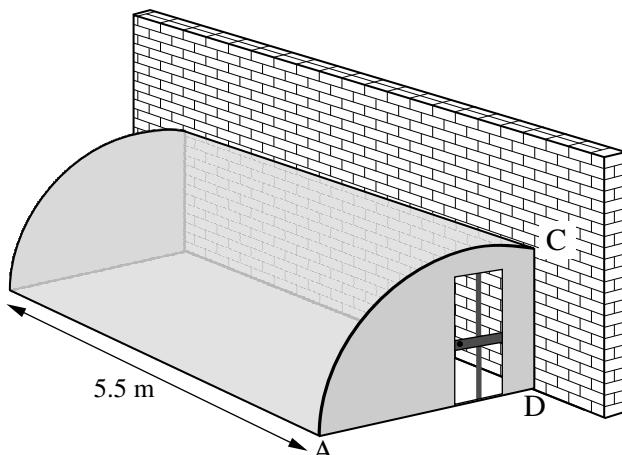


Fig. 13.1

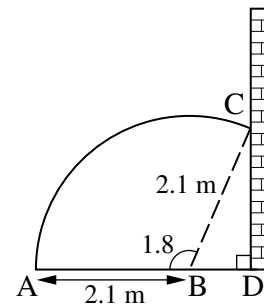


Fig. 13.2

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]

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