

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary General Certificate of Education
Advanced General Certificate of Education

MEI STRUCTURED MATHEMATICS

4752

Concepts for Advanced Mathematics (C2)

Wednesday 12 JANUARY 2005 Afternoon 1 hour 30 minutes

Additional materials:

Answer booklet

Graph paper

MEI Examination Formulae and Tables (MF2)

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the spaces provided on the answer booklet.
- There is an **insert** for use in Question 11.
- Answer **all** the questions.
- You are permitted to use a graphical calculator in this paper.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- 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.
- Final answers should be given to a degree of accuracy appropriate to the context.
- The total number of marks for this paper is 72.

This question paper consists of 5 printed pages, 3 blank pages and an insert.

ERRATUM NOTICE

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary GCE

MEI STRUCTURED MATHEMATICS

4752

Concepts for Advanced Mathematics (C2)

Wednesday

12 JANUARY 2005

Afternoon

1 hour 30 minutes

To be opened immediately

For the attention of the Examination Officer and Head of Mathematics

For the January session of examinations, all yellow examination papers beginning 47.. should have the new yellow formulae booklet MF2. All white papers beginning 26.. should have the blue formulae booklet MF12.

There has been an error when sending out the formulae booklets for C2 (4752) and D1 (4771). The 'legacy' formulae booklet (MF12) has been sent.

For the C2 (4752) examination on Wed 12th January 05, candidates may use the MF2 they used in the C1 (4751) examination.

For the D1 (4771) examination on Fri 14th January 05, the legacy formulae booklet MF12 can be used. This will not disadvantage candidates.

Any enquiry about this notice should be referred to the Information Bureau on 01223 553 998 or helpdesk@ocr.org.uk

Section A (36 marks)

1 Find $\frac{dy}{dx}$ when $y = x^6 + \sqrt{x}$. [3]

2 Find $\int \left(x^3 + \frac{1}{x^3} \right) dx$. [4]

3 Sketch the graph of $y = \sin x$ for $0^\circ \leq x \leq 360^\circ$.

Solve the equation $\sin x = -0.2$ for $0^\circ \leq x \leq 360^\circ$. [4]

4

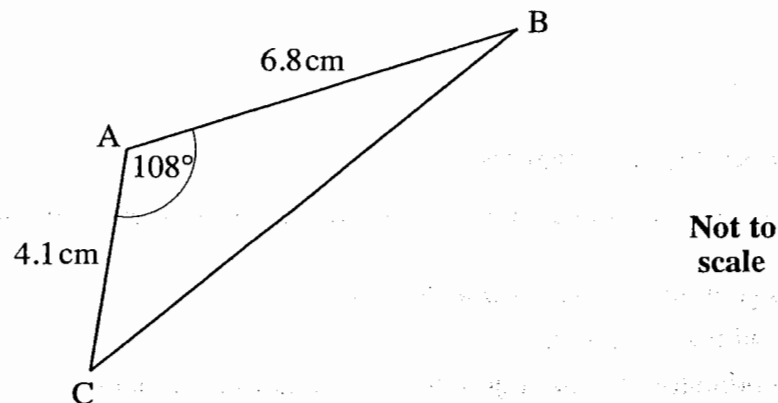


Fig. 4

For triangle ABC shown in Fig. 4, calculate

(i) the length of BC, [3]

(ii) the area of triangle ABC. [2]

5 The first three terms of a geometric progression are 4, 2, 1.

Find the twentieth term, expressing your answer as a power of 2.

Find also the sum to infinity of this progression. [5]

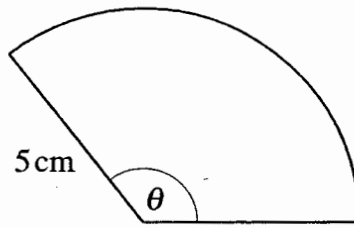
6 A sequence is given by

$$a_1 = 4,$$

$$a_{r+1} = a_r + 3.$$

Write down the first 4 terms of this sequence.

Find the sum of the first 100 terms of the sequence. [5]



Not to
scale

Fig. 7

Fig. 7 shows a sector of a circle of radius 5 cm which has angle θ radians. The sector has area 30 cm^2 .

(i) Find θ . [3]

(ii) Hence find the perimeter of the sector. [2]

8 (i) Solve the equation $10^x = 316$. [2]

(ii) Simplify $\log_a(a^2) - 4\log_a\left(\frac{1}{a}\right)$. [3]

Section B (36 marks)

- 9 (i) A tunnel is 100 m long. Its cross-section, shown in Fig. 9.1, is modelled by the curve

$$y = \frac{1}{4}(10x - x^2),$$

where x and y are horizontal and vertical distances in metres.

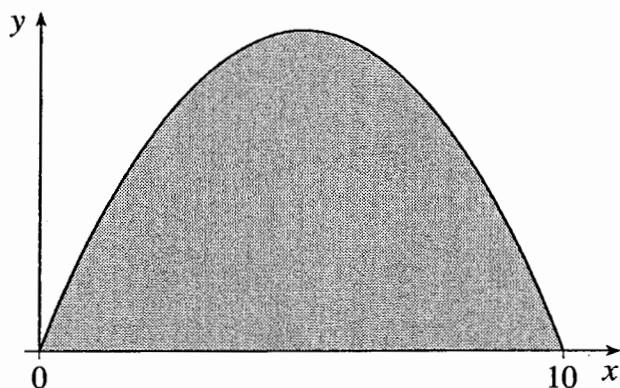


Figure 9.1

Using this model,

- (A) find the greatest height of the tunnel, [2]

- (B) explain why $100 \int_0^{10} y \, dx$ gives the volume, in cubic metres, of earth removed to make the tunnel. Calculate this volume. [5]

- (ii) The roof of the tunnel is re-shaped to allow for larger vehicles. Fig. 9.2 shows the new cross-section.

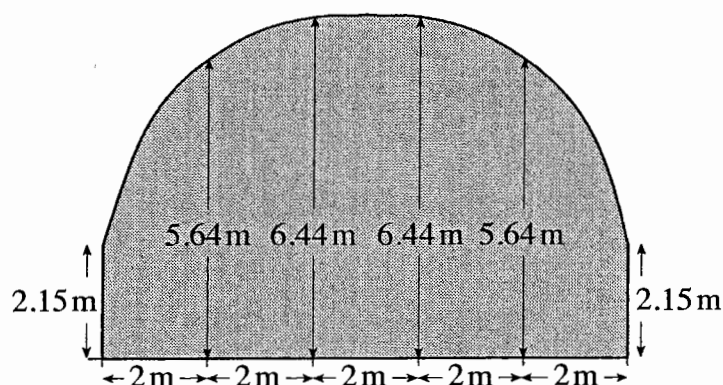


Fig. 9.2

Use the trapezium rule with 5 strips to estimate the new cross-sectional area.

- Hence estimate the volume of earth removed when the tunnel is re-shaped. [5]

10 A curve has equation $y = x^3 - 6x^2 + 12$.

(i) Use calculus to find the coordinates of the turning points of this curve. Determine also the nature of these turning points. [7]

(ii) Find, in the form $y = mx + c$, the equation of the normal to the curve at the point $(2, -4)$. [4]

11 Answer part (iii) of this question on the insert provided.

A hot drink is made and left to cool. The table shows its temperature at ten-minute intervals after it is made.

Time (minutes)	10	20	30	40	50
Temperature ($^{\circ}\text{C}$)	68	53	42	36	31

The room temperature is 22°C . The difference between the temperature of the drink and room temperature at time t minutes is $z^{\circ}\text{C}$. The relationship between z and t is modelled by

$$z = z_0 10^{-kt},$$

where z_0 and k are positive constants.

(i) Give a physical interpretation for the constant z_0 . [2]

(ii) Show that $\log_{10} z = -kt + \log_{10} z_0$. [2]

(iii) On the insert, complete the table and draw the graph of $\log_{10} z$ against t .

Use your graph to estimate the values of k and z_0 .

Hence estimate the temperature of the drink 70 minutes after it is made. [9]

Candidate Name	Centre Number	Candidate Number



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INSERT

Wednesday **12 JANUARY 2005** Afternoon 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- This insert should be used in Question 11.
- Write your name, centre number and candidate number in the spaces provided at the top of this page and attach it to your answer booklet.

This insert consists of 2 printed pages.

11 (iii)

t	10	20	30	40	50
z	46				
$\log_{10} z$					

