

**ADVANCED SUBSIDIARY GCE UNIT
MATHEMATICS (MEI)**

Concepts for Advanced Mathematics (C2)

TUESDAY 16 JANUARY 2007

4752/01

Morning
Time: 1 hour 30 minutes

Additional materials:

Answer booklet (8 pages)

Graph paper

MEI Examination Formulae and Tables (MF2)

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the spaces provided on the answer booklet.
- Answer **all** the questions.
- You are permitted to use a 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.
- The total number of marks for this paper is 72.
- There is an **insert** for use in Question 13.

ADVICE TO CANDIDATES

- Read each question carefully and make sure you know what you have to do before starting your answer.
- 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.

This document consists of **6** printed pages, **2** blank pages and an insert.

Section A (36 marks)

- 1 Differentiate $6x^{\frac{5}{2}} + 4$. [2]
- 2 A geometric progression has 6 as its first term. Its sum to infinity is 5.
Calculate its common ratio. [3]
- 3 Given that $\cos \theta = \frac{1}{3}$ and θ is acute, find the exact value of $\tan \theta$. [3]
- 4 Sequences A, B and C are shown below. They each continue in the pattern established by the given terms.
- A: 1, 2, 4, 8, 16, 32, ...
- B: 20, -10, 5, -2.5, 1.25, -0.625, ...
- C: 20, 5, 1, 20, 5, 1, ...
- (i) Which of these sequences is periodic? [1]
- (ii) Which of these sequences is convergent? [1]
- (iii) Find, in terms of n , the n th term of sequence A. [1]
- 5 A is the point $(2, 1)$ on the curve $y = \frac{4}{x^2}$.
- B is the point on the same curve with x -coordinate 2.1.
- (i) Calculate the gradient of the chord AB of the curve. Give your answer correct to 2 decimal places. [2]
- (ii) Give the x -coordinate of a point C on the curve for which the gradient of chord AC is a better approximation to the gradient of the curve at A. [1]
- (iii) Use calculus to find the gradient of the curve at A. [2]
- 6 Sketch the curve $y = \sin x$ for $0^\circ \leq x \leq 360^\circ$.
Solve the equation $\sin x = -0.68$ for $0^\circ \leq x \leq 360^\circ$. [4]

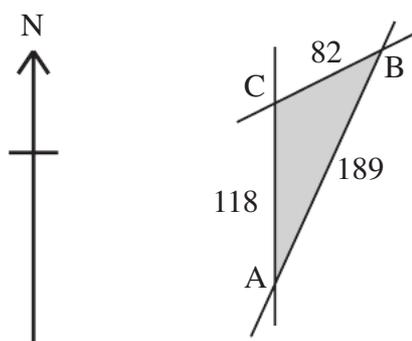
3

- 7 The gradient of a curve is given by $\frac{dy}{dx} = x^2 - 6x$. Find the set of values of x for which y is an increasing function of x . [3]
- 8 The 7th term of an arithmetic progression is 6. The sum of the first 10 terms of the progression is 30.
Find the 5th term of the progression. [5]
- 9 A curve has gradient given by $\frac{dy}{dx} = 6x^2 + 8x$. The curve passes through the point $(1, 5)$. Find the equation of the curve. [4]
- 10 (i) Express $\log_a x^4 + \log_a \left(\frac{1}{x}\right)$ as a multiple of $\log_a x$. [2]
(ii) Given that $\log_{10} b + \log_{10} c = 3$, find b in terms of c . [2]

[Section B starts on the next page.]

Section B (36 marks)

- 11 Fig. 11.1 shows a village green which is bordered by 3 straight roads AB, BC and CA. The road AC runs due North and the measurements shown are in metres.

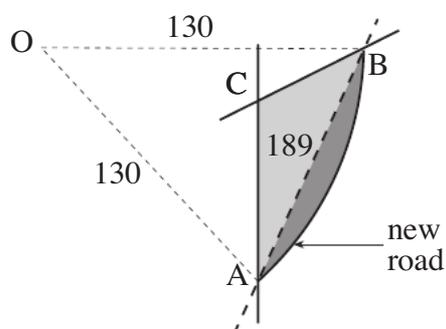


Not to scale

Fig. 11.1

- (i) Calculate the bearing of B from C, giving your answer to the nearest 0.1° . [4]
- (ii) Calculate the area of the village green. [2]

The road AB is replaced by a new road, as shown in Fig. 11.2. The village green is extended up to the new road.



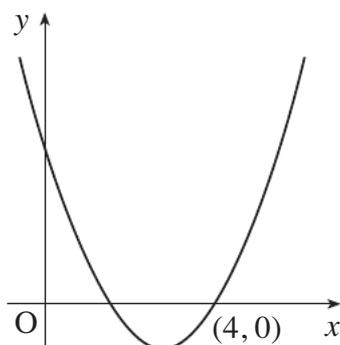
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Fig. 11.2

The new road is an arc of a circle with centre O and radius 130 m.

- (iii) (A) Show that angle AOB is 1.63 radians, correct to 3 significant figures. [2]
- (B) Show that the area of land added to the village green is 5300 m^2 correct to 2 significant figures. [4]

- 12 Fig. 12 is a sketch of the curve $y = 2x^2 - 11x + 12$.



Not to scale

Fig. 12

- (i) Show that the curve intersects the x -axis at $(4, 0)$ and find the coordinates of the other point of intersection of the curve and the x -axis. [3]
- (ii) Find the equation of the normal to the curve at the point $(4, 0)$.
Show also that the area of the triangle bounded by this normal and the axes is 1.6 units². [6]
- (iii) Find the area of the region bounded by the curve and the x -axis. [3]

- 13 Answer part (ii) of this question on the insert provided.

The table gives a firm's monthly profits for the first few months after the start of its business, rounded to the nearest £100.

Number of months after start-up (x)	1	2	3	4	5	6
Profit for this month (£ y)	500	800	1200	1900	3000	4800

The firm's profits, £ y , for the x th month after start-up are modelled by

$$y = k \times 10^{ax}$$

where a and k are constants.

- (i) Show that, according to this model, a graph of $\log_{10} y$ against x gives a straight line of gradient a and intercept $\log_{10} k$. [2]
- (ii) **On the insert**, complete the table and plot $\log_{10} y$ against x , drawing by eye a line of best fit. [3]
- (iii) Use your graph to find an equation for y in terms of x for this model. [3]
- (iv) For which month after start-up does this model predict profits of about £75 000? [3]
- (v) State one way in which this model is unrealistic. [1]