OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE UNIT **4752/01**

MATHEMATICS (MEI)

Concepts for Advanced Mathematics (C2)

TUESDAY 16 JANUARY 2007

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.

[Turn over

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 nth 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 $0° \leqslant x \leqslant 360°$.

Solve the equation $\sin x = -0.68$ for $0° \leqslant x \leqslant 360°$. [4]

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]

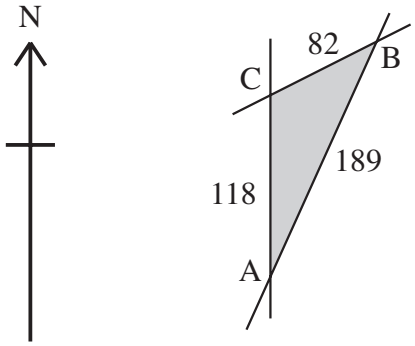
10 **(i)** Express $\log_a x^4 + \log_a\left(\frac{1}{x}\right)$ as a multiple of $\log_a x$. [2]

(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.



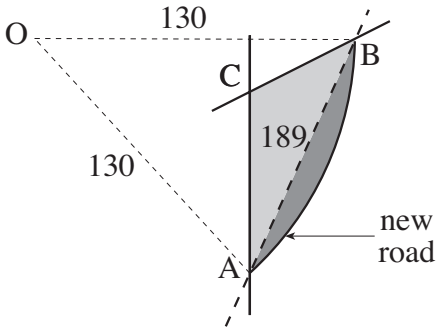
Not to scale

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.



Not to scale

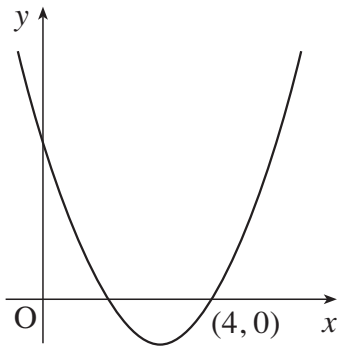
Fig. 11.2

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 units^2. [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 xth 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]

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INSERT

TUESDAY 16 JANUARY 2007

Morning
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Candidate Name	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- This insert should be used in Question **13(ii)**.
- Write your name, centre number and candidate number in the spaces provided above and **attach the page to your answer booklet**.

This insert consists of 2 printed pages.

[Turn over

13 (ii)

Number of months after start-up (x)	1	2	3	4	5	6
Profit for this month (£y)	500	800	1200	1900	3000	4800
$\log_{10} y$	2.70