

ADVANCED SUBSIDIARY GCE

MATHEMATICS (MEI)

Concepts for Advanced Mathematics (C2)

4752

Candidates answer on the Answer Booklet

OCR Supplied Materials:

- 8 page Answer Booklet
- Insert for Questions 5 and 12 (inserted)
- MEI Examination Formulae and Tables (MF2)

Other Materials Required:

None

Tuesday 13 January 2009
Morning

Duration: 1 hour 30 minutes



INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the spaces provided on the Answer Booklet.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- There is an **insert** for use in Questions **5** and **12**.
- 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.
- 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**.
- This document consists of **8** pages. Any blank pages are indicated.

Section A (36 marks)

1 Find $\int (20x^4 + 6x^{-\frac{3}{2}}) dx$. [4]

2 Fig. 2 shows the coordinates at certain points on a curve.

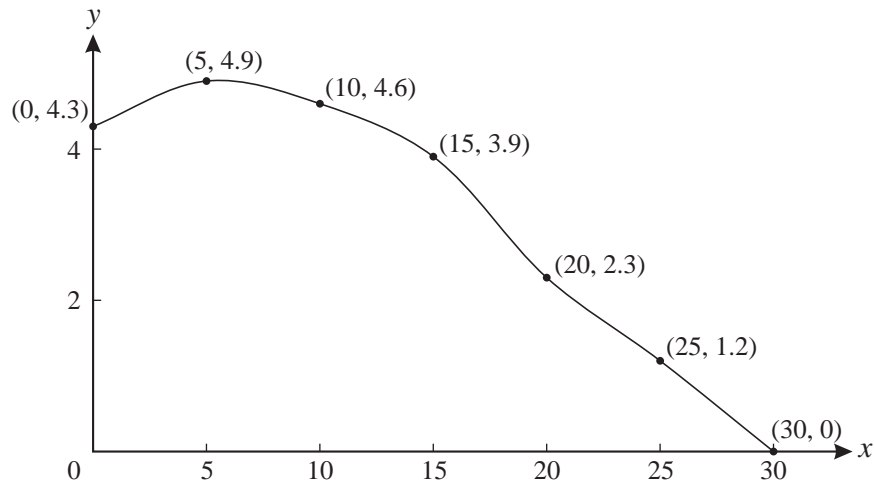


Fig. 2

Use the trapezium rule with 6 strips to calculate an estimate of the area of the region bounded by this curve and the axes. [4]

3 Find $\sum_{k=1}^5 \frac{1}{1+k}$. [2]

4 Solve the equation $\sin 2x = -0.5$ for $0^\circ < x < 180^\circ$. [3]

5 Answer this question on the insert provided.

Fig. 5 shows the graph of $y = f(x)$.

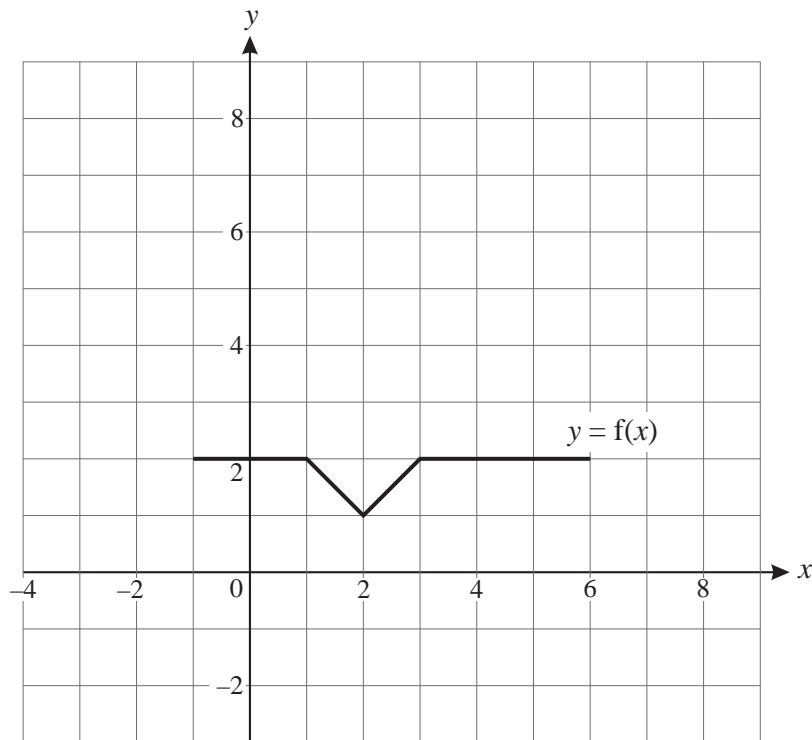


Fig. 5

On the insert, draw the graph of

(i) $y = f(x - 2)$, [2]

(ii) $y = 3f(x)$. [2]

6 An arithmetic progression has first term 7 and third term 12.

(i) Find the 20th term of this progression. [2]

(ii) Find the sum of the 21st to the 50th terms inclusive of this progression. [3]

7 Differentiate $4x^2 + \frac{1}{x}$ and hence find the x -coordinate of the stationary point of the curve $y = 4x^2 + \frac{1}{x}$. [5]

8 The terms of a sequence are given by

$$u_1 = 192,$$

$$u_{n+1} = -\frac{1}{2}u_n.$$

(i) Find the third term of this sequence and state what type of sequence it is. [2]

(ii) Show that the series $u_1 + u_2 + u_3 + \dots$ converges and find its sum to infinity. [3]

9 (i) State the value of $\log_a a$. [1]

(ii) Express each of the following in terms of $\log_a x$.

(A) $\log_a x^3 + \log_a \sqrt{x}$ [2]

(B) $\log_a \frac{1}{x}$ [1]

Section B (36 marks)

10 Fig. 10 shows a sketch of the graph of $y = 7x - x^2 - 6$.

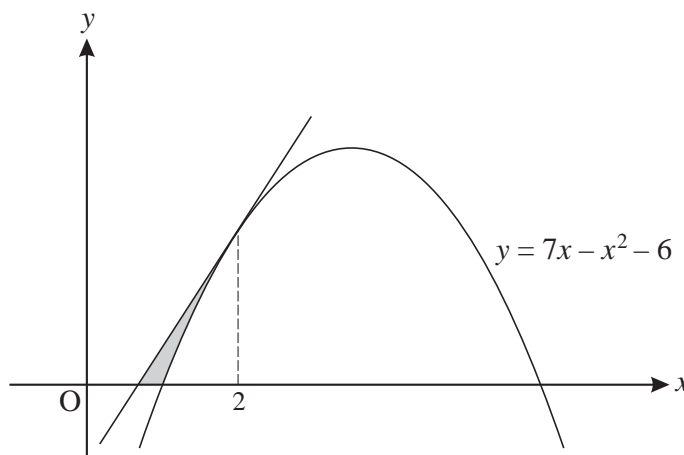


Fig. 10

(i) Find $\frac{dy}{dx}$ and hence find the equation of the tangent to the curve at the point on the curve where $x = 2$.

Show that this tangent crosses the x -axis where $x = \frac{2}{3}$. [6]

(ii) Show that the curve crosses the x -axis where $x = 1$ and find the x -coordinate of the other point of intersection of the curve with the x -axis. [2]

(iii) Find $\int_1^2 (7x - x^2 - 6) dx$.

Hence find the area of the region bounded by the curve, the tangent and the x -axis, shown shaded on Fig. 10. [5]

11 (i)

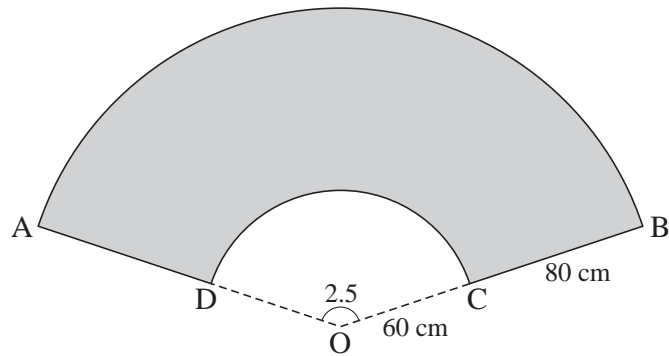


Fig. 11.1

Fig. 11.1 shows the surface ABCD of a TV presenter's desk. AB and CD are arcs of circles with centre O and sector angle 2.5 radians. $OC = 60$ cm and $OB = 140$ cm.

(A) Calculate the length of the arc CD. [2]

(B) Calculate the area of the surface ABCD of the desk. [4]

(ii) The TV presenter is at point P, shown in Fig. 11.2. A TV camera can move along the track EF, which is of length 3.5 m.

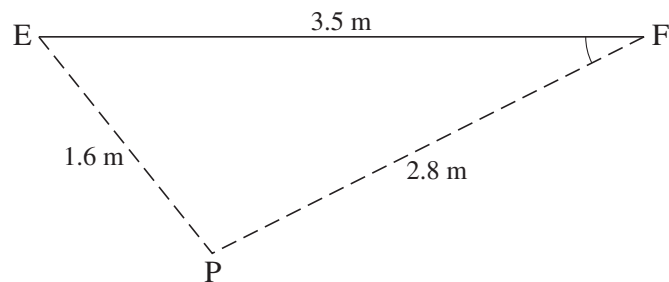


Fig. 11.2

When the camera is at E, the TV presenter is 1.6 m away. When the camera is at F, the TV presenter is 2.8 m away.

(A) Calculate, in degrees, the size of angle EFP. [3]

(B) Calculate the shortest possible distance between the camera and the TV presenter. [2]

[Question 12 is printed overleaf.]

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

The proposal for a major building project was accepted, but actual construction was delayed. Each year a new estimate of the cost was made. The table shows the estimated cost, £y million, of the project t years after the project was first accepted.

Years after proposal accepted (t)	1	2	3	4	5
Cost (£y million)	250	300	360	440	530

The relationship between y and t is modelled by $y = ab^t$, where a and b are constants.

(i) Show that $y = ab^t$ may be written as

$$\log_{10} y = \log_{10} a + t \log_{10} b. \quad [2]$$

(ii) **On the insert**, complete the table and plot $\log_{10} y$ against t , drawing by eye a line of best fit. [3]

(iii) Use your graph and the results of part (i) to find the values of $\log_{10} a$ and $\log_{10} b$ and hence a and b . [4]

(iv) According to this model, what was the estimated cost of the project when it was first accepted? [1]

(v) Find the value of t given by this model when the estimated cost is £1000 million. Give your answer rounded to 1 decimal place. [2]

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INSERT for Questions 5 and 12

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Duration: 1 hour 30 minutes



Candidate Forename		Candidate Surname	
Centre Number		Candidate Number	

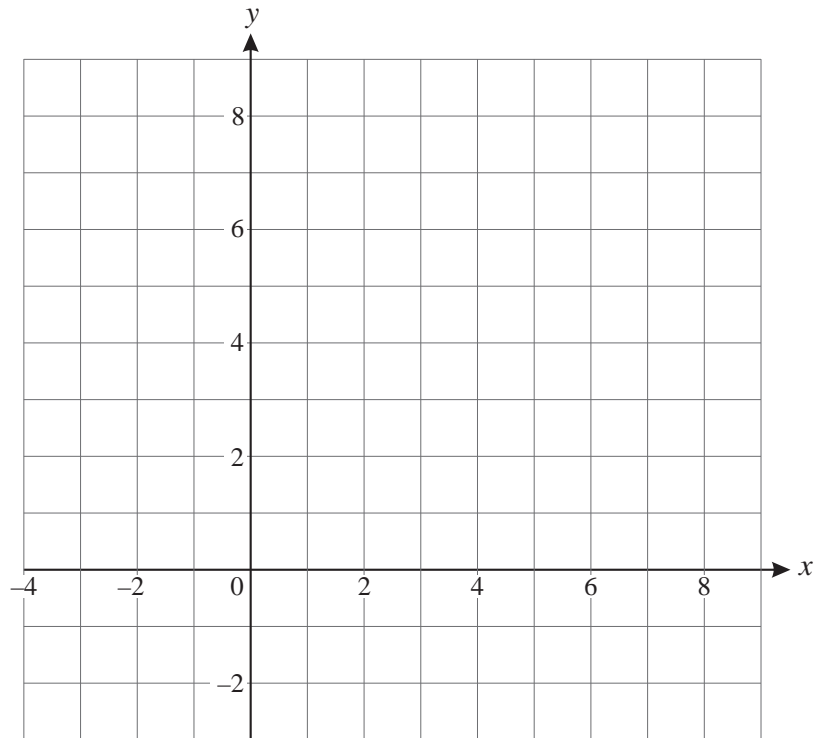
INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- This insert should be used to answer Question 5 and Question 12 part (ii).
- Write your answers to Question 5 and Question 12 part (ii) in the spaces provided in this insert, and **attach it to your Answer Booklet**.

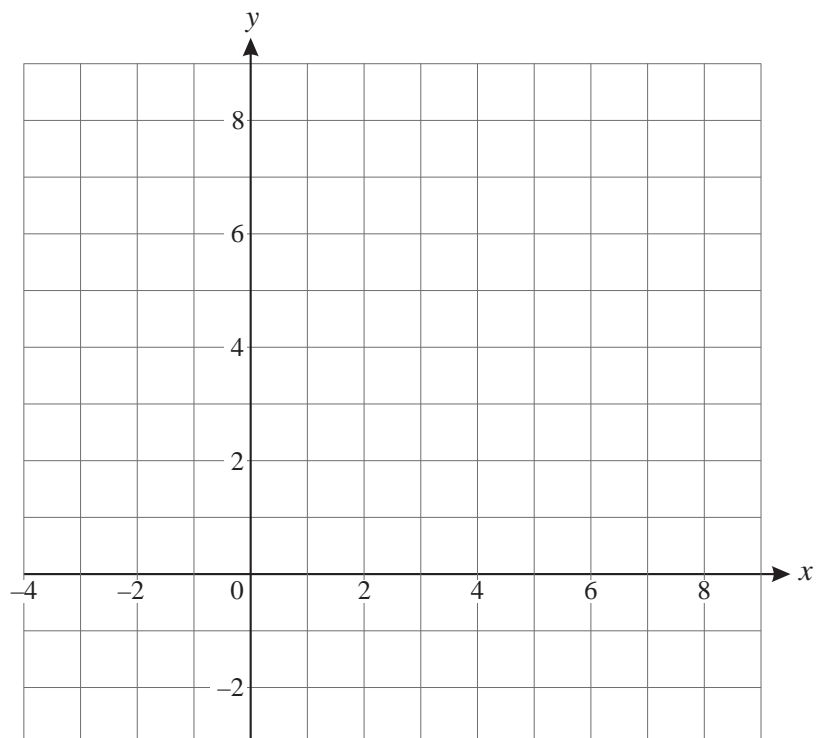
INFORMATION FOR CANDIDATES

- This document consists of 4 pages. Any blank pages are indicated.

5 (i) $y = f(x - 2)$



(ii) $y = 3f(x)$



12 (ii)

Years after proposal accepted (t)	1	2	3	4	5
Cost (£ y million)	250	300	360	440	530
$\log_{10} y$	2.398				

