



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 Question 12 (inserted)
- MEI Examination Formulae and Tables (MF2)

Other Materials Required:

None

Friday 15 January 2010

Afternoon

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 Question **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 $\int \left(x - \frac{3}{x^2} \right) dx$. [3]

2 A sequence begins

$$1 \quad 3 \quad 5 \quad 3 \quad 1 \quad 3 \quad 5 \quad 3 \quad 1 \quad 3 \quad \dots$$

and continues in this pattern.

(i) Find the 55th term of this sequence, showing your method. [1]

(ii) Find the sum of the first 55 terms of the sequence. [2]

3 You are given that $\sin \theta = \frac{\sqrt{2}}{3}$ and that θ is an acute angle. Find the **exact** value of $\tan \theta$. [3]

4 A sector of a circle has area 8.45 cm^2 and sector angle 0.4 radians. Calculate the radius of the sector. [3]

5

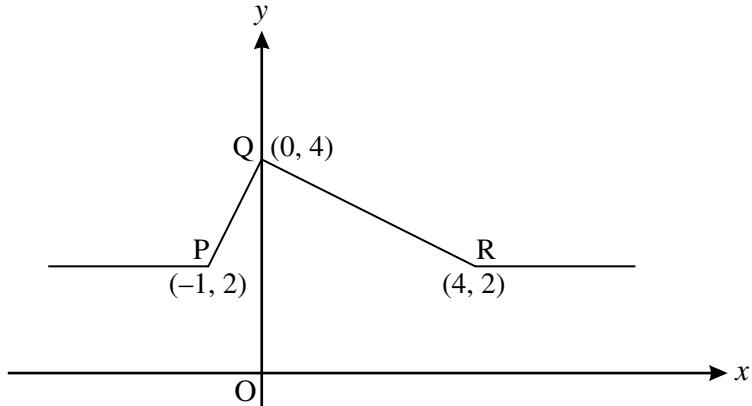


Fig. 5

Fig. 5 shows a sketch of the graph of $y = f(x)$. On separate diagrams, sketch the graphs of the following, showing clearly the coordinates of the points corresponding to P, Q and R.

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

(ii) $y = \frac{1}{4}f(x)$ [2]

6 (i) Find the 51st term of the sequence given by

$$u_1 = 5, \\ u_{n+1} = u_n + 4.$$

[3]

(ii) Find the sum to infinity of the geometric progression which begins

5 2 0.8

[2]

7

Not to scale

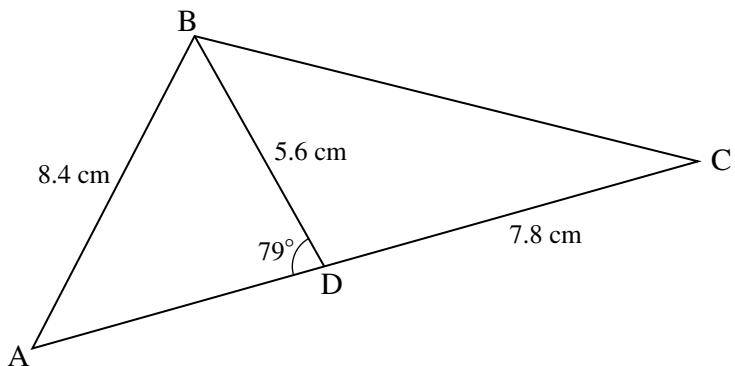


Fig. 7

Fig. 7 shows triangle ABC, with AB = 8.4 cm. D is a point on AC such that angle ADB = 79°, BD = 5.6 cm and CD = 7.8 cm.

Calculate

(i) angle BAD, [2]

(ii) the length BC. [3]

8 Find the equation of the tangent to the curve $y = 6\sqrt{x}$ at the point where $x = 16$. [5]

9 (i) Sketch the graph of $y = 3^x$. [2]

(ii) Use logarithms to solve $3^{2x+1} = 10$, giving your answer correct to 2 decimal places. [3]

Section B (36 marks)

10 (i) Differentiate $x^3 - 3x^2 - 9x$. Hence find the x -coordinates of the stationary points on the curve $y = x^3 - 3x^2 - 9x$, showing which is the maximum and which the minimum. [6]

(ii) Find, in exact form, the coordinates of the points at which the curve crosses the x -axis. [3]

(iii) Sketch the curve. [2]

11 Fig. 11 shows the cross-section of a school hall, with measurements of the height in metres taken at 1.5 m intervals from O.

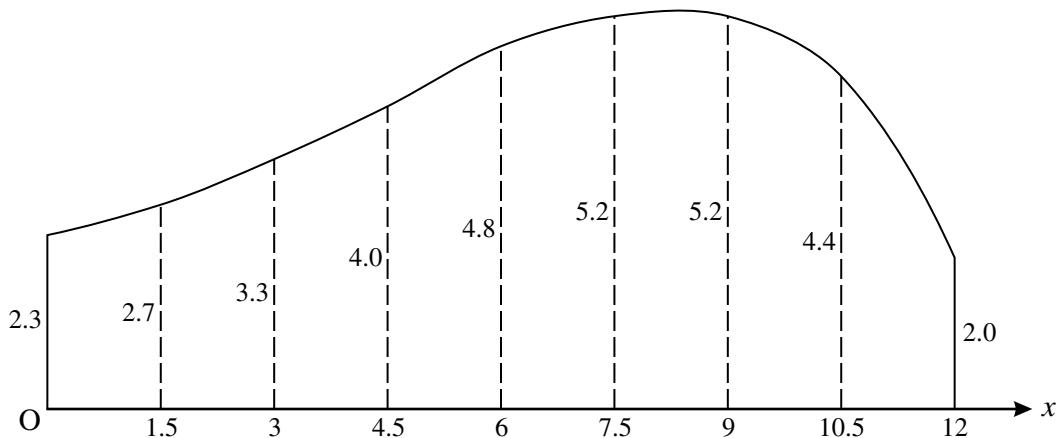


Fig. 11

(i) Use the trapezium rule with 8 strips to calculate an estimate of the area of the cross-section. [4]

(ii) Use 8 rectangles to calculate a lower bound for the area of the cross-section. [2]

The curve of the roof may be modelled by $y = -0.013x^3 + 0.16x^2 - 0.082x + 2.4$, where x metres is the horizontal distance from O across the hall, and y metres is the height.

(iii) Use integration to find the area of the cross-section according to this model. [4]

(iv) Comment on the accuracy of this model for the height of the hall when $x = 7.5$. [2]

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

Since 1945 the populations of many countries have been growing. The table shows the estimated population of 15- to 59-year-olds in Africa during the period 1955 to 2005.

Year	1955	1965	1975	1985	1995	2005
Population (millions)	131	161	209	277	372	492

Source: United Nations

Such estimates are used to model future population growth and world needs of resources. One model is $P = a10^{bt}$, where the population is P millions, t is the number of years after 1945 and a and b are constants.

- (i) Show that, using this model, the graph of $\log_{10} P$ against t is a straight line of gradient b . State the intercept of this line on the vertical axis. [3]
- (ii) **On the insert**, complete the table, giving values correct to 2 decimal places, and plot the graph of $\log_{10} P$ against t . Draw, by eye, a line of best fit on your graph. [3]
- (iii) Use your graph to find the equation for P in terms of t . [4]
- (iv) Use your results to estimate the population of 15- to 59-year-olds in Africa in 2050. Comment, with a reason, on the reliability of this estimate. [3]

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RECOGNISING ACHIEVEMENT

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MATHEMATICS (MEI)

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INSERT for Question 12

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Friday 15 January 2010
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Candidate Forename				Candidate Surname			
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Centre Number							Candidate Number					
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INSTRUCTIONS TO CANDIDATES

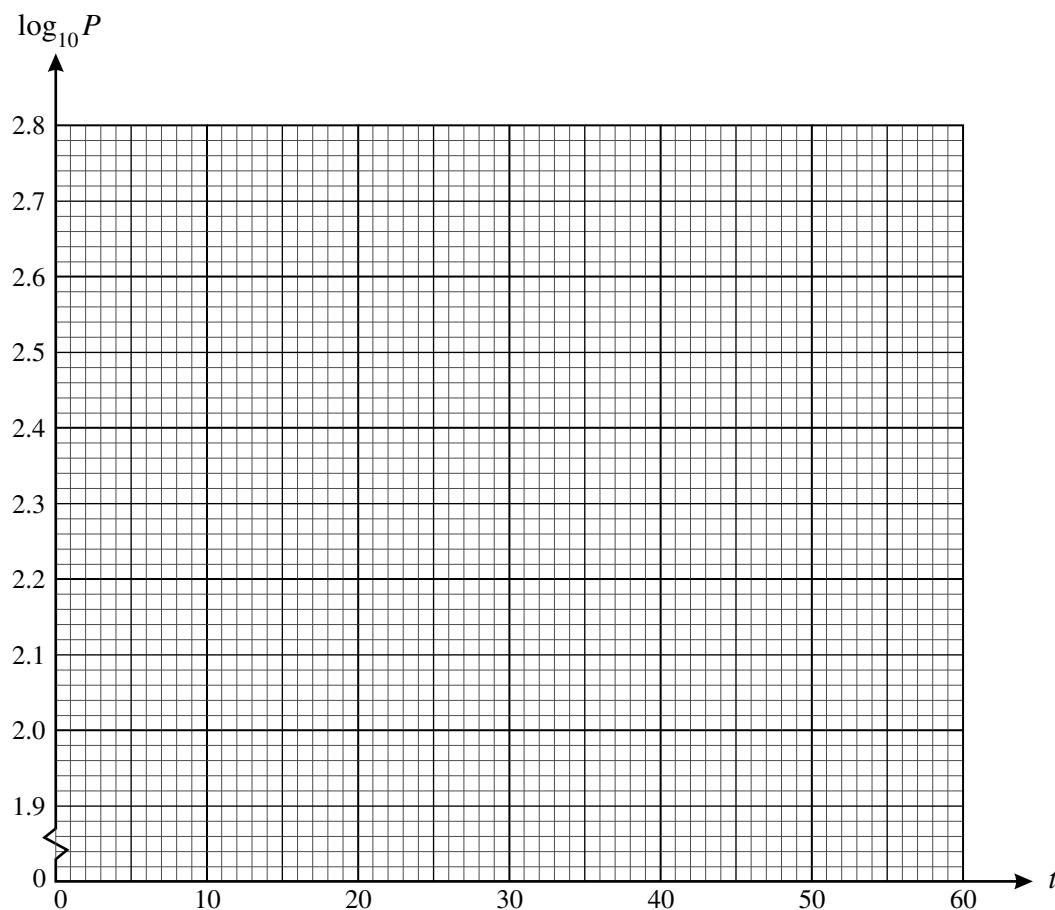
- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- This insert should be used to answer Question 12 part (ii).
- Write your answers to Question 12 part (ii) in the spaces provided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

INFORMATION FOR CANDIDATES

- This document consists of **2** pages. Any blank pages are indicated.

12 (ii)

Year	1955	1965	1975	1985	1995	2005
t	10	20	30	40	50	60
P	131	161	209	277	372	492
$\log_{10} P$	2.12	2.21				

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