



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 3 5 3 1 3 5 3 1 3 ...

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

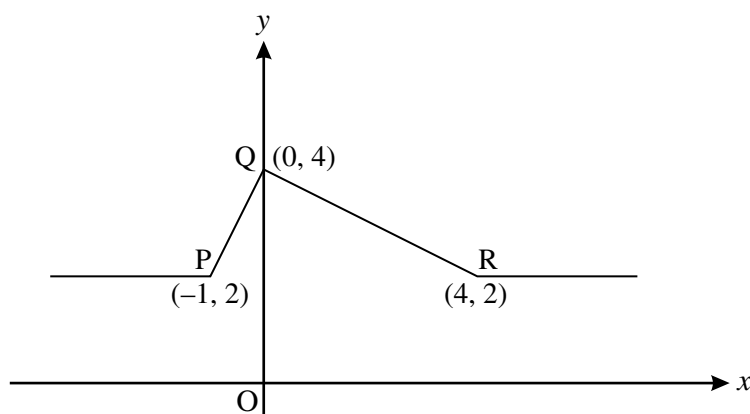


Fig. 5

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]

3

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

$$u_1 = 5,$$

$$u_{n+1} = u_n + 4. \quad [3]$$

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

$$5 \quad 2 \quad 0.8 \quad \dots \quad [2]$$

7

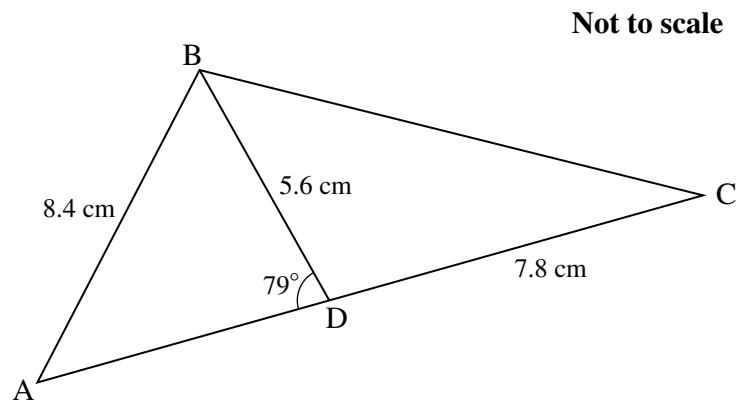


Fig. 7

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

Calculate

- (i) angle BAD, [2]

- (ii) the length BC. [3]

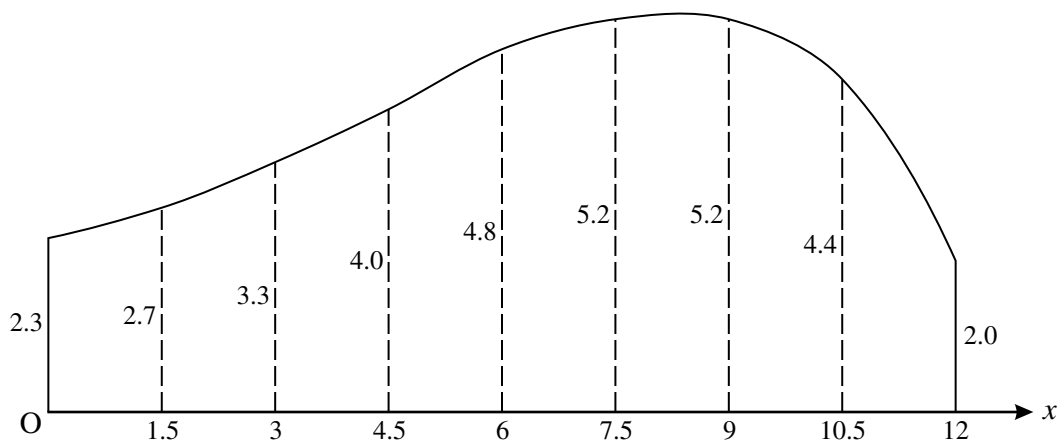
- 8 Find the equation of the tangent to the curve $y = 6\sqrt{x}$ at the point where $x = 16$. [5]

- 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. [2]

**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]

BLANK PAGE

BLANK PAGE

**Copyright Information**

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations, is given to all schools that receive assessment material and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.



ADVANCED SUBSIDIARY GCE

MATHEMATICS (MEI)

Concepts for Advanced Mathematics (C2)

INSERT for Question 12

4752

Friday 15 January 2010
Afternoon

Duration: 1 hour 30 minutes



Candidate Forename		Candidate Surname	
-----------------------	--	----------------------	--

Centre Number						Candidate Number				
---------------	--	--	--	--	--	------------------	--	--	--	--

INSTRUCTIONS TO CANDIDATES

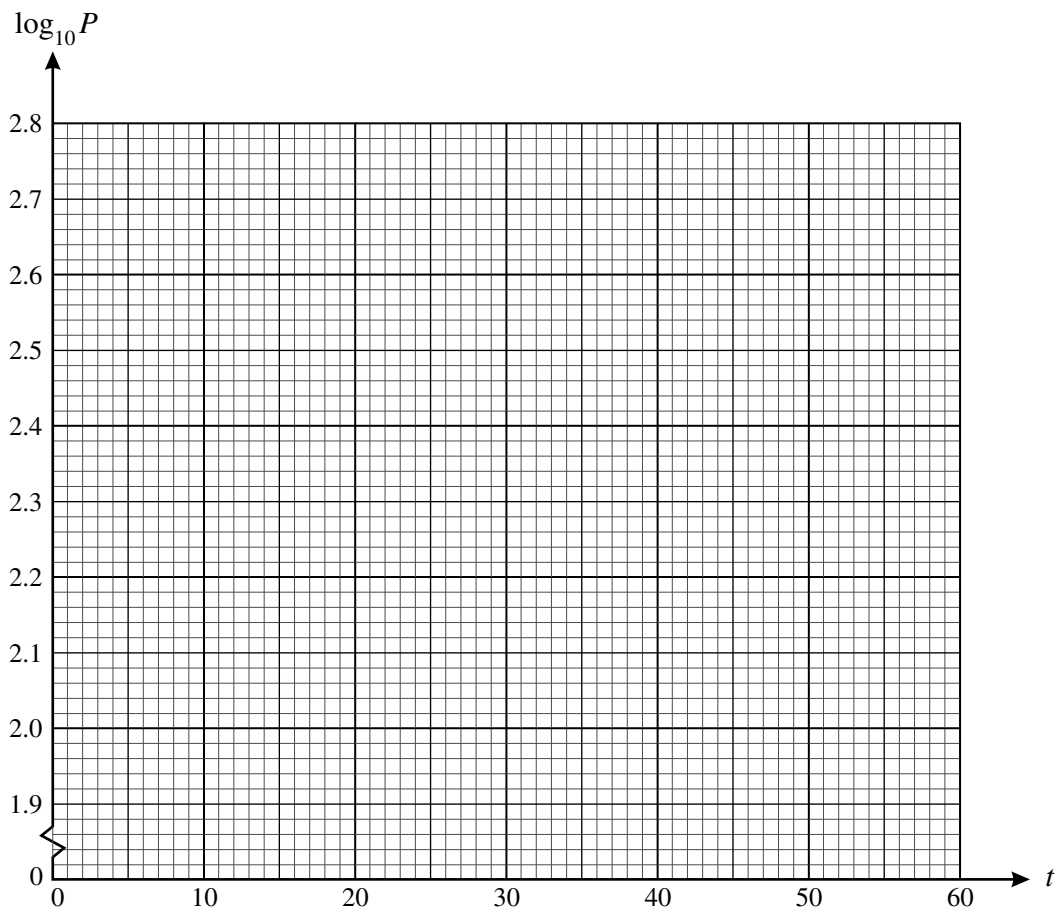
- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- This insert should be used to answer Question **12** part **(ii)**.
- Write your answers to Question **12** part **(ii)** in the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

**Copyright Information**

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations, is given to all schools that receive assessment material and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.