

# OCR

Oxford Cambridge and RSA

## Wednesday 3 June 2015 – Morning

### AS GCE MATHEMATICS (MEI)

4752/01 Concepts for Advanced Mathematics (C2)

#### QUESTION PAPER

Candidates answer on the Printed Answer Book.

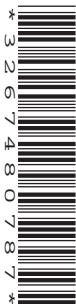
##### OCR supplied materials:

- Printed Answer Book 4752/01
- MEI Examination Formulae and Tables (MF2)

##### Other materials required:

- Scientific or graphical calculator

**Duration:** 1 hour 30 minutes



#### INSTRUCTIONS TO CANDIDATES

These instructions are the same on the Printed Answer Book and the Question Paper.

- The Question Paper will be found inside the Printed Answer Book.
- Write your name, centre number and candidate number in the spaces provided on the Printed Answer Book. Please write clearly and in capital letters.
- **Write your answer to each question in the space provided in the Printed Answer Book.** Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- You are permitted to use a scientific or graphical calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.

#### INFORMATION FOR CANDIDATES

This information is the same on the Printed Answer Book and the Question Paper.

- The number of marks is given in brackets [ ] at the end of each question or part question on the Question Paper.
- 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**.
- The Printed Answer Book consists of **12** pages. The Question Paper consists of **4** pages. Any blank pages are indicated.

#### INSTRUCTION TO EXAMS OFFICER/INVIGILATOR

- Do not send this Question Paper for marking; it should be retained in the centre or recycled. Please contact OCR Copyright should you wish to re-use this document.

## Section A (36 marks)

- 1 (i) Differentiate  $12\sqrt[3]{x}$ . [2]
- (ii) Integrate  $\frac{6}{x^3}$ . [3]
- 2 A sequence is defined by  $u_1 = 2$  and  $u_{k+1} = \frac{10}{u_k^2}$ .  
Calculate  $\sum_{k=1}^4 u_k$ . [3]
- 3 An arithmetic progression has tenth term 11.1 and fiftieth term 7.1. Find the first term and the common difference. Find also the sum of the first fifty terms of the progression. [5]
- 4 A sector of a circle has angle 1.5 radians and area  $27 \text{ cm}^2$ . Find the perimeter of the sector. [4]
- 5 Use calculus to find the set of values of  $x$  for which  $x^3 - 6x$  is an increasing function. [5]
- 6 (i) On the same axes, sketch the curves  $y = 3^x$  and  $y = 3^{2x}$ , identifying clearly which is which. [3]
- (ii) Given that  $3^{2x} = 729$ , find in either order the values of  $3^x$  and  $x$ . [2]
- 7 Show that the equation  $\sin^2 x = 3\cos x - 2$  can be expressed as a quadratic equation in  $\cos x$  and hence solve the equation for values of  $x$  between 0 and  $2\pi$ . [5]
- 8 Fig. 8 shows the graph of  $\log_{10} y$  against  $\log_{10} x$ . It is a straight line passing through the points (2, 8) and (0, 2). [4]

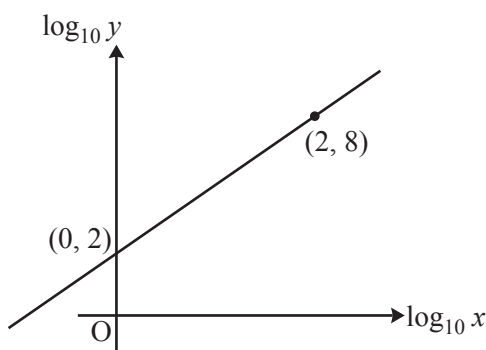


Fig. 8

Find the equation relating  $\log_{10} y$  and  $\log_{10} x$  and hence find the equation relating  $y$  and  $x$ . [4]

## Section B (36 marks)

9

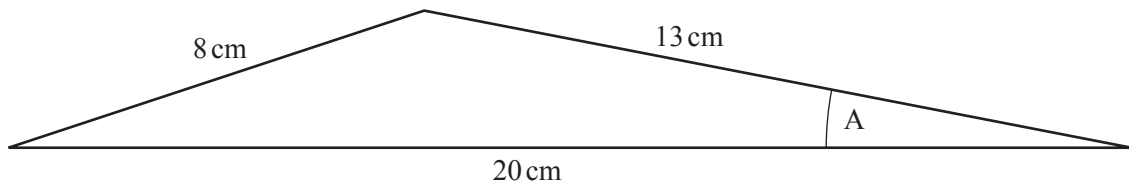


Fig. 9.1

- (i) Jean is designing a model aeroplane. Fig. 9.1 shows her first sketch of the wing's cross-section. Calculate angle A and the area of the cross-section. [5]
- (ii) Jean then modifies her design for the wing. Fig. 9.2 shows the new cross-section, with 1 unit for each of  $x$  and  $y$  representing one centimetre.

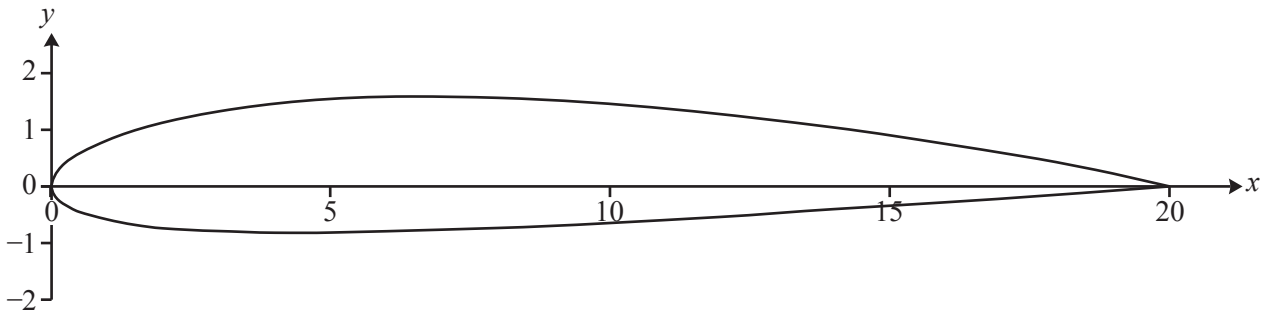


Fig. 9.2

Here are some of the coordinates that Jean used to draw the new cross-section.

Upper surface		Lower surface	
$x$	$y$	$x$	$y$
0	0	0	0
4	1.45	4	-0.85
8	1.56	8	-0.76
12	1.27	12	-0.55
16	1.04	16	-0.30
20	0	20	0

Use the trapezium rule with trapezia of width 4cm to calculate an estimate of the area of this cross-section. [6]

- 10 The gradient of a curve is given by  $\frac{dy}{dx} = 4x + 3$ . The curve passes through the point (2, 9).
- (i) Find the equation of the tangent to the curve at the point (2, 9). [3]
- (ii) Find the equation of the curve and the coordinates of its points of intersection with the  $x$ -axis. Find also the coordinates of the minimum point of this curve. [7]
- (iii) Find the equation of the curve after it has been stretched parallel to the  $x$ -axis with scale factor  $\frac{1}{2}$ . Write down the coordinates of the minimum point of the transformed curve. [3]
- 11 Jill has 3 daughters and no sons. They are generation 1 of Jill's descendants.

Each of her daughters has 3 daughters and no sons. Jill's 9 granddaughters are generation 2 of her descendants. Each of her granddaughters has 3 daughters and no sons; they are descendant generation 3.

Jill decides to investigate what would happen if this pattern continues, with each descendant having 3 daughters and no sons.

- (i) How many of Jill's descendants would there be in generation 8? [2]
- (ii) How many of Jill's descendants would there be altogether in the first 15 generations? [3]
- (iii) After  $n$  generations, Jill would have over a million descendants altogether. Show that  $n$  satisfies the inequality

$$n > \frac{\log_{10} 2000003}{\log_{10} 3} - 1.$$

Hence find the least possible value of  $n$ . [4]

- (iv) How many **fewer** descendants would Jill have altogether in 15 generations if instead of having 3 daughters, she and each subsequent descendant has 2 daughters? [3]

**END OF QUESTION PAPER**

**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 and is freely available to download from our public website ([www.ocr.org.uk](http://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.