

# 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.

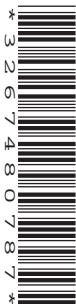
**OCR supplied materials:**

- 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

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## 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]

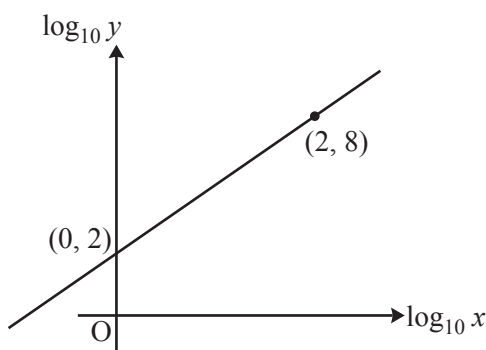


Fig. 8

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

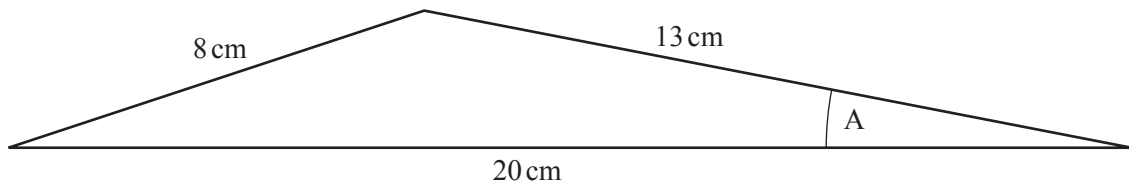


Fig. 9.1

- (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.

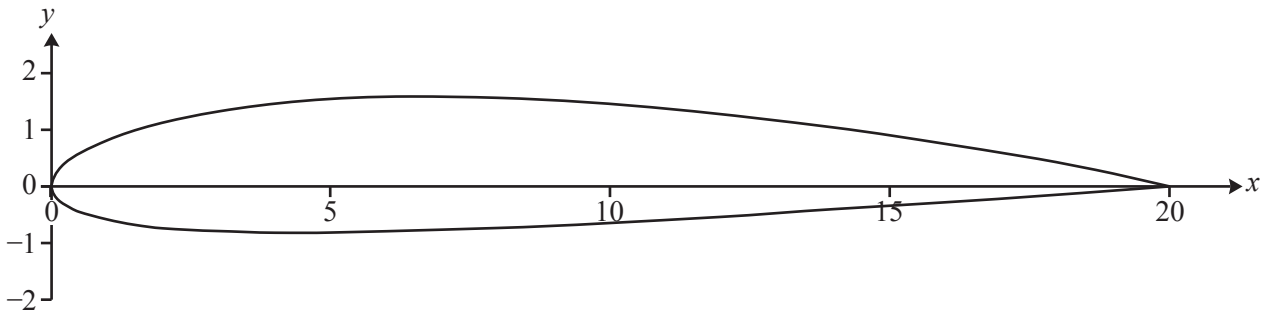


Fig. 9.2

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**

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