

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 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 2π . [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]

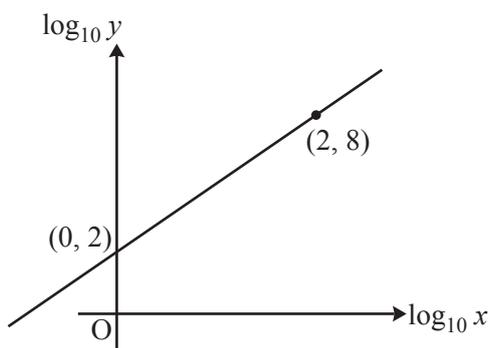


Fig. 8

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

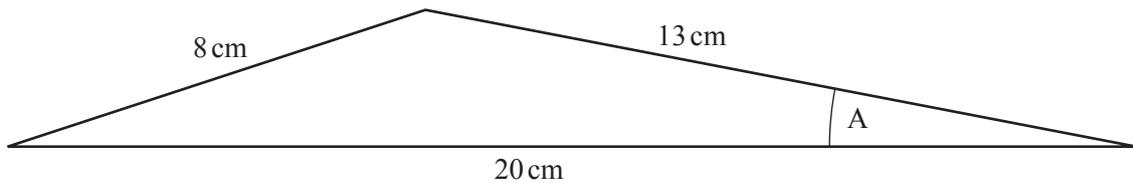


Fig. 9.1

- (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.

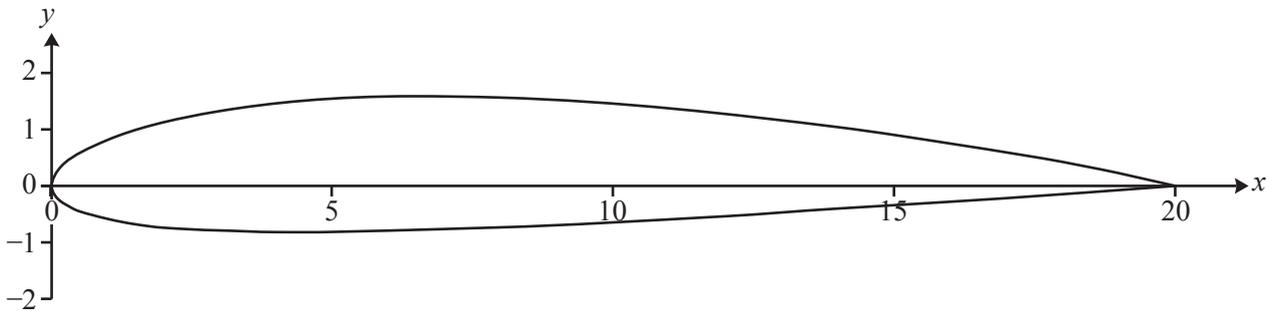


Fig. 9.2

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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