OXFORD CAMBRIDGE AND RSA EXAMINATIONS

AS GCE

4751/01

MATHEMATICS (MEI)

Introduction to Advanced Mathematics (C1)

QUESTION PAPER

MONDAY 14 JANUARY 2013: Morning

DURATION: 1 hour 30 minutes plus your additional time allowance

MODIFIED ENLARGED 24pt

Candidates answer on the Printed Answer Book or any suitable paper provided by the centre. The printed answer booklet may be enlarged by the centre.

OCR SUPPLIED MATERIALS:

Printed Answer Book 4751/01
MEI Examination Formulae and Tables (MF2)

OTHER MATERIALS REQUIRED:

None

READ INSTRUCTIONS OVERLEAF

DC (RW) 1460527645 72095/1

INSTRUCTIONS TO CANDIDATES

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

- **The Question Paper will be found in the centre of 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.**

- **You are NOT permitted to use a 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.**

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.**

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SECTION A (36 marks)

1 **Find the value of each of the following.**

(i) $\left(\frac{5}{3}\right)^{-2}$ **[2]**

(ii) $81^{\frac{3}{4}}$ **[2]**

2 **Simplify** $\dfrac{\left(4x^5y\right)^3}{\left(2xy^2\right)\times\left(8x^{10}y^4\right)}$. **[3]**

3 **A circle has diameter d, circumference C, and area A. Starting with the standard formulae for a circle, show that $Cd = kA$, finding the numerical value of k. [3]**

4 **Solve the inequality $5x^2 - 28x - 12 \leqslant 0$. [4]**

5 **You are given that $\mathrm{f}(x) = x^2 + kx + c$.**

Given also that $\mathrm{f}(2) = 0$ and $\mathrm{f}(-3) = 35$, find the values of the constants k and c. [4]

6 The binomial expansion of $\left(2x + \frac{5}{x}\right)^6$ has a term which is a constant. Find this term. [4]

7 (i) Express $\sqrt{48} + \sqrt{75}$ in the form $a\sqrt{b}$, where a and b are integers. [2]

(ii) Simplify $\frac{7 + 2\sqrt{5}}{7 + \sqrt{5}}$, expressing your answer in the form $\frac{a + b\sqrt{5}}{c}$, where a, b and c are integers. [3]

8 Rearrange the equation $5c + 9t = a(2c + t)$ to make c the subject. [4]

9 You are given that $\mathrm{f}(x) = (x + 2)^2(x - 3)$.

(i) Sketch the graph of $y = \mathrm{f}(x)$. [3]

(ii) State the values of x which satisfy $\mathrm{f}(x + 3) = 0$. [2]

SECTION B (36 marks)

10 (i) Points A and B have coordinates (–2, 1) and (3, 4) respectively. Find the equation of the perpendicular bisector of AB and show that it may be written as $5x + 3y = 10$. [6]

(ii) Points C and D have coordinates (–5, 4) and (3, 6) respectively. The line through C and D has equation $4y = x + 21$. The point E is the intersection of CD and the perpendicular bisector of AB. Find the coordinates of point E. [3]

(iii) Find the equation of the circle with centre E which passes through A and B. Show also that CD is a diameter of this circle. [5]

11 (i) Express $x^2 - 5x + 6$ in the form $(x - a)^2 - b$. Hence state the coordinates of the turning point of the curve $y = x^2 - 5x + 6$. [4]

(ii) Find the coordinates of the intersections of the curve $y = x^2 - 5x + 6$ with the axes and sketch this curve. [4]

(iii) Solve the simultaneous equations $y = x^2 - 5x + 6$ and $x + y = 2$. Hence show that the line $x + y = 2$ is a tangent to the curve $y = x^2 - 5x + 6$ at one of the points where the curve intersects the axes. [4]

12 You are given that

$$\mathrm{f}(x) = x^4 - x^3 + x^2 + 9x - 10.$$

(i) Show that $x = 1$ is a root of $\mathrm{f}(x) = 0$ and hence express $\mathrm{f}(x)$ as a product of a linear factor and a cubic factor. [3]

(ii) Hence or otherwise find another root of $\mathrm{f}(x) = 0$. [2]

(iii) Factorise $\mathrm{f}(x)$, showing that it has only two linear factors. Show also that $\mathrm{f}(x) = 0$ has only two real roots. [5]

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