

**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

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

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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 $\frac{(4x^5y)^3}{(2xy^2) \times (8x^{10}y^4)}$. [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 $5x^2 - 28x - 12 \leq 0$. [4]

5 You are given that $f(x) = x^2 + kx + c$.

Given also that $f(2) = 0$ and $f(-3) = 35$, 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 $f(x) = (x + 2)^2(x - 3)$.
- (i) Sketch the graph of $y = f(x)$. [3]
- (ii) State the values of x which satisfy $f(x + 3) = 0$. [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

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

- (i) Show that $x = 1$ is a root of $f(x) = 0$ and hence express $f(x)$ as a product of a linear factor and a cubic factor. [3]**
- (ii) Hence or otherwise find another root of $f(x) = 0$. [2]**
- (iii) Factorise $f(x)$, showing that it has only two linear factors. Show also that $f(x) = 0$ has only two real roots. [5]**

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