

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
AS GCE
4751/01

MATHEMATICS (MEI)

Introduction to Advanced Mathematics
(C1)

QUESTION PAPER

WEDNESDAY 16 MAY 2018: Morning

DURATION: 1 hour 30 minutes
plus your additional time allowance

MODIFIED ENLARGED 24pt

Candidates answer on the Printed Answer Book sent with the standard paper or any suitable paper provided by the centre. The Printed Answer Book may be enlarged by the centre.

OCR SUPPLIED MATERIALS:

Printed Answer Book sent with the standard paper

MEI Examination Formulae and Tables (MF2) sent with the standard paper

OTHER MATERIALS REQUIRED:

None

<p>NO CALCULATOR CAN BE USED FOR THIS PAPER</p>
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READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces provided on the Printed Answer Book or on the paper provided. Please write clearly and in capital letters.

If you use the Printed Answer Book, write your answer to each question in the space provided. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.

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

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 Simplify $(5a^2c)^3 \times 2a^4c^{-5}$. [2]
- 2 Find the equation of the line joining the points $(-1, 9)$ and $(2, -3)$, giving your answer in the form $y = mx + c$. State the coordinates of the points where this line intersects the axes. [5]
- 3 Find the value of
- (i) $(2\frac{1}{4})^{-2}$, [2]
- (ii) $(8000)^{\frac{2}{3}}$. [2]
- 4 For the following equation, express x in terms of y . [4]

$$\frac{x}{3y} = \frac{2x + 1}{y + 2}$$

- 5** Find the coordinates of the point of intersection of the lines $y = 4x + 3$ and $3x + 2y = 9$. **[4]**
- 6** Find the term that is independent of x in the binomial expansion of $\left(\frac{1}{x} - 3x\right)^6$. **[3]**
- 7** (i) Express $\sqrt{28} + 3\sqrt{175}$ in the form $a\sqrt{b}$, where a and b are integers and b is as small as possible. **[2]**
- (ii) Simplify $\frac{6}{5 - \sqrt{2}} - \frac{3\sqrt{2}}{5 + \sqrt{2}}$, giving your answer in the form $\frac{a + b\sqrt{2}}{c}$, where a , b and c are integers. **[3]**

8 For each of the following pairs of sentences A and B , give a reason why the statement $A \Leftrightarrow B$ is false and write either ' $A \Rightarrow B$ ' or ' $A \Leftarrow B$ ' to show the correct relationship.

(i) A : n is positive.
 B : $n^2 + 6$ is positive. **[2]**

(ii) A : The diagonals of a quadrilateral bisect each other but not at right angles.
 B : The quadrilateral is a rectangle but not a square. **[2]**

9 You are given that $f(x) = ax^3 + cx$ and that $f(-1) = 3$. You are also given that when $f(x)$ is divided by $(x - 4)$, the remainder is 108. Find the values of a and c . **[5]**

SECTION B (36 marks)

- 10 (i) Express $3x^2 - 9x + 5$ in the form $a(x + b)^2 + c$. Hence state the equation of the line of symmetry and the y -coordinate of the minimum point of the curve with equation $y = 3x^2 - 9x + 5$. [6]
- (ii) Find the coordinates of the points where the graph of $y = 3x^2 - 9x + 5$ intersects the axes. Give your answers in an exact form. Hence state the solution of the inequality $3x^2 - 9x + 5 < 0$. [4]

11 You are given that

$$f(x) = (2x + 5)(x^2 - 5x + 4).$$

(i) Sketch the graph of $y = f(x)$. **[4]**

(ii) You are given that

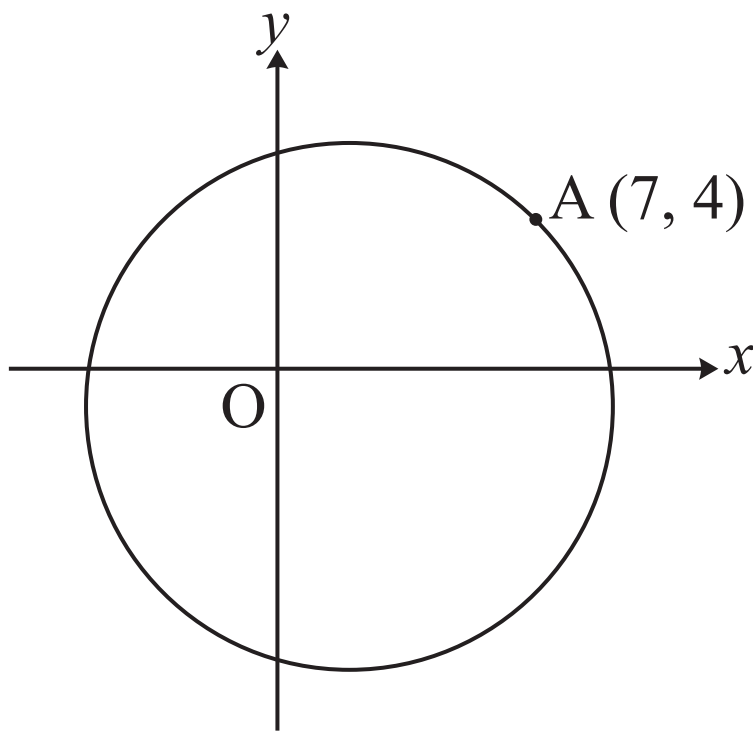
$g(x) = 2x^3 - 5x^2 - 17x + 48$. Show that $x = -3$ is a root of $g(x) = 0$ and that it is the only real root. **[6]**

(iii) Show that $y = g(x)$ is a translation of $y = f(x)$ by $\begin{pmatrix} 0 \\ k \end{pmatrix}$, finding the value of k . **[3]**

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- 12** Fig. 12 below shows a sketch of the circle with equation $(x - 2)^2 + (y + 1)^2 = 50$. You are given that the point A (7, 4) lies on the circle.

Fig. 12



- (i)** Write down the radius of this circle and the coordinates of its centre. **[2]**

- (ii) The line L has equation $y = 2x - 10$ and passes through the point A (7, 4). Use algebra to find the coordinates of the point B where the line L meets the circle again. Hence show that the perpendicular distance from the centre of the circle to the line L is $\sqrt{5}$. **[6]**
- (iii) Show that, when the line $y = 2x + k$ is a tangent to the circle, k satisfies the equation
- $$k^2 + 10k - 225 = 0. \quad \mathbf{[5]}$$

END OF QUESTION PAPER

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