

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
A2 GCE
4754/01A

MATHEMATICS (MEI)
Applications of Advanced
Mathematics (C4) Paper A

QUESTION PAPER

THURSDAY 13 JUNE 2013: Morning

DURATION: 1 hour 30 minutes
plus your additional time allowance

MODIFIED ENLARGED

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

OCR SUPPLIED MATERIALS:

Printed Answer Book 4754/01A
MEI Examination Formulae and Tables (MF2)

OTHER MATERIALS REQUIRED:

Scientific or graphical calculator

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 by the centre. Please write clearly and in capital letters.
- **IF YOU USE THE PRINTED ANSWER BOOK, WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED.** 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 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

- 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**.
- Any blank pages are indicated.
- This paper will be followed by **PAPER B: COMPREHENSION**.

INSTRUCTION TO EXAMS OFFICER/INVIGILATOR

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SECTION A (36 marks)

- 1 (i) Express $\frac{x}{(1+x)(1-2x)}$ in partial fractions. [3]
- (ii) Hence use binomial expansions to show that $\frac{x}{(1+x)(1-2x)} = ax + bx^2 + \dots$, where a and b are constants to be determined.

State the set of values of x for which the expansion is valid. [5]

- 2 Show that the equation $\operatorname{cosec} x + 5 \cot x = 3 \sin x$ may be rearranged as

$$3 \cos^2 x + 5 \cos x - 2 = 0.$$

Hence solve the equation for $0^\circ \leq x \leq 360^\circ$, giving your answers to 1 decimal place. [7]

- 3 Using appropriate right-angled triangles, show that $\tan 45^\circ = 1$ and $\tan 30^\circ = \frac{1}{\sqrt{3}}$.

Hence show that $\tan 75^\circ = 2 + \sqrt{3}$. [7]

- 4 (i) Find a vector equation of the line l joining the points $(0, 1, 3)$ and $(-2, 2, 5)$. [2]
- (ii) Find the point of intersection of the line l with the plane $x + 3y + 2z = 4$. [3]
- (iii) Find the acute angle between the line l and the normal to the plane. [3]

- 5 The points A, B and C have coordinates $A(3, 2, -1)$, $B(-1, 1, 2)$ and $C(10, 5, -5)$, relative to the origin O. Show that \overrightarrow{OC} can be written in the form $\lambda\overrightarrow{OA} + \mu\overrightarrow{OB}$, where λ and μ are to be determined.**

What can you deduce about the points O, A, B and C from the fact that \overrightarrow{OC} can be expressed as a combination of \overrightarrow{OA} and \overrightarrow{OB} ? [6]

SECTION B (36 marks)

- 6 The motion of a particle is modelled by the differential equation

$$v \frac{dv}{dx} + 4x = 0,$$

where x is its displacement from a fixed point, and v is its velocity.

Initially $x = 1$ and $v = 4$.

- (i) Solve the differential equation to show that $v^2 = 20 - 4x^2$. [4]

Now consider motion for which $x = \cos 2t + 2 \sin 2t$, where x is the displacement from a fixed point at time t .

- (ii) Verify that, when $t = 0$, $x = 1$. Use the fact that $v = \frac{dx}{dt}$ to verify that when $t = 0$, $v = 4$. [4]
- (iii) Express x in the form $R \cos(2t - \alpha)$, where R and α are constants to be determined, and obtain the corresponding expression for v . Hence or otherwise verify that, for this motion too, $v^2 = 20 - 4x^2$. [7]
- (iv) Use your answers to part (iii) to find the maximum value of x , and the earliest time at which x reaches this maximum value. [3]

- 7 Fig. 7 below shows the curve BC defined by the parametric equations

$$x = 5 \ln u, \quad y = u + \frac{1}{u}, \quad 1 \leq u \leq 10.$$

The point A lies on the x -axis and AC is parallel to the y -axis. The tangent to the curve at C makes an angle θ with AC, as shown.

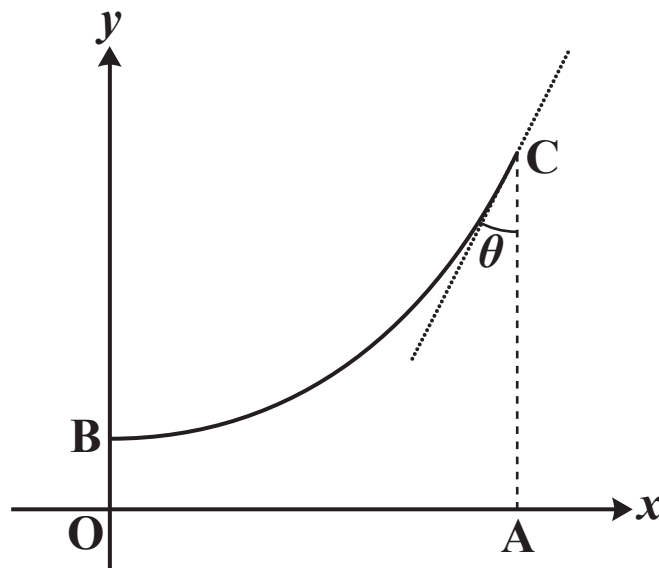


FIG. 7

- (i) Find the lengths OA, OB and AC. [5]
- (ii) Find $\frac{dy}{dx}$ in terms of u . Hence find the angle θ . [6]
- (iii) Show that the cartesian equation of the curve is $y = e^{\frac{1}{5}x} + e^{-\frac{1}{5}x}$. [2]

An object is formed by rotating the region OACB through 360° about Ox.

- (iv) Find the volume of the object. [5]

THERE ARE NO QUESTIONS WRITTEN ON THIS PAGE.



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