

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
A2 GCE
4753/01
MATHEMATICS (MEI)
Methods for Advanced Mathematics (C3)
QUESTION PAPER

MONDAY 16 JUNE 2014: 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 4753/01
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.

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.

SECTION A (36 marks)

- 1 Evaluate $\int_0^{\frac{1}{6}\pi} (1 - \sin 3x) dx$, giving your answer in exact form. [3]
- 2 Find the exact gradient of the curve $y = \ln(1 - \cos 2x)$ at the point with x -coordinate $\frac{1}{6}\pi$. [5]
- 3 Solve the equation $|3 - 2x| = 4|x|$. [4]
- 4 Fig. 4 shows the curve $y = f(x)$, where $f(x) = a + \cos bx$, $0 \leq x \leq 2\pi$, and a and b are positive constants. The curve has stationary points at $(0, 3)$ and $(2\pi, 1)$.

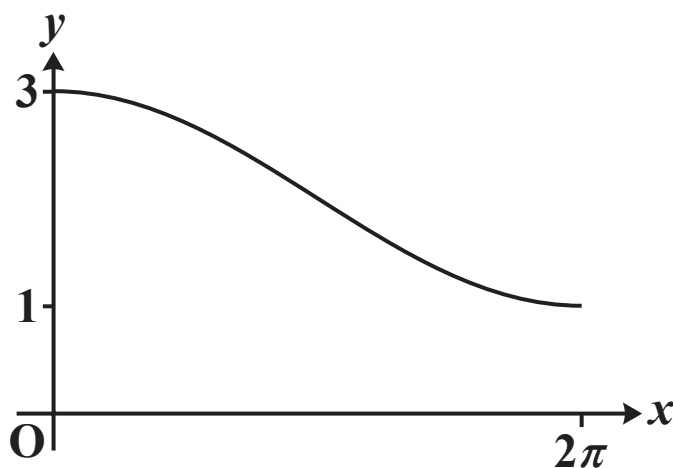


FIG. 4

- (i) Find a and b . [2]
- (ii) Find $f^{-1}(x)$, and state its domain and range. [5]

- 5 A spherical balloon of radius r cm has volume V cm³, where $V = \frac{4}{3}\pi r^3$. The balloon is inflated at a constant rate of $10 \text{ cm}^3 \text{ s}^{-1}$. Find the rate of increase of r when $r = 8$. [5]
- 6 The value £ V of a car t years after it is new is modelled by the equation $V = Ae^{-kt}$, where A and k are positive constants which depend on the make and model of the car.
- (i) Brian buys a new sports car. Its value is modelled by the equation

$$V = 20000 e^{-0.2t}.$$
 Calculate how much value, to the nearest £100, this car has lost after 1 year. [2]
- (ii) At the same time as Brian buys his car, Kate buys a new hatchback for £15000. Her car loses £2000 of its value in the first year. Show that, for Kate's car, $k = 0.143$ correct to 3 significant figures. [3]
- (iii) Find how long it is before Brian's and Kate's cars have the same value. [3]
- 7 Either prove or disprove each of the following statements.
- (i) 'If m and n are consecutive odd numbers, then at least one of m and n is a prime number.' [2]
- (ii) 'If m and n are consecutive even numbers, then mn is divisible by 8.' [2]

SECTION B (36 marks)

8 Fig. 8 shows the curve $y = f(x)$, where $f(x) = \frac{x}{\sqrt{2+x^2}}$.

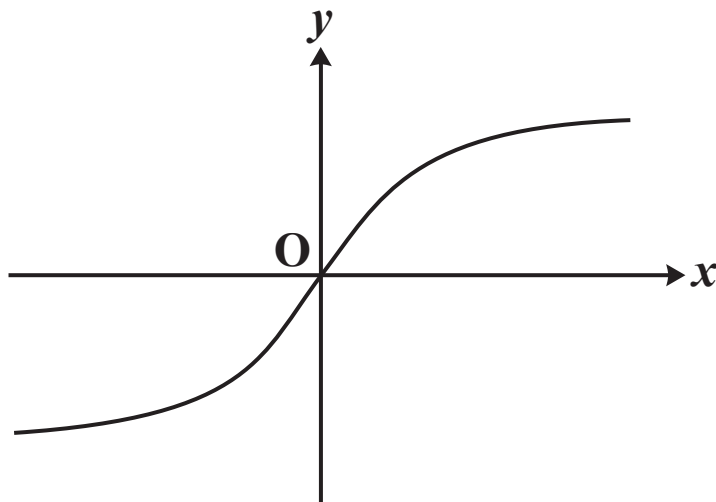


FIG. 8

- (i) Show algebraically that $f(x)$ is an odd function. Interpret this result geometrically. [3]
- (ii) Show that $f'(x) = \frac{2}{(2+x^2)^{\frac{3}{2}}}$. Hence find the exact gradient of the curve at the origin. [5]
- (iii) Find the exact area of the region bounded by the curve, the x -axis and the line $x = 1$. [4]

(iv) (A) Show that if $y = \frac{x}{\sqrt{2+x^2}}$, then $\frac{1}{y^2} = \frac{2}{x^2} + 1$. [2]

(B) Differentiate $\frac{1}{y^2} = \frac{2}{x^2} + 1$ implicitly to show that $\frac{dy}{dx} = \frac{2y^3}{x^3}$. Explain why this expression cannot be used to find the gradient of the curve at the origin. [4]

[Question 9 is printed overleaf.]

- 9 Fig. 9 shows the curve $y = xe^{-2x}$ together with the straight line $y = mx$, where m is a constant, with $0 < m < 1$. The curve and the line meet at O and P. The dashed line is the tangent at P.

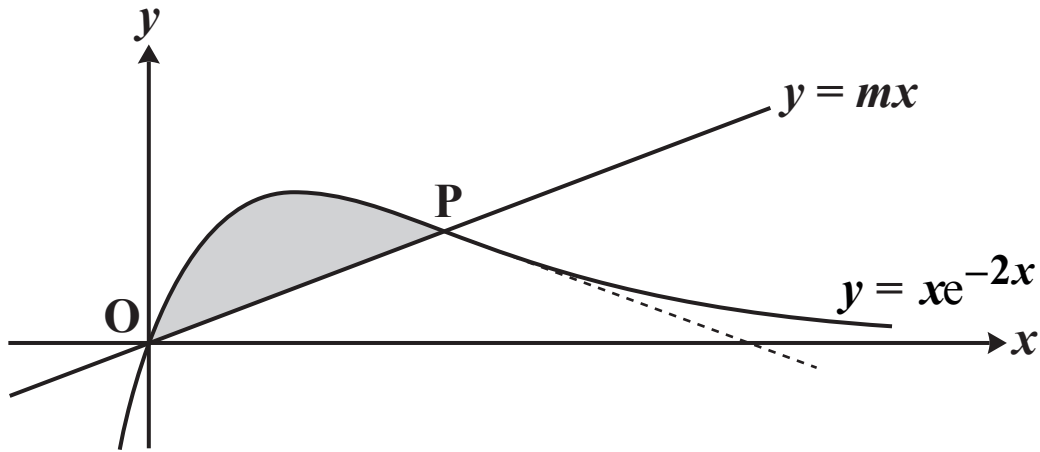


FIG. 9

- (i) Show that the x -coordinate of P is $-\frac{1}{2} \ln m$. [3]
- (ii) Find, in terms of m , the gradient of the tangent to the curve at P. [4]
- You are given that OP and this tangent are equally inclined to the x -axis.
- (iii) Show that $m = e^{-2}$, and find the exact coordinates of P. [4]
- (iv) Find the exact area of the shaded region between the line OP and the curve. [7]

END OF QUESTION PAPER

BLANK PAGE

BLANK PAGE

BLANK PAGE



Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

