

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Education
Advanced Level Examination
June 2011

Mathematics

MPC3

Unit Pure Core 3

Monday 13 June 2011 9.00 am to 10.30 am

For this paper you must have:

- the blue AQA booklet of formulae and statistical tables.
- You may use a graphics calculator.

Time allowed

- 1 hour 30 minutes

Instructions

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Write the question part reference (eg (a), (b)(i) etc) in the left-hand margin.
- You must answer the questions in the spaces provided. Do not write outside the box around each page.
- Show all necessary working; otherwise marks for method may be lost.
- Do all rough work in this book. Cross through any work that you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 75.

Advice

- Unless stated otherwise, you may quote formulae, without proof, from the booklet.

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
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8	
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TOTAL	



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QUESTION
PART
REFERENCE

Turn over ►



2 (a) (i) Find $\frac{dy}{dx}$ when $y = xe^{2x}$. (3 marks)

(ii) Find an equation of the tangent to the curve $y = xe^{2x}$ at the point $(1, e^2)$. (2 marks)

(b) Given that $y = \frac{2 \sin 3x}{1 + \cos 3x}$, use the quotient rule to show that

$$\frac{dy}{dx} = \frac{k}{1 + \cos 3x}$$

where k is an integer.

(4 marks)

QUESTION
PART
REFERENCE



QUESTION
PART
REFERENCE

Turn over ►



- 3** The curve $y = \cos^{-1}(2x - 1)$ intersects the curve $y = e^x$ at a single point where $x = \alpha$.
- (a)** Show that α lies between 0.4 and 0.5. (2 marks)
- (b)** Show that the equation $\cos^{-1}(2x - 1) = e^x$ can be written as $x = \frac{1}{2} + \frac{1}{2}\cos(e^x)$. (1 mark)
- (c)** Use the iteration $x_{n+1} = \frac{1}{2} + \frac{1}{2}\cos(e^{x_n})$ with $x_1 = 0.4$ to find the values of x_2 and x_3 , giving your answers to three decimal places. (2 marks)

QUESTION
PART
REFERENCE



QUESTION
PART
REFERENCE

Turn over ►



4 (a) (i) Solve the equation $\operatorname{cosec} \theta = -4$ for $0^\circ < \theta < 360^\circ$, giving your answers to the nearest 0.1° . (2 marks)

(ii) Solve the equation

$$2 \cot^2(2x + 30^\circ) = 2 - 7 \operatorname{cosec}(2x + 30^\circ)$$

for $0^\circ < x < 180^\circ$, giving your answers to the nearest 0.1° . (6 marks)

(b) Describe a sequence of two geometrical transformations that maps the graph of $y = \operatorname{cosec} x$ onto the graph of $y = \operatorname{cosec}(2x + 30^\circ)$. (4 marks)

QUESTION
PART
REFERENCE



QUESTION
PART
REFERENCE

Turn over ►



5 The functions f and g are defined with their respective domains by

$$f(x) = x^2 \quad \text{for all real values of } x$$

$$g(x) = \frac{1}{2x+1} \quad \text{for real values of } x, \quad x \neq -0.5$$

- (a) Explain why f does not have an inverse. (1 mark)
- (b) The inverse of g is g^{-1} . Find $g^{-1}(x)$. (3 marks)
- (c) State the range of g^{-1} . (1 mark)
- (d) Solve the equation $fg(x) = g(x)$. (3 marks)

QUESTION
PART
REFERENCE



[illegible]

6 (a) Given that $3 \ln x = 4$, find the exact value of x . (1 mark)

(b) By forming a quadratic equation in $\ln x$, solve $3 \ln x + \frac{20}{\ln x} = 19$, giving your answers for x in an exact form. (5 marks)

QUESTION
PART
REFERENCE



[illegible]

7 (a) On separate diagrams:

(i) sketch the curve with equation $y = |3x + 3|$; (2 marks)

(ii) sketch the curve with equation $y = |x^2 - 1|$. (3 marks)

(b) (i) Solve the equation $|3x + 3| = |x^2 - 1|$. (5 marks)

(ii) Hence solve the inequality $|3x + 3| < |x^2 - 1|$. (2 marks)

QUESTION
PART
REFERENCE



QUESTION
PART
REFERENCE

Turn over ►



8

Use the substitution $u = 1 + 2 \tan x$ to find

$$\int \frac{1}{(1 + 2 \tan x)^2 \cos^2 x} dx$$

(5 marks)

QUESTION
PART
REFERENCE

[illegible]

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Find the volume of the solid generated when the region R is rotated through 360° about the x -axis, giving your answer in an exact form. (6 marks)

QUESTION	PART	REFERENCE
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