

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	



General Certificate of Education
Advanced Level Examination
June 2011

Mathematics

MFP3

Unit Further Pure 3

Thursday 16 June 2011 1.30 pm to 3.00 pm

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.



J U N 1 1 M F P 3 0 1

5 (a) Given that $y = \ln(1 + 2 \tan x)$, find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$.

(You may leave your expression for $\frac{d^2y}{dx^2}$ unsimplified.) (4 marks)

(b) Hence, using Maclaurin's theorem, find the first two non-zero terms in the expansion, in ascending powers of x , of $\ln(1 + 2 \tan x)$. (2 marks)

(c) Find

$$\lim_{x \rightarrow 0} \left[\frac{\ln(1 + 2 \tan x)}{\ln(1 - x)} \right] \quad (4 \text{ marks})$$

QUESTION
PART
REFERENCE



6 A differential equation is given by

$$(x^3 + 1) \frac{d^2y}{dx^2} - 3x^2 \frac{dy}{dx} = 2 - 4x^3$$

(a) Show that the substitution

$$u = \frac{dy}{dx} - 2x$$

transforms this differential equation into

$$(x^3 + 1) \frac{du}{dx} = 3x^2u \quad (4 \text{ marks})$$

(b) Hence find the general solution of the differential equation

$$(x^3 + 1) \frac{d^2y}{dx^2} - 3x^2 \frac{dy}{dx} = 2 - 4x^3$$

giving your answer in the form $y = f(x)$. (8 marks)

QUESTION
PART
REFERENCE

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



7 The curve C_1 is defined by $r = 2 \sin \theta$, $0 \leq \theta < \frac{\pi}{2}$.

The curve C_2 is defined by $r = \tan \theta$, $0 \leq \theta < \frac{\pi}{2}$.

(a) Find a cartesian equation of C_1 . (3 marks)

(b) (i) Prove that the curves C_1 and C_2 meet at the pole O and at one other point, P , in the given domain. State the polar coordinates of P . (4 marks)

(ii) The point A is the point on the curve C_1 at which $\theta = \frac{\pi}{4}$.

The point B is the point on the curve C_2 at which $\theta = \frac{\pi}{4}$.

Determine which of the points A or B is further away from the pole O , justifying your answer. (2 marks)

(iii) Show that the area of the region bounded by the arc OP of C_1 and the arc OP of C_2 is $a\pi + b\sqrt{3}$, where a and b are rational numbers. (10 marks)

QUESTION
PART
REFERENCE

A large rectangular area with horizontal dotted lines, intended for the student's answer.



QUESTION
PART
REFERENCE

Area with horizontal dotted lines for writing.

END OF QUESTIONS

Copyright © 2011 AQA and its licensors. All rights reserved.

