Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	6	7	4	/	0	1	Signature	

Paper Reference(s)

6674/01

Edexcel GCE

Further Pure Mathematics FP1

Advanced/Advanced Subsidiary

Monday 16 June 2008 – Afternoon

Time: 1 hour 30 minutes

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
8	
Total	

Materials required for examination
Mathematical Formulae (Green)

Items included with question papers
Nil

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initials and signature.
Check that you have the correct question paper.
Answer ALL the questions. Write your answers in the spaces provided in this question paper.
When a calculator is used, the answer should be given to an appropriate degree of accuracy.

Information for Candidates

A booklet 'Mathematical Formulae and Statistical Tables' is provided.
Full marks may be obtained for answers to ALL questions.
The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 8 questions in this question paper. The total mark for this paper is 75.
There are 28 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
You should show sufficient working to make your methods clear to the Examiner.
Answers without working may not gain full credit.

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1. (a) Write down the value of the real root of the equation

$$x^3 - 64 = 0 .$$

(1)

(b) Find the complex roots of $x^3 - 64 = 0$, giving your answers in the form $a + \mathrm{i}b$, where a and b are real.

(4)

(c) Show the three roots of $x^3 - 64 = 0$ on an Argand diagram.

(2)

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Question 1 continued

Q1

(Total 7 marks)

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2. $$f(x) = 4\cos x + e^{-x}.$$

(a) Show that the equation $f(x) = 0$ has a root α between 1.6 and 1.7

(2)

(b) Taking 1.6 as your first approximation to α, apply the Newton-Raphson procedure once to $f(x)$ to obtain a second approximation to α. Give your answer to 3 significant figures.

(4)

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Question 2 continued

(Total 6 marks)

Q2

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3. The complex number z is defined by

$$z = \frac{a + 2\mathrm{i}}{a - \mathrm{i}}, \qquad a \in \mathbb{R},\ a > 0 .$$

Given that the real part of z is $\frac{1}{2}$, find

(a) the value of a,

(4)

(b) the argument of z, giving your answer in radians to 2 decimal places.

(3)

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Question 3 continued

(Total 7 marks)

Q3

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4. (a) Find, in terms of k, the general solution of the differential equation

$$\frac{d^2x}{dt^2} + 4\frac{dx}{dt} + 3x = kt + 5 \text{ , where } k \text{ is a constant and } t > 0 \text{ .}$$

(7)

For large values of t, this general solution may be approximated by a linear function.

(b) Given that $k = 6$, find the equation of this linear function.

(2)

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Question 4 continued

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Question 4 continued

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Question 4 continued

Q4

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5. (a) Find, in the simplest surd form where appropriate, the exact values of x for which

$$\frac{x}{2}+3=\left|\frac{4}{x}\right|.$$

(5)

(b) Sketch, on the same axes, the line with equation $y=\frac{x}{2}+3$ and the graph of $y=\left|\frac{4}{x}\right|$, $x \neq 0$.

(3)

(c) Find the set of values of x for which $\frac{x}{2}+3>\left|\frac{4}{x}\right|$.

(2)

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Question 5 continued

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Question 5 continued

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Question 5 continued

(Total 10 marks)

Q5

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6. (a) Express $\dfrac{2}{(r+1)(r+3)}$ in partial fractions.

(2)

(b) Hence prove, by the method of differences, that

$$\sum_{r=1}^{n} \frac{2}{(r+1)(r+3)} = \frac{n(an+b)}{6(n+2)(n+3)},$$

where a and b are constants to be found.

(6)

(c) Find the value of $\displaystyle\sum_{r=21}^{30} \frac{2}{(r+1)(r+3)}$, to 5 decimal places.

(3)

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Question 6 continued

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Question 6 continued

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Question 6 continued

(Total 11 marks)

Q6

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7. (a) Show that the substitution $y = vx$ transforms the differential equation

$$\frac{dy}{dx} = \frac{x}{y} + \frac{3y}{x}, \quad x > 0, \quad y > 0 \qquad \text{(I)}$$

into the differential equation

$$x\frac{dv}{dx} = 2v + \frac{1}{v}. \qquad \text{(II)}$$

(3)

(b) By solving differential equation (II), find a general solution of differential equation (I) in the form $y = f(x)$.

(7)

Given that $y = 3$ at $x = 1$,

(c) find the particular solution of differential equation (I).

(2)

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Question 7 continued

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Question 7 continued

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Question 7 continued

Q7

(Total 12 marks)

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8.

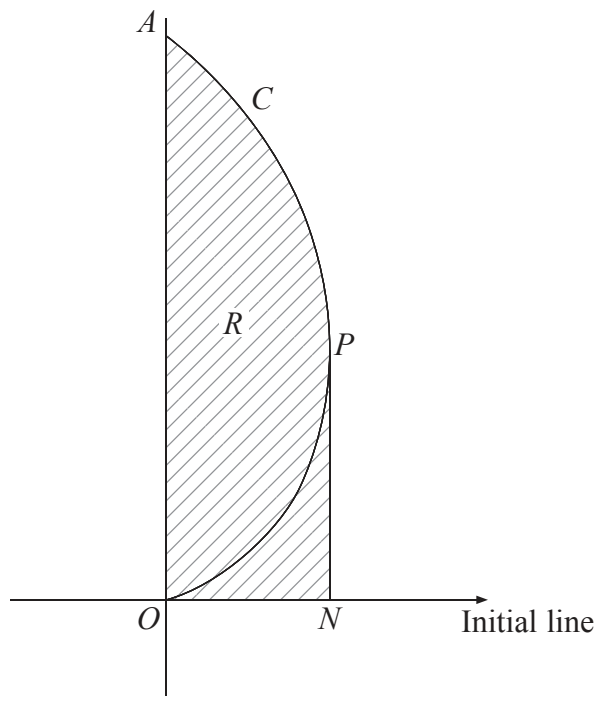

Figure 1

The curve C shown in Figure 1 has polar equation

$$r = 4(1 - \cos\theta), \qquad 0 \leqslant \theta \leqslant \frac{\pi}{2}.$$

At the point P on C, the tangent to C is parallel to the line $\theta = \frac{\pi}{2}$.

(a) Show that P has polar coordinates $\left(2, \frac{\pi}{3}\right)$.

(5)

The curve C meets the line $\theta = \frac{\pi}{2}$ at the point A. The tangent to C at P meets the initial line at the point N. The finite region R, shown shaded in Figure 1, is bounded by the initial line, the line $\theta = \frac{\pi}{2}$, the arc AP of C and the line PN.

(b) Calculate the exact area of R.

(8)

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Question 8 continued

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Question 8 continued

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Question 8 continued

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Question 8 continued

Q8

(Total 13 marks)

TOTAL FOR PAPER: 75 MARKS

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