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

Wednesday 17 June 2009 – Morning

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	**Items included with question papers**
Mathematical Formulae (Green)	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. Given that $x = \mathrm{i}$ is a complex solution of the equation

$$x^4 + 6x^3 + 26x^2 + 6x + 25 = 0 ,$$

(a) express $x^4 + 6x^3 + 26x^2 + 6x + 25$ as a product of two quadratic factors.

(4)

(b) Hence solve completely the equation $x^4 + 6x^3 + 26x^2 + 6x + 25 = 0$.

(2)

Leave blank

Question 1 continued

(Total 6 marks)

Q1

Leave blank

2. Find the general solution of the differential equation

$$\frac{\mathrm{d}^2x}{\mathrm{d}t^2}+6\frac{\mathrm{d}x}{\mathrm{d}t}+10x=\ \mathrm{e}^{-4t}.$$

(8)

Leave blank

Question 2 continued

(Total 8 marks)

Q2

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3. (a) Show that

$$\sum_{r=1}^{n} r(r+2)(r+4) = \frac{1}{4}n(n+1)(n+4)(n+5).$$

(5)

(b) Hence evaluate $\sum_{r=21}^{30} r(r+2)(r+4)$.

(2)

Leave blank

Question 3 continued

(Total 7 marks)

Q3

Leave blank

4. The complex numbers z_1 and z_2 are such that

$$z_1 = 5 + 2p\mathrm{i} \quad \text{and} \quad \frac{z_1}{z_2} = 1 - \mathrm{i},$$

where p is a real constant.

(a) Find z_2 in the form $a + b\mathrm{i}$, giving the real numbers a and b in terms of p.

(3)

Given that $\arg z_2 = \arctan 4$,

(b) find the value of p.

(2)

(c) Find the value of $|z_2|$.

(2)

(d) Show z_1, z_2 and $\frac{z_1}{z_2}$ on a single Argand diagram.

(2)

Leave blank

Question 4 continued

Leave blank

Question 4 continued

Leave blank

Question 4 continued

Q4

(Total 9 marks)

Leave blank

5. Given that α is the only real root of the equation

$$\sin 2x - \ln 3x = 0,$$

(a) show that $0.8 < \alpha < 0.9$

(2)

(b) Taking 0.9 as a first approximation to α, apply the Newton-Raphson procedure once to $f(x) = \sin 2x - \ln 3x$ to obtain a second approximation to α, giving your answer to 3 decimal places.

(5)

(c) Use linear interpolation once on the interval [0.8, 0.9] to find another approximation to α, giving your answer to 3 decimal places.

(3)

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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) Find, in the form $y = f(x)$, the general solution of the equation

$$\frac{dy}{dx} + y\cot x = \sin x, \quad 0 < x < \pi .$$

(6)

Given that $y = 1$ at $x = \frac{\pi}{2}$,

(b) show that, at $x = \frac{\pi}{4}$,

$$y = \frac{(6-\pi)\sqrt{2}}{8}$$

(4)

Leave blank

Question 6 continued

Leave blank

Question 6 continued

Leave blank

Question 6 continued

(Total 10 marks)

Q6

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7. (a) On the same diagram, sketch the graph of $y = x + 2$ and the graph of $y = \left|\frac{1}{x-2}\right|$.

Indicate on your sketch the coordinates of any points at which the graphs cross the axes, and state the equations of any asymptotes.

(6)

(b) Find the set of values of x for which

$$x + 2 < \left|\frac{1}{x-2}\right|$$

(6)

Question 7 continued

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Question 7 continued

Leave blank

Question 7 continued

(Total 12 marks)

Q7

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8.

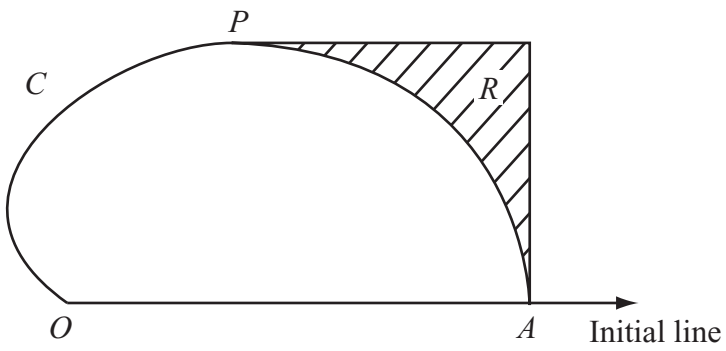

Figure 1

The curve C shown in Figure 1 has polar equation

$$r = 1 + \cos\theta, \qquad 0 \leqslant \theta < \pi .$$

At the point P on C, the tangent to C is parallel to the initial line.

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

(4)

The point A on C has polar coordinates $(2, 0)$.

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

(b) Find the exact area of R.

(9)

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Question 8 continued

Leave blank

Question 8 continued

Question 8 continued

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Q8

(Total 13 marks)

TOTAL FOR PAPER: 75 MARKS

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