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 19 June 2006 – 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
Mathematical Formulae (Green)

Items included with question papers
Nil

Candidates may use any calculator EXCEPT those with the facility for symbolic algebra, differentiation and/or integration. Thus candidates may NOT use calculators such as the Texas Instruments TI 89, TI 92, Casio CFX 9970G, Hewlett Packard HP 48G.

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.
Check that you have the correct question paper.
You must write your answer for each question in the space following the question.
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 24 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 must show sufficient working to make your methods clear to the examiner. Answers without working may gain no credit.

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1. The complex numbers z and w satisfy the simultaneous equations

$$2z + \mathrm{i}w = -1,$$

$$z - w = 3 + 3\mathrm{i}.$$

(a) Use algebra to find z, giving your answer in the form $a + \mathrm{i}b$, where a and b are real.

(4)

(b) Calculate $\arg z$, giving your answer in radians to 2 decimal places.

(2)

Leave blank

Question 1 continued

Q1

(Total 6 marks)

N 2 0 4 6 1 A 0 3 2 4

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2. **Figure 1**

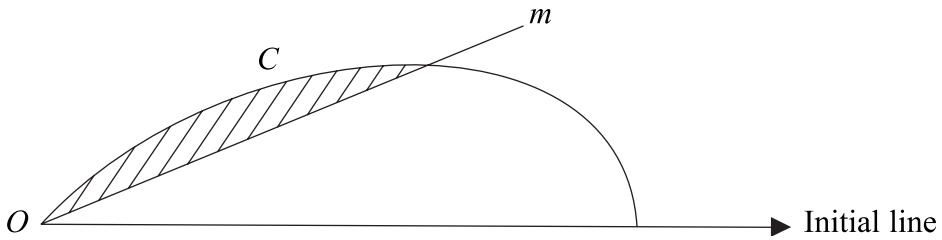

Figure 1 shows a curve C with polar equation $r = 4a\cos 2\theta$, $0 \leqslant \theta \leqslant \frac{\pi}{4}$, and a line m with polar equation $\theta = \frac{\pi}{8}$. The shaded region, shown in Figure 1, is bounded by C and m. Use calculus to show that the area of the shaded region is $\frac{1}{2}a^2(\pi - 2)$.

N 2 0 4 6 1 A 0 4 2 4

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Question 2 continued

Q2

(Total 7 marks)

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3. Given that $3x \sin 2x$ is a particular integral of the differential equation

$$\frac{d^2y}{dx^2} + 4y = k\cos 2x,$$

where k is a constant,

(a) calculate the value of k,

(4)

(b) find the particular solution of the differential equation for which at $x = 0$, $y = 2$, and for which at $x = \frac{\pi}{4}$, $y = \frac{\pi}{2}$.

(4)

N 2 0 4 6 1 A 0 6 2 4

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Question 3 continued

Q3

(Total 8 marks)

Leave blank

4. Given that 3 – 2i is a solution of the equation

$$x^4 - 6x^3 + 19x^2 - 36x + 78 = 0,$$

(a) solve the equation completely,

(7)

(b) show on a single Argand diagram the four points that represent the roots of the equation.

(2)

N 2 0 4 6 1 A 0 8 2 4

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Question 4 continued

Q4

(Total 9 marks)

Leave blank

5. Given that for all real values of r,

$$(2r+1)^3-(2r-1)^3=Ar^2+B,$$

where A and B are constants,

(a) find the value of A and the value of B.

(2)

(b) Hence, or otherwise, prove that $\sum_{r=1}^{n} r^2 = \frac{1}{6}n(n+1)(2n+1)$.

(5)

(c) Calculate $\sum_{r=1}^{40}(3r-1)^2$.

(3)

N 2 0 4 6 1 A 0 1 0 2 4

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Question 5 continued

Leave blank

Question 5 continued

Leave blank

Question 5 continued

Q5

(Total 10 marks)

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6. $$f(x) = 0.25x - 2 + 4\sin\sqrt{x}.$$

(a) Show that the equation $f(x) = 0$ has a root α between $x = 0.24$ and $x = 0.28$.

(2)

(b) Starting with the interval [0.24, 0.28], use interval bisection three times to find an interval of width 0.005 which contains α.

(3)

The equation $f(x) = 0$ also has a root β between $x = 10.75$ and $x = 11.25$.

(c) Taking 11 as a first approximation to β, use the Newton-Raphson process on $f(x)$ once to obtain a second approximation to β. Give your answer to 2 decimal places.

(6)

Leave blank

Question 6 continued

Leave blank

Question 6 continued

Leave blank

Question 6 continued

(Total 11 marks)

Q6

Leave blank

7. (a) Use algebra to find the exact solutions of the equation

$$|2x^2 + x - 6| = 6 - 3x.$$

(6)

(b) On the same diagram, sketch the curve with equation $y = |2x^2 + x - 6|$ and the line with equation $y = 6 - 3x$.

(3)

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

$$|2x^2 + x - 6| > 6 - 3x.$$

(3)

N 2 0 4 6 1 A 0 1 8 2 4

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Question 7 continued

Leave blank

Question 7 continued

Leave blank

Question 7 continued

Q7

(Total 12 marks)

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8. During an industrial process, the mass of salt, S kg, dissolved in a liquid t minutes after the process begins is modelled by the differential equation

$$\frac{\mathrm{d}S}{\mathrm{d}t} + \frac{2S}{120 - t} = \frac{1}{4}, \qquad 0 \leqslant t < 120.$$

Given that $S = 6$ when $t = 0$,

(a) find S in terms of t,

(8)

(b) calculate the maximum mass of salt that the model predicts will be dissolved in the liquid at any one time during the process.

(4)

N 2 0 4 6 1 A 0 2 2 2 4

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Question 8 continued

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Question 8 continued

Q8

(Total 12 marks)

TOTAL FOR PAPER: 75 MARKS

END

N 2 0 4 6 1 A 0 2 4 2 4