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 1 February 2010 – 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.
You must write your answer to 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 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 $z_1 = a + \mathrm{i}b$, where a and b are real, and that $z_2 = 3 - \mathrm{i}$,

(a) find $\frac{z_1}{z_2}$ in the form $x + \mathrm{i}y$, expressing the real numbers x and y in terms of a and b.
(3)

Given that $b = -2a$ and that $a > 0$,

(b) show that $|z_1| = a\sqrt{5}$,
(2)

(c) find the value of $\arg \frac{z_1}{z_2}$.
(3)

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Question 1 continued

Q1

(Total 8 marks)

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2. $$f(x) = x\cos x - 2x + 5$$

(a) Show that $f(x) = 0$ has a root α in the interval [2, 2.1].

(2)

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

(5)

(c) Show that your answer to part (b) gives α **correct** to 2 decimal places.

(2)

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Question 2 continued

Q2

(Total 9 marks)

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3. Given that 5 + 2i is a complex root of the equation

$$x^3 - 12x^2 + cx + d = 0, \qquad c, d \in \mathbb{R},$$

(a) write down the other complex root of the equation.

(1)

(b) Find the value of c and the value of d.

(5)

(c) Show the three roots of this equation on an Argand diagram.

(2)

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Question 3 continued

Q3

(Total 8 marks)

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4. Find the general solution of the differential equation

$$\frac{d^2x}{dt^2} + 6\frac{dx}{dt} + 9x = 5\cos t.$$

(10)

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Question 4 continued

Q4

(Total 10 marks)

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5. (a) Express $\frac{1}{(2r+1)(2r+5)}$ in partial fractions.

(2)

(b) Hence show, using the method of differences, that

$$\sum_{r=1}^{n} \frac{1}{(2r+1)(2r+5)} = \frac{n(8n+c)}{15(2n+3)(2n+5)} ,$$

where c is a constant to be found.

(6)

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Question 5 continued

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Question 5 continued

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Question 5 continued

(Total 8 marks)

Q5

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6.

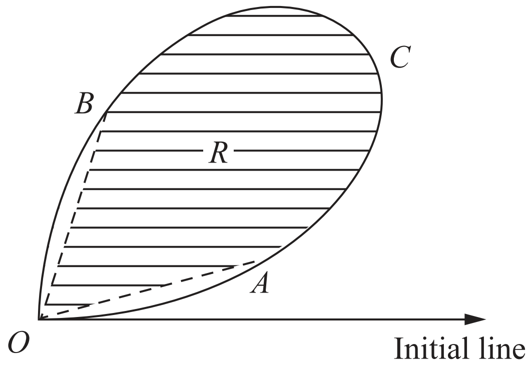

Figure 1

Figure 1 shows a sketch of the curve C with polar equation

$$r = a\sin 2\theta, \qquad 0 \leqslant \theta \leqslant \frac{\pi}{2},$$

where a is a positive constant.

At the points A and B on C, $r = \frac{1}{2}a$.

(a) Find the polar coordinates of A and B.

(3)

The shaded region R, shown in Figure 1, is bounded by OA, OB and the arc AB of C.

(b) Use integration to find the area of R, giving your answer in terms of a and π.

(6)

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Question 6 continued

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Question 6 continued

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Question 6 continued

Q6

(Total 9 marks)

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7.

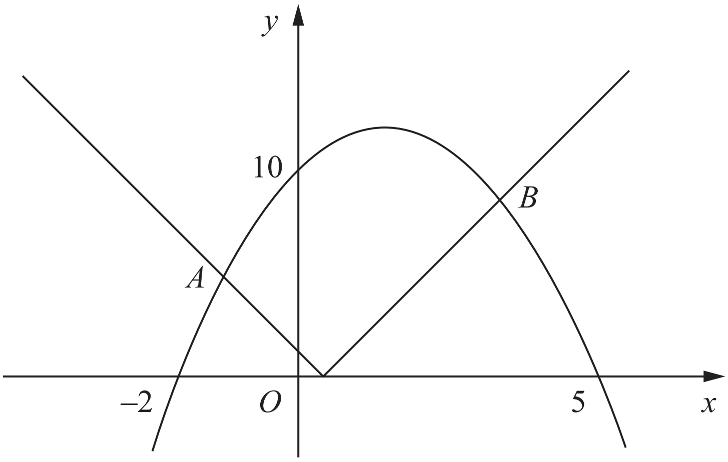

Figure 2

Figure 2 shows the graph of $y = 10 + 3x - x^2$ and the graph of $y = |3x - 1|$.

The graphs intersect at the points A and B.

(a) Use algebra to find the exact x-coordinates of A and B.

(5)

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

$$10 + 3x - x^2 > |3x - 1|.$$

(2)

(c) Find the set of values of x for which $|10 + 3x - x^2| < |3x - 1|$.

(3)

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Question 7 continued

Turn over

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Question 7 continued

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Question 7 continued

(Total 10 marks)

Q7

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8. (a) Show that the substitution $z = \dfrac{1}{y^2}$ transforms the differential equation

$$\frac{dy}{dx} + y = 4xy^3, \qquad y > 0, \qquad \text{(I)}$$

into the differential equation

$$\frac{dz}{dx} - 2z = -8x$$

(4)

(b) Hence find the solution of the differential equation (I) in the form $y = f(x)$.

(7)

The stationary point of the graph of a particular solution of the differential equation (I) is (x_1, y_1), $x_1 > 0$.

(c) Show that $y_1 = \dfrac{1}{2\sqrt{x_1}}$.

(2)

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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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