Centre No.					Pape	er Refer	ence			Surname	Initial(s)
Candidate No.			6	6	7	4	/	0	1	Signature	

## 6674/01 **Edexcel GCE**

# **Further Pure Mathematics FP1 Advanced/Advanced Subsidiary**

Friday 26 January 2007 – Afternoon

Time: 1 hour 30 minutes

Materials required for examination	Items included with question paper
Mathematical Formulae (Green)	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.

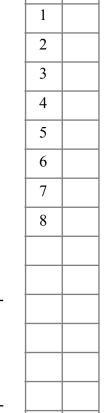
You must ensure that your answers to parts of questions are clearly labelled.

You must show sufficient working to make your methods clear to the examiner. Answers without working may gain no credit.

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Examiner's use only

Team Leader's use only

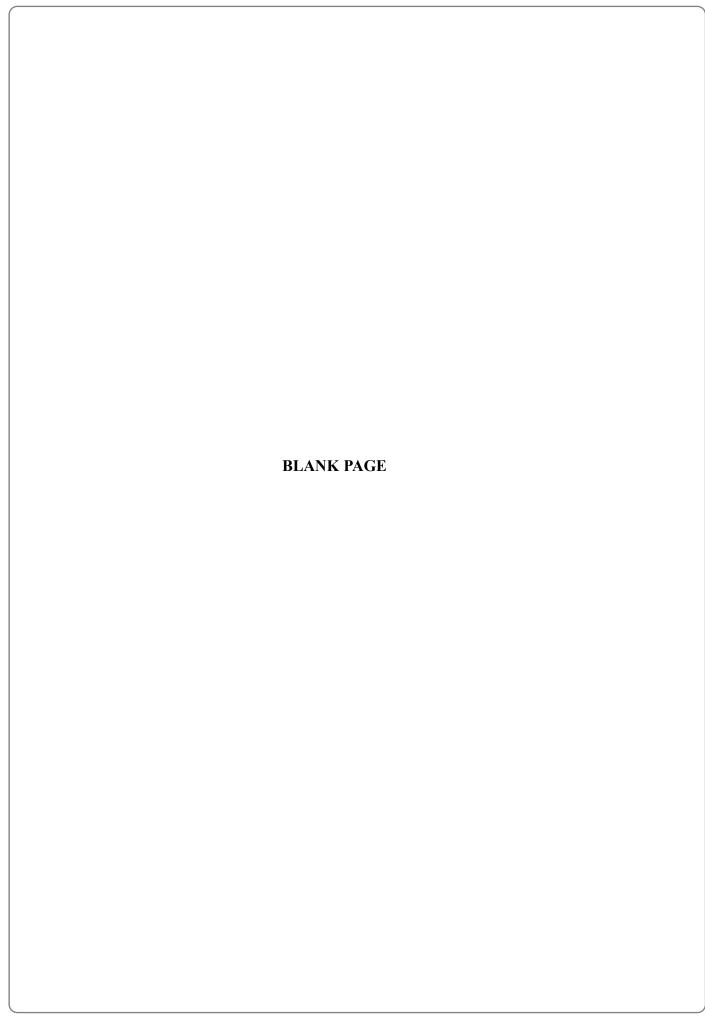
Question Number

Turn over

Total



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1. (a) Find the roots of the equation
---------------------------------------

$$z^2 + 2z + 17 = 0,$$

giving your answers in the form a + ib, where a and b are integers.

(3)

(b)	Show	these	roots	on a	n Arga	nd d	iagram
(0)	SHOW	uicsc	10013	on a	n mga	nu u	ıagıanı

**(1)** 

Q1

(Total 4 marks)

$x\frac{\mathrm{d}y}{\mathrm{d}x} + 2y = \cos x,  x > 0,$ giving your answer in the form $y = f(x)$ . (8)	Obtain the general solution of	f the differential equat	ion	
	giving your answer in the form	m y = f(x).		
				(8)

	Leave blank
Question 2 continued	
	Q2
(Total 8 marks)	

-	pers $z_1$ and $z_2$ are given by	
	$z_1 = 5 + 3i,$	
unhama u ia an inta	$z_2 = 1 + pi,$	
where $p$ is an integ		
(a) Find $\frac{z_2}{z}$ in the	form $a + ib$ , where $a$ and $b$ are expressed in term	ms of $p$ .
		(3)
Given that $\arg \left(\frac{z_2}{z_1}\right)$	$= \frac{\pi}{4},$	
(b) find the value	of p.	(2)
		(2)

Leave	
blank	

$$\frac{r^3 - r + 1}{r(r+1)} \equiv r - 1 + \frac{1}{r} - \frac{1}{r+1}, \quad \text{for } r \neq 0, -1.$$
(3)

n. <b>(6)</b>
n (

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**5.** 

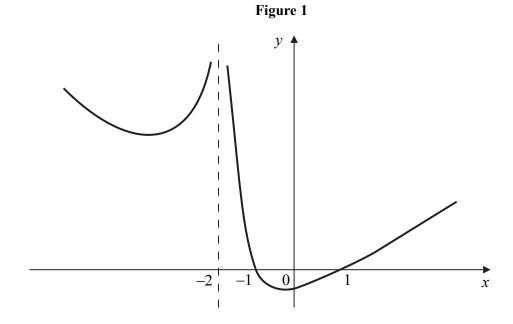


Figure 1 shows a sketch of the curve with equation

$$y = \frac{x^2 - 1}{|x + 2|}, \quad x \neq -2.$$

The curve crosses the *x*-axis at x = 1 and x = -1 and the line x = -2 is an asymptote of the curve.

(a) Use algebra to solve the equation  $\frac{x^2-1}{|x+2|} = 3(1-x)$ .

**(6)** 

(b) Hence, or otherwise, find the set of values of x for which

$$\frac{x^2 - 1}{|x + 2|} < 3(1 - x).$$

(3)

10

	Leave blank
Question 5 continued	

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Question 5 continued	
	Q5
(Total 9 marks)	

(a)	Find $f(2.0)$ and $f(2.5)$ , each to 4 decimal places, and show that the root $\alpha$ of the equation $f(x) = 0$ satisfies $2.0 < \alpha < 2.5$ .
	(3)
(b)	Use linear interpolation with your values of $f(2.0)$ and $f(2.5)$ to estimate $\alpha$ , giving your answer to 3 decimal places.
	(2)
(c)	Taking 2.25 as a first approximation to $\alpha$ , apply the Newton-Raphson process once to $f(x)$ to obtain a second approximation to $\alpha$ , giving your answer to 3 decimal places. (5)
(d)	Show that your answer in part (c) gives $\alpha$ correct to 3 decimal places.
	(2)
	(c)

Question 6 continued	Leave blank
	Q6
(Total 12 marks)	

7. A scientist is modelling the amount of a chemical in the human bloodstream. The amount x of the chemical, measured in mg  $l^{-1}$ , at time t hours satisfies the differential equation

$$2x\frac{d^2x}{dt^2} - 6\left(\frac{dx}{dt}\right)^2 = x^2 - 3x^4, \quad x > 0.$$

(a) Show that the substitution  $y = \frac{1}{x^2}$  transforms this differential equation into

$$\frac{\mathrm{d}^2 y}{\mathrm{d}t^2} + y = 3.$$

(5)

(b) Find the general solution of differential equation I

(4)

Given that at time t = 0,  $x = \frac{1}{2}$  and  $\frac{dx}{dt} = 0$ ,

(c) find an expression for x in terms of t,

**(4)** 

(d) write down the maximum value of x as t varies.

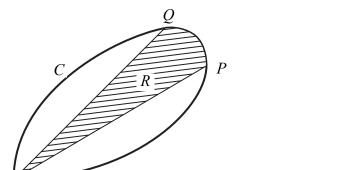
(1)

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Question 7 continued	

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8.

Figure 2



Initial line

Figure 2 shows a sketch of the curve C with polar equation

$$r = 4\sin\theta\cos^2\theta$$
,  $0 \le \theta < \frac{\pi}{2}$ .

The tangent to C at the point P is perpendicular to the initial line.

(a) Show that *P* has polar coordinates  $\left(\frac{3}{2}, \frac{\pi}{6}\right)$ .

**(6)** 

Leave blank

The point Q on C has polar coordinates  $\left(\sqrt{2}, \frac{\pi}{4}\right)$ .

The shaded region R is bounded by OP, OQ and C, as shown in Figure 2.

(b) Show that the area of R is given by

$$\int_{\frac{\pi}{6}}^{\frac{\pi}{4}} \left( \sin^2 2\theta \cos 2\theta + \frac{1}{2} - \frac{1}{2} \cos 4\theta \right) d\theta.$$

**(3)** 

(c) Hence, or otherwise, find the area of R, giving your answer in the form  $a + b\pi$ , where a and b are rational numbers.

**(5)** 

	Leave blank
Question 8 continued	


Question 8 continued		Leav blanl
		Q
	(Total 14 marks)	
	TOTAL FOR PAPER: 75 MARKS	
END		

