Centre No.					Pa	iper Re	eferenc	e		Surname	Initial(s)
Candidate No.			6	6	6	8	/	0	1 R	Signature	

Paper Reference(s)

## 6668/01R Edexcel GCE

# Further Pure Mathematics FP2 Advanced/Advanced Subsidiary

Friday 21 June 2013 – Morning

Time: 1 hour 30 minutes

Materials required for examination	Items included with question paper
Mathematical Formulae (Pink)	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 or symbolic differentiation/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 32 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.

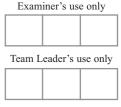
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Turn over

Total



<b>1.</b> <i>A</i>	A transformation	T	from	the	z-plane t	to t	he	w-plane	is	given	b	y
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$$w = \frac{z + 2i}{iz} \qquad z \neq 0$$

The transformation maps points on the real axis in the z-plane onto a line in the w-plane.

Find an equation of this line.

**(4)** 

$\frac{6x}{3-x} > \frac{1}{x+1}$	(7)

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

**(2)** 

(b) Hence show that

$$\sum_{r=1}^{n} \frac{2}{(r+1)(r+3)} = \frac{n(5n+13)}{6(n+2)(n+3)}$$

**(4)** 

(c) Evaluate  $\sum_{r=10}^{100} \frac{2}{(r+1)(r+3)}$ , giving your answer to 3 significant figures.

**(2)** 

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**4.** Given that

$$y\frac{\mathrm{d}^2 y}{\mathrm{d}x^2} + \left(\frac{\mathrm{d}y}{\mathrm{d}x}\right)^2 + 5y = 0$$

(a) find  $\frac{d^3y}{dx^3}$  in terms of  $\frac{d^2y}{dx^2}$ ,  $\frac{dy}{dx}$  and y.

(4)

Given that y = 2 and  $\frac{dy}{dx} = 2$  at x = 0

(b) find a series solution for y in ascending powers of x, up to and including the term in  $x^3$ .

(5)

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5. (a) Find, in the form y = f(x), the general solution of the equation

$$\frac{\mathrm{d}y}{\mathrm{d}x} + 2y \tan x = \sin 2x, \qquad 0 < x < \frac{\pi}{2}$$

**(6)** 

Given that y = 2 at  $x = \frac{\pi}{3}$ 

(b) find the value of y at  $x = \frac{\pi}{6}$ , giving your answer in the form  $a + k \ln b$ , where a and b are integers and k is rational.

**(4)** 

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- **6.** The complex number  $z = e^{i\theta}$ , where  $\theta$  is real.
  - (a) Use de Moivre's theorem to show that

$$z^n + \frac{1}{z^n} = 2\cos n\theta$$

where n is a positive integer.

**(2)** 

**(5)** 

(b) Show that

$$\cos^5\theta = \frac{1}{16}(\cos 5\theta + 5\cos 3\theta + 10\cos \theta)$$

(c) Hence find all the solutions of

$$\cos 5\theta + 5\cos 3\theta + 12\cos \theta = 0$$

in the interval  $0 \leqslant \theta < 2\pi$ 

**(4)** 

nestion 6 continued	 	

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(a) Find the value of  $\lambda$  for which  $\lambda t^2 e^{3t}$  is a particular integral of the 7. differential equation

$$\frac{\mathrm{d}^2 y}{\mathrm{d}t^2} - 6\frac{\mathrm{d}y}{\mathrm{d}t} + 9y = 6\mathrm{e}^{3t}, \qquad t \geqslant 0$$
(5)

(b) Hence find the general solution of this differential equation.

**(3)** 

Given that when t = 0, y = 5 and  $\frac{dy}{dt} = 4$ 

(c) find the particular solution of this differential equation, giving your solution in the form y = f(t).

**(5)** 

8.

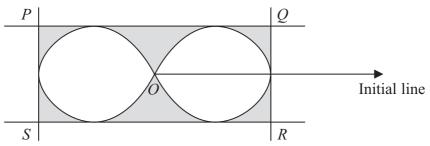


Figure 1

Figure 1 shows a closed curve C with equation

$$r = 3(\cos 2\theta)^{\frac{1}{2}}$$
, where  $-\frac{\pi}{4} < \theta \leqslant \frac{\pi}{4}$ ,  $\frac{3\pi}{4} < \theta \leqslant \frac{5\pi}{4}$ 

The lines PQ, SR, PS and QR are tangents to C, where PQ and SR are parallel to the initial line and PS and QR are perpendicular to the initial line. The point O is the pole.

(a) Find the total area enclosed by the curve C, shown unshaded inside the rectangle in Figure 1.

**(4)** 

(b) Find the total area of the region bounded by the curve *C* and the four tangents, shown shaded in Figure 1.

(9)

uestion 8 continued	
	(Total 13 marks)