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

Paper Reference(s)

### 6667/01

## **Edexcel GCE**

# Further Pure Mathematics FP1 Advanced/Advanced Subsidiary

Wednesday 22 June 2011 – 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 9 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**

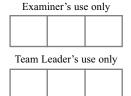
You must ensure that your answers to parts of questions are clearly labelled. You should show sufficient working to make your methods clear to the Examiner. Answers without working may not gain full credit.

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1.	$f(x) = 3^x + 3$	6x-7
	(a) Show that the equation $f(x) = 0$ has a roo	ot $\alpha$ between $x = 1$ and $x = 2$ . (2)
	<ul><li>(b) Starting with the interval [1, 2], use interval width 0.25 which contains α.</li></ul>	
	width 0.25 which contains a.	(3)

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**(2)** 

2.	$z_1 = -2 + i$		]
	(a) Find the modulus of $z_1$ .	(1)	
	(b) Find, in radians, the argument of $z_1$ , giving your answer to 2 decimal places.		

The solutions to the quadratic equation

$$z^2 - 10z + 28 = 0$$

are  $z_2$  and  $z_3$ .

- (c) Find  $z_2$  and  $z_3$ , giving your answers in the form  $p \pm i \sqrt{q}$ , where p and q are integers. (3)
- (d) Show, on an Argand diagram, the points representing your complex numbers  $z_1$ ,  $z_2$  and  $z_3$ .


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(a) Given that

$$\mathbf{A} = \begin{pmatrix} 1 & \sqrt{2} \\ \sqrt{2} & -1 \end{pmatrix}$$

- (i) find  $A^2$ ,
- (ii) describe fully the geometrical transformation represented by  $A^2$ .

**(4)** 

(b) Given that

$$\mathbf{B} = \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$$

describe fully the geometrical transformation represented by B.

**(2)** 

(c) Given that

$$\mathbf{C} = \begin{pmatrix} k+1 & 12 \\ k & 9 \end{pmatrix}$$

where k is a constant, find the value of k for which the matrix  $\mathbf{C}$  is singular.

**(3)** 


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4.	$f(x) = x^2 + \frac{5}{2x} - 3x - 1$ ,	$x \neq 0$
	$\angle X$	

(a) Use differentiation to find f'(x).

**(2)** 

The root  $\alpha$  of the equation f(x) = 0 lies in the interval [0.7, 0.9].

(b) Taking 0.8 as a first approximation to  $\alpha$ , apply the Newton-Raphson process once to f(x) to obtain a second approximation to  $\alpha$ . Give your answer to 3 decimal places.

5.	$\mathbf{A} = \begin{pmatrix} -4 & a \\ b & -2 \end{pmatrix}, \text{ where } a \text{ and } b \text{ are constants.}$
Given that the coordinates (2,	matrix <b>A</b> maps the point with coordinates $(4, 6)$ onto the point with $(-8)$ ,
(a) find the va	alue of $a$ and the value of $b$ . (4)
	R has area 30 square units. ed into another quadrilateral $S$ by the matrix $A$ . ues of $a$ and $b$ ,
(b) find the are	ea of quadrilateral S. (4)

Given that $z = x + iy$ , find the value of x and the value of y such	n that
$z + 3 i z^* = -1 + 13i$	
where $z^*$ is the complex conjugate of $z$ .	
	(7)



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7. (a) Use the results for  $\sum_{r=1}^{n} r$  and  $\sum_{r=1}^{n} r^2$  to show that

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

for all positive integers n.

**(6)** 

(b) Hence show that

$$\sum_{r=n+1}^{3n} (2r-1)^2 = \frac{2}{3} n \left( an^2 + b \right)$$

where a and b are integers to be found.

**(4)** 



The parabola C has equation $y^2 = 48x$ .	
The point $P(12t^2, 24t)$ is a general point on $C$ .	
(a) Find the equation of the directrix of C.	(2)
	(2)
(b) Show that the equation of the tangent to C at $P(12t^2, 24t)$ is	
$x - ty + 12t^2 = 0$	(4)
	(4)
The tangent to $C$ at the point $(3, 12)$ meets the directrix of $C$ at the point $X$ .	
(c) Find the coordinates of $X$ .	(4)
	(4)

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**9.** Prove by induction, that for  $n \in \mathbb{Z}^+$ ,

(a) 
$$\begin{pmatrix} 3 & 0 \\ 6 & 1 \end{pmatrix}^n = \begin{pmatrix} 3^n & 0 \\ 3(3^n - 1) & 1 \end{pmatrix}$$
,

**(6)** 

(b)  $f(n) = 7^{2n-1} + 5$  is divisible by 12.

-		
	<b>6</b> 1	







