**Mathematics FP1** 

Past Paper

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Centre No.					Pa	iper Re	eferenc	e		Surname	Initial(s)
Candidate No.			6	6	6	7	/	0	1 R	Signature	

Paper Reference(s)

### 6667/01R

### **Edexcel GCE**

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

Tuesday 10 June 2014 – Morning

Time: 1 hour 30 minutes

Materials required for examination Mathematical Formulae (Pink)

Items included with question papers

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 28 pages in this question paper. Any blank pages are indicated.

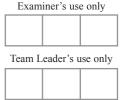
#### **Advice to Candidates**

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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The roots of the equation	
$2z^3 - 3z^2 + 8z + 5 = 0$	
are $z_1$ , $z_2$ and $z_3$	
Given that $z_1 = 1 + 2i$ , find $z_2$ and $z_3$	
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2.

$$f(x) = 3\cos 2x + x - 2, \quad -\pi \leqslant x < \pi$$

(a) Show that the equation f(x) = 0 has a root  $\alpha$  in the interval [2, 3].

**(2)** 

(b) Use linear interpolation once on the interval [2, 3] to find an approximation to  $\alpha$ . Give your answer to 3 decimal places.

**(3)** 

(c) The equation f(x) = 0 has another root  $\beta$  in the interval [-1, 0]. Starting with this interval, use interval bisection to find an interval of width 0.25 which contains  $\beta$ .

**(4)** 

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**3.** (i)

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

(a) Describe fully the single transformation represented by the matrix A.

**(2)** 

The matrix  $\mathbf{B}$  represents an enlargement, scale factor -2, with centre the origin.

(b) Write down the matrix **B**.

**(1)** 

(ii)

$$\mathbf{M} = \begin{pmatrix} 3 & k \\ -2 & 3 \end{pmatrix}, \text{ where } k \text{ is a positive constant.}$$

Triangle *T* has an area of 16 square units.

Triangle T is transformed onto the triangle T' by the transformation represented by the matrix M.

Given that the area of the triangle T' is 224 square units, find the value of k.

**(3)** 

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4. The complex number z is given by

$$z = \frac{p + 2i}{3 + pi}$$

where p is an integer.

(a) Express z in the form a + bi where a and b are real. Give your answer in its simplest form in terms of p.

**(4)** 

(b) Given that  $arg(z) = \theta$ , where  $\tan \theta = 1$  find the possible values of p.

**(5)** 

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5. (a) Use the standard results for  $\sum_{r=1}^{n} r$  and  $\sum_{r=1}^{n} r^3$  to show that

$$\sum_{r=1}^{n} r(r^2 - 3) = \frac{1}{4}n(n+1)(n+3)(n-2)$$

**(5)** 

(b) Calculate the value of  $\sum_{r=10}^{50} r(r^2 - 3)$ 

(3)



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6.

$$\mathbf{A} = \begin{pmatrix} 2 & 1 \\ -1 & 0 \end{pmatrix} \text{ and } \mathbf{B} = \begin{pmatrix} -1 & 1 \\ 0 & 1 \end{pmatrix}$$

Given that  $\mathbf{M} = (\mathbf{A} + \mathbf{B})(2\mathbf{A} - \mathbf{B})$ ,

(a) calculate the matrix  $\mathbf{M}$ ,

**(6)** 

(b) find the matrix C such that MC = A.

**(4)** 

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7. The parabola C has cartesian equation $y^2 = 4ax$ , $a > $	> 0
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The points  $P(ap^2, 2ap)$  and  $P'(ap^2, -2ap)$  lie on C.

(a) Show that an equation of the normal to C at the point P is

$$y + px = 2ap + ap^3$$

**(5)** 

(b) Write down an equation of the normal to C at the point P'.

(1)

The normal to C at P meets the normal to C at P' at the point Q.

(c) Find, in terms of a and p, the coordinates of Q.

**(2)** 

Given that S is the focus of the parabola,

(d) find the area of the quadrilateral SPQP'.

**(3)** 



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**8.** The rectangular hyperbola H has equation  $xy = c^2$ , where c is a positive constant.

The point  $P\left(ct, \frac{c}{t}\right)$ ,  $t \neq 0$ , is a general point on H.

An equation for the tangent to H at P is given by

$$y = -\frac{1}{t^2}x + \frac{2c}{t}$$

The points A and B lie on H.

The tangent to H at A and the tangent to H at B meet at the point  $\left(-\frac{6}{7}c, \frac{12}{7}c\right)$ .

Find, in terms of c, the coordinates of A and the coordinates of B.

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

$$\sum_{r=1}^{n} (r+1)2^{r-1} = n2^{n}$$

**(5)** 

(b) A sequence of numbers is defined by

$$u_1 = 0, \quad u_2 = 32,$$

$$u_{n+2} = 6u_{n+1} - 8u_n \qquad n \geqslant 1$$

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

$$u_n = 4^{n+1} - 2^{n+3}$$

**(7)** 

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