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

Monday 10 June 2013 - Morning

Time: 1 hour 30 minutes

Materials required for examination	Items included with question pape
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 10 questions in this question paper. The total mark for this paper is 75.

There are 36 pages in this question paper. Any blank pages are indicated.

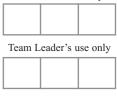
#### **Advice to Candidates**

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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Examiner's use only

Turn over

Total

PEARSON

1. The complex numbers z and w are given by

$$z = 8 + 3i$$
,  $w = -2i$ 

Express in the form a + bi, where a and b are real constants,

(a) z-w,

**(1)** 

(b) zw.



**2.** (i) 
$$\mathbf{A} = \begin{pmatrix} 2k+1 & k \\ -3 & -5 \end{pmatrix}$$
, where  $k$  is a constant

Given that

$$\mathbf{B} = \mathbf{A} + 3\mathbf{I}$$

where I is the  $2 \times 2$  identity matrix, find

(a)  $\mathbf{B}$  in terms of k,

(2)

(b) the value of k for which **B** is singular.

**(2)** 

(ii) Given that

$$\mathbf{C} = \begin{pmatrix} 2 \\ -3 \\ 4 \end{pmatrix}, \quad \mathbf{D} = (2 \ -1 \ 5)$$

and

$$E = CD$$

find E.




tinued



$$f(x) = \frac{1}{2}x^4 - x^3 + x - 3$$

(a) Show that the equation f(x) = 0 has a root  $\alpha$  between x = 2 and x = 2.5

**(2)** 

(b) Starting with the interval [2, 2.5] use interval bisection twice to find an interval of width 0.125 which contains  $\alpha$ .

**(3)** 

The equation f(x) = 0 has a root  $\beta$  in the interval [-2, -1].

(c) Taking -1.5 as a first approximation to  $\beta$ , apply the Newton-Raphson process once to f(x) to obtain a second approximation to  $\beta$ . Give your answer to 2 decimal places.

**(5)** 





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$$f(x) = (4x^2 + 9)(x^2 - 2x + 5)$$

(a) Find the four roots of f(x) = 0

**(4)** 

(b) Show the four roots of f(x) = 0 on a single Argand diagram.

5.

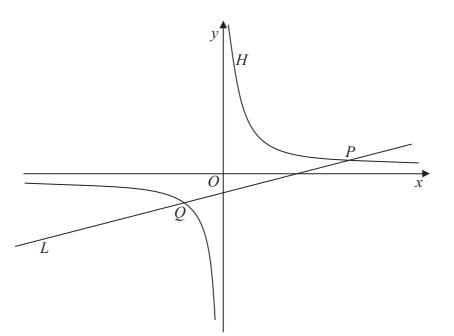


Figure 1

Figure 1 shows a rectangular hyperbola H with parametric equations

$$x = 3t, \quad y = \frac{3}{t}, \quad t \neq 0$$

The line L with equation 6y = 4x - 15 intersects H at the point P and at the point Q as shown in Figure 1.

(a) Show that *L* intersects *H* where  $4t^2 - 5t - 6 = 0$ 

(3)

Leave blank

(b) Hence, or otherwise, find the coordinates of points P and Q.

**(5)** 






$$\mathbf{A} = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}, \quad \mathbf{B} = \begin{pmatrix} 2 & 3 \\ 1 & 4 \end{pmatrix}$$

The transformation represented by  ${\bf B}$  followed by the transformation represented by  ${\bf A}$  is equivalent to the transformation represented by  ${\bf P}$ .

(a) Find the matrix **P**.

**(2)** 

Triangle T is transformed to the triangle T' by the transformation represented by  $\mathbf{P}$ .

Given that the area of triangle T' is 24 square units,

(b) find the area of triangle T.

**(3)** 

Triangle T' is transformed to the original triangle T by the matrix represented by  $\mathbf{Q}$ .

(c) Find the matrix **Q**.



7. The parabola C has equation $y^2 = 4ax$ , where a is a positive cons	<b>7.</b> 7	The parabola	C has equation	$v^2 = 4ax$ , whe	re a is a	positive co	onstant.
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The point  $P(at^2, 2at)$  is a general point on C.

(a) Show that the equation of the tangent to C at  $P(at^2, 2at)$  is

$$ty = x + at^2$$

(4)

The tangent to C at P meets the y-axis at a point Q.

(b) Find the coordinates of Q.

**(1)** 

Given that the point S is the focus of C,

(c) show that PQ is perpendicular to SQ.

**(3)** 





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

$$\sum_{r=1}^{n} r(2r-1) = \frac{1}{6} n(n+1)(4n-1)$$

**(6)** 

(b) Hence, show that

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

where a, b and c are integers to be found.

**(4)** 



estion 8 continued	

**9.** The complex number w is given by

$$w = 10 - 5i$$

(a) Find |w|.

**(1)** 

(b) Find arg w, giving your answer in radians to 2 decimal places.

**(2)** 

The complex numbers z and w satisfy the equation

$$(2+i)(z+3i) = w$$

(c) Use algebra to find z, giving your answer in the form a + bi, where a and b are real numbers.

**(4)** 

Given that

$$\arg(\lambda + 9i + w) = \frac{\pi}{4}$$

where  $\lambda$  is a real constant,

(d) find the value of  $\lambda$ .



estion 9 continued	



Leave	
blank	

10. (i) Use the standard results for  $\sum_{r=1}^{n} r^3$  and  $\sum_{r=1}^{n} r$  to evaluate

$$\sum_{r=1}^{24} (r^3 - 4r)$$

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

$$\sum_{r=0}^{n} (r^2 - 2r + 2n + 1) = \frac{1}{6} (n+1)(n+a)(bn+c)$$

for all integers  $n \ge 0$ , where a, b and c are constant integers to be found.

**(6)** 

**(2)** 

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estion 10 continued	



END	TOTAL FOR PAPER: 75 MARKS	
	(Total 8 marks)	
		Q1