Centre No.						Paper Reference							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

Monday 10 June 2013 – Morning

Time: 1 hour 30 minutes

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
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7	
8	
9	
Total	

Materials required for examination
Mathematical Formulae (Pink)

Items included with question papers
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 24 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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PEARSON

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1. $\mathbf{M} = \begin{pmatrix} a & 1 \\ 1 & 2-a \end{pmatrix}$, where a is a constant.

(a) Find det **M** in terms of a.

(2)

A triangle T is transformed to T' by the matrix **M**.

Given that the area of T' is 0,

(b) find the value of a.

(3)

Leave blank

Question 1 continued

Q1

(Total 5 marks)

Leave blank

2. $f(z) = z^3 + 5z^2 + 11z + 15$

Given that $z = 2i - 1$ is a solution of the equation $f(z) = 0$, use algebra to solve $f(z) = 0$ completely.

(5)

Leave blank

Question 2 continued

Q2

(Total 5 marks)

Leave blank

3. $$z_1 = \frac{1}{2}(1 + i\sqrt{3}), \quad z_2 = -\sqrt{3} + i$$

(a) Express z_1 and z_2 in the form $r(\cos\theta + i\sin\theta)$ giving exact values of r and θ.

(4)

(b) Find $|z_1 z_2|$.

(2)

(c) Show and label z_1 and z_2 on a single Argand diagram.

(2)

Leave blank

Question 3 continued

Q3

(Total 8 marks)

Leave blank

4. The hyperbola H has equation

$$xy = 3$$

The point $Q(1, 3)$ is on H.

(a) Find the equation of the normal to H at Q in the form $y = ax + b$, where a and b are constants.

(5)

The normal at Q intersects H again at the point R.

(b) Find the coordinates of R.

(5)

Leave blank

Question 4 continued

Q4

(Total 10 marks)

Leave blank

5. Prove, by induction, that $3^{2n} + 7$ is divisible by 8 for all positive integers n.

(6)

Leave blank

Question 5 continued

Q5

(Total 6 marks)

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6. A curve C is in the form of a parabola with equation $y^2 = 4x$.

$P(p^2, 2p)$ and $Q(q^2, 2q)$ are points on C where $p > q$.

(a) Find an equation of the tangent to C at P.

(5)

(b) The tangent at P and the tangent at Q are perpendicular and intersect at the point $R(-1, 2)$.

(i) Find the exact value of p and the exact value of q.

(4)

(ii) Find the area of the triangle PQR.

(4)

Leave blank

Question 6 continued

Leave blank

Question 6 continued

Leave blank

Question 6 continued

Q6

(Total 13 marks)

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7. (a) Use the standard results for $\sum_{r=1}^{n} r^2$ and $\sum_{r=1}^{n} r^3$ to show that

$$\sum_{r=1}^{n} r^2(r-1) = \frac{n(n+1)(3n+2)(n-1)}{12}$$

for all positive integers n.

(5)

(b) Hence find the sum of the series

$$10^2 \times 9 + 11^2 \times 10 + 12^2 \times 11 + \ldots + 50^2 \times 49$$

(3)

Leave blank

Question 7 continued

Q7

(Total 8 marks)

Leave blank

8. $f(x) = x^3 - 2x - 3$

(a) Show that $f(x) = 0$ has a root, α, in the interval [1, 2].

(3)

(b) Starting with the interval [1, 2], use interval bisection twice to find an interval of width 0.25 which contains α.

(3)

(c) Using $x_0 = 1.8$ as a first approximation to α, apply the Newton-Raphson procedure once to $f(x)$ to find a second approximation to α, giving your answer to 3 significant figures.

(5)

Leave blank

Question 8 continued

Leave blank

Question 8 continued

Leave blank

Question 8 continued

Q8

(Total 11 marks)

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9. With reference to a fixed origin O and coordinate axes Ox and Oy, a transformation from $\mathbb{R}^2 \rightarrow \mathbb{R}^2$ is represented by the matrix $\mathbf{A}$ where

$$\mathbf{A} = \begin{pmatrix} 3 & 1 \\ 1 & -2 \end{pmatrix}$$

(a) Find $\mathbf{A}^2$.

(2)

(b) Show that the matrix $\mathbf{A}$ is non-singular.

(2)

(c) Find $\mathbf{A}^{-1}$.

(2)

The transformation represented by matrix $\mathbf{A}$ maps the point P onto the point Q.

Given that Q has coordinates $(k - 1, 2 - k)$, where k is a constant,

(d) show that P lies on the line with equation $y = 4x - 1$

(3)

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Question 9 continued

Leave blank

Question 9 continued

Q9

(Total 9 marks)

TOTAL FOR PAPER: 75 MARKS

END