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Surname		Other names
Pearson Edexcel International Advanced Level	Centre Number	Candidate Number
Further Pu Mathema Advanced/Advance	tics F	-
Friday 20 May 2016 – Morn Time: 1 hour 30 minutes	ing	Paper Reference WFM01/01
You must have: Mathematical Formulae and Sta	atistical Tables (Bl	lue) Total Marks

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, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B). Coloured pencils and highlighter pens must not be used.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided
 there may be more space than you need.
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- When a calculator is used, the answer should be given to an appropriate degree of accuracy.

Information

- The total mark for this paper is 75.
- The marks for each question are shown in brackets
 use this as a quide as to how much time to spend on each question.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

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Turn over ▶



1. Use the standard results for $\sum_{r=1}^{n} r$ and for $\sum_{r=1}^{n} r^3$ to show that, for all positive integers n,

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

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

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Question 1 continued	blank
	Q1
(Total 4 marks)	



2.	A parabola P has cartesian equation $y^2 = 28x$. The point S is the focus of the parabola P.
	(a) Write down the coordinates of the point S. (1)
	Points A and B lie on the parabola P . The line AB is parallel to the directrix of P and cuts the x -axis at the midpoint of OS , where O is the origin.
	(b) Find the exact area of triangle <i>ABS</i> . (4)

Question 2 continued		blank
		Q2
	(Total 5 marks)	



3.

$$f(x) = x^2 + \frac{3}{x} - 1, \quad x < 0$$

The only real root, α , of the equation f(x) = 0 lies in the interval [-2, -1].

(a) Taking -1.5 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 2 decimal places.

(5)

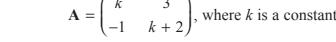
(b) Show that your answer to part (a) gives α correct to 2 decimal places.

(2)

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		(Total 7 marks)	



 $\mathbf{A} = \begin{pmatrix} k & 3 \\ -1 & k+2 \end{pmatrix}$, where k is a constant



(a) show that $det(\mathbf{A}) > 0$ for all real values of k,

(2)	
131	

(b) find A^{-1} in terms of k.

Given that

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Question 4 continued	blank
	Q4
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(Total 5 marks)	



5.	$2z + z^* = \frac{3+4i}{7+i}$
	Find z, giving your answer in the form $a + bi$, where a and b are real constants. You must show all your working.
	(5)

Question 5 continued	blank
	Q5
(Total 5 marks)	



- **6.** The rectangular hyperbola H has equation xy = 25
 - (a) Verify that, for $t \neq 0$, the point $P\left(5t, \frac{5}{t}\right)$ is a general point on H.

(1)

The point A on H has parameter $t = \frac{1}{2}$

(b) Show that the normal to H at the point A has equation

$$8y - 2x - 75 = 0$$

(5)

This normal at A meets H again at the point B.

(c) Find the coordinates of B.

(4)

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	Q6
(Total 10 marks)	
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7.

$$\mathbf{P} = \begin{pmatrix} \frac{5}{13} & -\frac{12}{13} \\ \frac{12}{13} & \frac{5}{13} \end{pmatrix}$$

(a) Describe fully the single geometrical transformation U represented by the matrix \mathbf{P} .

The transformation V, represented by the 2×2 matrix \mathbf{Q} , is a reflection in the line with equation y = x

(b) Write down the matrix \mathbf{Q} .

(1)

Given that the transformation V followed by the transformation U is the transformation T, which is represented by the matrix \mathbf{R} ,

(c) find the matrix **R**.

(2)

(d) Show that there is a value of k for which the transformation T maps each point on the straight line y = kx onto itself, and state the value of k.

(4)



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	Q7
(Total 10 marks)	



8.

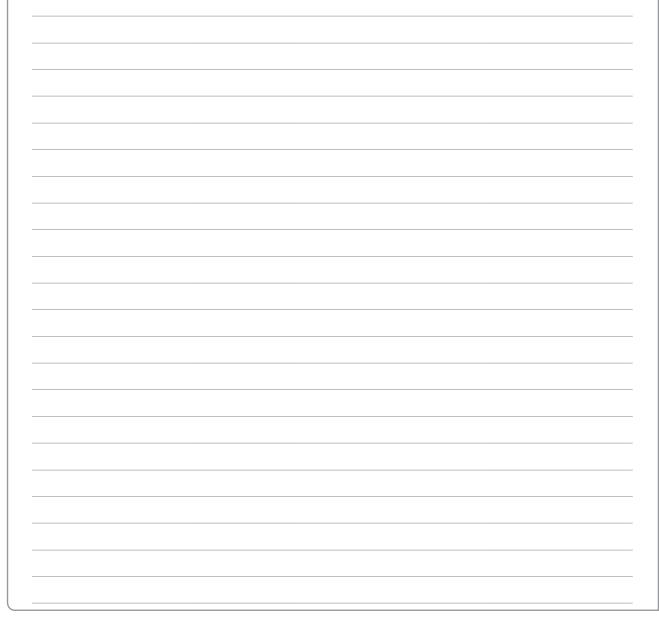
$$f(z) = z^4 + 6z^3 + 76z^2 + az + b$$

where a and b are real constants.

Given that -3 + 8i is a complex root of the equation f(z) = 0

(a) write down another complex root of this equation.

- (1)
- (b) Hence, or otherwise, find the other roots of the equation f(z) = 0
- **(6)**
- (c) Show on a single Argand diagram all four roots of the equation f(z) = 0
- **(2)**



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Question 8 continued	



Question 8 continued	

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	Q8
(Total 9 marks)	



9. The quadratic equation

$$2x^2 + 4x - 3 = 0$$

has roots α and β .

Without solving the quadratic equation,

- (a) find the exact value of
 - (i) $\alpha^2 + \beta^2$
 - (ii) $\alpha^3 + \beta^3$

(5)

(b) Find a quadratic equation which has roots $(\alpha^2 + \beta)$ and $(\beta^2 + \alpha)$, giving your answer in the form $ax^2 + bx + c = 0$, where a, b and c are integers.

(4)

uestion 9 continued	

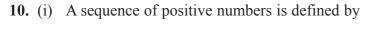


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Question 9 continued		
		Q9
	(Total 9 marks)	
	(Total 9 marks)	



(6)



$$u_1 = 5$$

 $u_{n+1} = 3u_n + 2, \quad n \geqslant 1$

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

$$u_n = 2 \times (3)^n - 1$$
 (5)

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

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

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Question 10 continued	
	Q10
(Total 11 marks)	
TOTAL FOR PAPER: 75 MARKS	
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