

Write your name here

Surname

Other names

**Pearson Edexcel**  
**International**  
**Advanced Level**

Centre Number

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Candidate Number

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# Further Pure Mathematics F1

**Advanced/Advanced Subsidiary**

Monday 16 January 2017 – Afternoon

**Time: 1 hour 30 minutes**

Paper Reference

**WFM01/01**

**You must have:**

Mathematical Formulae and Statistical Tables (Blue)

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 guide 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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Pearson

1.

(2)

(3)

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Question 1 continued

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Q1

(Total 5 marks)



(1)

(2)

(4)

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Question 2 continued

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Q2

(Total 7 marks)



3.

$$f(x) = x^4 + 2x^3 + 26x^2 + 32x + 160$$

Given that  $x = -1 + 3i$  is a root of the equation  $f(x) = 0$ , use algebra to find the three other roots of  $f(x) = 0$

*(Solutions based entirely on graphical or numerical methods are not acceptable.)*

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Question 3 continued

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Q3

(Total 7 marks)



- $$\sum_{r=1}^n r(2r+1)(3r+1) = \frac{1}{6}n(n+1)(an^2 + bn + c)$$

(5)

- $$\sum_{r=10}^{20} r(2r+1)(3r+1)$$

(2)



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### Question 4 continued

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**Question 4 continued**

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Question 4 continued

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Q4

(Total 7 marks)



(1)

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- (2)

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Question 5 continued

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Q5

(Total 8 marks)



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

(a) Taking 0.6 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)

(2)

**(Total 7 marks)**

15

**Turn over**



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

- The matrix  $\mathbf{B}$  represents a stretch, scale factor 3, parallel to the  $x$ -axis.

- (ii)

$$\mathbf{M} = \begin{pmatrix} -4 & 3 \\ -3 & -4 \end{pmatrix}$$

(c) Find  $\mathbf{M}^{-1}$  (2)



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**(Total 10 marks)**

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- (d) Hence find, in terms of  $a$ , the area of triangle  $BQR$ . (2)

Question 8 continued

Handwriting practice area with 30 horizontal lines.

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Question 8 continued

Lined area for writing the answer to Question 8.



**(Total 12 marks)**

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

$$\sum_{r=1}^n (4r^3 - 3r^2 + r) = n^3(n+1) \quad (6)$$

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

$$f(n) = 5^{2n} + 3n - 1$$

is divisible by 9 (6)

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**Question 9 continued**

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Question 9 continued

Handwriting practice area with 25 horizontal lines.

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Q9

Question 9 continued

Lined area for writing the answer to Question 9.

(Total 12 marks)

TOTAL FOR PAPER: 75 MARKS

END

