

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**

Friday 19 May 2017 – Morning

**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.

Turn over ►

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- $$3x^2 - 5x + 1 = 0$$

Without solving the quadratic equation, find the exact value of

$$\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$$

(4)



### Question 1 continued

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## Q1

**(Total 4 marks)**



$$\mathbf{A} = \begin{pmatrix} 3 & 1 & -2 \\ -1 & 0 & 5 \end{pmatrix} \text{ and } \mathbf{B} = \begin{pmatrix} 2 & 4 \\ -k & 2k \\ 3 & 0 \end{pmatrix}, \text{ where } k \text{ is a constant}$$

- (a) find the matrix  $\mathbf{AB}$ , (2)
- (b) find the exact value of  $k$  for which  $\det(\mathbf{AB}) = 0$  (2)



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Question 2 continued

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Q2

(Total 4 marks)



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

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

(5)

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Question 3 continued

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Q3

(Total 5 marks)



4. The rectangular hyperbola  $H$  has parametric equations

$$x = 4t, \quad y = \frac{4}{t}$$

The straight line with equation  $3y - 2x = 10$  intersects  $H$  at the points  $A$  and  $B$ .

Given that the point  $A$  is above the  $x$ -axis,

- (a) find the coordinates of the point  $A$  and the coordinates of the point  $B$ . (5)

- (b) Find the coordinates of the midpoint of  $AB$ . (2)

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Question 4 continued

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(Total 7 marks)

Q4



5.  $f(x) = 30 + \frac{7}{\sqrt{x}} - x^5, \quad x > 0$

The only real root,  $\alpha$ , of the equation  $f(x) = 0$  lies in the interval  $[2, 2.1]$ .

- (a) Starting with the interval  $[2, 2.1]$ , use interval bisection twice to find an interval of width 0.025 that contains  $\alpha$ . (4)
- (b) Taking 2 as a first approximation to  $\alpha$ , apply the Newton-Raphson process once to  $f(x)$  to find a second approximation to  $\alpha$ , giving your answer to 2 decimal places. (5)



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Question 5 continued

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Q5

(Total 9 marks)



- (4)

**Question 6 continued**

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**Q6**

**(Total 8 marks)**



$$f(z) = z^4 + 4z^3 + 6z^2 + 4z + a$$

Given that  $1 + 2i$  is a complex root of the equation  $f(z) = 0$

- (1)

- (7)

**(Total 8 marks)**

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- (a) Using calculus, show that an equation of the tangent to  $C$  at  $P$  is

This tangent cuts the directrix of  $C$  at the point  $A(-a, 6)$ , where  $a$  is a constant.

- (c) Find the exact value of  $p$ . (3)

- (d) Hence find the exact coordinates of the point  $P$ , giving each coordinate as a simplified surd. (3)



Question 8 continued

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### Question 8 continued

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Question 8 continued

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Q8

(Total 11 marks)



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$$z = \frac{1}{5} - \frac{2}{5}i$$

- (3)

$$zw = \lambda i$$

(3)

- (i) find  $\frac{4}{3}(z + w)$ ,

- (4)

Question 9 continued

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Question 9 continued

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Q9

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(Total 10 marks)



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- (e) Deduce from your answers to parts (c) and (d) that  $\sin 75^\circ = \frac{1 + \sqrt{3}}{2\sqrt{2}}$  and find the exact value of  $\cos 75^\circ$ , explaining your answers fully. (2)



**Question 10 continued**

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Question 10 continued

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**Question 10 continued**

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**TOTAL FOR PAPER: 75 MARKS**

28

