Write your name here

Surname	Other names

Pearson Edexcel
International Advanced Level

Centre Number | Candidate Number

Further Pure Mathematics F1

Advanced/Advanced Subsidiary

Wednesday 29 January 2014 – 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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1. $$f(x) = 6\sqrt{x} - x^2 - \frac{1}{2x}, \qquad x > 0$$

(a) Show that the equation $f(x) = 0$ has a root α in the interval [3, 4].

(2)

(b) Taking 3 as a first approximation to α, apply the Newton-Raphson process once to $f(x)$ to obtain a second approximation to α. Give your answer to 3 decimal places.

(5)

(c) Use linear interpolation once on the interval [3, 4] to find another approximation to α. Give your answer to 3 decimal places.

(3)

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Question 1 continued

Q1

(Total 10 marks)

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2. The quadratic equation

$$5x^2 - 4x + 2 = 0$$

has roots α and β.

(a) Write down the value of $\alpha + \beta$ and the value of $\alpha\beta$.

(2)

(b) Find the value of $\alpha^2 + \beta^2$.

(2)

(c) Find a quadratic equation which has roots

$$\frac{1}{\alpha^2} \text{ and } \frac{1}{\beta^2}$$

giving your answer in the form $px^2 + qx + r = 0$, where p, q and r are integers.

(4)

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Question 2 continued

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Question 2 continued

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Question 2 continued

Q2

(Total 8 marks)

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3.

$$\mathbf{A} = \begin{pmatrix} 6 & 4 \\ 1 & 1 \end{pmatrix}$$

(a) Show that **A** is non-singular.

(2)

The triangle R is transformed to the triangle S by the matrix **A**.

Given that the area of triangle R is 10 square units,

(b) find the area of triangle S.

(2)

Given that

$$\mathbf{B} = \mathbf{A}^4$$

and that the triangle R is transformed to the triangle T by the matrix **B**,

(c) find, without evaluating **B**, the area of triangle T.

(2)

Leave blank

Question 3 continued

Q3

(Total 6 marks)

Leave blank

4. $$f(x) = x^4 + 3x^3 - 5x^2 - 19x - 60$$

(a) Given that $x = -4$ and $x = 3$ are roots of the equation $f(x) = 0$, use algebra to solve $f(x) = 0$ completely.

(7)

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

(2)

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Question 4 continued

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Question 4 continued

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Question 4 continued

Q4

(Total 9 marks)

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

$$\sum_{r=1}^{n}(9r^2 - 4r) = \frac{1}{2}n(n+1)(6n-1)$$

for all positive integers n.

(4)

Given that

$$\sum_{r=1}^{12}\left(9r^2 - 4r + k(2^r)\right) = 6630$$

(b) find the exact value of the constant k.

(4)

Leave blank

Question 5 continued

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Question 5 continued

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Question 5 continued

Q5

(Total 8 marks)

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6.

(i) $$\mathbf{B} = \begin{pmatrix} -1 & 2 \\ 3 & -4 \end{pmatrix}, \qquad \mathbf{Y} = \begin{pmatrix} 4 & -2 \\ 1 & 0 \end{pmatrix}$$

(a) Find $\mathbf{B}^{-1}$.

(2)

The transformation represented by **Y** is equivalent to the transformation represented by **B** followed by the transformation represented by the matrix **A**.

(b) Find **A**.

(2)

(ii) $$\mathbf{M} = \begin{pmatrix} -\sqrt{3} & -1 \\ 1 & -\sqrt{3} \end{pmatrix}$$

The matrix **M** represents an enlargement scale factor k, centre (0, 0), where $k > 0$, followed by a rotation anti-clockwise through an angle θ about (0, 0).

(a) Find the value of k.

(2)

(b) Find the value of θ.

(2)

Leave blank

Question 6 continued

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Question 6 continued

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Question 6 continued

Q6

(Total 8 marks)

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7. (i) Given that

$$\frac{2w - 3}{10} = \frac{4 + 7\mathrm{i}}{4 - 3\mathrm{i}}$$

find w, giving your answer in the form $a + b\mathrm{i}$, where a and b are real constants. You must show your working.

(4)

(ii) Given that

$$z = (2 + \lambda\mathrm{i})(5 + \mathrm{i})$$

where λ is a real constant, and that

$$\arg z = \frac{\pi}{4}$$

find the value of λ.

(4)

Leave blank

Question 7 continued

Leave blank

Question 7 continued

Leave blank

Question 7 continued

Q7

(Total 8 marks)

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8. The parabola C has equation $y^2 = 4ax$, where a is a positive constant.

The point $P(ap^2, 2ap)$ lies on the parabola C.

(a) Show that an equation of the tangent to C at P is

$$py = x + ap^2$$

(4)

The tangent to C at the point P intersects the directrix of C at the point B and intersects the x-axis at the point D.

Given that the y-coordinate of B is $\frac{5}{6}a$ and $p > 0$,

(b) find, in terms of a, the x-coordinate of D.

(6)

Given that O is the origin,

(c) find, in terms of a, the area of the triangle OPD, giving your answer in its simplest form.

(2)

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Question 8 continued

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Question 8 continued

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Question 8 continued

Q8

(Total 12 marks)

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

$$f(n) = 7^n - 2^n \text{ is divisible by } 5$$

(6)

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Question 9 continued

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Question 9 continued

Q9

(Total 6 marks)

TOTAL FOR PAPER: 75 MARKS

END