Write your name here

Surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number	Candidate Number

Further Pure Mathematics F1

Advanced/Advanced Subsidiary

Monday 23 June 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 ▶

P44965A

5/5/1/

P 4 4 9 6 5 A 0 1 3 2

PEARSON

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1. Find the value of

$$\sum_{r=1}^{200} (r+1)(r-1)$$

(4)

Leave blank

Question 1 continued

(Total 4 marks)

Q1

P 4 4 9 6 5 A 0 3 3 2

Turn over

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2. Given that $-2 + 3\text{i}$ is a root of the equation

$$z^2 + pz + q = 0$$

where p and q are real constants,

(a) write down the other root of the equation.

(1)

(b) Find the value of p and the value of q.

(3)

Leave blank

Question 2 continued

(Total 4 marks)

Q2

P 4 4 9 6 5 A 0 5 3 2

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3.

$$\mathbf{A} = \begin{pmatrix} 4 & -2 \\ a & -3 \end{pmatrix}$$

where a is a real constant and $a \neq 6$

(a) Find $\mathbf{A}^{-1}$ in terms of a.

(3)

Given that $\mathbf{A} + 2\mathbf{A}^{-1} = \mathbf{I}$, where $\mathbf{I}$ is the 2×2 identity matrix,

(b) find the value of a.

(3)

Leave blank

Question 3 continued

Q3

(Total 6 marks)

P 4 4 9 6 5 A 0 7 3 2

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4. $$\mathrm{f}(x) = x^{\frac{3}{2}} - 3x^{\frac{1}{2}} - 3, \qquad x > 0$$

Given that α is the only real root of the equation $\mathrm{f}(x) = 0$,

(a) show that $4 < \alpha < 5$

(2)

(b) Taking 4.5 as a first approximation to α, apply the Newton-Raphson procedure once to $\mathrm{f}(x)$ to find a second approximation to α, giving your answer to 3 decimal places.

(5)

(c) Use linear interpolation once on the interval [4, 5] to find another approximation to α, giving your answer to 3 decimal places.

(3)

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Question 4 continued

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Question 4 continued

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Question 4 continued

(Total 10 marks)

Q4

P 4 4 9 6 5 A 0 1 1 3 2

5. Given that $z_1 = -3 - 4\text{i}$ and $z_2 = 4 - 3\text{i}$

(a) show, on an Argand diagram, the point P representing z_1 and the point Q representing z_2
(2)

(b) Given that O is the origin, show that OP is perpendicular to OQ.
(2)

(c) Show the point R on your diagram, where R represents $z_1 + z_2$
(1)

(d) Prove that $OPRQ$ is a square.
(2)

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Question 5 continued

P 4 4 9 6 5 A 0 1 3 3 2

Turn over

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Question 5 continued

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Question 5 continued

Q5

(Total 7 marks)

P 4 4 9 6 5 A 0 1 5 3 2

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6. It is given that α and β are roots of the equation $3x^2 + 5x - 1 = 0$

(a) Find the exact value of $\alpha^3 + \beta^3$

(3)

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

(5)

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Question 6 continued

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Question 6 continued

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Question 6 continued

Q6

(Total 8 marks)

P 4 4 9 6 5 A 0 1 9 3 2

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7.

$$\mathbf{P} = \begin{pmatrix} \frac{\sqrt{3}}{2} & -\frac{1}{2} \\ \frac{1}{2} & \frac{\sqrt{3}}{2} \end{pmatrix}$$

(a) Describe fully the single geometrical transformation U represented by the matrix **P**.
(3)

The transformation V, represented by the 2×2 matrix **Q**, is a reflection in the x-axis.

(b) Write down the matrix **Q**.
(1)

Given that V followed by U is the transformation T, which is represented by the matrix **R**,

(c) find the matrix **R**.
(2)

(d) Show that there is a real number k for which the transformation T maps the point $(1, k)$ onto itself. Give the exact value of k in its simplest form.
(5)

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Question 7 continued

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Question 7 continued

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Question 7 continued

Q7

(Total 11 marks)

P 4 4 9 6 5 A 0 2 3 3 2

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8. The hyperbola H has cartesian equation $xy = 16$
The parabola P has parametric equations $x = 8t^2$, $y = 16t$.

(a) Find, using algebra, the coordinates of the point A where H meets P.
(3)

Another point B (8, 2) lies on the hyperbola H.

(b) Find the equation of the normal to H at the point (8, 2), giving your answer in the form $y = mx + c$, where m and c are constants.
(5)

(c) Find the coordinates of the points where this normal at B meets the parabola P.
(6)

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Question 8 continued

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Question 8 continued

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Question 8 continued

(Total 14 marks)

Q8

P 4 4 9 6 5 A 0 2 7 3 2

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

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

(5)

(ii) Prove by induction that,

$$4^n + 6n + 8 \text{ is divisible by } 18$$

for all positive integers n.

(6)

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Question 9 continued

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Question 9 continued

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Question 9 continued

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Question 9 continued

Q9

(Total 11 marks)

TOTAL FOR PAPER: 75 MARKS

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