Pearson Edexcel International Advanced Level

Thursday 21 May 2026

Afternoon (Time: 1 hour 30 minutes)

Paper reference **WFM01/01A**

Mathematics

International Advanced Subsidiary/Advanced Level
Further Pure Mathematics F1
Question Paper

You must have:
Answer book (sent separately).
Do not return the question paper with the answer book.

Turn over

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Pearson

1. **In this question you must show all stages of your working.**
Solutions relying on calculator technology are not acceptable.

$$f(z) = 4z^3 - 5z^2 + 14z + 15$$

Given that $1 - 2i$ is a root of the equation $f(z) = 0$, determine the other two roots of the equation $f(z) = 0$

(5)

(Total for Question 1 is 5 marks)

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2. **In this question you must show all stages of your working.**
Solutions relying on calculator technology are not acceptable.

The rectangular hyperbola H has parametric equations

$$x = 6t \qquad y = \frac{6}{t} \qquad t \neq 0$$

The line l has equation $x - 3y + 3 = 0$

(a) Determine the coordinates of the points of intersection of H and l

(3)

Given that

- H and l intersect at the point P where $x < 0$
- the tangent to H at P intersects the x-axis at the point Q

(b) determine the x coordinate of Q

(3)

(Total for Question 2 is 6 marks)

3.

$$\mathbf{A} = \begin{pmatrix} 5k & k-3 \\ k+2 & k-1 \end{pmatrix}$$

where k is a constant.

Given that $\det \mathbf{A} = 5$

(a) determine the value of k

(3)

(b) Hence determine $\mathbf{A}^{-1}$, giving your answer in the form $\dfrac{1}{10}\begin{pmatrix} a & b \\ c & d \end{pmatrix}$

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

(2)

The transformation represented by $\mathbf{A}$ transforms the square S onto the square S'

Given that the sides of S have length 1.3

(c) determine the area of S'

(1)

The diagonals of S' intersect at the point $(-8, 6)$

(d) Determine, in simplest form, the coordinates of the point where the diagonals of S intersect.

(2)

(Total for Question 3 is 8 marks)

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4. **In this question you must show all stages of your working.**
Solutions relying entirely on calculator technology are not acceptable.

$$\mathrm{f}(x) = \frac{3}{2}x^3 - 6\sqrt{x} + \frac{1}{x} \qquad x > 0$$

(a) Determine $\mathrm{f}'(x)$

(2)

The equation $\mathrm{f}(x) = 0$ has a root α in the interval $[0.25, 0.35]$

(b) Using 0.25 as a first approximation to α, apply the Newton–Raphson process once to $\mathrm{f}(x)$ to determine a second approximation to α, giving your answer to 3 decimal places.

(2)

The equation $\mathrm{f}(x) = 0$ has a root β in the interval $[1.65, 1.7]$

(c) Use linear interpolation once on the interval $[1.65, 1.7]$ to determine an approximation to β, giving your answer to 3 decimal places.

(3)

(Total for Question 4 is 7 marks)

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5. The complex numbers z and w satisfy the simultaneous equations

$$3z + \mathrm{i}w = -1 + \mathrm{i}$$

$$kz - w = -9\mathrm{i}$$

where k is a real constant.

(a) Show that

$$z = \frac{24 + k + (3 - 8k)\mathrm{i}}{9 + k^2}$$

(3)

Given that $k = 2$

(b) show that $w = 4 + 7\mathrm{i}$

(2)

(c) Hence determine, in simplest form, the exact value of

(i) $\dfrac{|w|}{|z|}$

(ii) $\arg(z + w)$

(3)

(Total for Question 5 is 8 marks)

6.

$$\mathbf{A} = \begin{pmatrix} 3 & -2 \\ 2 & -1 \end{pmatrix}$$

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

$$\mathbf{A}^n = \begin{pmatrix} 2n+1 & -2n \\ 2n & 1-2n \end{pmatrix}$$

(5)

$$\mathbf{B} = \begin{pmatrix} p & -2 \\ -4 & 2 \end{pmatrix}$$

where p is a constant.

Given that

$$\mathbf{C} = \mathbf{A}^5 - \mathbf{AB} + 7\mathbf{I}$$

where $\mathbf{I}$ is the 2×2 identity matrix,

(b) use the result in part (a) to show that

$$\mathbf{C} = \begin{pmatrix} 10-3p & 0 \\ 6-2p & q \end{pmatrix}$$

where q is a constant to be determined.

(3)

(c) Describe fully the single transformation represented by $\mathbf{C}$ when $p = 3$

(2)

(Total for Question 6 is 10 marks)

7. The quadratic equation $2x^2 - 3x + 5 = 0$ has roots α and β.

You must answer parts (a) and (b) without solving the quadratic equation.

(a) Show that

$$(\alpha + 1)^3 (\beta + 1)^3 = 125$$

(3)

(b) Determine a quadratic equation with integer coefficients which has roots

$$\frac{1}{(\alpha + 1)^3} \quad \text{and} \quad \frac{1}{(\beta + 1)^3}$$

(5)

(Total for Question 7 is 8 marks)

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

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

(5)

(b) Hence determine the value of n for which

$$\sum_{r=2n}^{4n-1} r^3 = 1363 \left(\sum_{r=1}^{n} 1 \right)^2$$

(4)

(Total for Question 8 is 9 marks)

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9. The parabola C has equation $y^2 = 12x$

The point $P(3p^2, 6p)$, where $p \neq 0$, lies on C.

(a) Use calculus to show that the normal to C at P has equation

$$y + px = 6p + 3p^3$$

(3)

The point $Q(3q^2, 6q)$, where $q \neq 0$ and $q \neq p$, also lies on C.

Given that the chord PQ passes through the focus of C,

(b) show that $pq = -1$

(4)

The normal to C at P and the normal to C at Q intersect at the point R.

(c) Show that R has coordinates

$$\left(a(p+q)^2 + b,\ c(p+q)\right)$$

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

(5)

Given that P has coordinates $(12, 12)$

(d) determine, in simplest form, the exact coordinates of R.

(2)

(Total for Question 9 is 14 marks)

TOTAL FOR PAPER IS 75 MARKS

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