Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International Advanced Level

Thursday 21 May 2026

Afternoon (Time: 1 hour 30 minutes)

Paper reference **WFM01/01**

Mathematics

International Advanced Subsidiary/Advanced Level
Further Pure Mathematics F1

You must have:
Mathematical Formulae and Statistical Tables (Yellow), calculator

Total Marks

Candidates may use any calculator allowed by Pearson regulations. 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).
- **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.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 9 questions in this question paper. 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.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

Turn over ▶

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P 7 9 4 7 9 A 0 1 3 6

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1. $\mathbf{A} = \begin{pmatrix} 2 & 4 \\ 3 & 1 \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} 1 & k \\ 5 & 3k \end{pmatrix}$

where k is a constant.

Given that

$$\mathbf{C} = 3\mathbf{A} + 2\mathbf{B}$$

(a) determine $\mathbf{C}$ in simplest form in terms of k.

(2)

(b) Hence determine the value of k for which $\mathbf{C}$ is singular.

(3)

Given that $\mathbf{C}$ is non-singular,

(c) determine $\mathbf{C}^{-1}$ in simplest form in terms of k.

(2)

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Question 1 continued

Question 1 continued

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Question 1 continued

(Total for Question 1 is 7 marks)

2. The parabola C has equation $y^2 = 10x$ and the point S is the focus of C.

(a) Write down

(i) the coordinates of S,

(ii) the equation of the directrix of C.

(2)

Given that

- the point P lies on C
- the point Q lies on the directrix of C
- the line segment QP is parallel to the x-axis
- the distance PS is 20

(b) write down the distance QP

(1)

(c) determine the exact coordinates of the possible positions of P.

(3)

Question 2 continued

(Total for Question 2 is 6 marks)

3. (a) Use the standard results for summations to show that for all positive integers n

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

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

(4)

(b) Using the answer to part (a) and making your method clear, determine the value of

$$21 \times 38 + 23 \times 41 + 25 \times 44 + \ldots + 97 \times 152$$

(2)

Question 3 continued

Question 3 continued

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Question 3 continued

(Total for Question 3 is 6 marks)

4. $$f(x) = \frac{1}{10}x - \frac{(x-4)^2}{\sqrt{x}} \qquad x > 0$$

(a) Show that the equation $f(x) = 0$ has a root α in the interval [5.0, 5.1]

(2)

(b) Starting with the interval [5.0, 5.1], use interval bisection to determine an interval of width 0.025 which contains α.

(3)

The equation $f(x) = 0$ has another root β in the interval [3.1, 3.3]

(c) Determine $f'(x)$.

(3)

(d) Using $x_0 = 3.3$ as a first approximation for β, apply the Newton-Raphson process once to $f(x)$ to determine a second approximation for β, giving your answer to 3 decimal places.

(2)

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Question 4 continued

Question 4 continued

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Question 4 continued

(Total for Question 4 is 10 marks)

5. The quadratic equation

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

has roots α and β.

Without solving the equation,

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

(1)

(b) determine the value of $\alpha^3 + \beta^3$

(2)

(c) determine a quadratic equation that has roots

$$(\alpha^4\beta - 2) \text{ and } (\alpha\beta^4 - 2)$$

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

(5)

Question 5 continued

Question 5 continued

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Question 5 continued

(Total for Question 5 is 8 marks)

6. $f(z) = 12z^4 + Az^3 + Bz^2 + Cz - 306$

where A, B and C are integers.

Given that $z = 1 + 4i$ is a root of the equation $f(z) = 0$

(a) write down another root of the equation $f(z) = 0$

(1)

(b) Hence determine a quadratic factor of $f(z)$

(2)

Given also that $(3z - 2)$ is a factor of $f(z)$

(c) factorise $f(z)$ completely.

(3)

(d) Determine the value of A, the value of B and the value of C.

(3)

(e) Show all the roots of the equation $f(z) = 0$ on a single Argand diagram.

(2)

Question 6 continued

Question 6 continued

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Question 6 continued

(Total for Question 6 is 11 marks)

7. (i)

$$\mathbf{M} = \begin{pmatrix} 1 & 0 \\ 0 & 3 \end{pmatrix}$$

(a) Describe fully the single transformation represented by **M**.

(2)

The matrix **N** represents a reflection in the line with equation $y = -x$

(b) Write down the matrix **N**.

(1)

The transformation represented by **M** followed by the transformation represented by **N** is the transformation represented by the matrix **P**.

(c) Determine **P**.

(2)

(ii)

$$\mathbf{Q} = \begin{pmatrix} 5 & -1 \\ 5 & 3 \end{pmatrix}$$

A **regular** hexagon H with side length x is transformed to another hexagon H' by the transformation represented by **Q**.

Given that the area of H' is 200, determine, to 3 significant figures, the value of x.

(5)

Question 7 continued

Question 7 continued

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Question 7 continued

(Total for Question 7 is 10 marks)

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

$$f(n) = 3^{2n+4} - 2^{2n}$$

is divisible by 5

(5)

Question 8 continued

Question 8 continued

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Question 8 continued

(Total for Question 8 is 5 marks)

9. The rectangular hyperbola H has equation $xy = c^2$ where c is a positive constant.

The point $P\left(cp, \frac{c}{p}\right)$, where $p \neq 0$ and $p \neq \pm 1$, lies on H.

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

$$p^3x - py = c(p^4 - 1)$$

(4)

Given that

- the point $Q\left(cq, \frac{c}{q}\right)$, where $q \neq 0$ and $p \neq q$, also lies on H
- the normal to H at P meets H again at the point Q

(b) show that

$$p^3q = -1$$

(3)

Given also that the normal to H at Q meets H again at the point R,

(c) show that the gradient of PR is

$$-\frac{1}{p^k}$$

where k is a constant to be determined.

(5)

Question 9 continued

Question 9 continued

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Question 9 continued

Question 9 continued

(Total for Question 9 is 12 marks)

TOTAL FOR PAPER IS 75 MARKS

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