PMT

Write your name here

Surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Further Pure Mathematics F1

Advanced/Advanced Subsidiary

Sample Assessment Material
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. The complex numbers z_1 and z_2 are given by

$$z_1 = 2 + 8\mathrm{i} \quad \text{and} \quad z_2 = 1 - \mathrm{i}$$

Find, showing your working,

(a) $\dfrac{z_1}{z_2}$ in the form $a + b\mathrm{i}$, where a and b are real,

(3)

(b) the value of $\left|\dfrac{z_1}{z_2}\right|$,

(2)

(c) the value of $\arg \dfrac{z_1}{z_2}$, giving your answer in radians to 2 decimal places.

(2)

Leave blank

2. $$f(x) = 5x^2 - 4x^{\frac{3}{2}} - 6, \quad x \geqslant 0$$

The root α of the equation $f(x) = 0$ lies in the interval $[1.6, 1.8]$

(a) Use linear interpolation once on the interval $[1.6, 1.8]$ to find an approximation to α. Give your answer to 3 decimal places.

(4)

(b) Taking 1.7 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.

(6)

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3.

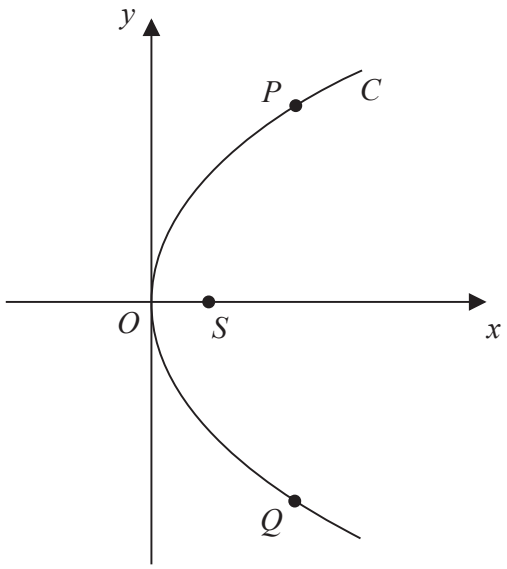

Figure 1

Figure 1 shows a sketch of the parabola C with equation $y^2 = 8x$.
The point P lies on C, where $y > 0$, and the point Q lies on C, where $y < 0$
The line segment PQ is parallel to the y-axis.

Given that the distance PQ is 12,

(a) write down the y coordinate of P,

(1)

(b) find the x coordinate of P.

(2)

Figure 1 shows the point S which is the focus of C.

The line l passes through the point P and the point S.

(c) Find an equation for l in the form $ax + by + c = 0$, where a, b and c are integers.

(4)

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Question 3 continued

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4. The quadratic equation

$$5x^2 - 4x + 1 = 0$$

has roots α and β.

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

(2)

(b) Show that $\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{6}{5}$

(4)

(c) Find a quadratic equation with integer coefficients, which has roots

$$\alpha + \frac{1}{\alpha} \text{ and } \beta + \frac{1}{\beta}$$

(6)

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Question 4 continued

(Total 12 marks)

Q4

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

$$f(n) = 5^n + 8n + 3 \text{ is divisible by } 4$$

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Question 5 continued

Q5

(Total 6 marks)

Leave blank

6. (a) Using the formulae for $\sum_{r=1}^{n} r$, $\sum_{r=1}^{n} r^2$ and $\sum_{r=1}^{n} r^3$, show that

$$\sum_{r=1}^{n} r(r+1)(r+3) = \frac{1}{12} n(n+1)(n+2)(3n+k)$$

where k is a constant to be found.

(7)

(b) Hence evaluate $\sum_{r=21}^{40} r(r+1)(r+3)$

(3)

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Question 6 continued

Q6

(Total 10 marks)

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7. The point $P\left(6t, \frac{6}{t}\right)$, $t \neq 0$, lies on the rectangular hyperbola H with equation $xy = 36$

(a) Show that an equation for the tangent to H at P is

$$y = -\frac{1}{t^2}x + \frac{12}{t}$$

(5)

The tangent to H at the point A and the tangent to H at the point B meet at the point $(-9, 12)$.

(b) Find the coordinates of A and B.

(7)

PMT

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Question 7 continued

(Total 12 marks)

Q7

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8. (i) The transformation U is represented by the matrix **P** where,

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

(a) Describe fully the transformation U.

(2)

The transformation V, represented by the matrix **Q**, is a stretch scale factor 3 parallel to the x-axis.

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

(1)

Transformation U followed by transformation V is a transformation which is represented by matrix **R**.

(c) Find the matrix **R**.

(3)

(ii)

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

Given that the matrix **S** represents an enlargement, with a positive scale factor and centre (0, 0), followed by a rotation with centre (0, 0),

(a) find the scale factor of the enlargement,

(2)

(b) find the angle and direction of rotation, giving your answer in degrees to 1 decimal place.

(3)

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Question 8 continued

Q8

(Total 11 marks)

TOTAL FOR PAPER: 75 MARKS

END