

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

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Pearson Edexcel International Advanced Level

Time 1 hour 30 minutes

Paper

reference

WFM03/01

Mathematics

**International Advanced Subsidiary/Advanced Level
Further Pure Mathematics F3**

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 8 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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Question 1 continued

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Leave
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Question 1 continued

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Question 1 continued

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Q1

Mark box

(Total 8 marks)

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Question 2 continued

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Question 2 continued

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Question 2 continued

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Q2

(Total 8 marks)





Question 3 continued

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Question 3 continued

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Q3

(Total 9 marks)



P 7 1 1 0 2 A 0 1 3 3 6

4.

$$\mathbf{M} = \begin{pmatrix} 6 & k & 2 \\ k & 5 & 0 \\ 2 & 0 & 7 \end{pmatrix}$$

where k is a constant.

Given that 3 is an eigenvalue of $\mathbf{M}$,

(a) determine the possible values of k .

(3)

Given that $k < 0$

(b) determine the other eigenvalues of $\mathbf{M}$.

(3)

(c) Determine a normalised eigenvector corresponding to the eigenvalue 3

(3)



Question 4 continued

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Question 4 continued

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Question 4 continued

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Q4

(Total 9 marks)



5. Determine

$$(i) \int \frac{1}{\sqrt{x^2 - 3x + 5}} dx \quad (3)$$

$$(ii) \int \frac{1}{\sqrt{63 + 4x - 4x^2}} dx \quad (4)$$

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Question 5 continued

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Question 5 continued

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Q5

(Total 7 marks)



6.

$$I_n = \int e^x \sin^n x \, dx \quad n \in \mathbb{Z} \quad n \geq 0$$

(a) Show that

$$I_n = \frac{e^x \sin^{n-1} x}{n^2 + 1} (\sin x - n \cos x) + \frac{n(n-1)}{n^2 + 1} I_{n-2} \quad n \geq 2 \quad (6)$$

(b) Hence find the exact value of

$$\int_0^{\frac{\pi}{2}} e^x \sin^4 x \, dx$$

giving your answer in the form $Ae^{\frac{\pi}{2}} + B$ where A and B are rational numbers to be determined.

(4)



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Question 6 continued

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Question 6 continued

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Q6

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(Total 10 marks)



P 7 1 1 0 2 A 0 2 5 3 6

Question 7 continued

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Question 7 continued

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Question 7 continued

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Q7

(Total 11 marks)



8. The ellipse E has equation

$$\frac{x^2}{9} + \frac{y^2}{4} = 1$$

(a) Determine the eccentricity of E (2)

(b) Hence, for this ellipse, determine

- (i) the coordinates of the foci,
- (ii) the equations of the directrices. (2)

The point P lies on E and has coordinates $(3 \cos \theta, 2 \sin \theta)$.

The line l_1 is the tangent to E at the point P

(c) Using calculus, show that an equation for l_1 is

$$2x \cos \theta + 3y \sin \theta = 6$$
 (3)

The line l_2 passes through the origin and is perpendicular to l_1

The line l_1 intersects the line l_2 at the point Q

(d) Determine the coordinates of Q (3)

(e) Show that, as θ varies, the point Q lies on the curve with equation

$$(x^2 + y^2)^2 = \alpha x^2 + \beta y^2$$

where α and β are constants to be determined. (3)

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Question 8 continued

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Question 8 continued

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Question 8 continued

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Question 8 continued

Lined area for writing the answer to Question 8.



Question 8 continued

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11

TOTAL FOR PAPER: 75 MARKS

36

