

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Pearson Edexcel
International
Advanced Level

Centre Number

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Candidate Number

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Monday 24 June 2019

Morning (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 (Blue), calculator

Total Marks

Candidates may use any calculator permitted 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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(Total 6 marks)

Q1



(5)

Question 2 continued

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Question 2 continued

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Question 2 continued

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(Total 9 marks)

Q2

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3. Find

$$(a) \int \frac{1}{8 + 4x + x^2} dx \quad (3)$$

$$(b) \int \frac{1}{\sqrt[3]{(8-4x-x^2)}} dx \quad (4)$$



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Question 3 continued

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Question 3 continued

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Question 3 continued

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Q3



4.

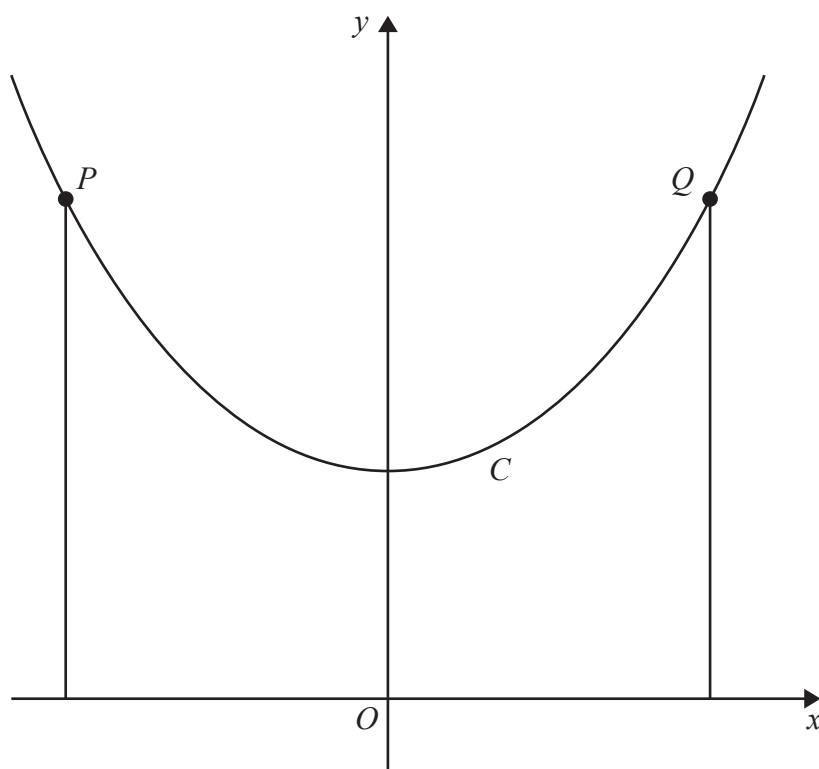


Figure 1

Figure 1 shows part of the curve C with equation

$$y = 3 \cosh\left(\frac{x}{3}\right)$$

The point P and the point Q lie on the curve. The point P has x coordinate $-3a$ and the point Q has x coordinate $3a$.

- (a) Find the length of the arc PQ , giving your answer as a multiple of $\sinh a$. (5)

Given that the length of the arc PQ is 12

- (b) show that the x coordinate of Q is $3\ln(p + \sqrt{q})$, where p and q are integers to be found, (2)

- (c) show that the y coordinate of Q is $r\sqrt{s}$ where r and s are integers to be found. (2)

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Question 4 continued

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Question 4 continued

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(Total 9 marks)

Q4

Mark box for Q4



$$\mathbf{r} = \begin{pmatrix} 4 \\ 2 \\ 1 \end{pmatrix} + \lambda \begin{pmatrix} 1 \\ 0 \\ 2 \end{pmatrix} + \mu \begin{pmatrix} 2 \\ 1 \\ 3 \end{pmatrix}$$

(a) Find a vector perpendicular to Π (2)

(b) Find α , giving your answer to the nearest degree. (4)

(c) Find the perpendicular distance from A to II (4)

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Question 5 continued

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Question 5 continued

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(Total 10 marks)

Q5



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$$\mathbf{M} = \begin{pmatrix} 3 & 0 & 1 \\ 1 & 2 & 2 \\ 4 & 0 & 3 \end{pmatrix}$$

- (c) Find an equation for the line l_2 , giving your answer in the form $(\mathbf{r} - \mathbf{c}) \times \mathbf{d} = \mathbf{0}$ where $\mathbf{c}$ and $\mathbf{d}$ are constant vectors.
- (5)



Question 6 continued

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Question 6 continued

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Question 6 continued

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Q6



7.

$$I_n = \int \cosh^n x \, dx \quad n \geq 0$$

(a) Show that, for $n \geq 2$

$$nI_n = \sinh x \cosh^{n-1} x + (n-1) I_{n-2} \quad (6)$$

(b) Hence find

$$\int \cosh^4 x \, dx \quad (4)$$

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Question 7 continued

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Question 7 continued

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Q7



Question 8 continued

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Question 8 continued

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Question 8 continued

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Q8

(Total 11 marks)

TOTAL FOR PAPER: 75 MARKS

END

