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| Candidate surname    |                      |                      |                      |                      | Other names          |                      |                      |                      |  |
| Centre Number        |                      |                      |                      |                      | Candidate Number     |                      |                      |                      |  |
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**Pearson Edexcel International Advanced Level**

**Thursday 16 January 2025**

Morning (Time: 1 hour 30 minutes) **Paper reference** **WMA13/01**

**Mathematics**

**International Advanced Level**

**Pure Mathematics P3**

**You must have:**  
Mathematical Formulae and Statistical Tables (Yellow), 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 10 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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1.  $f(x) = 2\sec x + 6x - 3$   $0 < x < \frac{\pi}{2}$

The equation  $f(x) = 0$  has a single root  $\alpha$

(a) Show that  $0.1 < \alpha < 0.2$

(2)

(b) Show that  $\alpha$  is a solution of

$$x = \frac{1}{2} - \frac{1}{3\cos x}$$

(1)

The iterative formula

$$x_{n+1} = \frac{1}{2} - \frac{1}{3\cos x_n}$$

is used to find  $\alpha$

(c) Starting with  $x_1 = 0.15$  and using the iterative formula,

(i) find, to 4 decimal places, the value of  $x_2$

(ii) find, to 4 decimal places, the value of  $\alpha$

(3)



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Question 1 continued

Lined area for writing the answer to Question 1.

(Total for Question 1 is 6 marks)



2. The weed on the surface of a pond is being monitored.

The surface area of the pond covered by the weed,  $A \text{ m}^2$ , is modelled by the equation

$$\log_{10} A = 1 + 0.03t$$

where  $t$  is the number of weeks after monitoring began.

**Use the equation of the model to answer parts (a) and (b).**

- (a) Find the surface area of the pond initially covered by the weed.

(1)

After  $T$  weeks,  $25 \text{ m}^2$  of the pond is covered by the weed.

- (b) Find the value of  $T$ , giving your answer to 2 decimal places.

(2)



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Question 2 continued

Handwriting practice area with horizontal lines.

(Total for Question 2 is 3 marks)



3.

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

A curve has equation

$$y = \frac{4x + 1}{(x + 3)^2} \quad x \neq -3 \quad x \in \mathbb{R}$$

Use calculus to find the range of values of  $x$  for which  $y$  is increasing.

(6)



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Question 3 continued

Handwriting practice area with horizontal lines.

(Total for Question 3 is 6 marks)



4. Given that

$$\frac{4x^3 + 2x^2 + 3x + 8}{x^2 + 4} \equiv Ax + B + \frac{Cx + D}{x^2 + 4}$$

(a) (i) find the values of the constants  $A$ ,  $B$  and  $C$

(ii) show that  $D = 0$

(4)

(b) Hence, using algebraic integration, find

$$\int_1^4 \frac{4x^3 + 2x^2 + 3x + 8}{x^2 + 4} dx$$

giving your answer in the form  $p + q \ln 2$ , where  $p$  and  $q$  are integers.

(5)



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Question 4 continued

Lined area for writing the answer to Question 4.



Question 4 continued

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Question 4 continued

Handwriting practice area with horizontal lines.

(Total for Question 4 is 9 marks)



5. A hot piece of metal is cooled by dropping it into water. The temperature,  $H^{\circ}\text{C}$ , of the metal,  $t$  minutes after it is dropped into the water, is modelled by the equation

$$H = 280e^{-0.05t} + 24 \quad t \geq 0$$

**Use the equation of the model to answer parts (a) to (d).**

- (a) Find the initial temperature of the piece of metal. (1)
- (b) On Diagram 1, sketch the graph of  $H$  against  $t$ . On your sketch, state the equation of the asymptote to the curve. (2)
- (c) Find the value of  $t$  for which  $H = 144$ , giving your answer to 2 decimal places.
- (Solutions based entirely on calculator technology are not acceptable.)* (3)
- (d) Show by differentiation that

$$\frac{dH}{dt} = a + bH$$

where  $a$  and  $b$  are constants to be found.



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Question 5 continued

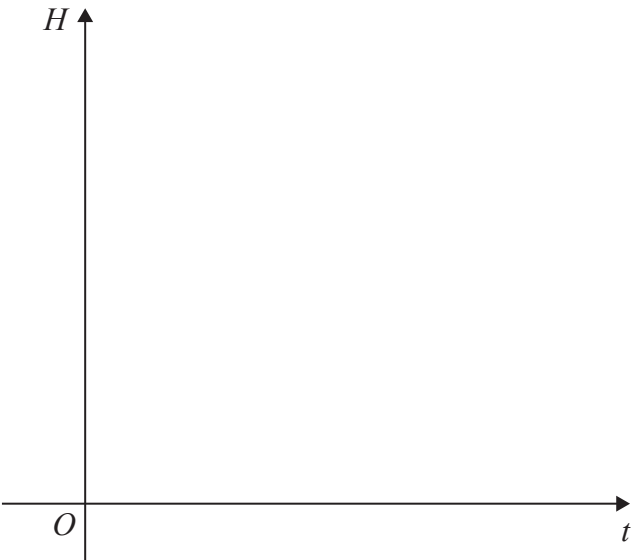


Diagram 1

Lined area for writing the answer.

Question 5 continued

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Question 5 continued

Handwriting practice area with horizontal lines.

(Total for Question 5 is 9 marks)





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Question 6 continued

Lined area for writing the answer to Question 6.



Question 6 continued

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Question 6 continued

Lined area for writing the answer to Question 6.

(Total for Question 6 is 8 marks)



7. Given that  $a$  and  $b$  are positive constants with  $a > b$ ,

(a) sketch, on **separate** diagrams, the graph with equation

(i)  $y = |3x - a|$

(ii)  $y = |3x - a| - b$

Show on each sketch

- the coordinates of the minimum point on the graph
- the coordinates of the point at which the graph crosses the  $y$ -axis

(6)

(b) Solve the equation

$$|3x - a| - b = 5x$$

giving any solution for  $x$  in terms of  $a$  and  $b$ .

(2)



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Question 7 continued

Lined area for writing the answer to Question 7.

(Total for Question 7 is 8 marks)



8.

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

- (i) Solve, for
- $0 < \theta < \pi$

$$3 \operatorname{cosec} \theta = 8 \cos \theta$$

giving your answers, in radians, to 3 significant figures.

(5)

- (ii) Solve, for
- $0 < x < 180^\circ$

$$\frac{\tan 2x - \tan 70^\circ}{1 + \tan 2x \tan 70^\circ} = -\frac{3}{8}$$

giving your answers, in degrees, to one decimal place.

(4)



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Question 8 continued

Lined area for writing the answer to Question 8.



Question 8 continued

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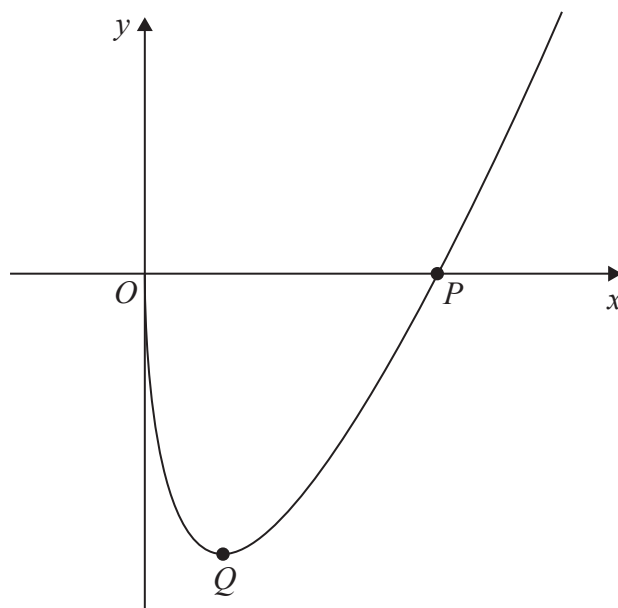
Question 8 continued

Lined area for writing the answer to Question 8.

(Total for Question 8 is 9 marks)



9.



### Figure 1

Figure 1 shows a sketch of part of the curve  $C$  with equation  $y = f(x)$  where

$$f(x) = 6\sqrt{x} \ln(4x) \quad x > 0$$

The curve cuts the  $x$ -axis at point  $P$

- (a) State the  $x$  coordinate of  $P$

(1)

The point  $Q$ , shown in Figure 1, is the stationary point on  $C$

- (b) Use calculus to find the exact coordinates of  $Q$

(5)

- (c) Hence find the range of the function  $g(x)$  where

$$g(x) = -2f(x)$$

(2)



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Question 9 continued

Lined area for writing the answer to Question 9.



Question 9 continued

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Question 9 continued

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(Total for Question 9 is 8 marks)



10.

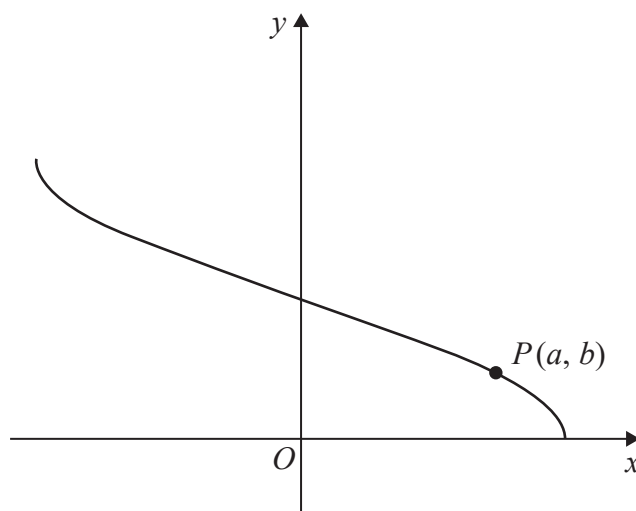


Figure 2

Figure 2 shows a sketch of the curve with equation

$$x = 3 \cos 2y \quad -3 \leq x \leq 3 \quad 0 \leq y \leq \frac{\pi}{2}$$

- (a) Find  $\frac{dx}{dy}$  in terms of  $y$ .

(2)

- (b) Hence show that

$$\frac{dy}{dx} = \frac{k}{\sqrt{9 - x^2}}$$

where  $k$  is a constant to be found.

(3)

The point  $P(a, b)$  lies on the curve and is shown in Figure 2.

Given that

- the gradient of the curve at  $P$  is  $-\frac{1}{4}$
- both  $a$  and  $b$  are positive

- (c) find the exact values of  $a$  and  $b$ .

(4)

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Question 10 continued

Lined area for writing the answer to Question 10.



**Question 10 continued**

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**(Total for Question 10 is 9 marks)**

**TOTAL FOR PAPER IS 75 MARKS**

