Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International Advanced Level

Tuesday 2 June 2026

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 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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1. A curve has equation $y = f(x)$ where

$$f(x) = \frac{2}{3}x^3 - 3x^2 + 5x + e^{2x}(1 - 2x) \qquad x \in \mathbb{R}$$

(a) Find $f'(x)$ giving the answer in simplest form.

(3)

The equation $f'(x) = 0$ has a single root, α

(b) Show that α lies in the interval $[0, 1]$

(2)

Given that the equation $f'(x) = 0$ can be written as

$$x = \frac{2x^2 + 5}{4e^{2x} + 6}$$

(c) use the iteration formula

$$x_{n+1} = \frac{2x_n^{\,2} + 5}{4e^{2x_n} + 6} \qquad \text{with } x_1 = 0$$

to find, to 4 decimal places,

(i) the value of x_3

(ii) the value of α

(3)

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Question 1 continued

Question 1 continued

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Question 1 continued

(Total for Question 1 is 8 marks)

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

The functions f and g are defined by

$$f(x) = 3 + 4e^{2x} \qquad x \in \mathbb{R}$$

$$g(x) = \sqrt{x + 5} \qquad x \in \mathbb{R} \quad x > -5$$

(a) State the range of f

(1)

(b) Find g^{-1}

(3)

(c) Find $gf\left(\ln\sqrt{7}\right)$

(2)

(d) Find the value of a, $a > 0$, for which

$$fg(a^2 - 5) = g(59)$$

giving the answer in the form $\ln p$ where p is an irrational constant.

(3)

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Question 2 continued

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Question 2 continued

(Total for Question 2 is 9 marks)

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

The curve C has equation $y = f(x)$ where

$$f(x) = \frac{4x^2 - 14x + 15}{x - 3} \qquad x < 3$$

(a) Find $f'(x)$, giving the answer in the form

$$\frac{ax^2 + bx + c}{(x-3)^2}$$

where a, b and c are constants.

(4)

(b) Hence find the coordinates of the turning point of C.

(2)

The point $P\left(\frac{5}{2}, -10\right)$ lies on C.

(c) Find the coordinates of the point to which P is mapped, when the curve with equation $y = f(x)$ is transformed to the curve with equation $y = f(2x) + 3$

(2)

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Question 3 continued

(Total for Question 3 is 8 marks)

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

Using algebraic integration, find the exact value of

$$\int_{\frac{\pi}{18}}^{\frac{\pi}{12}} (\sin 3x + \cos 3x)^2 \, \mathrm{d}x$$

(5)

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Question 4 continued

(Total for Question 4 is 5 marks)

5.

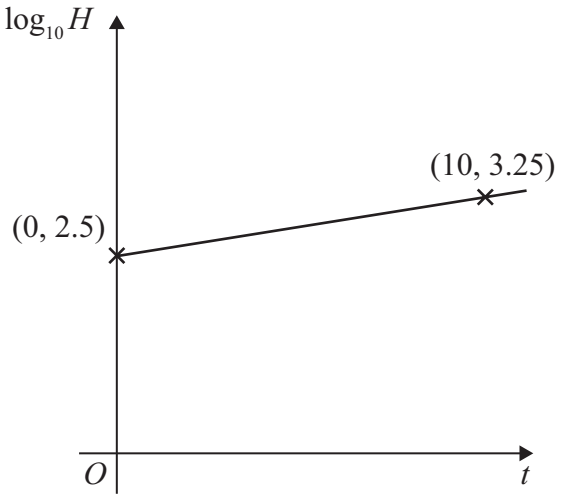


Figure 1

The recycling of household waste in a particular town is being monitored.

The number of households in the town, H, recycling their household waste, t years after monitoring began, is modelled by the equation

$$H = ab^t$$

where a and b are constants.

The line in Figure 1 shows the linear relationship between t and $\log_{10} H$

The line passes through the points (0, 2.5) and (10, 3.25)

Using this information,

(a) find, to 3 significant figures, the value of a and the value of b

(4)

(b) With reference to the model, interpret the value of the constant b

(1)

(c) Find the value of $\frac{dH}{dt}$ when $t = 5$, giving the answer to 2 significant figures.

(*Solutions relying entirely on calculator technology are not acceptable.*)

(2)

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Question 5 continued

(Total for Question 5 is 7 marks)

6. The curve C has equation

$$x = \left(3\sin 2y - \frac{6y}{\pi}\right)^2$$

Given that

- the point P with y coordinate $\frac{\pi}{4}$ lies on C
- the tangent to C at P cuts the x-axis at the point Q

use calculus to find the x coordinate of Q

(6)

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Question 6 continued

(Total for Question 6 is 6 marks)

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

The selling price of a car is monitored over a 15-year period.

The selling price P_C of the car, in thousands of pounds, t years after monitoring began, is modelled by the equation

$$P_C = 7 + 16e^{-0.1t} \qquad 0 \leqslant t \leqslant 15$$

Given that when $t = T$ the selling price of the car is £15 000

(a) find, according to the model, the value of T. Give the answer to 2 decimal places.

(3)

(b) Find the value of $\frac{dP_C}{dt}$ when $t = 5$. Give the answer to 2 decimal places.

(2)

The selling price of a van is monitored over the same 15-year period.

The selling price P_V of the van, in thousands of pounds, t years after monitoring began, is modelled by the equation

$$P_V = 4 + me^{-0.2t} \qquad 0 \leqslant t \leqslant 15$$

where m is a constant.

Use the equations of these models to answer parts (c) and (d).

Given that $P_V = 36$ when $t = 0$

(c) (i) state the value of m

(ii) find the difference between the initial selling price of the car and the initial selling price of the van.

(3)

When $t = \alpha$, the selling price of the car is equal to the selling price of the van.

(d) Find, using algebra and showing your working, the value of α, giving the answer to 3 significant figures.

(4)

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Question 7 continued

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Question 7 continued

(Total for Question 7 is 12 marks)

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

(a) Show that

$$\frac{\sec\theta\,\text{cosec}\theta}{4\text{cosec}\,4\theta} \equiv \cos 2\theta$$

(2)

(b) Hence show that the equation

$$4(5\cos^2\theta - 9)\,\text{cosec}\,4\theta = 3(1 + \tan^2 2\theta)\sec\theta\,\text{cosec}\,\theta$$

can be written as

$$a\cos^2 2\theta + b\cos 2\theta + c = 0$$

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

(3)

(c) Hence, solve for $0 < x < 180°$, $x \neq (45n)°$, $n \in \mathbb{N}$, the equation

$$4(5\cos^2 x - 9)\,\text{cosec}\,4x = 3(1 + \tan^2 2x)\sec x\,\text{cosec}\,x$$

giving the answers to one decimal place.

(4)

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Question 8 continued

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Question 8 continued

(Total for Question 8 is 9 marks)

9.

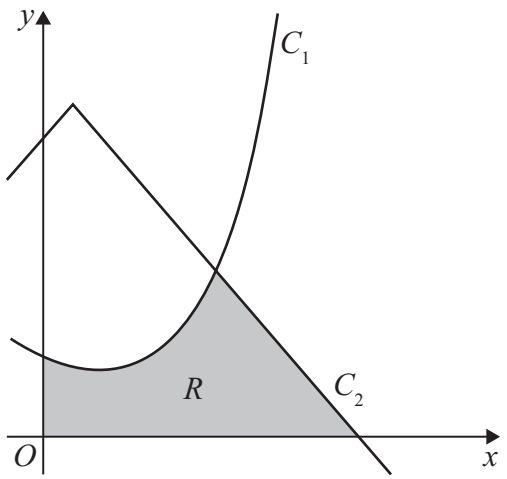


Figure 2

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

(a) Find $\int \left(\frac{11}{2x+5} + 4e^{x-3} \right) dx$

(2)

Figure 2 shows a sketch of part of the curve C_1 and part of the graph C_2
The curve C_1 has equation

$$y = \frac{11}{2x+5} + 4e^{x-3}$$

The graph C_2 has equation

$$y = a - |bx - 1|$$

where a and b are positive integers.

(b) State, in terms of a and/or b, the coordinates of the maximum point of C_2

(2)

Given that

- C_1 intersects C_2 at $x = 3$
- C_2 crosses the y-axis at (0, 9)

(c) find the value of a and the value of b

(3)

The region R, shown shaded in Figure 2, is bounded by C_1, C_2, the x-axis and the y-axis.

(d) Find the area of R, giving the answer to 3 significant figures.

(4)

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Question 9 continued

Question 9 continued

(Total for Question 9 is 11 marks)

TOTAL FOR PAPER IS 75 MARKS

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