Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International Advanced Level

Monday 19 January 2026

Morning (Time: 1 hour 30 minutes)

Paper reference **WMA13/01**

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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. $$g(x) = 3x - 5 + 5\sin\left(x^2\right)$$

where x is measured in radians.

(a) Show that $g(x) = 0$ has a root α in the interval $[0.7, 0.8]$

(2)

(b) Show that the equation $g(x) = 0$ can be written in the form

$$x = \left[\arcsin(1 - px)\right]^{\frac{1}{2}}$$

where p is a constant to be found.

(1)

Using the iteration formula

$$x_{n+1} = \left[\arcsin(1 - px_n)\right]^{\frac{1}{2}}$$

with the value of p found in part (b) and starting with $x_1 = 0.7$

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

(ii) find, by repeated iteration, the value of α, giving your answer to 4 decimal places.

(3)

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Question 1 continued

(Total for Question 1 is 6 marks)

2. (i) Given $y = x^2 \ln 2x$, find in simplest form, $\dfrac{dy}{dx}$

(2)

(ii) Given

$$f(x) = \frac{e^{2x}}{(4x+3)^2} \qquad x > -\frac{3}{4}$$

show that

$$f'(x) = \frac{2e^{2x}(ax+b)}{(4x+3)^3}$$

where a and b are constants to be found.

(4)

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Question 2 continued

(Total for Question 2 is 6 marks)

3. (i) Find, in simplest form,

$$\int 2(3x+5)^7 \, dx$$

(2)

(ii) $$f(x) = \frac{4x^3 + x^2 - 7x + 14}{(x-1)(x+2)} \qquad x > 1$$

(a) Write $f(x)$ in the form

$$ax + b + \frac{c}{x-1}$$

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

(4)

(b) Hence, using algebraic integration, find

$$\int_3^9 f(x) \, dx$$

writing the answer in simplest form.

(4)

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Question 3 continued

Question 3 continued

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Question 3 continued

(Total for Question 3 is 10 marks)

4. The resting heart rate, h beats per minute, of a particular group of mammals, can be modelled by the equation

$$\log_{10} h = 2.4 - 0.25 \log_{10} m$$

where m kg is the mass of the mammal.

The mass of one of these mammals is 3 kg.

According to the model,

(a) find the resting heart rate of this mammal. Give your answer to 3 significant figures.

(2)

(b) Show that the equation of the model can be written in the form

$$h = \frac{p}{m^q}$$

giving each of the values of the constants p and q to 3 significant figures where appropriate.

(3)

(c) With reference to the model, interpret the value of the constant p.

(1)

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Question 4 continued

(Total for Question 4 is 6 marks)

5. The function f is defined by

$$f : x \to \frac{2x+16}{x-4} \qquad x \neq 4$$

(a) Find $ff(x)$, giving your answer as a single fraction in its simplest form.

(3)

(b) Find $f^{-1}(12)$

(2)

The function g is defined by

$$g : x \to \ln x \qquad x > 0 \quad x \neq e^4$$

(c) Find the exact values of a such that

$$fg(a) = g(a)$$

(3)

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Question 5 continued

Question 5 continued

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Question 5 continued

(Total for Question 5 is 8 marks)

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

(a) Show that the equation

$$2\cos(\theta - 60°) = 3\sin\theta$$

can be written in the form

$$\tan\theta = \frac{1}{6}\left(3 + \sqrt{3}\right)$$

(4)

(b) Hence solve, for $0 \leqslant x < 180°$, the equation

$$2\cos(2x - 70°) = 3\sin(2x - 10°)$$

giving your solutions to one decimal place.

(3)

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Question 6 continued

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Question 6 continued

(Total for Question 6 is 7 marks)

7.

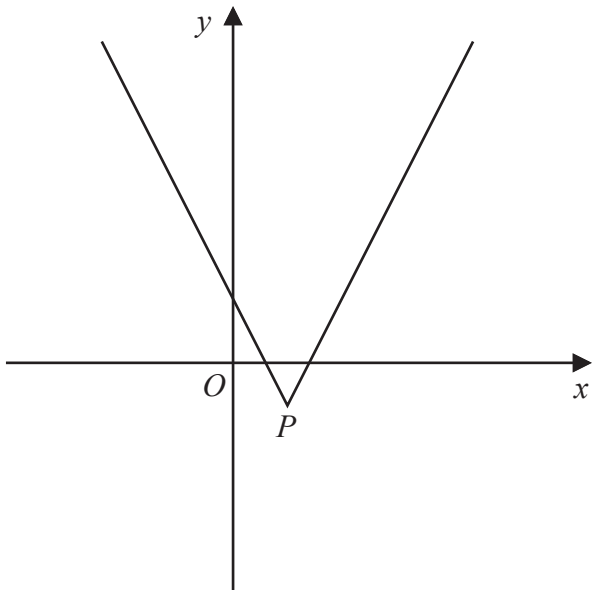


Figure 1

Figure 1 shows a sketch of part of the graph with equation $y = \mathrm{f}(x)$, where

$$\mathrm{f}(x) = |3x - 11| - 4$$

The vertex of the graph is at the point P, as shown in Figure 1.

(a) State the coordinates of P.

(2)

(b) Solve the equation $\mathrm{f}(x) = 8$

(3)

The line l has equation $y = mx$, where m is a constant.

Given that l intersects the graph of $y = \mathrm{f}(x)$ at exactly one point,

(c) find the possible values of m.

(3)

The graph with equation $y = \mathrm{f}(x)$ is transformed onto the graph with equation $y = a\,\mathrm{f}(x - b)$, where a and b are constants.

Given that the vertex of the graph with equation $y = a\,\mathrm{f}(x - b)$ is $(5, 16)$

(d) find the value of a and the value of b.

(2)

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Question 7 continued

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Question 7 continued

(Total for Question 7 is 10 marks)

8. A curve has equation

$$x = e^{2\tan y} \qquad -\frac{\pi}{2} < y < \frac{\pi}{2}$$

Show that

$$\frac{dy}{dx} = \frac{a}{x\left(b + (\ln x)^n\right)}$$

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

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Question 8 continued

(Total for Question 8 is 4 marks)

9. $\mathrm{h}(x) = 8 + 3\sin x(\cos x - 2\sin x) \quad 0 \leqslant x \leqslant 2\pi$

(a) Write $\mathrm{h}(x)$ in the form

$$P + R\sin(2x + \alpha)$$

where P, R and α are positive constants, $0 < \alpha < \frac{\pi}{2}$

Give the exact values of P and R and give the value of α, in radians, to 3 decimal places.

(6)

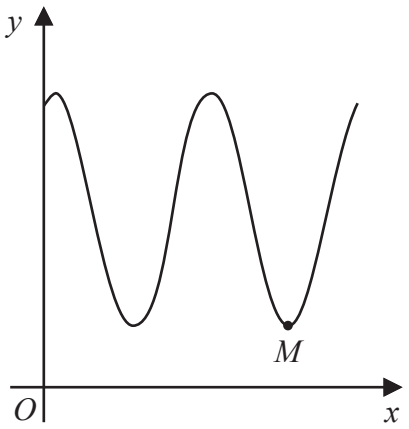


Figure 2

Figure 2 is a sketch of the curve with equation $y = \mathrm{h}(x)$

(b) State the range of h.

(1)

The point M, shown in Figure 2, is the minimum point on the curve with the largest x coordinate.

(c) Find the x coordinate of M.

(Solutions based entirely on calculator technology are not acceptable.)

(2)

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Question 9 continued

Question 9 continued

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Question 9 continued

(Total for Question 9 is 9 marks)

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

Two populations of insects are being studied over the same period of time.

The number of insects N_A in population A, t years after the start of the study, is modelled by the equation

$$N_A = 8000 + 900e^{0.2t}$$

According to the model,

(a) find the rate of growth in the number of insects in population A exactly 5 years after the start of the study.

(2)

The number of insects N_B in population B, t years after the start of the study, is modelled by the equation

$$N_B = 8000 + Pe^{kt}$$

where P and k are positive constants.

Given that

- there are 10 000 insects in population B at the start of the study
- there are 11 570 insects in population B exactly 4 years after the start of the study
- there are the same number of insects in population A and population B after T years

find, according to the models,

(b) the exact value of P and the value of k to 3 decimal places,

(4)

(c) the value of T, giving your answer to one decimal place.

(3)

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Question 10 continued

Question 10 continued

(Total for Question 10 is 9 marks)

TOTAL FOR PAPER IS 75 MARKS

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