

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

Pearson Edexcel International Advanced Level

Wednesday 31 May 2023

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.

Turn over ►

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1.

$$g(x) = x^6 + 2x - 1000$$

(a) Show that $g(x) = 0$ has a root α in the interval $[3, 4]$

(2)

Using the iteration formula

$$x_{n+1} = \sqrt[6]{1000 - 2x_n} \quad \text{with } x_1 = 3$$

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

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

(3)

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Question 1 continued

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(Total for Question 1 is 5 marks)

Question 2 continued

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(Total for Question 2 is 6 marks)

3. (i) Find $\frac{d}{dx} \ln(\sin^2 3x)$ writing your answer in simplest form. (2)

(ii)(a) Find $\frac{d}{dx} (3x^2 - 4)^6$ (2)

(b) Hence show that

$$\int_0^{\sqrt{2}} x(3x^2 - 4)^5 dx = R$$

where R is an integer to be found.

(Solutions relying on calculator technology are not acceptable.) (3)

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Question 3 continued

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(Total for Question 3 is 7 marks)

P 7 2 8 7 0 A 0 7 3 2

4. The function f is defined by

$$f(x) = 2x^2 - 5 \quad x \geq 0 \quad x \in \mathbb{R}$$

- (a) State the range of f

(1)

On the following page there is a diagram, labelled Diagram 1, which shows a sketch of the curve with equation $y = f(x)$.

- (b) On Diagram 1, sketch the curve with equation $y = f^{-1}(x)$.

(2)

The curve with equation $y = f(x)$ meets the curve with equation $y = f^{-1}(x)$ at the point P

Using algebra and showing your working,

- (c) find the exact x coordinate of P

(3)

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Question 4 continued

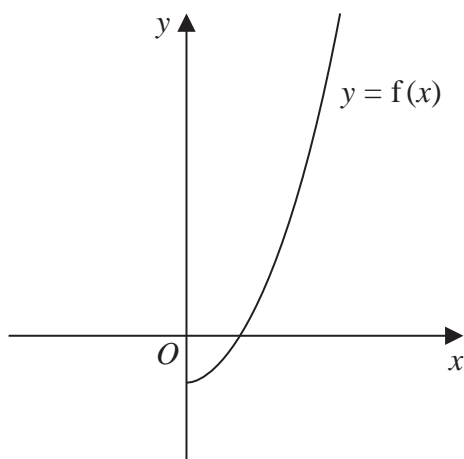


Diagram 1

(Total for Question 4 is 6 marks)



5.

In this question you must show all stages of your working.

Solutions relying entirely on calculator technology are not acceptable.

(i) Solve, for $0 < x < \pi$

$$(x - 2)(\sqrt{3} \sec x + 2) = 0 \quad (3)$$

(ii) Solve, for $0 < \theta < 360^\circ$

$$10 \sin \theta = 3 \cos 2\theta \quad (4)$$

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Question 5 continued

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Question 5 continued

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(Total for Question 5 is 7 marks)

6.

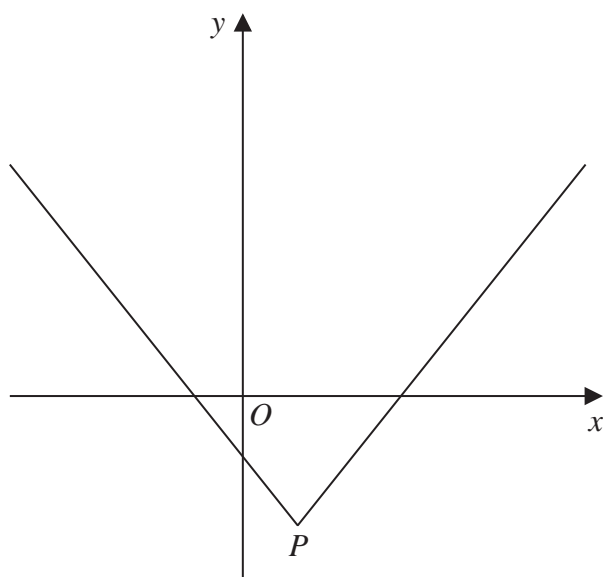
**Figure 2**

Figure 2 shows a sketch of the graph $y = f(x)$, where

$$f(x) = 3|x - 2| - 10$$

The vertex of the graph is at point P , shown in Figure 2.

(a) Find the coordinates of P

(2)

(b) Find $ff(0)$

(2)

(c) Solve the inequality

$$3|x - 2| - 10 < 5x + 10$$

(2)

(d) Solve the equation

$$f(|x|) = 0$$

(3)



Question 6 continued

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Question 6 continued

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Question 6 continued

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(Total for Question 6 is 9 marks)

Question 7 continued

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Question 7 continued

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Question 7 continued

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(Total for Question 7 is 8 marks)

A Cartesian coordinate system with a horizontal x -axis and a vertical y -axis. The origin is labeled O . A curve, labeled C , is plotted. The curve approaches a vertical asymptote at $x = -1$ from the right. It crosses the x -axis at a point to the left of the y -axis, passes through the origin O , reaches a local maximum in the first quadrant, and then decreases, asymptotically approaching the x -axis as x increases.

Figure 3 shows a sketch of the curve C with equation $y = f(x)$, where

(a) Show that

where A is a constant to be found.

(4)

(b) Hence find the exact coordinates of the two stationary points on C .

(3)

The function g is defined by

$$g(x) = 8f(x - 2)$$

(c) Find the coordinates of the maximum stationary point on the curve with equation $y = g(x)$.

(2)

Question 8 continued

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Question 8 continued

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Question 8 continued

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(Total for Question 8 is 9 marks)

9.

In this question you must show all stages of your working.

Solutions relying entirely on calculator technology are not acceptable.

(a) Show that

$$\frac{\cos 2x}{\sin x} + \frac{\sin 2x}{\cos x} \equiv \operatorname{cosec} x \quad x \neq \frac{n}{2} \quad n \in \mathbb{Z} \quad (3)$$

(b) Hence solve, for $0 < \theta < \frac{\pi}{2}$

$$\left(\frac{\cos 2\theta}{\sin \theta} + \frac{\sin 2\theta}{\cos \theta} \right)^2 = 6 \cot \theta - 4$$

giving your answers to 3 significant figures as appropriate.

(5)

(c) Using the result from part (a), or otherwise, find the exact value of

$$\int_{\frac{\pi}{6}}^{\frac{\pi}{4}} \left(\frac{\cos 2x}{\sin x} + \frac{\sin 2x}{\cos x} \right) \cot x \, dx \quad (2)$$

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Question 9 continued

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Question 9 continued

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(Total for Question 9 is 10 marks)

Figure 4 shows a sketch of the curve with equation

$$x = \frac{2y^2 + 6}{3y - 3}$$

- (a) Find $\frac{dx}{dy}$ giving your answer as a fully simplified fraction.

(4)

The tangents at points P and Q on the curve are parallel to the y -axis, as shown in Figure 4.

- (b) Use the answer to part (a) to find the equations of these two tangents.

(4)

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Question 10 continued

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Question 10 continued

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(Total for Question 10 is 8 marks)**TOTAL FOR PAPER IS 75 MARKS**