

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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Wednesday 22 January 2020

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 (Lilac), 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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Question 1 continued

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(Total 6 marks)

Q1



2. The function f and the function g are defined by

$$f(x) = \frac{12}{x+1} \quad x > 0, x \in \mathbb{R}$$

$$g(x) = \frac{5}{2} \ln x \quad x > 0, x \in \mathbb{R}$$

(a) Find, in simplest form, the value of $fg(e^2)$ (2)

(b) Find f^{-1} (3)

(c) Hence, or otherwise, find all real solutions of the equation

$$f^{-1}(x) = f(x) \quad (3)$$

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Question 2 continued

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Question 2 continued

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Question 2 continued

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(Total 8 marks)

Q2

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Question 3 continued

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Q3



Question 4 continued

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Question 4 continued

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Question 4 continued

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(Total 11 marks)

Q4



5. (a) Use the substitution $t = \tan x$ to show that the equation

$$12 \tan 2x + 5 \cot x \sec^2 x = 0$$

can be written in the form

$$5t^4 - 24t^2 - 5 = 0 \quad (4)$$

- (b) Hence solve, for $0 \leq x < 360^\circ$, the equation

$$12 \tan 2x + 5 \cot x \sec^2 x = 0$$

Show each stage of your working and give your answers to one decimal place. (4)

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Question 5 continued

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Question 5 continued

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Question 5 continued

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Q5

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6.

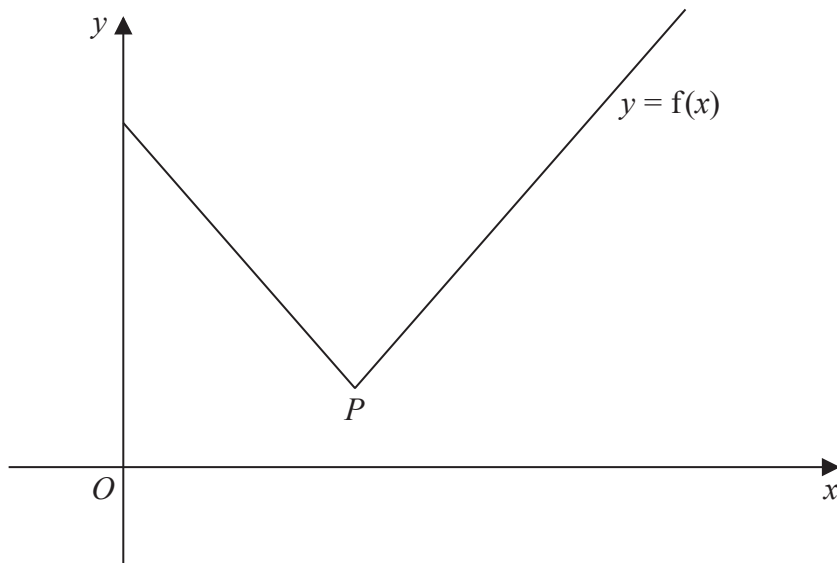


Figure 2

Figure 2 shows part of the graph with equation $y = f(x)$, where

$$f(x) = 2|2x - 5| + 3 \quad x \geq 0$$

The vertex of the graph is at point P as shown.

(a) State the coordinates of P .

(2)

(b) Solve the equation $f(x) = 3x - 2$

(4)

Given that the equation

$$f(x) = kx + 2$$

where k is a constant, has exactly two roots,

(c) find the range of values of k .

(3)



Question 6 continued

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Question 6 continued

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(Total 9 marks)

Q6

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7.

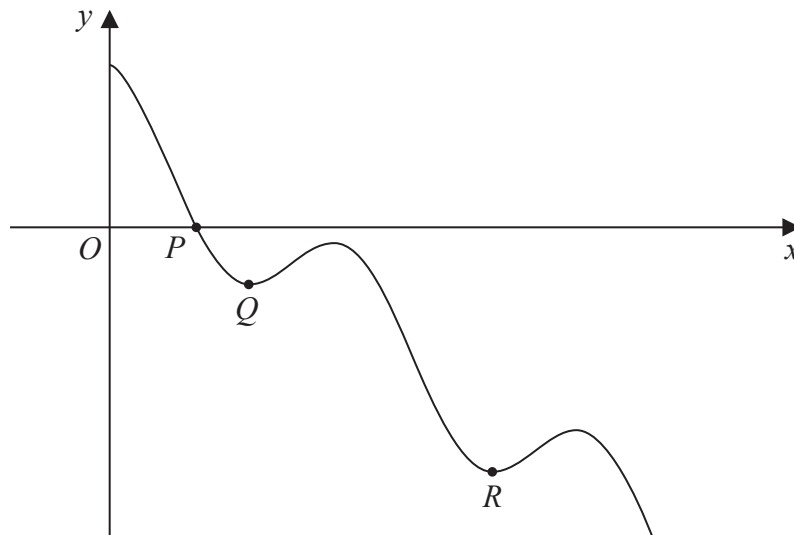


Figure 3

Figure 3 shows a sketch of part of the curve with equation

$$y = 2 \cos 3x - 3x + 4 \quad x > 0$$

where x is measured in radians.

The curve crosses the x -axis at the point P , as shown in Figure 3.

Given that the x coordinate of P is α ,

- (a) show that α lies between 0.8 and 0.9 (2)

The iteration formula

$$x_{n+1} = \frac{1}{3} \arccos(1.5x_n - 2)$$

can be used to find an approximate value for α .

- (b) Using this iteration formula with $x_1 = 0.8$ find, to 4 decimal places, the value of
- (i) x_2
- (ii) x_5 (3)

The point Q and the point R are local minimum points on the curve, as shown in Figure 3.

Given that the x coordinates of Q and R are β and λ respectively, and that they are the two smallest values of x at which local minima occur,

- (c) find, using calculus, the exact value of β and the exact value of λ . (6)



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Question 7 continued

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Question 7 continued

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(Total 11 marks)

Q7



8. (i) Find, using algebraic integration, the exact value of

$$\int_3^{42} \frac{2}{3x-1} dx$$

giving your answer in simplest form.

(4)

(ii)
$$h(x) = \frac{2x^3 - 7x^2 + 8x + 1}{(x-1)^2} \quad x > 1$$

Given $h(x) = Ax + B + \frac{C}{(x-1)^2}$ where A , B and C are constants to be found, find

$$\int h(x) dx$$

(6)

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Question 8 continued

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Question 8 continued

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(Total 10 marks)

Q8



9.

$$f(\theta) = 5 \cos \theta - 4 \sin \theta \quad \theta \in \mathbb{R}$$

- (a) Express $f(\theta)$ in the form $R\cos(\theta + \alpha)$, where R and α are constants, $R > 0$ and $0 < \alpha < \frac{\pi}{2}$. Give the exact value of R and give the value of α , in radians, to 3 decimal places.

(3)

The curve with equation $y = \cos \theta$ is transformed onto the curve with equation $y = f(\theta)$ by a sequence of two transformations.

Given that the first transformation is a stretch and the second a translation,

- (b) (i) describe fully the transformation that is a stretch,
(ii) describe fully the transformation that is a translation.

(2)

Given

$$g(\theta) = \frac{90}{4 + (f(\theta))^2} \quad \theta \in \mathbb{R}$$

- (c) find the range of g .

(2)



Question 9 continued

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Question 9 continued

Q9

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END

TOTAL FOR PAPER IS 75 MARKS

