

Please check the examination details below before entering your candidate information

Candidate surname		Other names	
Centre Number		Candidate Number	

Pearson Edexcel International Advanced Level

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. Find, using calculus, the x coordinate of the stationary point on the curve with equation

$$y = (2x + 5)e^{3x}$$

(4)

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Question 1 continued

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Q1

(Total 4 marks)

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

$$\sin 2\theta = k$$

(3)

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

(2)

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Question 2 continued

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(4)

where a is a rational constant to be found.

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Q3

(Total 6 marks)



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

$$A = \frac{80pe^{0.15t}}{pe^{0.15t} + 4}$$

Given that

- 30m^2 of the surface of the pond was covered by the weed at the start of the study
- 50m^2 of the surface of the pond was covered by the weed T days after the start of the study

(a) show that $p = 2.4$

(2)

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

(Solutions relying entirely on graphical or numerical methods are not acceptable.)

(4)

The weed grows until it covers the surface of the pond.

(c) Find, according to the model, the maximum possible surface area of the pond.

(1)

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Question 4 continued

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Q4

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5.

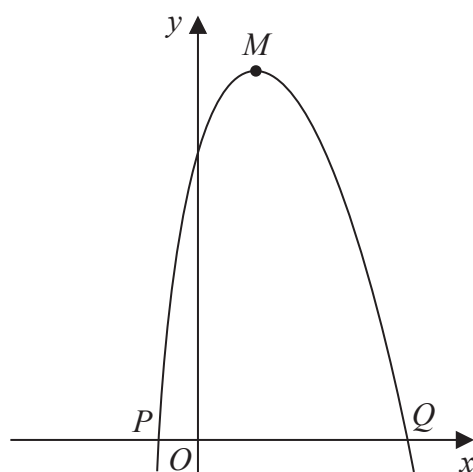


Figure 1

Figure 1 shows a sketch of part of the curve with equation

$$y = 6 \ln(2x + 3) - \frac{1}{2}x^2 + 4 \quad x > -\frac{3}{2}$$

The curve cuts the negative x -axis at the point P , as shown in Figure 1.

- (a) Show that the x coordinate of P lies in the interval $[-1.25, -1.2]$

(2)

The curve cuts the positive x -axis at the point Q , also shown in Figure 1.

Using the iterative formula

$$x_{n+1} = \sqrt{12 \ln(2x_n + 3) + 8} \quad \text{with } x_1 = 6$$

- (b) (i) find, to 4 decimal places, the value of x_2
(ii) find, by continued iteration, the x coordinate of Q . Give your answer to 4 decimal places.

(3)

The curve has a maximum turning point at M , as shown in Figure 1.

- (c) Using calculus and showing each stage of your working, find the x coordinate of M .

(4)

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Question 5 continued

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Question 5 continued

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Q5

(Total 9 marks)



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6. The function f is defined by

$$f(x) = \frac{5x - 3}{x - 4} \quad x > 4$$

- (a) Show, by using calculus, that f is a decreasing function.

(3)

- (b) Find f^{-1}

(3)

- (c) (i) Show that $\text{ff}(x) = \frac{ax+b}{x+c}$ where a, b and c are constants to be found.

- (ii) Deduce the range of ff .

(5)

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Question 6 continued

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Question 6 continued

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Q6

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(Total 11 marks)



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

(a) State the coordinates of the vertex, V , of the graph.

(2)

(b) Solve, using algebra,

(4)

(c) Sketch the graph with equation

stating the coordinates of the local maximum point and each local minimum point.

(4)

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Question 7 continued

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Question 7 continued

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Q7

(Total 10 marks)



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The amount of the antibiotic, x milligrams, in the patient's bloodstream t hours after the dose was given, is found to satisfy the equation

(a) Show that this equation can be written in the form

where p and q are constants to be found. Give the value of p to the nearest whole number and the value of q to 2 significant figures.

(4)

(b) With reference to the equation in part (a), interpret the value of the constant p .

(1)

When a different dose of the antibiotic is given to another patient, the values of x and t satisfy the equation

(c) Use calculus to find, to 2 significant figures, the value of $\frac{dx}{dt}$ when $t = 5$

(3)

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Question 8 continued

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Question 8 continued

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Q8

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Question 9 continued

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Question 9 continued



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(Total 8 marks)

Q9



A Cartesian coordinate system with a horizontal x -axis and a vertical y -axis. The origin is labeled O . A curve, labeled C , passes through the origin. In the first quadrant, the curve is concave down and increases as x increases. In the third quadrant, the curve is concave up and decreases as x decreases, approaching the y -axis as a vertical asymptote.

Figure 3 shows a sketch of the curve C with equation

(a) Show that

$$\frac{dy}{dx} = \frac{y}{x(1+2y)} \quad (4)$$

(b) find the range of possible values for k . (3)

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Question 10 continued

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Q10

(Total 7 marks)

END

TOTAL FOR PAPER IS 75 MARKS

