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 **WMA14/01**

Mathematics

International Advanced Level
Pure Mathematics P4

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) Find the first 4 terms of the binomial expansion, in ascending powers of x, of

$$\frac{2}{\sqrt{9-2x}} \qquad |x| < \frac{9}{2}$$

giving each coefficient as a simplified fraction.

(5)

By substituting $x = 1$ into the answer to part (a),

(b) find an approximation for $\sqrt{7}$, giving your answer to 4 decimal places.

(2)

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Question 1 continued

Q1

(Total 7 marks)

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2. The curve C has parametric equations

$$x = \frac{t^4}{2t+1} \qquad y = \frac{t^3}{2t+1} \qquad t > 0$$

(a) Write down $\frac{x}{y}$ in terms of t, giving your answer in simplest form.

(1)

(b) Hence show that all points on C satisfy the equation

$$x^3 - 2xy^3 - y^4 = 0$$

(3)

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Question 2 continued

Q2

(Total 4 marks)

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3. The curve C has equation

$$3y^2 - 11x^2 + 11xy = 20y - 36x + 28$$

(a) Find, in simplest form, $\frac{dy}{dx}$ in terms of x and y.

(5)

The point $P(4, k)$, where k is a constant, lies on C.

Given that $k < 0$

(b) find the value of the gradient of C at P

(5)

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Question 3 continued

(Total 10 marks)

Q3

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

(a) Express $f(x)$ in partial fractions.

(4)

(b) Hence find $\int f(x)\,dx$

(3)

(c) Find

$$\int_3^5 f(x)\,dx$$

giving your answer in the form $a + \ln b$, where a and b are rational numbers to be found.

(2)

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Question 4 continued

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Question 4 continued

Q4

(Total 9 marks)

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5. With respect to a fixed origin O, the lines l_1 and l_2 are given by the equations

$$l_1 : \mathbf{r} = \begin{pmatrix} 4 \\ 4 \\ -5 \end{pmatrix} + \lambda \begin{pmatrix} 2 \\ -3 \\ 6 \end{pmatrix} \qquad l_2 : \mathbf{r} = \begin{pmatrix} 13 \\ -1 \\ 4 \end{pmatrix} + \mu \begin{pmatrix} 5 \\ 1 \\ -3 \end{pmatrix}$$

where λ and μ are scalar parameters.

(a) Show that l_1 and l_2 meet and find the position vector of their point of intersection A.

(6)

(b) Find the acute angle between l_1 and l_2, giving your answer in degrees to one decimal place.

(3)

A circle with centre A and radius 35 cuts the line l_1 at the points P and Q.

Given that the x coordinate of P is greater than the x coordinate of Q,

(c) find the coordinates of P and the coordinates of Q.

(4)

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Question 5 continued

(Total 13 marks)

Q5

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6. Use integration by parts to show that

$$\int e^{2x} \cos 3x \, dx = pe^{2x} \sin 3x + qe^{2x} \cos 3x + k$$

where p and q are rational numbers to be found and k is an arbitrary constant.

(6)

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Question 6 continued

Q6

(Total 6 marks)

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7. Water is flowing into a large container and is leaking from a hole at the base of the container.

At time t seconds after the water starts to flow, the volume, $V\,\text{cm}^3$, of water in the container is modelled by the differential equation

$$\frac{\mathrm{d}V}{\mathrm{d}t} = 300 - kV$$

where k is a constant.

(a) Solve the differential equation to show that, according to the model,

$$V = \frac{300}{k} + A\mathrm{e}^{-kt}$$

where A is a constant.

(5)

Given that the container is initially empty and that when $t = 10$, the volume of water is increasing at a rate of $200\,\text{cm}^3\,\text{s}^{-1}$

(b) find the exact value of k.

(4)

(c) Hence find, according to the model, the time taken for the volume of water in the container to reach 6 litres. Give your answer to the nearest second.

(2)

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Question 7 continued

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Question 7 continued

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Question 7 continued

Q7

(Total 11 marks)

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8. Use proof by contradiction to prove that, for all positive real numbers x and y,

$$\frac{9x}{y} + \frac{y}{x} \geqslant 6$$

(4)

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Question 8 continued

Q8

(Total 4 marks)

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9.

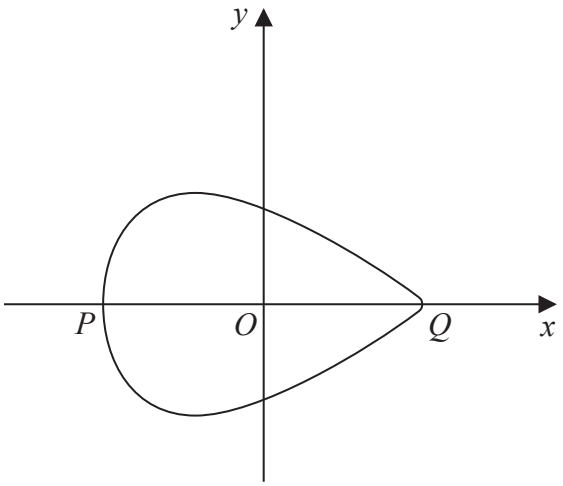

Figure 1

Figure 1 shows a sketch of a closed curve with parametric equations

$$x = 5\cos\theta \qquad y = 3\sin\theta - \sin 2\theta \qquad 0 \leqslant \theta < 2\pi$$

The region enclosed by the curve is rotated through π radians about the x-axis to form a solid of revolution.

(a) Show that the volume, V, of the solid of revolution is given by

$$V = 5\pi\int_{\alpha}^{\beta} \sin^3\theta\,(3 - 2\cos\theta)^2\,\mathrm{d}\theta$$

where α and β are constants to be found.

(4)

(b) Use the substitution $u = \cos\theta$ and algebraic integration to show that $V = k\pi$ where k is a rational number to be found.

(7)

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Question 9 continued

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Question 9 continued

Q9

(Total 11 marks)

TOTAL FOR PAPER IS 75 MARKS

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