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Candidate surname					Other names				
Centre Number				Candidate Number					
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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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Q:1/1/1/



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1. The curve C has equation

$$xy^2 = x^2y + 6 \quad x \neq 0 \quad y \neq 0$$

Find an equation for the tangent to C at the point $P(2, 3)$, giving your answer in the form $ax + by + c = 0$ where a , b and c are integers.

(6)

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- 2. (a) Find, in ascending powers of x , the first three non-zero terms of the binomial series expansion of

$$\sqrt[3]{1 + 4x^3} \quad |x| < \frac{1}{\sqrt[3]{4}}$$

giving each coefficient as a simplified fraction.

(4)

- (b) Use the expansion from part (a) with $x = \frac{1}{3}$ to find a rational approximation to $\sqrt[3]{31}$

(3)

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Question 3 continued

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Question 3 continued

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Q3

(Total 9 marks)



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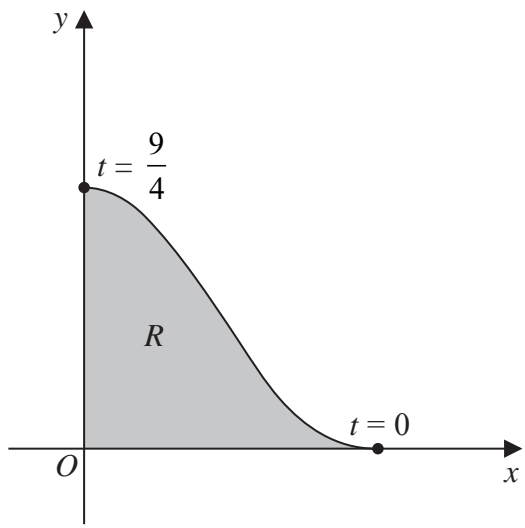


Figure 2

Figure 2 shows a sketch of the curve with parametric equations

$$x = \sqrt{9 - 4t} \quad y = \frac{t^3}{\sqrt{9 + 4t}} \quad 0 \leq t \leq \frac{9}{4}$$

The curve touches the x -axis when $t = 0$ and meets the y -axis when $t = \frac{9}{4}$

The region R , shown shaded in Figure 2, is bounded by the curve, the x -axis and the y -axis.

(a) Show that the area of R is given by

$$K \int_0^{\frac{9}{4}} \frac{t^3}{\sqrt{81 - 16t^2}} dt$$

where K is a constant to be found.

(4)

(b) Using the substitution $u = 81 - 16t^2$, or otherwise, find the exact area of R .

(Solutions relying on calculator technology are not acceptable.)

(6)

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7.

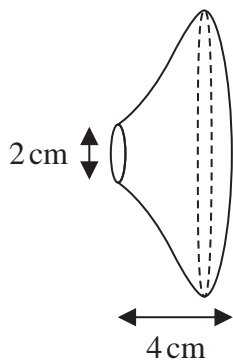


Figure 3

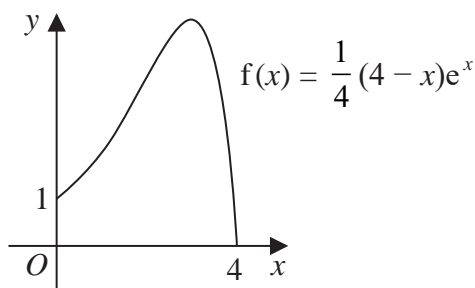


Figure 4

Figure 3 shows the design of a doorknob.

The shape of the doorknob is formed by rotating the curve shown in Figure 4 through 360° about the x -axis, where the units are centimetres.

The equation of the curve is given by

$$f(x) = \frac{1}{4} (4 - x)e^x \quad 0 \leq x \leq 4$$

(a) Show that the volume, $V\text{cm}^3$, of the doorknob is given by

$$V = K \int_0^4 (x^2 - 8x + 16)e^{2x} dx$$

where K is a constant to be found.

(3)

(b) Hence, find the exact value of the volume of the doorknob.

Give your answer in the form $p\pi(e^q + r)\text{cm}^3$ where p , q and r are simplified rational numbers to be found.

(5)

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9. (a) Find the derivative with respect to y of

$$\frac{1}{(1 + 2 \ln y)^2} \quad (2)$$

- (b) Hence find a general solution to the differential equation

$$3 \operatorname{cosec}(2x) \frac{dy}{dx} = y(1 + 2 \ln y)^3 \quad y > 0 \quad -\frac{\pi}{2} < x < \frac{\pi}{2} \quad (4)$$

- (c) Show that the particular solution of this differential equation for which $y = 1$ at $x = \frac{\pi}{6}$ is given by

$$y = e^{A \sec x - \frac{1}{2}}$$

where A is an irrational number to be found.

(5)

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Question 9 continued

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