Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel
International Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Specimen Paper

(Time: 1 hour 30 minutes) | Paper Reference **WMA14/01**

Mathematics

International Advanced Level
Pure Mathematics P4

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 8 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.

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1. Use the binomial theorem to expand

$$\sqrt[3]{(8-3x)^2} \qquad |x| < \frac{8}{3}$$

in ascending powers of x, up to and including the term in x^3, fully simplifying each term.

(5)

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Question 1 continued

(Total for Question 1 is 5 marks)

Q1

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2. (a) Express $\dfrac{1}{(2x+3)(3x+2)}$ in partial fractions.

(3)

(b) Hence find, in the form $y = f(x)$, the general solution of the differential equation

$$(2x+3)(3x+2)\frac{dy}{dx} = 5y \qquad x > 0,\ y > 0$$

(5)

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Question 2 continued

(Total for Question 2 is 8 marks)

Q2

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3. Using the substitution $u = 1 + \tan x$, find the exact value of

$$\int_0^{\frac{\pi}{3}} \frac{1}{\cos^2 x + \sin x \cos x} \, dx$$

(6)

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Question 3 continued

(Total for Question 3 is 6 marks)

Q3

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4.

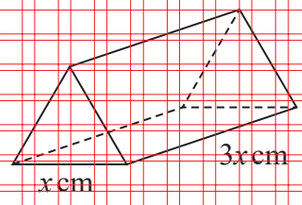

Figure 1

Figure 1 shows a right triangular prism. The cross-section is an equilateral triangle with side x cm and the length of the prism is $3x$ cm, with $x > 2$

Given that the cross-sectional area of the prism is changing at a rate of $(2 - x)$ cm^2 s^{-1}

(a) find, in terms of x, an expression for $\frac{dx}{dt}$

(4)

(b) find the rate of decrease of the volume of the prism when $x = 2.05$

(4)

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Question 4 continued

(Total for Question 4 is 8 marks)

Q4

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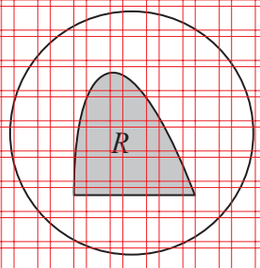

Figure 2

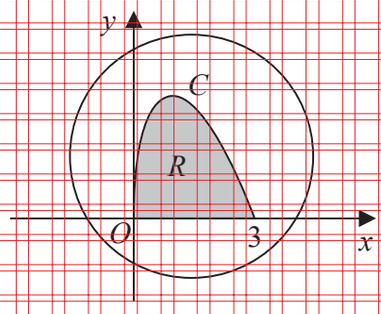

Figure 3

Figure 2 shows the design for a logo of a fishing club. The design is made up of a shaded region R inside a circle of radius 3

The region R is the area between the x-axis and the curve C shown in Figure 3.

The curve C is defined by the parametric equations

$$x = 4\sin^2 t \qquad y = 3\sin 3t \qquad 0 \leqslant t \leqslant \frac{\pi}{3}$$

(a) Prove that

$$\sin 3t \equiv 3\sin t - 4\sin^3 t$$

(3)

(b) Using algebraic integration find, to 3 significant figures, the percentage of the circle that is shaded as part of the logo.

(8)

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Question 5 continued

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Question 5 continued

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Question 5 continued

(Total for Question 5 is 11 marks)

Q5

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6. Relative to a fixed origin O, the points A and B have position vectors $\overrightarrow{OA} = \begin{pmatrix} 9 \\ 5 \\ 12 \end{pmatrix}$ and $\overrightarrow{OB} = \begin{pmatrix} 13 \\ -3 \\ 4 \end{pmatrix}$ respectively.

The line l_1 has equation

$$\mathbf{r} = \overrightarrow{OA} + \lambda \begin{pmatrix} 2 \\ 1 \\ 3 \end{pmatrix}$$

and the line l_2 has equation

$$\mathbf{r} = \overrightarrow{OB} + \mu \begin{pmatrix} 10 \\ -5 \\ 1 \end{pmatrix}$$

where λ and μ are scalar parameters.

(a) Show that l_1 and l_2 intersect at a point X, and find the coordinates of X.

(6)

(b) Find the coordinates of the point P such that $XAPB$ is a parallelogram.

(2)

(c) Show that $XAPB$ is a rhombus.

(2)

(d) Prove by contradiction that $XAPB$ is not a square.

(3)

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Question 6 continued

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Question 6 continued

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Question 6 continued

(Total for Question 6 is 13 marks)

Q6

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7. (a) Use integration by parts to show that

$$\int e^{2x}\cos 2x\,dx = \frac{e^{2x}(\sin 2x + \cos 2x)}{4} + c$$

where c is an arbitrary constant.

(5)

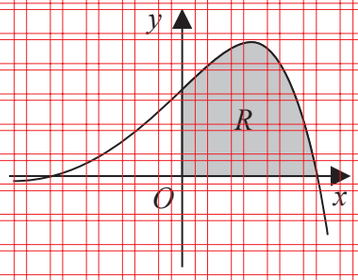

Figure 4

Figure 4 shows a sketch of part of the curve with equation $y = f(x)$ where

$$f(x) = e^x \cos x$$

The finite region R, shown shaded in Figure 4, is bounded by the curve, the positive y-axis and the positive x-axis.

The region R is rotated through 2π radians about the x-axis to form a solid of revolution.

(b) Using the result from part (a), find the exact volume of the solid formed.

(6)

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Question 7 continued

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Question 7 continued

(Total for Question 7 is 11 marks)

Q7

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8. The curve C has equation

$$11e^{x-2y} + 5xy^2 = 1 + 5x^2$$

The point $P(2, 1)$ lies on C.

(a) Show that at P, $\frac{dy}{dx} = -2$

(5)

(b) Find the exact coordinates of the points where the normal to C at P crosses the curve C again.

(8)

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Question 8 continued

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Question 8 continued

Q8

(Total for Question 8 is 13 marks)

TOTAL FOR PAPER IS 75 MARKS

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