

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

Pearson Edexcel International Advanced Level

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Morning (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 ►

1.

$$f(x) = (3 - 2x)^{-4}, \quad |x| < \frac{3}{2}$$

Find the binomial expansion of $f(x)$, in ascending powers of x , up to and including the term in x^2 , giving each coefficient as a simplified fraction.

(4)

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(Total for Question 1 is 4 marks)

2. Three **consecutive** terms in a sequence of real numbers are given by

$$k, 1 + 2k \text{ and } 3 + 3k$$

where k is a constant.

Use proof by contradiction to show that this sequence is not a geometric sequence.

(5)

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Question 2 continued

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(Total for Question 2 is 5 marks)

3. Find, showing all steps of your working, the exact value of

$$\int_1^3 \frac{3x^2 + 8}{x^2 - 4x} dx$$

(7)

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Question 3 continued

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(Total for Question 3 is 7 marks)

4.

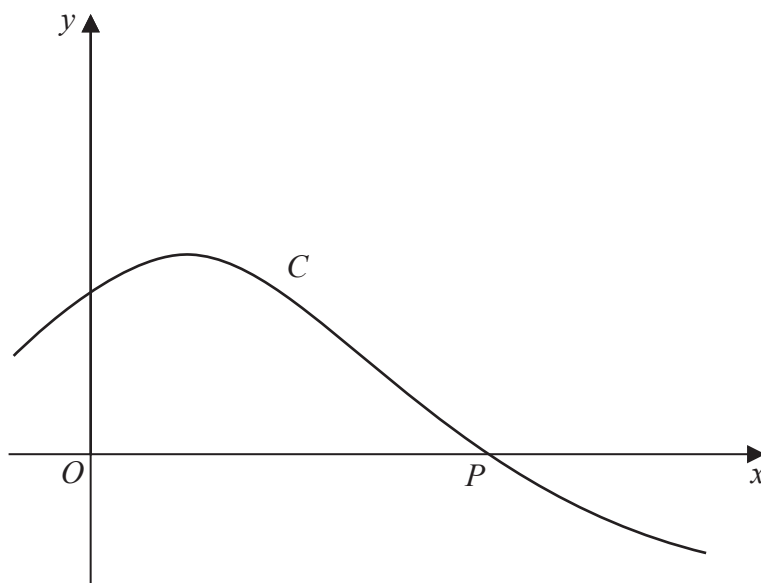
**Figure 1**

Figure 1 shows a sketch of the curve C with parametric equations

$$x = 1 + 3 \tan t \quad y = 2 \cos 2t \quad -\frac{\pi}{6} \leq t \leq \frac{\pi}{3}$$

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

- (a) Find the equation of the tangent to C at P , writing your answer in the form $y = mx + c$, where m and c are constants to be found.

(5)

The curve C has equation $y = f(x)$, where f is a function with domain $[k, 1 + 3\sqrt{3}]$

- (b) Find the exact value of the constant k .

(1)

- (c) Find the range of f .

(2)

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Question 4 continued

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(Total for Question 4 is 8 marks)

5.

In this question you must show all stages of your working.

Solutions relying on calculator technology are not acceptable.

A curve has equation

$$16x^3 - 9kx^2y + 8y^3 = 875$$

where k is a constant.

(a) Show that

$$\frac{dy}{dx} = \frac{6kxy - 16x^2}{8y^2 - 3kx^2} \quad (4)$$

Given that the curve has a turning point at $x = \frac{5}{2}$,

(b) find the value of k (4)

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6. Use the substitution $x = 2 \sin \theta$ to find the exact value of

$$\int_0^{\sqrt{3}} \frac{1}{(4-x^2)^{\frac{3}{2}}} dx$$

(7)

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Question 6 continued

Handwriting practice area with horizontal lines.

(Total for Question 6 is 7 marks)

7. Relative to a fixed origin O , the line l has vector equation

$$\mathbf{r} = \begin{pmatrix} -1 \\ -4 \\ 6 \end{pmatrix} + \lambda \begin{pmatrix} 2 \\ 1 \\ -1 \end{pmatrix}$$

where λ is a scalar parameter.

Points A and B lie on the line l , where A has coordinates $(1, a, 5)$ and B has coordinates $(b, -1, 3)$.

- (a) Find the value of the constant a and the value of the constant b . (3)

- (b) Find the vector \overrightarrow{AB} . (2)

The point C has coordinates $(4, -3, 2)$

- (c) Show that the size of the angle CAB is 30° (3)

- (d) Find the exact area of the triangle CAB , giving your answer in the form $k\sqrt{3}$, where k is a constant to be determined.

The point D lies on the line l so that the area of the triangle CAD is twice the area of the triangle CAB .

- (e) Find the coordinates of the two possible positions of D . (4)

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Question 7 continued

Lined area for writing the answer to Question 7.

Question 7 continued

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8.

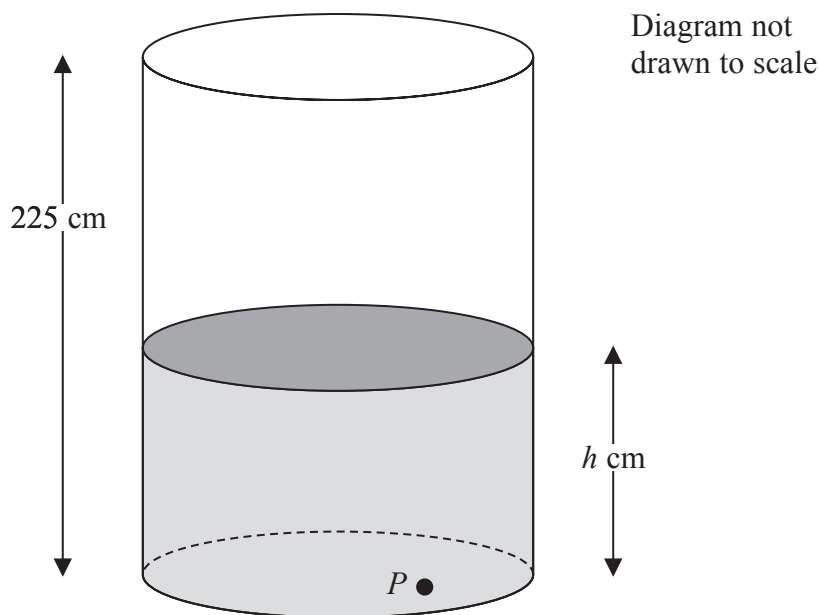


Figure 2

Figure 2 shows a vertical cylindrical tank of height 225 cm containing a liquid.

The liquid is leaking out of a hole P in the base of the tank.

At time t minutes after the leaking starts, the height of the liquid in the tank is h cm.

The rate at which the height of the liquid in the tank is decreasing, at any time t minutes, is modelled as being proportional to the square root of the height of the liquid in the tank.

When $t = 0$, $h = 225$ and when $t = 125$, $h = 100$

The liquid stops leaking from the tank when $h = 0$

By forming and solving a differential equation,

(a) show that the model leads to the equation

$$h = (15 - 0.04t)^2 \quad 0 \leq t \leq a$$

stating the value of the constant a .

(7)

(b) Find, according to the model, the time taken for the height of the liquid in the tank to decrease from 100 cm to 50 cm. Give your answer to the nearest minute.

(3)

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Question 8 continued

Lined area for writing the answer to Question 8.

Question 8 continued

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Question 8 continued

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(Total for Question 8 is 10 marks)

9.

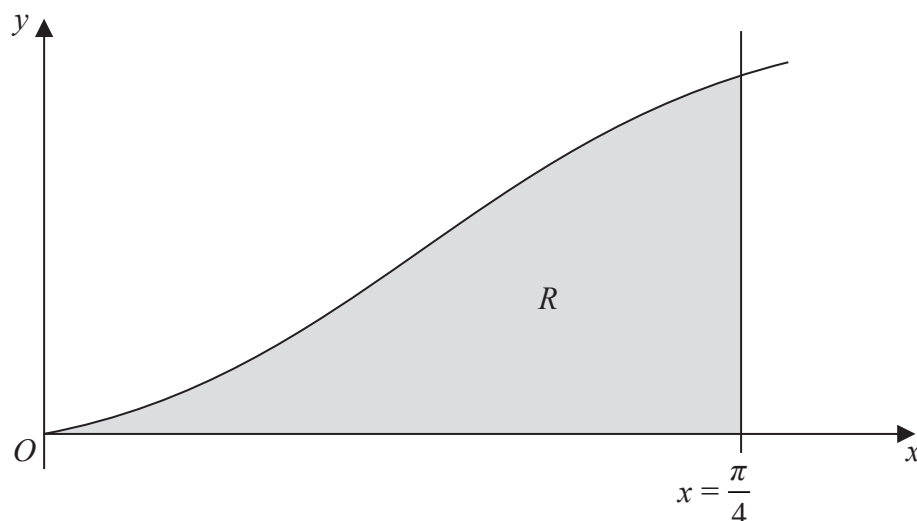


Figure 3

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

$$y = x(\sin x + \cos x), \quad 0 \leq x \leq \frac{\pi}{4}$$

The finite region R , shown shaded in Figure 3, is bounded by the curve, the x -axis and the line $x = \frac{\pi}{4}$. This shaded region is rotated through 2π radians about the x -axis to form a solid of revolution, with volume V .

(a) Assuming the formula for volume of revolution show that $V = \int_0^{\frac{\pi}{4}} \pi x^2 (1 + \sin 2x) dx$ (3)

(b) Hence using calculus find the exact value of V .

You must show your working.

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

(9)

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Question 9 continued

Lined area for writing the answer to Question 9.

Question 9 continued

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Question 9 continued

Lined area for writing the answer to Question 9.

Question 9 continued

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(Total for Question 9 is 12 marks)

TOTAL FOR PAPER IS 75 MARKS